TERRA NOSTRA

Schriften der GeoUnion Alfred-Wegener-Stiftung – 2010/5

24. Internationale Polartagung

der Deutschen Gesellschaft für Polarforschung
Obergurgl, 6. bis 10. September 2010

Programm und Zusammenfassung der Tagungsbeiträge

IMGI
Institut für Meteorologie und Geophysik · Universität Innsbruck

AWI
Alfred-Wegener-Institut
für Polar- und Meeresforschung
in der Helmholtz-Gemeinschaft

TERRA NOSTRA – *Schriften der GeoUnion Alfred-Wegener-Stiftung*

Publisher
Verlag

GeoUnion
Alfred-Wegener-Stiftung

GeoUnion Alfred-Wegener-Stiftung
Arno-Holz-Str. 14, 12165 Berlin, Germany
Tel.: +49 (0)30 7900660, Fax: +49 (0)30 79006612
Email: infos@geo-union.de

Editorial office
Schriftleitung

Dr. Christof Ellger
GeoUnion Alfred-Wegener-Stiftung
Arno-Holz-Str. 14, 12165 Berlin, Germany
Tel.: +49 (0)30 79006622, Fax: +49 (0)30 79006612
Email: Christof.Ellger@gfe-berlin.de

Vol. 2010/5
Heft 2010/5

24. Internationale Polartagung der DGP
Programm und Zusammenfassung der Tagungsbeiträge

Editor
Herausgeber

Prof. Michael Kuhn
Institut für Meteorologie und Geophysik der Universität Innsbruck

Editorial staff
Redaktion

Anna Haberkorn, Angelika Neuner, Fritz Pellet
Institut für Meteorologie und Geophysik der Universität Innsbruck

Heidemarie Kassens
IFM - GEOMAR, Kiel

Printed by
Druck

Weserdruckerei Grassé GmbH, Bremerhaven

ISSN 0946-8978

GeoUnion Alfred-Wegener-Stiftung – Berlin, Juni 2010

Inhalt Seite

TAGUNGSPROGRAMM

Sonntag, 5. September 2010

14:30 – 17:30 Sitzung des erweiterten Vorstands und Beirats der DGP

18:00 – 21:00 Registrierung / Icebreaker

Montag, 6. September 2010

09:00 – 10:30 Eröffnung

Schnee und Eis

11:00 – 11:30 **Eingeladener Vortrag**
Michael Kuhn (Universtät Innsbruck) - Das Eis der Erde im Kreislauf Energie, Wasser & Spurenstoffe

11:30 – 11:45 *Helmut Rott (Universität Innsbruck), F. Müller, T. Nagler, D. Floricioiu* - The Mass Deficit of Outlet Glaciers on the Antarctic Peninsula after Disintegration of Northern Larsen Ice Shelf

11:45 – 12:00 *Gabriele Bippus (ENVEO), Helmut Rott* - Spatial and temporal pattern of snow and ice area extent in late summer in various glacier regions of the world observed by Landsat

12:00 – 12:15 *Dana Floricioiu (DLR), W. Abdel-Jaber, M. Eineder* - Recent observations of the Antarctic ice sheet velocity with high resolution TerraSAR-X radar imagery

12:15 – 12:30 *Reinhard Dietrich (TU Dresden), A. Groh, H. Ewert* - Bestimmung der Eismassenbilanz von Antarktika und Grönland mittels Satellitendaten

Mittagspause

Leben im Eis

14:00 – 14:30 **Eingeladener Vortrag**
Birgit Sattler (Universität Innsbruck), Michael Storrie-Lombardi, Wolfgang Sattler, Roland Psenner - Mikrobielles Leben in der Kryosphäre

14:30 – 14:45 *Mikhail Andreev (Komarov Botanical Institute)* - Lichens of continental Antarctic: biodiversity, geography and ecology

14:45 – 15:00 *Ivan Parnikoza (Ukrainian Society for Genetics and Selections), J. Smykla, I. A. Kozeretska, V. A. Kunak* - Characteristics of the Antarctic herb Tundra along two ecological gradients

15:00 – 15:15 *Barbara Post (Universität Innsbruck), B. Sattler, M. Kainz, H. Dastych* - Comparative food web analyses with stable isotopes of Tardigrades in glacial ecosystems of Spitsbergen and the Alps

15:15 – 15:30 *Claudia Colesie (Universität Kaiserslautern), B. Büdel* - Biological soil crusts from Antarctic Dry Valleys: composition and photosynthetic capacity

Kaffeepause

16:00 – 16:15 *Eva-Maria Pfeiffer (Universität Hamburg)* - Heiße Prozesse in kalten Böden: Ein Überblick zur Boden bezogenen Forschung im sibirischen Permafrost

16:15 – 16:30 *Dirk Wagner (AWI Potsdam), H. Frentzel, C. Knoblauch* Characterization of methane-producing microorganisms by stable isotope probing: Who is active in Siberian permafrost soils?

16:30 – 16:45 *Janosch Malaszkiewicz (AWI Potsdam), D. Wagner* - Activity Measurements of Methanogenic Archaea Isolated from Siberian Permafrost under simulated Mars Analog Conditions

16:45 – 17:00 *Juliane Grieß (AWI Potsdam), K. Mangelsdorf, D. Wagner* - Response of the Siberian methane cycling microbial community to climate changes in Late Pleistocene and Holocene

17:00 – 17:15 *Felizitas Bajerski (AWI Potsdam), L. Padur, D. Wagner* - Microbial communities' structure and development of de-glaciated areas in two glacier forefield regions on Larsemann Hills, East Antarctica.

17:15 – 17:30 *Arwyn Edwards (Aberystwyth University), B. Sattler, A. Anesio, S. Rassner, B. Hubbard, W. Perkins, M. Young, G. Griffith* - Cryoconite holes as ice-cold hot-spots of microbial diversity and activity

17:30 – 17:45 *Katherina Hell (Universität Innsbruck), J. Zarsky, B. Sattler* - Effect of snow melt on the bacterial diversity in the accumulation zone of a high arctic glacier

17:45 – 18:45 **Poster, Wein und Bier**

20:00 – 21:00 **Abendvortrag: Piccardsaal - Obergurgl**
Helmut Rott (Universität Innsbruck) - Gletscher und Meeresspiegel

Dienstag, 7. September 2010

Polare Meere

09:00 – 09:30 **Eingeladener Vortrag**
Jörn Thiede (University of Copenhagen), Lester Lembke-Jene - Scientific Drilling in High Northern Latitudes

09:30 – 09:45 *Lester Lembke-Jene (AWI Bremerhaven), J. Thiede, B. Wolff-Boenisch, R. Azzolini, N. Biebow, O. Eldholm, P. Egerton* - Investigating Polar Oceans with the European Research Icebreaker AURORA BOREALIS: the Scientific and Operational Context

09:45 – 10:00 *Erki Tammiksaar (Jakob-von-Uexküll-Zentrum, Tartu)* - Strömungen im Nordpolarmeer – Vorstellungen im 19. Jahrhundert und deren Entwicklung

10:00 – 10:15 *Leonid Timokhov (AARI, St. Petersburg), I.M.Ashik, I. Dmitrenko, H. Kassens, J. Hoelemann, S. Kirillov, A. Novikhin, I.V. Polyakov, V.T. Sokolov* - Anomalous changes of the Arctic Ocean and Siberian Seas during IPY 2007/2008 and possible consequences

10:15 – 10:30 *Jens Hölemann (AWI Bremerhaven), T. Krumpen, S. Kirillov, T. Klagge, H. Kassens, L. Timokhov* - Arctic Change and Polynyas: A closer look at the Laptev Sea (Siberian Arctic)

Kaffeepause

11:00 – 11:15 *Dorothea Bauch (IFM-GEOMAR, Kiel), I. A. Dmitrenko, J. A. Hölemann, H. Kassens, S. A. Kirillov, T. Krumpen, A. Nikulina, L. Timokhov* - Stable oxygen isotope investigation in the Laptev Sea coastal polynya during April 2008 and April 2009: Impacts of the polynya on the water mass structure of the Laptev Sea shelf and the Arctic Ocean halocline

11:15 – 11:30 *Frank Nissen (AWI Bremerhaven), R. Stein, A. Hegewald, T. Dufek, J. Matthiessen, W. Jokat* - Grounded Pleistocene Ice Sheets or Ice Shelves on the Medeleev Ridge and East Siberian Continental Slope (Arctic Ocean)

11:30 – 11:45 *Eberhard Fahrbach (AWI Bremerhaven), M. Hoppema, G. Rohardt, O. Boebel, O. Klatt, A. Wisotzki* – Erwärmung des Tiefen- und Bodenwassers im Weddellmeer

11:45 – 12:00 *Hartmut Hellmer (AWI Bremerhaven), O. Huhn, R. Timmermann, M. Schroeder* – On the freshening of the northwestern Weddell Sea continental shelf

12:00 – 12:15 *Claudia Hanfland (AWI Bremerhaven), I. Stimac, W. Geibert* – High productivity in an ice melting hotspot at the eastern boundary of weddell Gyre

12:15 – 12:30 *Hannes Grobe (AWI Bremerhaven), Dieter K. Fütterer, Evgeny Gurvich, Heinz Miller, Rainer Sieger* – Alfred Wegeners Großkontinent und die Datenbibliothek der Polarforschung

Mittagspause

DFG-Schwerpunktprogramm 1158:
Antarktisforschung mit vergleichenden Untersuchungen in arktischen Eisgebieten

14:00 – 14:15 *Martin Melles (Universität Köln)* - Introduction and Overview

Antarctica in the Earth System

14:15 – 14:45 **Eingeladener Vortrag**
Karsten Gohl (AWI Bremerhaven), A. Denk, F. Wobbe, T. Kalberg, A. Lindeque, G. Uenzelmann- Neben, E. Weigelt – Linking tectonics and West Antarctic ice sheet dynamics

14:45 – 15:00 *Oliver Huhn (Universität Bremen), M. Rhein* – Boden- und Tiefenwasserbildung und Export im atlantischen Sektor des südlichen Ozeans

15:00 – 15:15 *Michael Weber (Universität Köln), G. Kuhn* – Ice-sheet retreat and paleoceanography in the Weddell Sea, Antarctica

15:15 – 15:30 *Michael Raupach* (Forschungsinstitut Senckenberg, Deutsches Zentrum für Marine Biodiversitätsforschung, Wilhelmshaven), *J. Dambach, F. Leese* – Roads, highways and trails to Antarctica: case studies of Crustaceans based on molecular markers

Kaffeepause

Development of the Continent

16:00 – 16:30 **Eingeladener Vortrag**
Christoph Held (AWI Bremerhaven), K. Pöhlmann, S. Agrawal, F. Leese - The importance of physical isolation of the Southern Ocean for the long-term stability of polar adaptations

16:30 – 16:45 *Frank Lisker (Universität Bremen), A. L. Läufer* – Uplift and exhumination of the Transantarctic Mountains: a new, consistent concept

16:45 – 17:00 *Robert Schöner (Universität Jena), L. Viereck-Götte, B. Bomfleur, J. Schneider, M. Elsner, U. Berner, M. Abratis, R. Gaupp, H. Kerp* - Initiation of magmatism in the Ferrar Large Igneous Province: Insights from multidisciplinary research in North Victoria Land, Antarctica

17:00 – 17:15 *Malte Thoma (AWI Bremerhaven), K. Grosfeld, C. Mayer, F. Pattyn* - Subglacial Lake Vostok: Impact of the basal mass balance of subglacial lakes on the ice sheet.

17:15 – 17:30 *Magnus Lucassen (AWI Bremerhaven)* - Adaptability of Antarctic fish to climate factors: Transcriptomic profiling and functional implications

Arbeitskreise

17:30 – 18:30 Glaziologie
17:30 – 18:30 Geologie
17:30 – 18:30 Geodäsie

Mittwoch, 8. September 2010

Adaption to Severe Climate

09:00 – 09:30 **Eingeladener Vortrag**
Gerhard Kuhn (AWI Bremerhaven), F. Niessen - Stabilität und Variabilität des Westantarktischen Eisschildes archiviert in glazialmarinen Sedimenten (ANDRILL) auf dem antarktischen Schelf

09:30 – 09:45 *Christine Wesche (AWI Bremerhaven), W. Dierking* - Eisberge und Meereis in SAR Bildern

09:45 – 10:00 *Ulf Karsten (Universität Rostock), J. Wölfel, A. Wulff, C. Wiencke* - Structure and function of benthic diatom assemblages in polar waters - biomass, primary production and ecophysiological performance

10:00 – 10:15 *C. Printzen (BiK-F), S. Domaschke, F. Fernandez, F. Mendoza* - Photobiont selection as a way of ecotypical differentiation in widespread lichens? A case study on Cetraria aculeata

10:15 – 10:30 *Hans-Ulrich Peter (Universität Jena), M. Kopp, S. Lisovski, M. Ritz, R. Phillips, S. Hahn* - Migration, Phylogeographie und Nahrungsökologie antarktischer Skuas (Catharacta antarctica lonnbergi & C. maccormicki)

Kaffeepause

Dynamics of Climate Components

11:00 – 11:30 **Eingeladener Vortrag**
Eberhard Fahrbach (AWI Bremerhaven), A. Behrend – The Sea Ice Thickness in the Atlantic Sector of the Southern Ocean

11:30 – 11:45 *Günther Heinemann (Universität Trier), R. Timmermann, L. Ebner, V. Haid* - Eis-Ozean-Atmosphäre Wechselwirkungen im westlichen Weddell-Meer: Hochaufgelöste Simulation mit COSMO und FESOM

11:45 – 12:00 *Michiel Rutgers v. d. Loeff (AWI Bremerhaven), C. Venchiarutti, J. Friedrich* - Natürliche Radionuklide im Südozean: ein Beitrag zu GEOTRACES

12:00 – 12:15 *Sascha Willmes (Universität Trier), C. Haas, M. Nicolaus* - Hemisphärische Unterschiede im Verlauf der Schneeschmelze auf Meereis. Eine Analyse kombinierter Modell- und Fernerkundunsgstudien.

12:15 – 12:30 *Sieglinde Ott (Universität Düsseldorf), E. Ullrich, J.-P. de Vera* - The effect of climate components on lichen symbiosis at habitats of North Victoria Land, Antarctica

Mittag

Ab 14:00 **Exkursion zum Rotmoosferner**

Donnerstag, 9. September

Klima und Atmosphäre

09:00 – 09:30 **Eingeladener Vortrag**
Lothar Viereck-Goette (Universität Jena) – Volcanic Eruptions Under Ice

09:30 – 09:45 *Solveig Estrada (BGR Hannover), F. Henjes- Kunst, D. Damaske, F. Tessensohn* - Die verschwundenen Vulkane an der Nares Strait und der Island-Plume

09:45 – 10:00 *Martin Melles (Universität Köln), J. Brigham- Grette, P. Minyuk, C. Koeberl, El'gygytgyn Scientific Party* - The El'gygytgyn Drilling Project, NE Siberia: Operational Success in 2008/09 and First Results

10:00 – 10:15 *Elisabeth Stütz (Universität Innsbruck), A. Gohm, F. Obleitner, A. Dörnbrack, R. Baumann* - Dynamically and thermally driven flows over and around Svalbard: A case study based on numerical simulations and airborne measurements

10:15 – 10:30 *Ingeborg Levin (Universität Heidelberg), D. Wagenbach, R. Weller* - Verifizierung globaler Emissionen anthropogener Treibhausgase anhand langzeitiger atmosphärischer Beobachtungen in hochpolaren Gebieten

Kaffeepause

Schnee und Eis

11:00 – 11:15 *Andrea Fischer (Universität Innsbruck)* - Comparison of direct and geodetic mass balance on a multi-annual time scale

11:15 – 11:30 *Wilfried Korth (Beuth Hochschule, Berlin), U. Hofmann* - Wiederholungsmessung des Höhenprofils über das Inlandeis Grönlands

11:30 – 11:45 *Daniel Steinhage (AWI Bremerhaven), H. Oerter, J. Schwander, C. Wesche, M. Bock, P. Kaufmann, F. Wilhelms* - Ergebnisse der glaziologischen Feldkampagne 2007 und früherer Befliegungen zur Untersuchung der Struktur des Halvfarryggen, Antarktis

11:45 – 12:00 *P. Bohleber (Universität Heidelberg), R. Drews, A. Heilig, H. Konrad, O. Eisen, D. Wagenbach* - How cold glaciers in the summit region of the Alps may add to polar glaciological research

12:00 – 12:15 *Christoph Elsässer (Universität Heidelberg), D. Wagenbach, H. Oerter, A. Wegner, M. Hansson, A. Wallner* - What may be learned from cosmogenic Beryllium-10 measurements in near surface Antarctic firn?

12:15 – 12:30 *Olaf Eisen (AWI Bremerhaven), Y. Kristoffersen, C. Hofstede, A. Lambrecht, C. Mayer, R. Blenkner* - Vibroseismics on ice sheets and shelves

Mittag

14:00 – 16:00 DGP-Mitgliederversammlung

Kaffeepause

16:30 – 17:30 Poster, Wein & Bier

Arbeitskreise

17:30 – 18:30 Permafrost
17:30 – 18:30 Geschichte

Freitag, 10. September 2010

Mensch und Polargebiete

09:00 – 09:30 **Eingeladener Vortrag**
Gerlis Fugmann (Justus-Liebig Universität Giessen) – Inuit auf neuen Wegen

09:30 – 09:45 *Wolfgang Schöner (ZAMG Wien), B. Sattler, A. Richter* - Die Österreichische Gesellschaft für Polarforschung

09:45 – 10:00 *Mare Pit (IASC Potsdam), V. Rachold* - The International Arctic Science Committee (IASC) - an Overview

10:00 – 10:15 *Cornelia Lüdecke (Universität München)* - "Endkampf um den Südpol" - Das Internationale Geophysikalische Jahr (1957-1958) in deutschen Medien

10:15 – 10:30 *Andreas Kaiser (Fachhochschule Mainz), L. Kindermann* – ICEBERG Ruhr 2010

Kaffeepause

11:00 – 11:15 *Wolfgang Schöner (ZAMG Wien), B. Sattler, M. Panzenböck* – Linking polar research to school – experiences from Austria

11:15 – 11:30 *Sabine Motzkus (AWI Bremerhaven), C. Kopsch* – Virtuelles Klassenzimmer – Unterricht der AWIPEV Station

11:30 – 11:45 *Heidemarie Kassens (IFM-GEOMAR, Kiel), V. Dmitriev, N. Kakhro, N. Kaledin, E.-M. Pfeiffer, V. Troyan,* - German-Russian Master Program for Applied Polar and Marine Sciences POMOR: A Unique International Experience in Educational Cooperation

Polare Meere

11:45 – 12:00 *Olaf Boebel (AWI Bremerhaven), M. Breitzke, E. Burkhardt, H. Bornemann* - Strategic Assessment of the Risk Posed to Marine Mammals by the Use of Airguns in the Antarctic: Concepts, Methods, Results and Controversies

12:00 – 12:15 *Ilse Van Opzeeland (AWI Bremerhaven), S. Van Parijs, L. Kindermann, O. Boebel* - Acoustic ecology of marine mammals in the Antarctic coastal ocean

12:15 – 12:30 *Ansa Lindeque (AWI Bremerhaven), K. Gohl* - Deep sea seismic stratigraphy of the Amundsen Sea and Ross Sea, West Antarctica: Preliminary results of the first linking record

Mittag

14:00 – 14:15 *Mirko Scheinert (Technische Universität Dresden), A. F. Zakrajsek, R. Dietrich, L. Eberlein, S. A. Marenssi* - Gezeitenmessungen in der Antarktis: Von historischen Messungen der Ozeangezeiten zur Gezeitengravimetrie im IPY-Projekt POLENET

Schnee und Eis

14:15 – 14:30 *Daniel Binder (ZAMG Wien), W. Schöner, B. Hynek, G. Weyss, M. Olefs , J. Abermann* - Examining Glacial Hydrology of a Glacial Lake Outburst Flood at the A. P. Olsen Ice Cap by means of Ground Penetrating Radar Data

14:30 – 14:45 *Christoph Mayer (LRZ-BAdW München), M. Thoma, K. Grosfeld, M. J. Siegert, A. Wright* - Subglacial Lake Regimes, the hydrological conditions at the bottom of the Antarctic Ice Sheet

14:45 – 15:00 *Gernot Groemer (ÖWF)* - Permafrost on Mars

15:00 – 15:15 *Izabela Szuman (Adam Mickiewicz University Poland), M. Ewertowski* - Conceptual model of ice sheet - permafrost interaction (Last Glacial Maximum, Central - Western Poland)

15:15 – 15:30 *Estella Weigelt (AWI Bremerhaven), K. Gohl, G. Uenzelmann-Neben, R. Larter* - Ice sheet variations in the western Amundsen Sea Embayment as depicted in seismic data

Kaffeepause

Arbeitskreise

16:00 – 17:00 Lehrer

Samstag, 11.09.2010 / Sonntag, 12.09.2010

Exkursion Hochjochhospiz (ganztägig mit Übernachtung)

POSTERLISTE

S. Adams, S. Willmes, T. Krumpen, J. Hölemann, G. Heinemann
Ableitung von Dünneisdicken in der Laptev See Polynya aus hochaufgelösten Eisoberflächentemperaturen

O. Boebel, L. Kindermann, H. Klinck, G. Rohardt
Long term CTD Observations Under the Ekström Ice Shelf at the PALAOA Acoustic Observatory

D. Damaske, G. Jentzsch, A. Läufer, P. Schindler
Interpretation gravimetrischer und magnetischer Daten in der Region Nordviktoria-Land, Antarktis, hinsichtlich der Krustenstruktur und der Geometrie der wesentlichen Störungssysteme

D. Damaske, S. Estrada, B. Schreckenberger, G. Oakey
Aeromagnetic Anomalies over northern Ellesmere Island, Canadian Arctic, and their Geological Interpretation

A. Denk, K. Gohl, F. Wobbe
Analysis of helicopter- and shipborne magnetic data in the Amundsen Sea Embayment, West Antarctica

R. Drews, O. Eisen, W. Rack, D. Steinhage, I. Weikusat
Anisotropic backscatter in ice-penetrating radar data: potential mechanisms and implications

L. Ebner, M. Bauer, G. Heinemann
Mesozyklonenverfolgung und Sensitivitätsstudien in der Antarktis

A. Friedrich, G. Heinemann, S. Willmes
Untersuchung der Polynjadynamik im Weddellmeer-Gebiet mit Hilfe von Fernerkundungsdaten

L. Füreder, J. E. Brittain
Are High Arctic stream food webs linked to catchment properties?

N. Gentsch
Landscape controls of organic C content and fraction composition in permafrost soils, Central Siberia

V. Haid, R. Timmermann, G. Heinemann, L. Ebner
Simulation of coastal polynyas and associated ocean processes in the western Weddell Sea

C. Hanfland, T. Michler- Cieluch, C. Sprengel, J. Bijma
Postgraduate Education: The Helmholtz Graduate School for Polar and Marine Research (POLMAR)

S. Härtel, H.H. Christiansen
Formation and Dynamics of Holocene Syngenetic Ice-Wedge Polygons in Adventdalen, Svalbard, Norway

A. Holzinger, D. Remias, C. Lütz
The arctic ice alga Ancylonema nordenskiöldii – ultrastructure and physiological potential

V. Ivanets, O. Tyshchenko, I. Parnikoza, I. Kozeretska, P. Convey
Reproductive structures in Bryophyta from the Argentine Islands as regional warming indicators

D. Janussen, C. Göcke
Porifera (Sponges) of the deep Weddell Sea, Antarctic: Preliminary results from the ANDEEP-SYSTCO expeditions, 2002-2008 with RV "Polarstern"

G. Jentzsch, A. Capra, R. Ricker, P. Schindler
Geodynamics of North-Victoria-Land, Antarctica, derived from GPS and micro-gravity measurements

N. John, R. Schöner, R. Gaupp
The Permian Beacon Supergroup of North Victoria Land, Antarctica: Evolution of a fluvial system

E. Kaup, B. Sharma
RESPONSE OF LAKES TO HALF CENTURY HUMAN IMPACT - SCHIRMACHER OASIS, ANTARCTICA

L. Kindermann, D. P. Zitterbart , E. Burkhardt, O. Boebel
Detection and Tracking of Whales Using a Ship-Borne, 360° Thermal Imaging System

C. Knöfel, J. Hartmann, Y. M. Ryvkin, Y. V. Orlov, V. V. Lukin, R. Dietrich, A. Y. Matveev, V. P. Grebnev
Langzeitige Eisoberflächenhöhenänderungen aus wiederholten geodätischen Beobachtungen im Einzugsgebiet des Hays-Gletschers, Enderby-Land/Antarktis

C. Kopsch
Was verbindet die Arktis mit dem Fläming?

S. Korsun, I. Kozeretska, I. Parnikoza
The influence of natural and anthropogenic agents on the chemical composition of soils in the maritime Antarctic

I. Yu. Parnikoza, O. I. Kozeretska, I. O. Andreev, V. A. Kunakh
Terrestrial vegetation analysis on the Argentine Islands Archipelago

A. Lambrecht, C. Mayer, A. Surazakov, D. Floricioiu, V. Aizen
Variations of a large, high elevation glacier during the last century: Fedchenko Glacier, Pamir

J. Lindow, C. Spiegel, J. Johnson, J.A. Smith, F. Lisker, K. Gohl
Exhumation and deglaciation history of Marie Byrd Land and Ellsworth Land, West Antarctica – First constraints from apatite (U-Th-Sm)/He dating

E. Lipka, I. Szuman
Reconstruction of ice-flow patterns in central Poland

H. Matthes, A. Rinke, K. Dethloff
Regional characteristics of extremes and variability in Arctic temperature

B. May, D. Wagenbach, P. Steier, W. Haeberli
Prospect and limitations in radiocarbon dating of Alpine ice

F. Müller, E. Magnússon, H. Rott, T. Nagler, D. Floricioiu
Comparison of TerraSAR-X Ice Motion Retrieval with In-Situ GPS Data at Breidamerkurjökull, Iceland

N. Neckel, R. Drews, O. Eisen, W. Rack, D. Steinhage
Surface velocities and mass flux in the vicinity and hinterland of the Neumayer III station (Antarctica)

M. Nicolaus, S. Hudson, S. Gerland
Observations of spectral albedo and transmittance of sea ice and its snow cover

H. Oerter
Schneepegel-Messungen im Umfeld der Georg-von-Neumayer und Neumayer-II Stationen in den Jahren 1982-2008

H. Poigner, D. Wilhelms-Dick, D. Abele
Trace metals in Antarctic bivalve shells - Indicators of environmental change

J. Prenzel, F. Lisker
Werkzeuge zur Untersuchung antarktischer Hebungsprozesse und deren Grenzen

T. Sanders, C. Fiencke, E.-M. Pfeiffer
Ammonia oxidizing Bacteria and not Archaea dominate in the permafrost-affected soils on Samoylov Island in the Lena River Delta, Siberia

M. Scheinert
Schwerefeld und Geoid in der Antarktis

E. Schlosser, J. G. Powers, E. Isaksson, H. Oerter
The precipitation regime of Dronning Maud Land, Antarctica – implications for ice core interpretation

H. Schröder, S. Hoffmann, G. Kuhn, F. Niessen, D. Schmitt, T. Wonik
Physical properties of sedimentary rocks from the AND-2A borehole, ANDRILL Southern McMurdo Sound Project, Antarctica

J. Schweers, S. Krause, L. Hamdan, T. Treude
Methane cycling in sediments of the Beaufort-Sea (Arctic Ocean): Potential impacts of Global Change

B. Standhartinger, B. Sattler, R. Psenner
Bacterial biodiversity in ice and glacier caves in the Alps and Antarctica

M. Stober
Aktuelle Tendenzen zur Veränderung des Inlandeises in Bereich des Swiss Camps (West Grönland) und zur Fließgeschwindigkeit des Eqip Sermia Gletschers.

M. Thoma, K. Grosfeld, C. Mayer, A. M. Smith, J. Woodward, N. Ross, M. Siegert
Tipping temperatures within Subglacial Lake Ellsworth, West Antarctica

R. Treffeisen, P. Lemke, K. Dethloff
On the importance for climate science communication – the climate office for polar regions and sea level rise

J. Wagner, A. Gohm, A. Dörnbrack, A. Schäfler
The mesoscale structure of polar lows - simulations and airborne measurements

C. Walther, A. Rinke, C. Knöfel, R. Dietrich, K. Detloff
Comparison of Antarctic total water vapour from measurements, reanalyses and regional climate simulations

C. Wegner, D. Bauch, J. Hoelemann, I. Dmitrenko, S. Kirillov, H. Kassens, L. Timokhov
Interannual variability of sediment transport dynamics on the Laptev Sea shelf (Siberian Arctic)

H. Wiesel, G. Delisle, B. Kuczewski, U. Herpers, M. Altmaier
Vereisungsgeschichte von Queen Maud Land (Antarktis) – neue Daten zum Freilegungsalter von Nunatakern südöstlich des Wohlthat Massivs

J. Zarsky
Nitrogen cycling in aquatic ecosystems in the high Arctic: Contribution of microbial communities in periglacial lakes and cryoconite holes

VORTRAGSKURZFASSUNGEN

- alphabetisch nach Name der/des Erstautorin/Erstautors sortiert -

Lichens of continental Antarctic: biodiversity, geography and ecology

Mikhail P. Andreev

Komarov Botanical Institute, Laboratory of Lichenology & Bryology, St. Petersburg, Russian

Known lichen flora of Antarctic continent excluding Antarctic Peninsula, which situated mainly in different physic-geographical zone, at present numbers 133 species. Approximately it comes to tierce of the whole lichen flora of Antarctic concerned together with Subantarctic, which estimated in all around 500 lichen species. Previously 83 species was indicated for the continental Antarctic (Øvsedal, Lewis Smith, 2001). Many areas around the continent, from the Schirmacher oasis (Dronning Maud Land) in the West to the Walgreen Coast (Ellsworth Land) in the East, mainly near Russian Antarctic stations, were visited and investigated lichenologicaly during the last decade. Local lichen floras of nine continental oases in Eastern and Western Antarctic were studied in depth and some areas were visited and investigated only briefly. Numerous lichen specimens were collected in all available ice- and snow-free areas in various habitats and on different substrates: rocks, stones, ground, and mosses and were identified using standard methods.

The highest diversity of lichens and the most rich lichen vegetation were discovered in large oases, situated in Eastern Antarctic in the heart of the continent, distantly (100-200 km) from the ice barrier: in Schirmacher oasis, near Radok Lake in Prince Charles Mountains and on Bunger Hills (Queen Mary Land). Extensive areas situated further south, and inaccessible up till now (like Mawson Escarpment, Wohlthat Massiv, Sør Rondane Mountains etc.) can presume high enough lichen diversity and rather rich vegetation as well.

The most rich local lichen floras – of Schirmacher oasis and of Bunger Hills are not studied completely yet, but number already now more than 65 and 46 species correspondingly. Small coastal oases and nunataks number normally less than 30 species. The comparative richness of the foregoing lichen floras caused presumably by large total areas of oases, because of that by higher diversity of habitats, and by higher level of investigation. The poorness of flora and vegetation in compare with Subantarctic areas and with Arctic and Alpine territories is caused by the extreme harsh environmental and climate conditions. Most important for natural occurrence, normal growth and reproduction of lichens in Antarctic are deficit of liquid water and of nitrogen, short vegetative period, high level of solar radiation and abrasive influence of sand and snow. Low temperatures, inaccessibility and high level of insulation of ice-free land reduce distribution opportunity for lichens and other plants. The rock substrates are more stable and let to have better protection for organisms. The majority of lichens under such specific conditions is crustose and saxicolous. Communities and associations of foliose and fruticose lichens are rarer and occur in well-protected places. Sand and fine detritus stabilized by permafrost become stable enough to be used as a normal substrate for saxicolous species. Moss cushions in moist and wind-protected depressions are the best substrate for many crustose and foliose epibryophytic lichens, ensure the richest vegetation in such habitats. The luxuriant vegetation is more typical for the habitats situated near bird's nests, snowbeds and other sources of melted water and nitrogen, and for protected places: north-exposed slopes, depressions and cracks in rocks and boulders. The most common and dominant lichen species on the majority of ice-free territories are *Usea sphacelata*, *Pseudephebe minuscula*, *Umbilicaria decussata, Umbilicaria aprina, Rhizoplaca melanophthalma, Lecidea cancriformis, Lepraria alpina, Buellia frigida, Acarospora gwynnii, Candelariella flava, Rinodina olivaceobrunnea* etc.

Geographical structures of local lichen floras and of the whole flora of the continent are almost the same. Two big groups – of bipolar species (*Amandinea punctata, Caloplaca citrina, Carbonea vorticosa, Lecidella stigmatea, Physcia caesia, Umbilicaria decussata* etc.) and the lichens with endemic Antarctic distribution (*Buellia frigida, Candelariella flava, Carbonea assentiens, Xanthoria mawsonii* etc.) take almost equally around 90% of the flora. Their distribution on the continent could be estimated as disjunctive circumpolar. Minority of lichens has more narrow distribution in Antarctic – magellanic (areas of distribution are concerned with South America), peninsular (concerned with Antarctic Peninsula region or maritime Antarctic) or subantarctic (predominantly concerned with Subantarctic islands). Specific local endemic species absent on the continent in spite of high level of territorial insulation, but because of the youth of Antarctic flora, similarity of environmental conditions in all parts of Antarctic, and of significant hardiness of lichens.

Microbial communities structure and development of de-glaciated areas in two glacier forefield regions on Larsemann Hills, East Antarctica.

Felizitas Bajerski, Lisa Padur, Dirk Wagner

AWI Potsdam

The progressing climate change is causing a decrease of glaciated areas in cold adapted habitats, whereby new terrain is becoming exposed to soil formation and accessible for microbial colonisation. Microorganism are known to play an important role in primary succession and podogenesis of these areas, but Antarctic terrestrial microbial communities are still hardly investigated and only little data are available. Especially in the view of climate change it is essential to get more information about the development of freshly exposed glacier forefields regarding the microbial communities' structure and their dependence on habitat formation. Furthermore, unaffected glacier forefields provide a unique opportunity as a natural laboratory to study the functional diversity of microbial life and its areal and temporal development in extreme environments. The understanding of this special microbial system is quite necessary, because microorganism form the initial basis for the development of the ecosystem.
A polyphasic approach, containing geochemical and microbiological examinations, will be used to describe the habitat characteristics and the complex system of microbial communities. The DFG-Project "Development and function of microbial communities in a glacial forefield chronosequence on Larsemann Hills, East Antarctic" (WA 1554/9-1), integrated in the Priority Programme 1158 "Antarctic Research with Comparable Investigations in Arctic Sea Ice Areas", is primarily focused on the structure and development of de-glaciated areas in two glacier forefield regions. The Larsemann Hills are located on the Ingrid Christensen Coast of Princess Elizabeth Land in Prydz Bay, Eastern Antarctica (69°30'S, 76°20'E). The study site is characterised by an ice-free area of approximately 50 km^2 and a marine influenced continental climate leading to intensive physical weathering processes. Neither initial vegetation nor soil formation processes could be observed in the research area.
First geochemical results in the "Glacier Transect" chronosequence showed low values for water (0.24 to 3.69%), carbon content (<0,1 to 0,4%) and conductivity (4.9 to 55.9 µs/cm). Measurements in the samples of the second transect "Black Valley" resulted in little higher water (0.22 to 14.86%), carbon content (<0.1 to 1.96%) and conductivity (5.2 to 75.0 µs/cm). The pH-values ranged from pH 4.86 to pH 8.49 for the Glacier Transect and from pH 5.98 to pH 6.91 for the Black Valley Transect. Water content and pH-value decreased in the Glacier Transect chronosequence with an increasing distance to the glacier, in which the water content was higher in the deeper sediment than in the upper layers and surfaces samples. All Black Valley Transect samples had similar pH values between pH 6 and pH 7. According to the horizontal distribution there is a positive correlation between water content and increasing depth, whereas the carbon content is higher in the upper layers. The soil parameter data determined so far do not show a clear gradient within the Black Valley Transect.
Current microbiological examinations, e.g. fingerprinting methods like DGGE (Denaturing Gradient Gel Electrophoresis) and T-RFLP (Terminal-Restriction Fragment Length Polymorphism), shall provide a general over-view of the microbial community structure and distribution. DGGE analyses with general bacterial primers GC_341F and 907R produced around 21 bands per soil sample in the Glacier Transect and around 24 bands per soil sample in the Black Valley Transect. In both transects the banding pattern indicated a higher diversity (more bands) in the vicinity of the glaciers. The trend, suggesting decreasing band numbers with increasing distance to the glacier, will have to be confirmed with T-RFLP analyses. Culture-dependent methods have also been carried out. Enrichment cultures from both study sites could be obtained by plating soil solutions on BR-media (Bunt-Rovira, 1955) and Reasoner's 2A agar (R2A, Reasoner und Geldreich, 1985; Merck). Both media were used to determine the number of cultivable heterotrophs. In the Glacier Transect there were between $0.3*10^5$ CFU/g soil (R2A) and $0.7*10^5$ CFU/g soil (BR). Colony counts in the Black Valley Transect revealed a significantly higher number of $18*10^5$ CFU/g soil (R2A) and $101*10^5$ CFU/g soil (BR). Several heterotrophic aerobic bacteria were isolated and cultivated at 10°C. The present geochemical and microbiological results suggest a higher microbial quantity and diversity in the Black Valley Transect than in the Glacier Transect. A gradient along the chronosequences could be assumed but will have to be proven in further analyses. Future studies shall elaborately characterise the microbial communities and their development in dependence of habitat properties. Stable isotope probing will be carried out to determine active microorganisms and enzyme activity tests will give an insight into the functional meaning of the predominant microbial species in the habitat. Direct cell counts with DAPI as well as the abundance of genes through real

time PCR will detect the quantity of microorganism along the chronosequence.

Stable oxygen isotope investigation in the Laptev Sea coastal polynya during April 2008 and April 2009: Impacts of the polynya on the water mass structure of the Laptev Sea shelf and the Arctic Ocean halocline

Dorothea Bauch[1], Igor A. Dmitrenko[1], Jens A. Hölemann[2], Heidemarie Kassens[1], Sergey A. Kirillov[3], Thomas Krumpen[2], Anna Nikulina[1], Leo Timokhov[3]

[1]Leibniz Institute of Marine Sciences, Kiel
[2] AWI Bremerhaven
[3]Arctic and Antarctic Research Institute, St. Petersburg, Russia

The vast Siberian shelf regions cover more than 1/3 of the total Arctic Ocean area and receive fresh water from several huge rivers, which are primarily the Ob and Yenisey rivers in the Kara Sea and the Lena River in the Laptev Sea. The Lena River is one of the largest Siberian rivers and runoff is released onto the Laptev Sea shelf mainly during summer [e.g. Létolle et al., 1993]. During winter the Siberian shelves are ice covered and polynyas and flaw leads are opened repeatedly by off-shore winds and freeze up again accordingly [Bareiss and Görgen, 2005; Zakharov, 1966]. The Siberian shelves supply freshwater to the Arctic Ocean halocline and are main production areas for arctic sea-ice. As a result brine waters are produced and exported to the Arctic Ocean halocline as well as to the Arctic Ocean bottom and deep waters [Bauch et al., 1995, 2009]. An important question is therefore the feedback of these processes with the ongoing climate change. During the ice covered season atmosphere and ocean are largely decoupled and the reoccurring polynyas and flaw leads have therefore a major impact on the shelf hydrology. The goal of our study is to examine the role of the Laptev Sea coastal polynya in modifying the Laptev Sea shelf bottom hydrography and thereby its potential impact on the structure of the Arctic Ocean halocline.

Helicopter based observations were carried out during April 2008 and April 2009 in 10 to 800 m distance from the fast ice edge contouring the offshore perimeter of the West New Siberian (WNS) coastal polynya at about 20 to 30 m water depth. Stable isotope results ($\delta^{18}O$) in combination with hydrographic results can be used to identify the different freshwater sources (and sinks). Low salinity river water is strongly depleted in its stable isotope composition. Brine waters released during sea-ice formation into the water column can also be clearly identified, since sea-ice processes strongly influence the salinity balance of the water column with only a minor effect on the $\delta^{18}O$ values of the water.

In April 2008 we observed vertical mixing within the polynya with sea-ice formation events as well as wind-driven on-shelf near-bottom saline water intrusions. During the wind driven opening of the Laptev Sea coastal polynya vertical mixing resulted in uniform T-S and stable isotope profiles. The salinity and $\delta^{18}O$ signature of this polynya water reveals relatively large fractions of brines, but also a relatively large fractions of river water as a result of the wind driven vertical mixing. Our data confirm the formation of Laptev Sea bottom waters within the Laptev Sea coastal polynya.

The overall correlation between salinity and $\delta^{18}O$ reveals two well defined mixing lines in April 2008. The waters from the surface layer and inner shelf regime fall on a relatively low salinity mixing line between river water and the locally formed polynya water. A high salinity mixing line is present between the locally formed polynya waters and the waters from bottom water intrusions. At the beginning of our measurement campaign a high salinity bottom layer with relatively cold water was present. After a phase of polynya activity a warm intrusion was observed to replace the bottom layer in the entire study area. Both bottom layer intrusions show a relatively small influence of brine and river water and cannot be isotopocally distinguished. Therefore it might be speculated, that the warm as well as the cold bottom layer have a common remote origin, but have taken a different modification history on the shelf.

The dataset from April 2009 shows no uniform pattern in its salinity and $\delta^{18}O$ correlation and is thereby in contrast to observations made in April 2008. Stations sampled in April 2009 reveal no uniform polynya water and the dataset shows no common mixing lines. Due to technical limitations during winter, both winter datasets are locally strongly restricted compared to summer datasets. Nevertheless the dataset from April 2008 reflects the shelf hydrography observed during summer over the central und eastern Laptev Sea and documents the importance of the Laptev Sea polynya for the entire shelf hydrography. The dataset from April 2009 on the other hand seems to be dominated by local processes. The observed differences in the polynyas impact on the water mass structure of the Laptev Sea may in consequence result in an altered export of waters from the Laptev Sea to the Arctic Ocean halocline [Bauch et al., 2009]. Future studies

have to investigate, how frequent the observed states in the impact of the polynya on the water structure is.

The Sea Ice Thickness in the Atlantic Sector of the Southern Ocean

Axel Behrendt, Eberhard Fahrbach

AWI Bremerhaven

Sea ice covers millions of square kilometers of the Earth's ocean surface. Therefore it significantly regulates the surface fluxes of water, heat and momentum between the ocean and the atmosphere. Moreover, sea ice is important for the climate on Earth because: It hampers gas exchange between ocean and atmosphere, it reflects a large portion of sunlight and it contributes to the formation of deep and bottom waters which are part of the global ocean circulation. Examining the changes of sea ice has thus become an important field in Earth System Science.
Thickness and extent are the two main characteristics of a sea ice cover and are important indicators of climatic changes. Sea ice extent is measured with microwave sensors from satellites since 1979 and shows a large-scale retreat of Arctic sea ice. Also the ice thickness in the Arctic reduced, as shown by upward sonar measurements from submarines since 1953. With the rapid decline of Arctic sea ice, also the Antarctic sea ice cover has attracted more scientific interest. The extent of Antarctic sea ice shows a small but significant positive trend for the period since satellite measurements began. But contrary to the Arctic, our knowledge about the long-term development of Southern Ocean sea ice thickness is still very limited. There are two main reasons for this lack of information: (1) The thickness of sea ice is still not routinely measured from space with sufficient accuracy and (2) there are no submarine measurements of ice draft for the Antarctic. But various airborne and in-situ techniques – like electromagnetic induction sounding, laser altimetry, ship-based observations and drilling- have been successfully applied in different regions of the Southern Ocean. However, the data gained by these methods are often biased towards thin ice and provide only short snapshots of the ice thickness.
To date, the only way of monitoring the long-term variations of the sea ice thickness in the Southern Ocean are moored upward looking sonars (ULSs). These instruments are attached to the upper end of a mooring rope and can measure over periods of up to two years. The basic principle of a ULS draft measurement is transmitting ultrasonic sound pulses towards the surface and measuring the travel time of the reflected sound signal. Knowing the sound velocity, the travel times can be converted into distances. With the precise knowledge of the instrument depth, the detected time intervals can be used to calculate the thickness of the subsurface portion (draft) of the sea ice. The Alfred Wegener Institute (AWI) maintains an array of 13 ULSs in the Atlantic sector of the Southern Ocean since 1990, which provides a unique dataset of Antarctic sea ice thickness.
This presentation introduces the ULS-dataset and shows first results of the variability of sea ice thickness in the Weddell Sea. One goal of this project was to assimilate all available ULS-data that have been processed by different methods since 1990. The obtained dataset shows, that the monthly mean sea ice thickness at the tip of the Antarctic Peninsula decreased by almost two meters since 1990. Contrary, the ice thickness near the Fimbul Ice Shelf in the southeaster n Weddell Sea shows a positive trend for the period 2000-2008.
As there were still gaps in the thickness record due to instrument failure or loss of moorings, the missing data for the eastern Weddell Sea were filled by an iterative method based on multichannel singular spectrum analysis (M-SSA). The resulting time series span a period of 12 years and enable the assessment of interannual variability. Whereas thickness changes in the eastern Weddell Sea show no distinct trend, significant changes occurr close to the Antarctic, in the region of the Antarctic coastal current.

Examining Glacial Hydrology of a Glacial Lake Outburst Flood at the A. P. Olsen Ice Cap by means of Ground Penetrating Radar Data

Daniel Binder[1], Wolfgang Schöner[1], Bemhard Hynek [1], Gernot Weyss[1], Marc Olefs[1], Jakob Abermann[2]

[1]Department of Climatology, Central Institute for Meteorology and Geodynamics (ZAMG), Vienna, Austria
[2]Institute for Meteorology and Geophysics, University of Innsbruck, Austria

Glacial Lake Outburst Floods (GLOFs) are natural hazards threatening an increasing amount of people living near glaciated areas. Caused by the chaotic characteristics of a GLOF, forecasting is a very challenging business and only a few made the attempt to

really quantitatively solve this problem. Comparing GLOF events of different field sites and even of the same field site often give an inconsistent picture indicating the existence of many outburst mechanisms. However, beside the non-linear behaviour of the outburst mechanism itself, the hydrology of a glacier is a key question.
The Austrian IPY contribution FERMAP aimed the East of Greenland. Based at the Danish Research Station Zackenberg (74°28'N, 20°34'W) two adjacent glaciers (Freya Glacier and A. P. Olsen Ice Cap) were of main interest. Ground Penetrating Radar (GPR) was applied to yield snow cover- and ice thickness distribution for the two glaciers. During the gathering of ice thickness data of the South East pointing outlet glacier of the A. P. Olsen Ice Cap (74°38'N, 21°26'W) dominant englacial and subglacial reflections drew attention to itself. Dominant englacial and subglacial reflections are all located downwards in flow direction of the remaining structures of a lake outburst. The glacial stream of the investigated outlet glacier drains into the Zackenberg River , which passes directly the Zackenberg Research Station. In the period of 1997-2008 floods were documented qualitatively by photos and quantitatively by discharge data, showing obvious peaks. Registered floods mostly occurred in the period July-November. Following these observations the noteworthy englacial and subglacial reflections are most likely part of a channel system conducting water of outburst flood through the glacier. Gathered GPR data were analyzed to gain informations about channel dimensions and fillings and englacial/ subglacial pathway(s) of the water. Furthermore the mapped water pathway(s) will be compared with modelled pathway(s).

Spatial and temporal pattern of snow and ice area extent in late summer in various glacier regions of the world observed by Landsat

Gabriele Bippus[1], Helmut Rott[1, 2]

[1]ENVEO IT, Innsbruck, Austria
[2]Institute of Meteorology and Geophysics, University of Innsbruck, Austria

As contribution to the GlobGlacier project of the European Space Agency, data of the Landsat Thematic Mapper (TM) since 1984 and Landsat Enhanced Thematic Mapper Plus (ETM+) since 1999 are used to investigate changes in snow / ice area extent at end of summer on glaciers in the Chugach and Kenai Mountains (Alaska), Ötztal and Stubai Alps (Austria / Italy), North Patagonian Icefield (Chile), Jotunheimen / Breheimen (Norway), and Kashmir Himalaya (India / Pakistan). A semi-automated algorithm has been developed to derive late summer snow / ice area (LSSIA) extent from topographically corrected Landsat data, requiring as input orthorectified optical satellite scenes, digital elevation model (DEM) and glacier outlines, as available from the Global Land Ice Measurements from Space (GLIMS) project.
In order to determine the snow / ice area extent, which is a useful proxy for the accumulation area ratio (AAR), the acquisition date of the satellite data is critical. Images should be taken as close as possible to the date with maximum extent of the ablation area. As Landsat sensors are measuring in the optical and infrared spectral range, cloud-free scenes or sub-scenes are required. Therefore repeat observations of individual glaciers are sometimes separated by several years in time. Nevertheless, a suitable data base is available for studying multi-year trends in accumulation patterns over the selected regions.
For snow / ice area mapping the near infrared band of Landsat data is used, due to saturation on snow and ice areas in the visible bands. After radiometric calibration, a topographic correction is applied following Ekstrand's method in order to reduce topographically induced illumination effects. The effect of DEM accuracy on the topographic correction and the retrieval of the LSSIA is investigated. The new ASTER GDEM, available since June 2009, is used for glaciers in the Alps, Norway, and Alaska. For a sub-set of Alpine glaciers high resolution national DEMs are employed as well for comparison. For Patagonia and Kashmir Himalaya the DEM of the Shuttle Radar Topography Mission (SRTM) is preferred because the ASTER GDEM shows on some of the glaciers large errors. The processed scenes are combined with glacier outlines, and finally a manually selected threshold is applied on the topographically corrected near infrared band to derive the LSSIA.
The resulting LSSIA maps are combined with the DEM to get an altitude distribution of late summer snow areas on glaciers. Late Summer Snow Lines (LSSL) are derived by vectorizing snow maps. The snow / ice area extent is used as proxy for the AAR and the elevation of LSSL is used as proxy for the equilibrium line altitude (ELA). Applying published relations between net mass balance and AAR or ELA, the mass balance of individual glaciers is estimated from the LSSIA and LSSL data.
The Landsat analysis is applied to study temporal and spatial patterns of mass balance on selected glaciers in different climate zones.

Relevant data sets are available for the years 1986 / 1987, 1999 / 2000, and 2009 / 2010.
The satellite data enable to estimate glacier mass balance for complete mountain ranges by extrapolating field measurements made on individual glaciers. The spatial pattern of LSSIA can be mapped for glacier regions world-wide, based on satellite data sets available in the archives since the mid 1980s. The GlobGlacier project and planned follow on activities are aimed at exploiting this data set in support of climate research.

Strategic Assessment of the Risk Posed to Marine Mammals by the Use of Airguns in the Antarctic: Concepts, Methods, Results and Controversies

Olaf Boebel[1], Monika Breitzke[1,2], Elke Burkhardt[1], Horst Bornemann[1]

[1]AWI Bremerhaven
[2]University of Bremen

Over the past two years, the AWI prepared a comprehensive, strategic assessment of the risk posed to marine mammals by the use of airguns for scientific, geophysical research in the Southern Ocean around Antarctica. The study attempts distinguishing between aspects of *analysis* (based on scientific knowledge and numerical calculations) and *evaluation* (based on a set of risk criteria and associated thresholds). The term *assessment* is used to describe the overall process, involving both *analysis* and *evaluation*.
The *analytical* part commences with a synopsis of environmental (oceanographic and bathymetric) and operational characteristics from all seismic expeditions that had been conducted in the Antarctic by the AWI. This resulted in a set of 4 basic environmental scenarios, which, combined with a set of 6 airgun configurations, were used to calculate single shot acoustic fields (sound pressure level (SPL) and sound exposure level (SEL)) by numerical (finite difference 2.5 D full waveform) modelling for a realistic ocean of 10x10 km dimension, resulting in a total of 24 different acoustic scenarios [Breitzke and Bohlen, 2010].
The current state of ecological knowledge was compiled for the 14 cetacean and 6 pinniped species to which the Antarctic represents an important habitat. Ecological and physiological information such as dive cycles and hearing curves are subsequently used to guide estimations of cumulative exposure levels and to develop mitigation measures.

The identification of hazards – including associated evaluation criteria and threshold levels –provides the critical link between the sound propagation *analysis* and the risk *evaluation*. As currently no legally binding set of numerical threshold levels exists for this ocean region, we conducted a review of the pertinent literature. Three different risk categories were identified, for which a set of evaluation criteria was extracted from primarily three recent overview articles: (1) Southall et al., [2007], which provides numerical thresholds for the risk of "direct, immediate injury"; (2) Cox et al., [2006], from which a list of "abetting factors" was extracted for the risk of "indirect, immediate damage", i.e. the so-called beaked whale scenario; and (3) The National Research Council [2005], which suggests a set of mostly qualitative evaluation criteria for the risk of "biologically significant acoustic disturbance".
By applying these criteria to the modelled acoustic fields (under the assumption of the ship following a straight course), critical exposure radii were calculated for single and multiple exposures. Finally, the resulting risk for individual animals and ensuing risks at the population level were evaluated by including information on species status and migratory behaviour, considering operational scenarios both with and without proposed mitigation measures in place.
The analysis reveals that the risk for a marine mammal to incur "direct, immediate injury" from multiple exposures cannot be excluded in the immediate (up to several 100 m) vicinity of the airgun clusters, whereas "indirect, immediate damage" of an individual appears rather unlikely. A risk of "biologically significant acoustic disturbance", while negligible for juveniles and adults, cannot be excluded for the (merely hypothetical, hitherto unobserved) possibility of acoustically induced mother/calf separations. However, a possible manifestation of any of these risks depends on a whale actually being within the respective acoustic range of the ship. This results in a negligible probability for any of these risks at a population level, with the exception of a "not to be excluded" possibility of population level consequences for the Antarctic blue whales due to the abovementioned (hypothetical) possibility of mother/calf separations. The probability of this later impact is however estimated to be smaller than estimates of the natural mortality rate or of the PBR (possible biological removal), as used in other contexts.
Noting the a) large existing gaps in the knowledge pertinent to this issue, and b) the fact that marine mammal behaviour is not fully predictable for an individual animal, it is unavoidable to base parts of such assessments on extrapolations of the current best

knowledge, statistical descriptions of typical behaviour and even on educated guessing. When such steps had to be taken here, we attempted to adhere to a *conservative* approach in our calculation and evaluation of contingent risks. The term *conservative* thereby stands for a selection of parameters or proxies, which chooses those that overestimate the risk while providing increased protection for the marine mammal. Nevertheless, with the risk *evaluation* being critically dependent on the thresholds used, it is no surprise that some selections made in this study are met with disagreement when discussed with various stakeholders. It is with these controversial issues (to be presented in detail at the meeting), that the scientific community's expertise and guidance – preferably in form of peer reviewed publications - would be most helpful to further develop balanced and objective risk assessments acceptable to the majority of stakeholders.

How cold glaciers in the summit region of the Alps may add to polar glaciological research

Pascal Bohleber[1], Reinhard Drews[2], Achim Heilig[1], Hannes Konrad[1], Olaf Eisen[1,2], Dietmar Wagenbach[1]

[1]Institut für Umweltphysik, Universität Heidelberg
[2]AWI Bremerhaven

The non-temperated glacier saddle Colle Gnifetti (Monte Rosa summit range, 4500m asl) offers polar properties regarding englacial temperature and accumulation rate, but differs greatly from polar areas through its strong horizontal gradients of almost all glaciological parameters. Accordingly, this well characterized glacier constitutes an ideal target for pilot-studies dedicated to innovative polar research attempts. In this context, the LIMPICS project ("linking micro-physical properties to macro features in ice sheets with geophysical techniques") currently deploys instruments on the Colle Gnifetti drilling site, among others, for combining seismic pilot studies with routine ground-penetrating radar (GPR) soundings. Here we report on our attempt linking GPR reflectors to the stratigraphical information on impurity and physical properties obtained from our dense ice core array made up by four down-to-bedrock cores. By evaluating clear reflector signals confined to the upper (firn) section we were able to successfully link the ice core quartet by GPR horizon series allowing for mapping dated isochrones over the last 100 years. Thereby, we obtained an independent consistency assessment of the core chronologies and a detailed picture on the 3D accumulation distribution greatly improving the interpretation of the ice core derived isotope temperature record. Finally, we briefly outline our concept for investigating the origin of GPR reflectors deploying dielectrical and chemical ice core data. Supported by a relatively simple glacier flow model this attempt is eventually aimed at deriving the areal extension of the punctual ice core information (a challenge we meet on the large scale polar ice sheets as well).

Biological soil crusts from Antarctic Dry Valleys: composition and photosynthetic capacity

Claudia Colesie, Prof. Dr. Burkhard Büdel

Department of Biology, University of Kaiserslautern

Biological soil crusts (BSCs) can be found in all dry areas of the world, including the polar regions. In the McMurdo Dry V alley region (Antarctica), these conglomerates of soil, cyanobacteria, algae, microfungi, lichens, and bryophytes are one of the very rare terrestrial photoautotrophic communities. Biological soil crusts occur sporadically in this ice-free dry valley region with its arid climate where the availability of water is regular and reliable (Green, 2001).
Recent findings of biological soil crust in these regions (Diamond Hill 79°50'31.6"S, Garwood Valley 78°01'399 "S) lead to the suggestion that soil crusts may occur further south and under harsher conditions than previously expected. Those soil crusts were mainly dominated by green-algal lichens like *Acarospora gwynnii* C.W. Dodge & E.D. Rudolph or *Caloplaca citrina* (Hoffm.) Th. Fr. Cyanobacterial soil crusts (mainly dominated by *Nostoc commune* (Vaucher) ex Bornet & Flahault) can be found along shores. Experimental CO_2 -gas-exchange measurements of this BSCs (including at least 5 mm of soil underneath the photoautotrophic organisms) allow to establish a model of net carbon fixation under different environmental conditions. The following were experimentally changed: incident light (0-1500 µ E); temperature (- 2° to 7° C), and water content reflecting natural realities. Our analyses revealed that there is photosynthetic activity at temperatures below 0 °C. In accordance with the high light intensities dry valley organisms have to compete with, the light-saturation-point was reached at 750 µE. Optimum temperatures for net photosynthesis were reached at 5° C.

Average net photosynthesis rates at –2 °C exceeded those of the respiration rates at the same temperature by a factor of 8. Respiration rates were generally low and strongly correlated with temperature. The chlorophyll content of the soil crusts was used as reference value for metabolic activity and demonstrated a surprisingly high result with 157 mg Chl $_{a+b}$ /m² (n=3; std dev.:46,6 mg Chla$_{+b}$ /m²). In the investigated area crust coverage ranged from 0.8 to 1.0%.

Bestimmung der Eismassenbilanz von Antarktika und Grönland mittels Satellitendaten

Reinhard Dietrich[1], Andreas Groh[2], Heiko Ewert[1]

[1]Institut für Planetare Geodäsie, TU Dresden
[2]Universität des Saarlandes, Saarbrücken, Germany

Die Satelliten-Schwerefeldmission GRACE erlaubt es, Massenänderungen im System Erde zu untersuchen. Im Beitrag werden die Daten der GRACE-Mission genutzt, um aktuelle Massentrends für Antarktika und Grönland zu bestimmen. Dabei werden auch einzelne Einzugsgebiete grosser Gletschersysteme analysiert. Die Satellitenmission ICESat diente dazu, mittels Laseraltimeter genaue Oberflächenhöhen zu bestimmen. Es werden die Daten dieser Mission genutzt, um ebenfalls Variationen und Trends für Antarktika und Grönland zu bestimmen. Die Ergebnisse beider Datensätze werden gemeinsam interpretiert. Der Beitrag Antarktikas und Grönlands zum aktuellen Meeresspiegelanstieg wird abgeschätzt.

Cryoconite holes as ice- cold hot-spots of microbial diversity and activity

Arwyn Edwards[1], Birgit Sattler[2], Alexandre Anesio[3], Bryn Hubbard[4], William Perkins[4], Michael Young[1], Gareth Griffith[1]

[1]Institute of Biological, Environmental & Rural Sciences, Aberystwyth University, UK
[2]Institute for Ecology, Innsbruck University, Austria
[3]Bristol Glaciology Centre, School of Geographical Sciences, Bristol University, UK
[4]Institute of Geography & Earth Sciences, Aberystwyth University, UK

A common assumption that glaciers and other elements of the cryosphere are devoid of life is challenged by a growing body of evidence supporting the concept of a glacial ecosystem which is dominated by microbes. Recent work demonstrates that microbial communities in cryoconite holes on glacier surfaces make underestimated yet significant contributions to global biogeochemical cycles. Less is known about the extent of microbial diversity in cryoconite, and our research objective is to redress this imbalance. This talk will outline work conducted over the last four years on cryoconite sediments collected from three glaciers in the High Arctic archipelago of Svalbard in 2006 and 2007 in collaboration between UK and Austrian researchers. Advanced molecular analyses of microbial diversity in these sediments demonstrate the presence of a rich and diverse microbial community indigenous to these cryoconite holes. These studies show that the structure of the bacterial community within each hole is closely related to the levels of microbial activity within the hole and in turn glacier-specific physico-chemical conditions. Insights afforded b y these studies suggest the possibility of interactions between the cryoconite hole microbial community and the dynamics of the glacier upon which it resides, which may prove significant due to its implications.

Vibroseismics on ice sheets and shelves

Olaf Eisen[1], Yngve Kristoffersen[2], Coen Hofstede[1], Astrid Lambrecht[3], Christoph Mayer[4], Rick Blenkner[2]

[1]AWI Bremerhaven
[2]University of Bergen, Norway
[3]Institute of Meteorology and Geophysics, University of Innsbruck, Austria
[4]BAdW Munich

We present first-time-ever results of active seismic measurements on an ice shelf with a vibroseismic source. The overall goal of this pilot study was to investigate the feasibility of vibroseismic operations on a porous firn layer to image ice and sedimentary structures and stratigraphies. Conventional explosive seismic surveys require the time- and energy intensive drilling of 10-20 m deep boreholes to reach denser firn to avoid strong attenuation and ground roll. In contrast, vibroseismics can be operated directly from the surface. Vibro- and explosive seismic measurements were conducted in the 2009/10 field season in Dronning Maud Land, Antarctica, within the LIMPICS project. A Failing Y-1100 vibrator mounted on a truck on skis with a total mass of

16 t was used on the Ekstr^misen ice shelf near Neumayer III, where ice is about 100-200 m thick and overlies about the same amount of water. A 60 channel snowstreamer was used for data acquisition. Measurement geometry yields 120 channels with 6.25 m group spacing. Moreover, calibrated hydrophones deployed in the water column underneath the ice shelf at PALAOA were used for quantifying propagating energy and wave characteristics. This enables us to determine absolute amplitudes of the two sources, reflection and absorption coefficients. Within several days, a total of 28.3 km of vibroseismic and 5.6 km of explosive seismic profiles were acquired. Our results show that the vibroseismic source is at least equal to the explosive source in terms of stratigraphic imaging capabilities. The explosive charge (300 g) yields higher frequencies than the employed vibroseismic 10-100 Hz, 10 s linear sweep but generates stronger ground roll. In combination with a snow streamer the vibroseismic operation with its known source characteristics enables us to easily obtain multi-fold coverage for sophisticated data processing along seismic over-ice traverses in comparably short time periods. We believe that this technique has the potential to considerably advance the utilization of seismic methods for glaciological and geological studies alike. Applications would include the determination of intra-ice properties, conditions at the basal interface and sub-ice geology, e.g. for pre-site surveys for sediment coring such as ANDRILL or the characterisation of subglacial lake environments.

What may be learned from cosmogenic Beryllium-10 measurements in near surface Antarctic firn?

Christoph Elsässer[1], Dietmar Wagenbach[1], Hans Oerter[2], Anna Wegner[1,2], Margareta Hansson[3], Anton Wallner[4]

[1]Institut für Umweltphysik, Universität Heidelberg
[2]AWI Bremerhaven
[3]Department of Physical Geography and Quaternary Geology, Stockholm University, Sweden
[4]Vienna Environmental Research Accelerator, Universität Wien, Austria

Currently ^{10}Be is widely deployed in the investigations of deep Antarctic ice cores, since it basically allows reconstructing the long term variability of solar activity as well as identifying fast changes in the earth's magnetic field. This concept is based on the facts that ^{10}Be is mainly produced by cosmic rays interacting with nitrogen or oxygen of the atmosphere and becomes afterwards immediately attached to atmospheric aerosol particles which eventually deposit onto the ice sheet by precipitation and dry fallout. Hence, ^{10}Be is thought to carry the production signal of cosmogenic radionuclides which is governed by the effective cosmic ray intensity varying along with solar and terrestrial magnetic field properties. However, due to the particulate form of ^{10}Be its concentration measured in firn or ice depends as well on snow accumulation rates, which are strongly variable in space and time. Different to chemical aerosol species this effect may be rather significant for ^{10}Be for which the (primarily interesting) production rate variability is comparably small. Aimed at tackling the problem of distinguishing between production and accumulation rate driven changes in the ^{10}Be ice core signals we analyzed ^{10}Be in snow pits and firn cores at various Antarctic sites strongly differing in their mean annual accumulation rate. Including the coastal region at Neumayer, down and up stream areas to the deep EPICA drilling site at Kohnen as well as the Dome C position, this sample set covers accumulation rates from more than 100 down to a few cm water per year. Evaluation of this unique ^{10}Be data set backed up by direct atmospheric observations at Neumayer and Kohnen Stations revealed that: (i) the spatial distribution of the
typical ^{10}Be concentration in surface firn is controlled by the climatologic accumulation rate which leads to a change in the ^{10}Be level by up to factor of 6. (ii) surprisingly , even the most simple air/ firn transfer model reproduces ^{10}Be at almost all Antarctic sites but fails in case of the Halvfarryggen ice rise (south of Neumayer) where an untypical high (though not yet understood) accumulation rate prevails. (iii) the ^{10}Be related upstream effect for the EDML core may amount up to a factor of 2 over several 100km, hence much higher than the typical production rate related ^{10}Be variability ranging between 20 and 30% only. We will discuss the implications of these findings focusing on the perspective correcting ^{10}Be ice core time series for externally derived accumulation changes and, vice versa, deploying this tracer as paleo-precipitation gauge. Finally, we will assess the expected up-stream influence at the EDML drilling site with respect to aerosol related time series.

Die verschwundenen Vulkane an der Nares Strait und der Island-Plume

Solveig Estrada, Friedhelm Henjes-Kunst, Detlef Damaske, Franz Tessensohn

Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover

Im Paläozän, vor etwa 60 Ma, begannen sich rund um Grönland Meeresbecken zu öffnen (Labradorsee, Baffin Bay, Nordostatlantik; Eurasisches Becken des Arktischen Ozeans), womit der endgültige Zerfall von Laurasia eingeleitet wurde. Grönland war dadurch zunächst von kontinentalen Riftzonen umgeben, die sich erst westlich (Labradorsee und Baffin Bay) und dann östlich (Norwegische und Grönländische See) zu ozeanischen Spreizungszonen entwickelten. Diese Prozesse waren von intensiver vulkanischer Aktivität begleitet. Bekannt sind die großen Flutbasaltprovinzen in West- und Ostgrönland. Als deren Ursache wird nach einer verbreiteten (wenn auch nicht unwidersprochenen) Hypothese die Existenz eines Mantelplumes angenommen, dessen breiter Kopf sich vor 60 Ma unter Zentral-Grönland befunden haben soll. Durch die Plattenbewegungen geriet schließlich der junge mittelozeanische Rücken des Nordatlantiks in den Einflussbereich dieses "Hotspots", was zu verstärktem Vulkanismus und zur Entstehung Islands führte. Erst im April dieses Jahres haben wir die Folgen dieser noch immer andauernden vulkanischen Aktivität auf Island erlebt.

Am Nordwest-Rand von Grönland, im Gebiet der heutigen Nares Strait, bildete sich jedoch kein Ozeanbecken aus. Die Öffnung der Labradorsee und die damit verbundene Nordost-Bewegung Grönlands relativ zu Nordamerika müsste im Paläozän zur Entstehung einer Transform-Störung ("Wegener-Störung") geführt haben. Die Existenz dieser Störungszone wird noch immer kontrovers diskutiert. Jedoch wurden während geologischer Feldarbeiten der BGR Hannover und des GSC Calgary 1998-2000 auf Ellesmere Island am nordwestlichen Rand der Nares Strait links-laterale Strike-Slip-Bewegungen nachgewiesen (Mayr 2008). Diese Bewegungen haben zur Entstehung von Grabenstrukturen mit tiefen Sedimentbecken geführt, vergleichbar mit dem heutigen Jordan-Graben auf der Arabischen Halbinsel. In einigen dieser Becken besteht der klastische Eintrag zu einem großen Teil aus vulkanischem Material (von Miall 1982 erstmals beschrieben). Während der Feldcampagnen gesammelte vulkanische Gerölle wurden petrographisch und geochemisch analysiert sowie radiometrisch datiert. Sie stammen von Laven und Ignimbriten eines stark differenzierten, an inkompatiblen Elementen angereicherten Alkali-Vulkanismus ab (Estrada et al. 2009). $^{40}Ar/^{39}Ar$-Altersdaten an Amphibolen und Feldspäten, die aus den Geröllen separiert werden konnten, beweisen, dass der "Nares-Strait-Vulkanismus" vor etwa 61 bis 58 Ma aktiv war.

Aus dem Chemismus und den Nd- und Sr-Isotopendaten der Gerölle kann abgeleitet werden, dass sich die Schmelzen in mindestens 85 km Teufe gebildet haben und von einem lithosphärischen Mantel abstammen, der isotopisch inhomogen und metasomatisch an inkompatiblen Elementen angereichert war. Die Elementanreicherung muss sich in geologisch relativ kurzer Zeit vor der Schmelzbildung ereignet haben und wurde möglicherweise durch vulkanische Prozesse in der Kreidezeit verursacht. Am Lake Hazen auf Ellesmere Island, westlich von der Fundstelle der vulkanischen Gerölle, befinden sich Erosionsreste kreidezeitlicher, ca. 100 Ma alter Flutbasalte.

Die "alten" Flutbasalte in der kanadischen Arktis (Ellesmere Island, Axel Heiberg Island), werden gemeinsam mit Basalten und Doleriten auf Franz-Josephs-Land und Svalbard sowie dem aseismischen Alpha-Rücken einer "High Arctic Large Igneous Provinz" (HALIP) zugerechnet (Tarduno 1998), die vermutlich ebenfalls durch einen Mantelplume verursacht wurde. Einige Forscher nehmen an, dass der Island-Plume nicht erst vor 60 Ma unter Grönland aufgestiegen ist, sondern schon viel länger existiert hat und auch für die kreidezeitliche HALIP verantwortlich war (Forsyth et al. 1986).

Wo sind die Vulkane von der Nares Strait geblieben? Vulkanbauten oder Reste davon konnten in den eisfreien Gebieten an Land bisher nicht nachgewiesen werden. Sie wurden möglicherweise vollständig erodiert. Eine aeromagnetische Befliegung über der nördlichen Nares Strait 2001 zeigte, dass die vulkanischen Sedimente in den paläozänen Becken am Nordwest-Rand der Nares Strait langgesteckte positive Anomalien des Erdmagnetfeldes verursachen, die sich in die Nares Strait hinein in Richtung Lincolnsee fortsetzen (Damaske & Oakey 2006). Runde Anomalienmuster, die sich östlich davon in der Nares Strait aneinander reihen, könnten evtl. Magmenkammern des verschwunden Vulkanismus nachzeichnen. Dieser Fragestellung soll durch eine weitere aeromagnetische Befliegung, die für 2011 in BGR-Planung ist, nachgegangen werden. Der Nares-Strait-Vulkanismus könnte durchaus weiter verbreitet gewesen sein, als seine "Rückstände" vermuten lassen. Ein weiterer Hinweis dafür könnten vulkanische Aschelagen (Bentonite) in der paläozänen Basilika-Formation auf Spitzbergen sein, deren Chemismus sehr gut mit dem von ignimbritischen vulkanischen Geröllen übereinstimmt. Das könnte bedeuten, dass die Nares-Strait-Vulkane viel

größere Aschewolken produziert haben als zum Beispiel vor kurzem der Island-Vulkan Eyjafjallajökull, was wiederum zu klimatischen Schwankungen im Paläozän beigetragen haben kann.

Erwärmung des Tiefen- und Bodenwassers im Weddellmeer

E. Fahrbach, M. Hoppema, G. Rohardt, O. Boebel, O. Klatt, A. Wisotzki

AWI Bremerhaven

Der Südliche Ozean trägt durch die Bildung des Antarktischen Bodenwassers (AABW) wesentlich zur globalen ozeanischen Umwälzbewegung bei. Im Südlichen Ozean ist das Weddellmeer das Gebiet mit dem bedeutendsten Beitrag. Die AABW-Bildung wird durch den Einstrom von Quellwassermassen, Transformationsprozesse und den Ausstrom des neu gebildeten Wassers bestimmt. Daten, die zwischen 1984 und 2008 auf 8 Wiederholungsschnitten, mit verankerten Geräten und profilierenden Floats im Weddellwirbel auf dem Meridian von Greenwich – meist mit dem FS Polarstern - gewonnen wurden, werden genutzt, um die Veränderungen im Weddell-System zu quantifizieren. Veränderungen wurden im Warmen Tiefenwasser (WDW) mit einem Temperaturmaximum in den 1990ern und einem Minimum in 2005 gefunden. Aber auch in den tieferen Wassermassen traten signifikante Veränderungen auf. Während im WDW dekadische Fluktuationen vorherrschen, wurde als Mittel über die gesamte Wassersäule ein positiver Trend über 24 Jahre gefunden, der durch Fluktuationen im Einstrom in den Wirbel und der Zirkulation in ihm entsteht. Eine mögliche Erklärung dieser Variationen sind Veränderungen in den atmosphärischen Antriebskräften, die zur langfristigen Zunahme von Temperatur und Salzgehalt führen, wodurch das Weddellmeer zum Wärmespeicher über längere Zeiträume wird.

Comparison of direct and geodetic mass balance on a multi-annual time scale

Andrea Fischer

Institute of Meteorology and Geophysics, University of Innsbruck, Austria

Glacier mass balance is a sensitive indicator of climate change. The mass balance results from the amount of ablation and accumulation on a glacier and is directly related to the atmospheric conditions. The mass balance of alpine glaciers is usually measured with the direct or glaciological method involving field measurements of ablation stakes and snow pits. While the direct glaciological method is used for the monitoring of the current mass balance of accessible glaciers, the geodetic method allows the calculation the mass balance of large and remote glaciers and ice sheets as well as the use of historical topographic data to extent time series into the past. This is done by deriving the volume change from surface topography data acquired on different dates. The mass balance between these dates is calculated using additional assumptions or measurements of the density of the surface layer.

To gain information on current mass changes and sea level rise, the geodetic method allows the monitoring of large glacier areas and longer time spans. For the joint analysis of direct and geodetic mass balance data, it is important to know if

-direct and geodetic mass balance differ systematically

-the difference between the direct and the geodetic mass balance depends on the length

-the difference between the direct and the geodetic mass balance depends on the volume change occurring in the period.

To answer these questions, direct and geodetic mass balance data of six Austrian glaciers acquired between 1953 and 2006 are compared in this study. The average length of the 19 periods is 15.2 years, the minimum 2 years and the maximum 53 years. The resulting mean deviation between the geodetic and the direct data is -0.6 m w.e., the minimum difference between the direct and the geodetic method is -7.0 m w.e., and the maximum 5.6 m w.e. The results of these six Austrian glaciers are compared to published data of Griesgletscher, Gulkana Glacier, Zongo Glacier, Storglacieren, South Cascade, Lemon Creek glacier and Storbreen. These data include 25 time periods with an average length of 17.2 years. The longest period is 57 years, the shortest 2 years. The mean deviation between the geodetic and the direct data is -0.2 m w.e., the minimum -7.2 m w.e., and the maximum 3.6 m w.e. The error analysis showed that basal melt, seasonal snow cover and density changes of the surface layer each cause errors in the same magnitude as the mean annual thickness change of Austrian glaciers between 1969 and 1997 which is -1 m. The development of a more than 100 m deep depression on the tongue of Mittelbergferner

between 1997 and 2006 showed that on this specific location basal and surface melt contribute each about 50% to the total ablation.
The direct mass balance measures the mass change taking place at the glacier surface, whereas the volume change measured by the geodetic method also results from internal or basal mass ablation and changes in or misinterpretations of the density of the surface layer, which are not necessarily related to without mass change. Therefore, the geodetic and the direct mass balance differ systematically.
The analysis showed that the difference between the direct and the geodetic method is related to the mass balance within this period and shows specific trends for some glaciers. These specific trends are related to glacier topography and mass balance: valley glacier with pronounced basal runoff system show higher rates of basal melt, whereas glaciers in higher altitudes experience high amounts of accumulation of seasonal snow falls which are causing a misinterpretation of the density of the surface layer. Taking that into account, a general recommendation for a length of the period for the geodetic method can not be given. It turned out, that a longer period does not necessarily result in a higher accuracy of the geodetic mass balance data.
Thus both geodetic and direct mass balance data provide valuable, but complementary information on the glacier mass balance.

Recent observations of the Antarctic ice sheet velocity with high resolution TerraSAR-X radar imagery

Dana Floricioiu, Wael Abdel-Jaber, Michael Eineder

DLR- IMF Oberpfaffenhofen

The knowledge of ice flow and its variations is of great importance for glacier and ice sheet mass balance. The reaction of ice sheets to climate changes and their impact on sea level can not be understand and predicted without knowledge of ice dynamics and the amount of ice discharge to the ocean.
So far the Antarctic Ice Sheet velocity field has been derived mainly from Radarsat-1 data acquired during the Radarsat-1 Antarctic Mapping Project (RAMP) in 1997 and 2000. By rotating the satellite to collect data left of the orbital track, Radarsat-1 was the first Synthetic Aperture Radar (SAR) sensor capable of imaging areas south of about 80°S latitude and to the pole. Although RAMP offered the first high resolution mapping of the entire continent the interferometric coverage below 80°S was limited due to mission constraints.
Eleven years later as part of the International Polar Year (IPY) 2007-2008 the German TerraSAR-X satellite initiated high resolution acquisitions in left looking mode over specific sites close to the South Pole complementary to the Canadian Radarsat-2 who first imaged the entire continent in dual polarization with 150 km swath width and 25 m resolution in late 2008. With only 30 km swath width TerraSAR-X focused on glacier basins and ice streams of high scientific interest located on the Ronne-Filchner and Ross Ice Shelves and in the Transantarctic Mountains.
Pairs of TerraSAR-X data at 11 days intervals and 3 m resolution were acquired starting with October 2008. Most of the data are highly coherent because no melting is present at these latitudes where snow drift or snow fall is minimal. Different methods for ice motion studies based on TerraSAR-X data are presented. For fast moving areas the SAR signal may decorrelate in 11 days, but cross-correlation can be applied to repeat pass amplitude images. The surface velocity vector can be calculated by tracking stable amplitude features which can be easily observed in the crevassed sections of the glaciers and ice streams. On the smoother areas and on slowly moving ice the 11-day repeat pass images are highly coherent. In this case phase interferometry and speckle tracking can be applied because both techniques do not need distinct amplitude features. Although phase interferometry is more accurate than speckle tracking it has the disadvantage to provide only the line of sight component of velocity. The combined techniques allow the calculation of two-dimensional velocity field revealing unique details of ice flow.
An analysis of the dynamics of several glaciers close to the South Pole derived from recent TerraSAR-X images is presented. The highly detailed TerraSAR-X data very clearly delineate flow stripes, shear margins and individual crevasses. On Recovery Glacier system some of the larger crevasses can be observed in both 1997 (Radarsat-1) and 2008 (TerraSAR-X) data allowing for an estimate of the 11-year average surface velocity. For one of its tributary ice streams the entire velocity field from the onset of the fast ice flow to the junction with the main trunk was derived for the first time with TerraSAR-X.

Inuit auf neuen Wegen: Landrechtsverträge und ihr Erbe

Gerlis Fugmann

Department of Geography, University Giessen

Nunatsiavut, the Inuit region in Northern Labrador, has undergone major changes in the last
few years that currently have an impact on the development perspectives of this remote region. Today, Nunatsiavut is the home of ca. 2400 Inuit and Kablunângajuit (Settler) living in five coastal communities. In 2005 the Labrador Inuit were the last Inuit group in Canada to sign a land claim agreement (Labrador Inuit Land Claim Agreement) with the Government of Canada and the Government of Newfoundland and Labrador, concluding a negotiation process that started in 1977. New political institutions on the regional (Nunatsiavut Government) and community level (Inuit Community Governments) were created. Compensation payments, new ownership structures of land, and resource royalty shares opened up new opportunities for the Inuit. At the same time, especially in the economic sector new trends can be witnessed that will have a major effect on traditional economic settings and employment structures. Fisheries, as the traditional economic sector along the Labrador coast is currently struggling and losing its influence whereas mining projects like the Voisey's Bay Nickel Mine of Vale Inco Newfoundland and Labrador Limited are gaining importance. The private sector in the Nunatsiavut communities is trying to profit from those new developments and to contribute to the economy by creating job opportunities for local residents.

The community of Nain is the largest settlement in the region and the administrative centre of the Nunatsiavut Government. Like many northern Aboriginal communities, Nain faces major problems in terms of education, training and job opportunities. It has a high unemployment rate of almost 30 percent. With 47.9 percent of the inhabitants being younger than 25 years of age, the potential workforce is increasing steadily, competing for the only limited number of jobs available in the community. In the 1970s, the cod fishery lost its status as major source of income in Nain. Today, the fish plant, operated by the Torngat Fish Producers Cooperative Society is only able to open for one month a year with financial support by the Nunatsiavut Government. The current local administration names the Nunatsiavut Government, the Inuit Community Government as well as the Labrador Inuit Development Corporation as the three major employers in the community. The Voisey's Bay Nickel Mine, situated only 35 kilometres southwest of Nain, is also impacting the community by creating jobs and spin-off effects for local businesses. In addition to these major employers in Nain, there are a number of small businesses in the private sector supported by various initiatives on the national, provincial (e.g. Regional Economic Development Boards in Newfoundland and Labrador) as well as regional level (e.g. Nunatsiavut Business Centre Inc.).

The following paper is based on a study conducted by the author in Nain in the summer of 2008. The purpose is to illustrate the changes within the community, how small businesses in the community of Nain react to the described changes and what kind of chances they have for future development. Data is derived from semi-structured interviews with local business owners, representatives of the Nain Inuit Community Government as well as the Nunatsiavut Government.

Linking tectonics and West Antarctic ice sheet dynamics

Karsten Gohl[1], Astrid Denk[1,2], Florian Wobbe[2], Thomas Kalberg[1], Ansa Lindeque[1], Gabriele Uenzelmann-Neben[1], Estella Weigelt[1]

[1]AWI Bremerhaven
[2]Univerität zu Köln, Germany

An understanding of the glacial history of the Amundsen Sea Embayment (ASE) and Pine Island Bay (PIB) is essential for proposing models on the future development of the West Antarctic Ice Sheet. This requires an understanding of the tectonic history and knowledge of tectonic features such as lineaments, ridges, sills and basins, because basement morphology and inherited erosional features control the flow direction of ice-sheets and the influx of Circum-Polar Deep Water (CDW). This is an attempt to reconstruct the tectonic history with the aim to search for basement features and crustal boundaries which may be correlated to the flow and dynamics of the ice-sheet. The Amundsen Sea Embayment of West Antarctica is in a prominent location for a series of tectonic and magmatic events from Paleozoic to Cenozoic times. Seismic, magnetic and gravity data from the embayment and PIB reveal the crustal thickness and significant tectonic features. NE-SW trending magnetic and gravity anomalies and the thin crust indicate a former rift zone

which was active during or in the run-up to the breakup process between Chatham Rise and West Antarctica before or at 90 Ma. NW-SE trending gravity and magnetic anomalies, following a prolongation of Peacock Sound, indicate the extensional southern boundary to the Bellingshausen Plate which was active between 79 and 61 Ma. It is likely that the prominent Pine Island Trough follows a structural boundary between the crustal blocks of Ellsworth Land and Marie Byrd Land. Data are shown from the ASE and PIB which can be interpreted in context with the reconstruction of the ice advance and retreat history in this area. Differences in the behaviour of the ice-sheet are shown to exist for the western and eastern parts of PIB due to basement structures affecting the inflow of CDW.

Response of the Siberian methane cycling microbial community to climate changes in Late Pleistocene and Holocene

Juliane Griess[1], Kai Mangelsdorf[2], Dirk Wagner[1]

[1]AWI Potsdam
[2]Deutsches GeoForschungsZentrum (GFZ), Potsdam

Permafrost environments are supposed to be strongly affected by the currently observed global temperature rise. About one third of global soil carbon is preserved in permafrost and an increase in temperature might increase the microbial turnover of recent as well as ancient carbon and cause the release of large amounts of greenhouse gases such as methane. To predict future methane emissions and to estimate the global atmospheric carbon budget, we need to understand the present composition of microorganisms being involved in cycling of methane and know their response to climate changes in the past. Therefore, a combination of quantitative and qualitative analyses of the variations in composition of bacterial and archaeal communities involved in the Siberian methane cycle was accomplished to reveal variations in permafrost deposits of the Holocene and Late Pleistocene. Such an approach was used on permafrost sediments for the first time.

A 23 m long permafrost core drilled in 2002 on Kurungnakh Island, Lena Delta, Siberia, was examined using biogeochemical as well as microbiological methods. The interpretation of our data was done in context of a paleoclimate reconstruction based on pollen analysis at the same site (Schirrmeister et al., 2002). The sediments of Kurungnakh achieve different climatic stages: cold & dry, warm & wet, Holocene warming. As a general result it is shown that it was possible to recover lipid biomarkers and amplifiable DNA throughout the Kurungnakh permafrost sequence with an age of up to 42 ka. First analyses of glycerol dialkyl glycerol tetraethers (GDGTs) were conducted. GDGTs provide paleo-signals of archaeal and bacterial communities, since these lipids are already partly degraded but their core lipids are relatively stable outside intact cells. Highest amounts of ether lipids were found in the upper layer and at the bottom of the core. Total GDGT contents show highest concentrations with 495 ng/g sediment at 122 cm depth, with 70 ng/g sediment at 1184 to 1745 cm and with about 400 ng/g sediment at 2320 cm depth, whereas GTGTs are dominated by bacterial branched GDGTs. Generally, the results of GDGT analyses correlate to measured contents of total organic carbon (TOC) and concentrations of *in-situ* methane in the deposits.

Furthermore vertical variations of archaeal biomarkers such as archaeol, caldarchaeol and crenarchaeol could be detected. Archaeol concentration varied between 3.84 and 62.5 ng/g sediment. The highest amounts were measured on top and bottom of the core and at a peak at 1745 cm depth. These changes are probably caused by changing compositions of archaeal communities as a response to temperature changes.

To complete our information on the qualitative composition of microbial communities, DNA-based analyses using DGGE and clone libraries were conducted using archaeal and methanotrophic specific primer combinations. Fingerprints of archaeal 16 S rRNA gene sequences of the different permafrost samples show distinct variations in the microbial community composition within the vertical profile. Sequence analyses showed a diversity of methanogens affiliated with *Methanobacteriaceae*, *Methanosarcinaceae* and *Methano-microbiaceae*. Highest diversity of methanogens could be detected at depth of 1507 cm and 1745 cm, which were also characterized by high amounts of archaeol, whereas samples with a low amount of archaeol showed only less diversity.

Additionally the presence of aerobic methanotrophic communities was analysed using diploptene (Hop-22(29)ene) as a characteristic biomarker. We suggest that this marker reflects fossil communities of methane oxidizing bacteria being present during time of sedimentation of the respective deposits (former upper "aerobic" active layer). The variability of the diploptene distribution correlates to measured rates of methane and content of TOC. The presence of high amounts

of diploptene might be caused by the release of considerable amounts of methane being substrate to the aerobic methanotrophic communities in former active layer. This process is stimulated by temperature since content of diploptene increases with warming events. We suggest that paleo methane emissions from permafrost appear to be higher during warmer periods.
Both biogeochemical as well as microbiological methods revealed variation within the composition of past and present microbial communities and showed indications of response to climate changes.

Alfred Wegeners Großkontinent und die Datenbibliothek der Polarforschung

Hannes Grobe, Dieter K. Fütterer, Evgeny Gurvich, Heinz Miller, Rainer Sieger

AWI Bremerhaven

Das Alfred-Wegener-Institut betreibt seit 15 Jahren eine Datenbibliothek für die Erdsystemforschung, die nach dem Großkontinent benannt wurde, in dem vor 200 Millionen Jahren alle Kontinente vereint waren: PANGAEA. In diesem Sinne führt das System Daten von zur Zeit 80 000 Parametern aus der hohen Atmosphäre bis in die tiefe Erde aus allen Bereichen der Geosphäre zusammen. Die Georeferenzierung in Zeit und Raum, eine konsistente und internationalen Standards folgende Formatierung in Kombination mit moderner Datawarehouse-Technologie ermöglichen es beliebige Teilmengen aus dem Gesamtbestand in Sekunden zu extrahieren. Webservices verteilen die Inhalte als zitierfähige Einheiten über Suchmaschinen, Bibliothekskataloge und Portale. Teil eines jeden Datensatzzitates ist ein dauerhafter Identi kator (DOI) als langfristig zuverlässiger Verweis auf jedes digitale Objekt. In Kooperation mit Verlagen können Supplements zu Publikationen in Pangaea abgelegt werden und erscheinen dann automatisch auf der entsprechenden Seite der Zeitschrift. Das System kann auch selbst als Verlagssystem für die Publikation von Daten verwendet werden. Pangaea steht jedem Projekt, Institut oder einzelnen Wissenschaftlern für die Ablage ihrer Daten zur Verfügung. Entsprechend den Vorgaben der Zuwendungsgeber werden die Daten unter der Creative Commons Attribution Lizens im Open Access bereitgestellt.
Im Rahmen der Datenarchäologie mit Pangaea werden Altdaten digitalisiert und maschinenlesbar zur freien Verfügung gestellt - 3 Beispiele:
(1) Im Internationalen Polarjahr wurden die bisher nicht elektronisch verfügbaren und somit wissenschaftlich kaum ausgewerteten Daten des ersten IPY (1882-1883) digitalisiert und 2010 auf CD publiziert.
(2) Alle Artikel der Zeitschrift „Polarforschung" wurden gescannt, mit einer Texterkennung verarbeitet und über das Publikationsrepository des AWI verfügbar gemacht. „Polarforschung" ist seit 2010-03 eine im *„Directory of Open Access Journals"* (DOAJ) eingetragene Zeitschrift. Alle in „Polarforschung" publizierten Daten wurden über Pangaea als elektronische Supplements erfaßt.
(3) Im Rahmen des ARCOD Projektes wird eine Bestandsaufnahme von Daten aus russischen Archiven durchgeführt. Im ersten Teil konnten Daten aus der Arktis digitalisiert werden und mit den verfügbaren Metadaten, z.T. ins englische übersetzt, über Pangaea zur allgemeinen Nutzung zur Verfügung gestellt werden.

Permafrost on Mars

Gernot Groemer

Österreichisches Weltraum Forum, PolAres; Institut für Astro- und Teilchenphysik, Universität Innsbruck, Austria

The planet Mars has a cryosphere which is similar to its terrestrial counterpart, including the presence of permafrost detected with remote sensing techniques from the Mars orbit. This water repository is generally considered as one of the hotspots for astrobiology, allowing to sustain liquid subsurface water due to brine pockets under certain conditions.
In the framework of the PolAres programme of the Austrian Space Forum the exploration of these Martian sites is simulated under Mars-analogue conditions, including the development of a highly realistic spacesuit simulator dubbed "Aouda". Preliminary tests have been carried out at the Pasterze glacier in Austria as well as subsurface locations such as the Koppenbrueller-Cave in Upper Austria.
We report on the operational lessons learned when studying permafrost repositories under simulated space exploratio conditions.

Ice-ocean-atmosphere interactions in the western Weddell Sea: high-resolution simulations using COSMO and FESOM

Günther Heinemann[1], Ralph Timmermann[2], Lars Ebner[1], Verena Haid[2]

[1]Dept. of Environmental Meteorology, University of Trier
[2]AWI Bremerhaven

We perform high-resolution simulations in the Weddell Sea region using the non-hydrostatic atmosphere model COSMO with a newly implemented thermodynamic sea ice model. Global GME data with 40 km resolution provide the initial and boundary conditions for COSMO runs with 15 km resolution covering most of the Antarctic. In a second nesting step, the results of the COSMO 15 km simulations are used for runs with 5 km resolution covering the Weddell Sea area. A further dynamical downscaling to a resolution of 1km is also possible for subareas of the Weddell Sea. The COSMO simulations are designed to resolve mesoscale systems such as mesocyclones and the katabatic wind system, which are of major importance for physical processes in the Antarctic. Due to the limitations of remote sensing techniques and in-situ measurements, numerical simulations are a valuable tool to investigate mesoscale systems and ice-ocean-atmosphere interactions in the Antarctic. Results are presented for realistic cases studies of mesocyclones and katabatic wind events in the Weddell Sea area. The impact on the formation of coastal polynyas and the associated heat release from the ocean into the atmosphere is investigated.
For the simulation of oceanic processes we configured the Finite-Element Sea-ice Ocean Model FESOM on a grid that combines a global model domain with a high resolution (< 3 km) area along the coasts of the Weddell Sea. Simulations are performed with forcing data from NCEP reanalysis, fields from GME, and from the high-resolution COSMO simulations, and are compared with coarse-scale model runs. The signature of coastal polynyas is visible already in simulations with 1.5° horizontal resolution, however mostly as a reduced ice thickness. In the high-resolution experiments, polynya signature is much sharper. We clearly see reoccurring areas of strongly reduced or zero ice concentration and high negative fresh water flux (i.e. strong salt input) along the eastern coast of the Antarctic Peninsula and in front of the Ronne Ice Shelf, but also off Brunt Ice Shelf and Riiser-Larsen Isen. In case of the coarse grid, these small-scale polynyas appear rather blurred; merely the polynya located at Ronne Basin and the high freezing rates over Berkner Bank show as local maxima of negative fresh water flux.
Vertical profiles of temperature and salinity at a location at the outer edge of Ronne Basin, where coastal polynyas recurrently form, clearly show the differences between the simulations at different resolutions. While the coarse grid features a stratified ocean with a cold surface layer and Modified Warm Deep Water (MWDW) below, the high-resolution grid allows for a distinct polynya to form. Higher salt input in this case leads to stronger convection and to a ventilation and erosion of the warmer subsurface water. Formation of High Salinity Shelf Water (HSSW) and an almost homogeneously mixed subsurface water column at this location are the results. In both cases, summer melt and the effect of advection are sufficient to freshen the surface water considerably. While this summer signature reaches depths of about 400m in the high-resolution case, it is confined to the top 100 m in the coarse-scale simulation. High-resolution simulations show plumes of cold water forming at the southwestern corner of the continental shelf, flowing down the slope, subsequently mixing with the warmer water masses around, while drifting north. Signatures of similar cold water plumes have been observed during the ISPOL campaign in summer 2004/2005.

The importance of physical isolation of the Southern Ocean for the long-term stability of polar adaptations

Christoph Held[1], Kevin Pöhlmann[1], Shobhit Agrawal[1], Florian Leese[2]

[1]AWI Bremerhaven
[2]Ruhr University of Bochum

The fauna of the Antarctic has long been recognized as being uniquely adapted to one of the harshest environments in the world's ocean which is emphasized by the high degree of species living only in the Southern Ocean. Recent molecular work on bottom-living invertebrates demonstrates that although the shelf is inhabited by different species of ecologically very similar species they tend to be most closely related to one another while maintaining a more distant relationship to species living at lower latitudes. Although any kind of genetic specialization in principle opens new avenues to cope with special climatic conditions in the Antarctic, on the other hand the genetic basis to adaptation is under pressure from influx of differently adapted organisms from outside the Southern Ocean. It

has long been held that the physical isolation of the Antarctic marine fauna realized by the opening of the Drake Passage to deep waters and the establishment of the Antarctic Circumpolar Current have provided this isolation over more than 20 million years. The genetic structure of a species, i.e. the spatial distribution of genetic variance within a single gene pool, provides a meaningful insight into the processes that may lead to discontinuous distribution of intraspecific genetic variance and thus, over evolutionary times, to the generation of new species. We have estimated the amount of gene flow in three species of invertebrates between isolated habitats inside the Antarctic and the Magellan province using fast evolving molecular markers. Our results indicate that there is no clear correlation between the genetic homogeneity of a species and the magnitude of physical and oceanographic barriers between parts of its distribution area. Instead, the realized dispersal depends on biotic factors, which in extreme cases can override physical parameters and lead to long-distance gene flow even in species which seem otherwise ill-equipped to overcome significant barriers to dispersal. Our data indicate that physical isolation of the Southern Ocean was not the single most important circumstance that enabled the Antarctic fauna to evolve in isolation from the fauna from lower latitudes. Ã☒n times of accelerating environmental change in Antarctic waters this may mean that the Antarctic fauna will increasingly be subject to invasion of less strongly adapted species from outside the Southern Ocean.

Effect of Snow Melt on the Bacterial Diversity in the Accumulation Zone of a High Arctic Glacier

Katherina Hell, Jakub Zarsky, Birgit Sattler

Institute of Ecology, University of Innsbruck, Austria

The biota of the cryosphere gain increasing interest. Astonishingly, little is known about the activity, compositions and shifts of the inhabiting microbial communities and the fate of organic and inorganic matter inside the snow pack so far. Driven by the ongoing snow melt throughout the arctic, microorganisms inhabiting the snow pack undergo transformations in their community structure and subsequently in their activity. As a consequence airborne pollutants and nutrients deposited on the snow cover could be transformed and relocated by the different changing microbial communities.

As microbial activity inside of snow packs manly depends on the availability of liquid water, former dormant cells could literally be revived by the snow melt and thus, in all probability, lead to a shift in the structure of the microbial community. Metabolism and enhanced transport mechanisms by melt flow of nutrients and depositions in snow will result in biogeochemical cycling processes inside the snow. As a result, these flows will eventually reach the underlying ice cover of a glacier and ice sheet, respectively, being made available for other trophic levels. In order to better understand the consequences of the snow-melt more investigations about the triggering processes of biogeochemical cycling are required.

The role of bacteria in cycling nutrients is apparent. It has been shown that supraglacial microbial communities with adequate nutrient supplies can be involved in cycling carbon with rates of global significance. But until now, nothing is known about the shift of microbial communities in connection with depositions on snow and their cycling. As nitrogen is a critical element in the Arctic, due to the high rates of atmospheric depositions, the snow inhabiting microorganisms could form the first possible ecosystem, where nitrogen could be transformed and relocated.

However, there is a lack of field data of the activity of microbial cells under in situ conditions. By determination of the microbial communities and their potential to use atmospheric depositions as nutrients or even accumulators we intend to close the gap of knowledge between airborne pathways and subsequent cycling from the snow pack to the ice bodies such as glaciers and ice sheets.

The scientific focus of this investigation aims at the most vital interdisciplinary problems of the climatic change and future development of Arctic ecosystems: Namely biological activity and the potential capacity for nutrient cycling in glacial ecosystems. Using metagenomic methods such as FISH (fluorescent in situ hybridization) and DGGE (denaturing gradient gel electrophoresis) the microbial community occupying the snow pack is to be determined. The investigation of the effects of the snow melt on the bacterial diversity and activity and the resulting nutrient cycling will give a broader picture of the in situ conditions.

On the freshening of the northwestern Weddell Sea continental shelf

Hartmut H. Hellmer[1], Oliver Huhn[2], Ralph Timmermann[1], Michael Schroeder[3]

[1]AWI Bremerhaven
[2]Institut für Umweltphysik, Universität Bremen
[3]Biotechnology Center, TU Dresden

For the last five decades the Antarctic Peninsula faces the strongest atmospheric warming on Earth with severe consequences for its glaciers, ice shelves, sea ice cover, and the surrounding marginal seas. We analyzed hydrographic data from the northwestern Weddell Sea continental shelf of three austral winters (1989, 1997, and 2006) and two summers following the last winter cruise. The whole water column north of 66S freshened by ~0.1 between the winters of the 17-year period, replaced by deep waters of the Central Bransfield Strait Basin in summer. The discussion of the causes for the salinity decrease favors an increased input of glacial melt from underneath Larsen C Ice Shelf. However, the 2-m/a melt rate, necessary for a year-by-year freshening, could be reduced to 0.75 m/a due to a recent increase of precipitation and a retreating sea ice cover in the northwestern Weddell Sea.

Arctic Change and Polynyas: A closer look at the Laptev Sea (Siberian Arctic

Jens Hölemann[1], Thomas Krumpen[1], Sergey Kirillov[2], Torben Klagge[3], Heidemarie Kassens[3], Leonid Timokhov[3]

[1]AWI Bremerhaven
[2] Arctic and Antarctic Research Institute, St. Petersburg, Russia
[3]Leibniz-Institute of Marine Sciences, Kiel

The recurrent polynya in the Laptev Sea (Siberian Arctic) has been recognized as an area of intensive ice formation. The growth of new ice within the polynya induces a salt flux that should have a distinct effect on the hydrography of the Laptev Sea shelf. Because of the remoteness and hazardous weather conditions, direct oceanographic observations during the period of the most dynamic polynya openings in the Laptev Sea (November-March) do not exist. Motivated by the assumption that the polynyas are among the first polar systems to be impacted by climate change, two oceanographic moorings were deployed in 2007 in the area of the Laptev Sea shelf polynya for a period of two years. In parallel, synthetic aperture radar imagery (ENVISAT-SAR) was acquired from October 2007 until May 2009. This case study, which also includes modelling of ice production and extensive field experiments at the polynya, was conducted within the framework of the Russian-German "Laptev Sea System" project. Temperature and salinity data from the moorings (2007-2009), modelling results and field experiments demonstrate that the hydrography within the polynya in the south-eastern Laptev Sea is dominated by a distinct salinity/density stratification of the water column (pycnocline). A perennial density stratification caused by high freshwater inputs through river discharge and melting of sea ice is a characteristic of the vertical water mass structure in the central and eastern Laptev Sea. As a consequence of the low initial surface salinities, haline-driven convection induced by the high salt flux during ice formation is limited to the surface layer (0-20 m water depth), and thus cannot lead to the formation of dense shelf bottom water. Instead we observed that during extensive polynya openings wind- and current-induced turbulence causes mixing of the low-salinity surface waters with the more saline bottom waters, which results in a decrease of bottom water salinities during polynya events. This surprising observation is also in contradiction to the presumption that polynyas in the south-eastern Laptev Sea contribute to the formation of dense shelf water that might "feed" the lower Arctic halocline or ventilate the deep basin. On the other hand the observations make clear that polynyas are a major driver to ocean dynamics on the Siberian shelves. The findings also imply that changes in the frequency of occurrence and the extension of polynya openings will primarily alter biogeochemical cycles, land-ocean transport pathways on the shelf, and upper-boundary conditions for the subsea permafrost in the Laptev Sea. The impact on the water mass stratification in the Arctic Basin is only of secondary importance.

Boden- und Tiefenwasserbildung und Export im atlantischen Sektor des Südlichen Ozeans

Oliver Huhn, Monika Rhein

Universität Bremen

Der Hauptbeitrag von Antarktischem Bodenwasser (AABW) zum Weltozean wird in der Weddellsee gebildet. Änderungen in dessen

Bildungsrate – verursacht durch Änderung der Umwelt-Randbedingungen – könne die Stärke und Variabilität der Meridionalen Umwälzbewegung und damit das Klima und Klimavariabilitäten beeinflussen. Änderungen im AABW Bildungsprozess und der Menge frisch gebildeten AABWs können auch die Aufnahme von anthropogenem CO_2 im tiefen Ozean beeinflussen.
Messungen und Auswertung verschiedener Spurengase können zum Verständnis der Bildungsprozesse von Tiefen- und Bodenwasser, ihrer Veränderlichkeiten, den Exportpfaden und der damit zusammenhängenden Aufnahme von anthropogenem Kohlenstoff aus der Atmosphäre beitragen. Fluorchlorkohlenwasserstoffe (FCKWs) sind zeitlich veränderliche Spurengase, die die Bestimmung von internen Verweilzeiten, Transportzeitskalen und Mischungsprozessen ermöglichen. Edelgasmessungen unterstützen die Untersuchung von Wassermassenbildungsraten im Zusammenhang mit basalem Schmelzen von Eisschelfen.
Unsere Untersuchungen belegen u. a. die Bedeutung der Eisschelfe in der westlichen Weddellsee (Larsen Eisschelf) als wichtiges Bildungsgebiet für AABW, das in der Weddellsee zirkuliert und sich teils nach Osten über den Greenwich-Meridian hinweg, aber auch Norden und sogar nach Westen durch Öffnungen des Süd-Scotia-Rückensystems in die Drakestraße hinein ausbreitet. Ebenso zeigen sie die Veränderungen dieser Prozesse an.
Auch die Aufnahme von anthropogenem Kohlenstoff, die nicht direkt bestimmt werden kann, wird durch Spurengasmessungen untersucht. Wichtige Ergebnisse hierbei sind, dass der Ein- und Ausstrom von Tiefenwasser in die Weddellsee über den Greenwich-Meridian keine großen Mengen anthropogenem Kohlenstoff enthält und dass sich netto aus dieser Zirkulation keine wesentliche Änderung im Kohlenstoffgehalt der tiefen Weddellsee ergibt.

ICEBERG Ruhr 2010: Ein Kunstprojekt

Andreas Kaiser[1], Lars Kindermann[2]

[1]Fachhochschule Mainz, Kunst/ Innenarchitektur
[2]AWI Bremerhaven

Steuern wir auf eine Klimakatastrophe unbekannten Ausmaßes zu? Sind Treibhausgase und andere Emissionen Ursache für das Schmelzen der Gletscher und Pole? Verändert sich das Klima von selbst im Wandel der Zeiten? Hat die Zahl der Naturkatastrophen wirklich zugenommen oder spielt uns das eine global vernetzte Medienwelt nur vor?
Für das Kulturhauptstadtjahr Ruhr2010 ist der Kölner Künstler und Hochschullehrer Andreas Kaiser mit dem Polarforscher und Physiker Lars Kindermann eine Kooperation eingegangen, die Kunst und Wissenschaft miteinander verbindet. Für sechs Monate schwimmt auf dem Baldeneysee in Essen ein künstlicher Eisberg. Darauf leuchtet orange ein kleines Forscherzelt aus dem nachts Naturgeräusche dringen. Windheulen, Donnergrollen, Regenprasseln und Meeresrauschen schallen über den See. Die Naturgeräusche diverser Klimazonen verweisen auf regenerierbare Ressourcen, die zugleich Ziel aktueller Energieforschung als auch Symbol für die zerstörende Wirkung der Klimaverschiebung sind. Während nachts der Forscher in seinem kleinen Zelt auf einem Berg von gespeicherten Klimadaten nach Erkenntnis sucht, bricht die Naturgewalt über ihn herein.
In den ICEBERG ist ein Container eingegraben, der ähnliche Ausmaße hat wie die PALAOA Messstation (Perennial Acoustic Observatory in the Antarctic Ocean) des Alfred Wegener Instituts (AWI). Die Forschungsarbeiten am AWI entschlüsseln die globalen Veränderungen, die teils natürlich und teils durch Menschen hervorgerufen sind. Die Energieversorgung der Horchstation PALAOA in der Antarktis ist eine Insellösung: Solarzellen, Windgenerator und Methanol- Brennstoffzelle. Tagsüber ist die Scholle auf dem See begehbar. Jeweils vier Besucher können für einige Minuten das Innere des Eisbergs betreten. Dort erwartet sie ein Raum, der in eigenartiges Licht getaucht ist und merklich abkühlt. Drei Fenster öffnen den Blick zum einen in die Konstruktion des Iceberg mit seinen technischen Apparaturen zur Immitation von Naturphänomenen, dann die poetische Transkription von akustischen Signalen in visuelle Daten und die räumliche Aufbewahrung von Natur in Datenspeichern. Die drei Fenster stellen Fragen um den energetischen Aufwand künstlerischer und wissenschaftlicher Forschung. Eigenartige Laute, akustische Signale, die der AWI-Physiker Lars Kindermann aus dem Meer fischt werden dort wahrnehmbar gemacht. Durch die Zusammenarbeit von Künstler und Forscher ist es möglich, Original-Bänder zu verwenden, die jährlich aus der Antarktis geholt werden und diese Daten in den ICEBERG- Container zu übertragen Neben dem Knacken des brechenden Eises sind Meeresbewohner wie Weddelrobben und Seeleoparden hörbar. Doch anders als die üblichen Walgesänge der Buckelwale entstehen bei dieser Klangcollage Bilder aus anderen Welten.

Structure and function of benthic diatom assemblages in polar waters – biomass, primary production and ecophysiological performance

U. Karsten[1], J. Wölfel[1], A. Wulff[3], C. Wiencke[2]

[1]Institute of Biological Sciences, University of Rostock
[2]AWI Bremerhaven
[3]Institute of Marine Ecology, University of Gothenburg, Sweden

Shallow water coastal sediments are worldwide dominated by microphytobenthic diatoms. These phototrophic biofilms often cover extensive sediment areas and are responsible for high rates of primary production. Although the structure of the pelagic and benthic food webs in the Arctic Kongsfjorden (Spitsbergen) and Antarctic Potter Cove (King George Island) as well as in other polar regions are well described, even basic information on primary production for most algal groups under cold water conditions are still lacking, particularly for sediment dwelling diatoms. Therefore, the main goal of this project was to study the ecological importance of microphytobenthic communities by measuring their primary production under natural Arctic conditions. Two methodological approaches, both based on planar oxygen optodes, were used for quantification of this process: 1.) *in situ* measurements were carried out at representative stations and different water depths using newly developed benthic chambers, and 2.) in parallel sediment cores taken by divers were incubated in the laboratory under controlled conditions. For the calculation of the annual production further analysis of biomass (areal chl. a concentration), sediment characteristics and underwater light conditions had to be included.
The data from Kongsfjorden as well as those available for other Arctic and Antarctic regions clearly suggest that the microphytobenthos contributes significantly to the ecosystem production in coastal polar waters. The generally low-light requirements of polar benthic diatoms well contributes to their ecological success and performance under the prevailing harsh environmental conditions. While Arctic benthic diatoms can be characterised as polar eurythermal, those from Antarctic waters are often more polar stenothermal. This conspicuous difference in temperature requirements can be explained by the much longer cold-water history of Antarctica which resulted in a higher degree of endemic species.

Wiederholungsmessung des Höhenprofils über das Inlandeis Grönlands

Wilfried Korth, Uwe Hofmann

Technische Fachhochschule Berlin

In den Jahren 2002 und 2006 wurde von einer Expeditionsgruppe von Geodäten, Geophysikern und Alpinisten ein 700km langes Profil über das Inlandeis Grönland zwischen Ammassalik und Ilulissat mittels GPS-Beobachtungen vermessen. Als Ergebnis liegen Höhen und Höhenänderungen mit einer Genauigkeit von ca. 5cm bzw. 2cm/a vor. Der Massenverlust im südlichen Teil Grönlands liegt in der Größenordnung von ca. 0.5m/a, wobei im Einzugsgebiet des Illulissat Eisstroms Maximalwerte von fast 2m/a erreicht werden. Die Daten können als unmittelbare Bodenkontrolle für Satellitenmissionen wie Icesat oder Cryosat verwendet werden. Im Sommer 2010 erfolgte die zweite Wiederholungsmessung des Profils. Damit können die Ergebnisse der ersten beiden Messkampagnen verifiziert werden, aber auch eventuelle Geschwindigkeitsänderungen der Massenveränderungen erkannt werden. Insbesondere im Einzugsgebiet des Eisstroms bei Ilulissat ist mit einer Beschleunigung des Massenverlustes in weiten Bereichen der Eiskappe zu rechnen, da sich auch die Geschwindigkeit des Eisstroms stark erhöht hat. Im Beitrag werden erste Ergebnisse der Messung aus dem Jahr 2010 im Zusammenhang mit dem Gesamtprojekt vorgestellt.

Stabilität und Variabilität des Westantarktischen Eisschildes archiviert in glazialmarinen Sedimenten (ANDRILL) auf dem antarktischen Schelf

Gerhard Kuhn, Frank Niessen

AWI Bremerhaven

Numerische Modellierungen versuchen vorherzusagen, wie bei einer zukünftigen globalen Erwärmung sich die vorhandenen kontinentalen Eismassen verhalten werden und welche Konsequenzen sich für einen Meeresspiegelanstieg hieraus ergeben. Hierfür werden Daten benötigt und Beobachtungen aus Archiven, die vergangene Umweltszenarien beschreiben und möglichst wärmere Klimaphasen als die heutige widerspiegeln. Der

Westantarktische Eisschild wird durch die Topographie seines Untergrundes besonders sensibel auf Klimaänderungen reagieren. Wir haben in verschiedenen Regionen, dem Rossmeer, dem Amundsenmeer und an der Antarktischen Halbinsel und auf unterschiedlichen Zeitskalen Sedimente untersucht, die während wärmerer Klimaphasen als die heutige vom Miozän bis zum Holozän abgelagert wurden.
Die Analysen der ANDRILL Bohrungen, die mit einem Kerngewinn von 98 % zwei mehr als 1100 m lange Kerne im Rossmeer gewinnen konnten, ergeben vom Miozän bis in das Pleistozän wiederholt Hinweise auf einen stärkeren Rückzug des Eises über das heutige Maß hinaus, was periodisch sogar mit einem Kollaps des Westantarktischen Eisschildes einherging. Modellierungen berechnen für diese Szenarien einen Meeresspiegelanstieg durch das verringerte Eisvolumen in der Antarktis um 7 Meter. Mächtige Diatomite wurden während dieser Warmzeiten abgelagert, die kaum Anzeichen von Sedimenteintrag aus Eisbergen zeigen und sich in offener mariner Umgebung bildeten. Geochemische Studien zur Herkunft der terrigenen Sedimentkomponenten zeigen wie stark variabel die Umweltänderungen in dieser Region über lange Zeiträume waren. Dolomitbildungen, dessen Genese bisher aus diesen Ablagerungsbedingungen nicht bekannt war, markieren oft den Übergang von einer Kaltzeit zu einer Warmzeit. Mischungsprozesse zwischen Schmelz- und Meerwasser und die Aufkonzentration von Sole durch verschiedenartige Ausfrierprozesse werden hier als Ursachen für die Karbonatausfällungen in Betracht gezogen.
Heute zeigt der Pine Island Gletscher im Amundsen Sea Embayment das Einzugsgebiet mit dem stärksten Eisrückzug der Westantarktis. Wir erkunden durch Kartierung glazialmorphologischer Strukturen vor den Gletschern auf dem Schelf und der Analyse von Sedimentkernen, ob dieser Rückgang kontinuierlich seit der holozänen Erwärmung fortschreitet, oder ob er ein Anzeichen der rezenten Erwärmung ist. Großskalige glaziale Lineationen zeigen an, dass sich im letzten Glazial die Eismassen bis zur Schelfkante erstreckten und es Bereiche mit schnell fließenden Eisströmen und dazwischen langsam fließenden oder stationären Eiskappen gegeben haben muss. Ablagerungen an für längere Zeit stationären Aufsetzzonen sprechen für einen schrittweisen Rückzug des Eisschildes nach der letzten Vereisung. Auch hier finden wir direkt nach dem Aufbruch des Eisschildes auf dem Schelf Sedimentlagen mit hohen Gehalten an Diatomeen-Skeletten, die eine Phase mit hoher biogener Produktion anzeigt.

Die Auswirkungen der rezenten Erwärmung auf den Gletscherrückzug lassen sich besonders gut auf King George Island untersuchen, einem klimatisch sehr sensiblen Gebiet mit einer durchschnittlichen Temperaturerhöhung um 2 bis 3 C° seit 1950. In einem multidisziplinären Ansatz werden hier im IMCOAST Forschungsprojekt die biogeochemischen und abiogenen Umweltveränderungen an Land und im küstennahen Meer untersucht. Sedimentkerne aus der Maxwell Bay zeigen hochaufgelöst für die letzten 2000 Jahre auch die regionalen Auswirkungen auf globale Klimaschwankungen wie dem Klimaoptimum im Mittelalter und der kleinen Eiszeit. Korngrößenanalysen lassen einen verstärkten Eintrag von Schmelzwasser während des Klimaoptimums und einen reduzierten während der kleinen Eiszeit erkennen. Bisher lässt sich aber an diesem Parameter noch keine Verstärkung beobachten, die mit dem rezenten Temperaturanstieg in Zusammenhang gebracht werden kann.

Das Eis der Erde im Kreislauf von Energie, Wasser und Spurenstoffen.

Michael Kuhn

Institut für Meteorologie und Geophysik, Universität Innsbruck.

Das Klimasystem der Erde und das Wetter der mittleren Breiten nehmen ihre Energie aus deren Transfer vom Gewinn der niederen zum Verlust der mittleren und hohen Breiten. Die Energiebilanz dieser Defizitgebiete wird durch die hohe Albedo von Schnee und Eis und die meridionalen Temperaturgradienten gesteuert.
Für diesen globalen Kreislauf und für die grundsätzlich verschiedenen Energiebilanzen der Antarktis und des grönländischen Inlandeises gegenüber der des arktischen Packeises werden Zahlenbeispiele gegeben. Als typisch für Rückkopplungen im polaren Klimasystem werden das Eis-Albedo-Feedback und der Effekt der Oberflächenhöhe erklärt.
Das Eis der extrapolaren Gebirge beeinflusst einerseits den lokalen Wasserkreislauf, was am langfristigen Trend im 20 Jahrhundert und an kurzfristigen Schwankungen wie im heißen Sommer gezeigt wird. Andererseits lieferte es trotz seiner relativ zum polaren Eis geringen Oberfläche den größeren Beitrag zum Meeresspiegelanstieg im 20. Jahrhundert.
Die Anwendung der Analysen von Isotopenverhältnissen und Spurenstoffkonzentrationen im polaren und alpinen Eis zur Rekonstruktion des glazialen

und rezenten Klimas wird im dritten Teil mit Beispielen aus den Arbeiten des Instituts für Meteorologie und Geophysik belegt.

Investigating Polar Oceans with the European Research Icebreaker AURORA BOREALIS: the Scientific and Operational Context

Lester Lembke-Jene[1], Joern Thiede[2], Bonnie Wolff-Boenisch[1, 3], Roberto Azzolini[3], Nicole Biebow[1], Olav Eldholm[4], Paul Egerton[3]

[1]AWI Bremerhaven
[2]University of Copenhagen, Denmark
[3]European Science Foundation, Strasbourg, France
[4]University of Bergen, Norway

Polar oceans are characterized by extreme environmental conditions for humans and materials, and have remained the least accessible regions to scientists — yet they are essential for understanding global environmental variability and predicted to face substantial

The European Polar Board of the European Science Foundation initiated the development and scientific rationale for a novel and dedicated research icebreaker with technical capabilities unrealized before. This research icebreaker shall enable autonomous operations in the central Arctic Ocean and the Southern Ocean, even during the severest ice conditions in the deep winter, serving all marine disciplines of polar research including scientific drilling: The European Research Icebreaker and Deep-Sea Drilling Vessel AURORA BOREALIS.

AURORA BOREALIS is presently planned as a multi-purpose vessel. The ship can be deployed as a research icebreaker in all polar waters during any season of the year, as it shall meet the specifications of the highest ice classification attainable (IACS Polar Code 1) for icebreakers. In addition it is currently the only vessel worldwide that is technically designed to autonomously keep station in ice-infested waters — an essential prerequisite for carrying out future scientific ocean drilling expeditions in the Arctic Ocean or ice-covered Southern Ocean. During the times when it is not employed for drilling, it will operate as the most technically advanced multi-disciplinary research vessel in the Arctic or polar Southern Ocean. It is planned to serve as a sustained long-term inter-disciplinary marine observatory that complements other planned infrastructures like the northern nodes of the "European Multidisciplinary Sea-Floor Observatory" (EMSO) or the "Svalbard Integrated Arctic Earth Observing System" (SIOS). AURORA BOREALIS is envisioned as a „European scientific flagship facility" (fully open to non-European partners), a multidisciplinary platform for studies ranging from the sub-seafloor into the atmosphere.

The berthing capacity of 120 personnel total (scientists, technical support and crew) allows accommodating a sufficient number of science party members offshore. The present scientific implementation documents plan for about one polar scientific drilling expedition per year in a to-be-determined configuration. As the vessel is a multi-disciplinary platform, operations for the entire year are not dependant on drilling operations alone. While principal access to the vessel will be based on a competitive proposal review and evaluation system, the allocation of timeslots specifically for drilling would preferably be given over to IODP handling and planning systems in a cooperative mode using the strengths and capacities of the future program. Depending on interests and needs of the scientific communities a preferential focus in non-drilling expedition planning could be established e.g. for dedicated geophysical pre-site survey works in areas inaccessible by other vessels to secure critical data needed for later drilling expeditions.

Verifizierung globaler Emissionen anthropogener Treibhausgase anhand langzeitiger atmosphärischer Beobachtungen in hochpolaren Gebieten

Ingeborg Levin[1], Dietmar Wagenbach[1], Rolf Weller[2]

[1]Institut für Umweltphysik, Universität Heidelberg
[2]AWI Bremerhaven

Die Langzeitbeobachtung von Treibhausgasen in der antarktischen Atmosphäre liefert grundlegende Information über globale, zeitliche Trends dieser Spurenstoffe. Der Vergleich mit entsprechenden Messungen in der Arktis erlaubt außerdem Rückschlüsse auf deren Quellverteilung. An der Antarktisstation Neumayer werden von uns seit nahezu drei Jahrzehnten regelmäßig Luftproben zur Analyse der wichtigsten anthropogenen Treibhausgase wie Kohlendioxid (CO_2), Methan (CH_4), Lachgas (N_2O) und Schwefelhexafluorid (SF_6) durchgeführt (*Weller et al.,* 2007). Darüber hinaus führen wir an vielen dieser Proben auch Messungen der Isotopen-Verhältnisse durch, die zusätzliche Information über die Quellen dieser Gase liefern.

Im Fall des CO_2 nehmen hier Radiokohlenstoff-Messungen ($^{14}CO_2$) eine Sonderstellung ein. Das Verhältnis von $^{14}C/C$ im atmosphärischen CO_2 wird natürlicherweise durch das Gleichgewicht zwischen Produktion in der oberen Atmosphäre und den Zerfall (mit einer radioaktiven Halbwertszeit von 5730 Jahren) in allen Kohlenstoff-Reservoiren, also Atmosphäre, Biosphäre und Ozean bestimmt. Durch die künstliche Produktion großer ^{14}C-Mengen während der oberirdischen Kernwaffentests in den 1950er und 1960er Jahren in der Atmosphäre wurde dieses Gleichgewicht empfindlich gestört. Der sogenannte „^{14}C-Bomben-Peak" hat seither wertvolle Einsichten in die Dynamik des globalen Kohlenstoffkreislaufs geliefert (*Levin et al.*, 2010a). Heute, etwa 50 Jahre später, ist diese Störung in der Atmosphäre wieder nahezu abgeklungen, weshalb derzeit das $^{14}C/C$-Verhältnis im atmosphärischen CO_2 wesentlich durch Emissionen von ^{14}C-freiem fossilen Verbrennungs-CO_2 bestimmt wird. Diese Verbrennungs-CO_2-Quellen, die ja maßgeblich für den globalen atmosphärischen CO_2 Anstieg seit etwa 1890 verantwortlich sind, liegen zu mehr als 90% in der Nordhemisphäre. Ihre spezielle Isotopensignatur (kein ^{14}C) beeinflusst daher auch die Nord-Süd-Verteilung von $^{14}CO_2$ in der Atmosphäre. Beide Signale, sowohl der globale Abfall des $^{14}CO_2$ durch die Verdünnung mit ^{14}C-freiem CO_2 aus der Verbrennung fossiler Energieträger als auch die Nord-Süd-Verteilung von $^{14}CO_2$ kann genutzt werden, um die globale fossile CO_2-Quellstärke auf unabhängige Weise aus atmosphärischen Messungen abzuschätzen. Die Unsicherheiten dieser sog. *top-down* Methode, die für CO_2 zwischen 25% und 30% liegen, werden diskutiert.

Ein weiteres prominentes Beispiel für die Nutzung der langzeitigen atmosphärischen Treibhausgasmessungen an Neumayer zur Bestimmung seiner globalen anthropogenen Quellen liefert SF_6. Im Gegensatz zu atmosphärischem CO_2, welches in ständigem Austausch mit Ozean und Biosphäre steht, hat SF_6 praktisch nur anthropogene Quellen und aufgrund der großen Stabilität dieses symmetrischen Moleküls auch nur sehr kleine Abbauraten in der Atmosphäre (Mesosphäre). Die atmosphärische Lebensdauer von SF_6 wird daher mit etwa 3200 Jahren angegeben. Seine Emissionen sind zum großen reduziert werden müssen. Teil verknüpft mit der Verteilung elektrischer Energie (es wird als Lösch- und Isoliergas in Mittel- und Hochspannungsanlagen verwendet). SF_6 ist ein Molekül mit einem der höchsten Treibhauspotenziale (1 kg zusätzliches SF_6 ist auf einem Zeithorizont von 100 Jahren ebenso wirksam wie etwa 24 Tonnen CO_2); daher fällt es auch in die Gruppe der Treibhausgase, deren Emissionen im Rahmen des Kyoto-Protokolls berichtet und reduziert werden müssen.

Da SF_6 keine wesentlichen Senken in der Atmosphäre hat, kann seine Quellstärke aus dem Anstieg seiner atmosphärischen Konzentration direkt berechnet werden. Wir präsentieren unsere in ihrer Präzision weltweit einmaligen Messungen in Nord- und Südhemisphäre und die daraus abgeleiteten globalen Emissionsraten. Es zeigt sich, dass die globalen SF_6-Emissionen nach der Ratifizierung des Kyoto-Protokolls 1995 zunächst leicht abgenommen haben, dass die Rate der Emissionen jedoch seit etwa dem Jahr 2000 wieder deutlich zunimmt (*Levin et al.*, 2010b). Ein Vergleich mit den Emissionen, die weltweit von den Industriestaaten im Rahmen des United Nations Framework Convention of Climatic Change (UNFCCC) berichtet wurden, zeigt außerdem, dass diese Angaben mit großer Wahrscheinlichkeit die tatsächlichen Emissionen stark unterschätzen.

Unsere Messungen und deren Auswertung zeigen, welche große Bedeutung hochpräzisen langjährigen atmosphärischen Beobachtungen (vor allem auch in polaren Breiten) zukommt. Sie erfüllen nicht nur die wichtige Aufgabe des *Monitoring* der Treibhausgaspegel in der globalen Atmosphäre. Vielmehr stellen sie eine einmalige Möglichkeit dar, die viel diskutierten Emissionsminderungen von Treibhausgasen verlässlich zu verifizieren und damit dem Konzept des sog. *Carbon Trading* eine belastbare Basis zu schaffen.

Deep sea seismic stratigraphy of the Amundsen Sea and Ross Sea, West Antarctica: Preliminary results of the first linking record

Ansa Lindeque, Karsten Gohl

AWI Bremerhaven

Seamless circum-Antarctic palaeosedimentary and palaeobathymetry maps and grids spanning the Cretaceous to present are important, because sedimentary thickness and sedimentation rates are needed to reconstruct more realistic seafloor geometries, palaeotopography and long term climate change models. To create such a dataset around Antarctica, a complete network of cross-linked deep-sea seismic reflection profiles is necessary. In this context, the multinational Circum-Antarctic Stratigraphy and Palaeobathymetry (CASP) initiative was born to

provide constraints for palaeo-climate modelling. Existing international seismic data cover most of Antarctica's continental rise, but from 130°W to 160°W, a completely unsurveyed sector on the western margin of Antarctica, between the Ross Sea and Amundsen Sea, prevents closure of the Circum-Antarctic sedimentary grids, and palaeostratigraphic link. During the RV Polarstern cruise, from January to March 2010, the Alfred Wegener Institute acquired ca. 5000 km high resolution multichannel seismic data on the West Antarctic margin, using a 3 km streamer and 3 GI-guns. Among these profiles, is a ca. 1500 km multichannel seismic reflection profile - the first crossing the previously unsurveyed sector. Preliminary results show minimum sediment thickness of ~0.75s two-way-time (TWT) in the Ross Sea and maximum sediment thickness of ~2.5s TWT in the Amundsen Sea. A clear acoustic basement occurs at ~6 to 8s TWT depth and similar to the internal reflectors, is traceable across the entire length of the profile. The basement topography is slightly rugged at the Ross Sea, becoming undulating and then smooth up to 123°W, where it meets the Mary Byrd Seamount region, and becomes more rugged towards the continental shelf. The continuous seismic reflectors of three distinct sedimentary packages are mostly horizontal and undisturbed, and thus provide the first possibility to link the seismic stratigraphy of pre-glacial, transitional and glacially dominated sedimentary packages in the Ross Sea, with similar stratigraphy in the Amundsen Sea. This data brings us a significant step closer to the circum-Antarctic isopach maps and grids.

Uplift and exhumation of theTrans-antarctic Mountains: a new, consistent concept

Frank Lisker[1], A.L. Läufer[2]

[1]Institut für Geowissenschaften, Universität Bremen
[2]Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover

Crossing Antarctica for ~3500 km and reaching altitudes of up to 4500 m, the Transantarctic Mountains (TAM) represent the main structural and geomorphological feature of Antarctica. They form the uplifted rift shoulder of the Cenozoic West Antarctic Rift System, and divide the continent into the East Antarctic Craton and West Antarctica. The Proterozoic/ early Paleozoic basement of the TAM is overlain unconformably by Late Devonian to Early Jurassic sedimentary rocks of the Beacon Supergroup that was deposited within a large intra-continental basin. Both basement and Beacon sequence are intercalated or covered by up to 400 m thick Ferrar volcanic rocks with an age of ~177 Ma. Besides from the occurrence of some late Cenozoic mafic volcanic rocks and shallow marine sediments, the post-Jurassic tectonic history of the TAM is not recorded by petrological or stratigraphic evidence.

Therefore, the uplift and exhumation history of the TAM established during the last two decades chiefly relies on thermochronological data. Apatite fission track data from various locations throughout the TAM were interpreted in terms of long-lasting crustal cooling and exhumation since Jurassic times. Three distinctive episodes of exhumation and uplift during the Early Cretaceous, Late Cretaceous, and Cenozoic were related to regional rifting events: (I) the initial breakup between Australia and Antarctica, (II) the main extension phase between East and West Antarctica along low-angle extensional faults; and (III) southward propagation of seafloor spreading from the Adare Trough into continental crust underlying the western Ross Sea in the early Cenozoic (cf. Fitzgerald, 2002; Lisker, 2002).

However, recent work carried out within SPP 1158 highlights some severe problems of this traditional scenario with respect to regional trends and diachronism of exhumation, and paleogeographic considerations. Timing and amount of exhumation vary significantly between different segments of the TAM despite of a uniform distribution of marker horizons (stratigraphic units, erosion surfaces), and they do not spatially correlate with the loci of tectonic activities. The paradigm also does not provide a satisfying fit of the continental shelves and shelf deposits of Antarctica and Australia, and is in conflict with regional Cretaceous climate models. Most importantly, an evaluation of thermochronological data and stratigraphic record reveals fundamental crossover relationships between both age types.

The paper highlights this tautology and introduces the simple and consistent concept of a long-lasting Mesozoic basin on the continental margin segments of Antarctica and Australia based on thermochronological, petrological, stratigraphic, tectonic, geomorphological, and paleogeographic evidence. Substantial Jurassic volcanism (Ferrar magmatism) along the whole TAM does not mark the termination of the Beacon basin but represents only an episode within an ongoing process of crustal extension, and diffuse Cretaceous heating/ cooling signals (e.g., Molzahn et al., 1999) result from varying heat flow within the late Paleozoic–Mesozoic

Basin. In contrast, Paleocene crustal cooling is clearly related to exhumation, probably tectonically induced by the onset of rifting of the West Antarctic Rift System.

"Endkampf um den Südpol" - Das Internationale Geophysikalische Jahr (1957-1958) in deutschen Medien

Cornelia Lüdecke

Ak Geschichte der Polarforschung, München

Als 1954 die Planungen für das Internationale Geophysikalische Jahr (IGJ) 1957-1958 bekanntgegeben wurden, tauchte die Antarktis in den Schlagzeilen deutscher Tageszeitungen und Illustrierten wieder auf. Neben der strategischen Bedeutung des südlichen Kontinents wurden Besitzansprüche bei einer möglichen Aufteilung der Antarktis im Kontext mit der künftigen Ausbeutung von Bodenschätzen thematisiert. Denkbare deutsche Ansprüche riefen Reminiszenzen an die Entdeckung und erfolgreiche Luftvermessung des Neuschwabenlandes hervor. Politische und militärische Rivalitäten zwischen den USA und den UdSSR ließen die wissenschaftliche Vorbereitung des IGJ als Kampf um noch nicht vergebene Anteile erscheinen. Der militärische Sprachgebrauch der Berichterstattung wurde immer dominierender, als in diesem Zusammenhang Schlagworte wie "Großangriff", „Kalter Krieg" oder "Endkampf" in den Schlagzeilen auftauchten. Es hatte den Anschein, daß beim IGJ die Wissenschaft benutzt wurde, um das politische und ökonomische Wettrennen zum Südpol zu decken. Beispielsweise veröffentlichte ein in New York lebender deutscher Journalist Anfang 1957 in der „Süddeutschen Zeitung" eine Artikelserie unter dem Titel „Die Festung Antarktis wird eingekreist", dessen weitere Wortwahl Erinnerungen an das Dritte Reich hervorruft. Während wissenschaftliche Artikel das IGJ sehr nüchtern behandelten, hoben populäre Beiträge das Abenteuer, die Bodenschätze und die militärische Bedeutung der Antarktis in Kalten Krieg hervor, wobei die Wortwahl sehr dem Militärjargon verhaftet war. Dieser oberflächliche Befund könnte dazu anregen, das Thema in einem interdisziplinären Projekt detaillierter zu untersuchen.

Adaptability of Antarctic fish to climate factors: Transcriptomic profiling and functional implications

Magnus Lucassen

AWI Bremerhaven

Temperature as an important climate factor has a pervasive impact on all biological processes and is therefore defining the large scale biogeography of marine ectothermal organisms. Latitudinal distribution of populations and species is mainly defined by their acclimation capacity under fluctuations of environmental factors. Thermal limitation becomes firstly effective at the intact organism, and then at lower levels, cellular processes and molecular functions. Inadequate oxygen supply seems to be the first indicator of thermal intolerance. The molecular mechanisms defining thermal limits and acclimation capacities have been traditionally studied by describing effects on single proteins or protection mechanisms. Since thermal properties of individual molecules largely exceed the temperature window of whole animals, thermal limits are ultimately set at the level of integration of molecules into functional units and networks up to whole organism level. Environmental stressors other than a rise in temperature (e.g. ocean acidification due to elevated PCO2, oxygen limitation) may result in similar responses of the underlying protection and acclimation systems or vice versa: the additive effect of several stressors may be caused by using the same molecular apparatus for response.
The Antarctic eelpout *Pachycara brachycephalum* lives circum-polar at water conditions around 0°C. By combining explorative transcriptomic studies with inductive approaches we aim to identify effective mechanisms, defining climate sensitivity and adaptability of this cold-stenothermal species. Therefore, we characterised the liver transcriptome by pyrosequencing of a normalized cDNA library. Based on this the expression of several candidate genes was followed during the time-course of warm acclimation (5°C, 6 weeks). Elevated respiratory chain capacities in liver contrasted with the general picture of cold-induced mitochondrial proliferation in temperate fish. Furthermore, by profiling transcript levels of functional genes in relation to mediative transcription factors large rearrangements of the central energy metabolism became visible, with a shift of the balance from lipid to carbohydrate metabolism. In a canonical correspondence analysis the factors time and temperature divided the incubated animals in

two groups and short- and long-term effects could be distinguished. Overall, the data indicate an improvement of metabolic processes upon warm acclimation. Moreover, long-term acclimation of fish facing combinations of warming and high CO_2 indicate reasonable adaptability, but with opposing trends for the two factors. The implication of these results will be discussed with respect to the realised ecological niche of the species and future climate scenarios.

Activity Measurements of Methanogenic Archaea Isolated from Siberian Permafrost under simulated Mars Analog Conditions

Janosch Malaszkiewicz, Dirk Wagner

AWI Potsdam

The environmental conditions of early Mars and early Earth are assumed to have been most similar. The oldest proofs of life on Earth, which can be found as microfossils in Archaean rocks, date back to this time of about 3.8 Ga ago. Regarding this one can presume that life might have evolved on Mars, too. Martian life must have adapted to the drastic change of conditions on the planet or become extinct. Plausible forms of still existing prokaryotic life on Mars are lithoautothrophic subsurface ecosystems. Comparable environments exist in the permafrost regions on Earth.
On Mars frozen water in form of surface glaciers and subsurface ground ice layers but also water in a liquid state - which is one of the most important factors for the existence of life - could be observed by NASA and ESA missions. The detection of methane on Mars by Mars Express lead to the conclusion that it must be of a recent origin because of its rather short persistence time in the atmosphere of a few hundreds of years. Thinkable sources of the methane are active volcanism - that could not yet be observed on modern Mars - or biogenic production. The correlation between the presence of water vapour and methane on the Martian surface which occur both in higher concentrations in the same regions and time intervals are an indication of a biological source of the methane on Mars. Methanogenic archaea from terrestrial permafrost regions are therefore one of the most suitable candidates for possible existing life on Mars. They have evolved under early Earth conditions, grow lithoautotorphicly under strictly anaerobic surroundings, are able to tolerate low temperatures and have survived in the extreme environments of permafrost affected soils for several millions of years.
This PhD project is associated to the Helmholtz-Alliance "Planetary Evolution and Life" and is focused on experiments with strains of methanogenic archaea that have been isolated from the active layer of permafrost on Samoylov Island in the Lena Delta, Siberia. Former experiments with these strains revealed significantly higher survival rates compared to non-permafrost strains after the exposure to a simulated Martian diurnal profile with alternating temperatures between -75°C and +20°C, humidity from 0.1 to 0.9 aw and a Mars-like gas composition and pressure (Morozova et al., 2007). In the current work it will be examined if the methanogenic archaea from permafrost do not only survive simulated Martian conditions but rather are able to show an active metabolism. Also the effects of mars analog minerals in form of artificial soils and the contribution of biofilm formation on the activity, survival and water retention capability of these organisms is to be investigated.
A first growth test with artificial soils added in concentrations between 0.0 and 5.0% to the culture media was performed with permafrost and non-permafrost strains as a reference with incubation temperatures of 10 and 28°C. Tested Mars analog minerals were "JSC-Mars-1A", "Early Acidic Mars" and "Late Basic Mars". The results showed an increase of methane formation rates measured via gas chromatography for all strains after adding small amounts of soil analoges for all tested minerals at both temperatures. Higher amounts of minerals leaded to lower methane formation rates or had no significant effect. Only for the permafrost strains an increase of the methane formation rates at 10°C could be observed with 5.0% of "Late Basic Mars" compared to lower mineral concentrations.
The activity of the methanogenic archaea under simulated Martian conditions is to be determined via measuring of their methane production. Therefore a laser system based on wavelength modulation spectroscopy will be used, which can be attached to a simulation chamber where the strain samples can be exposed to the specific Mars analog conditions.
To study the limits that are necessary for methanogenic archaea from terrestrial permafrost regions to maintain their activity with simulation experiments helps to understand more about the possibilities for life in the Martian cryosphere as well as in other potential extraterrestrial permafrost habitats.

Subglacial Lake Regimes, the hydrological conditions at the bottom of the Antarctic Ice Sheet

Christoph Mayer[1], Malte Thoma[1,2], Klaus Grosfeld[2], Martin J. Siegert[3], Andy Wright[3]

[1]BAdW München
[2]AWI Bremerhaven
[3]School of GeoSciences, University of Edinburgh, United Kingdom

Since the first discovery of subglacial lakes in the late 1960s the knowledge about subglacial water bodies has changed dramatically. First only a small number of lakes (17) were identified in the centre of the Antarctic Ice Sheet, including Lake Vostok. The development of ideas concerning internal hydrological conditions and mass exchange with the ice sheet took a long time to develop. Since the mid 1990s more than 300 subglacial lakes have been discovered underneath the ice sheet, ranging from some kilometres to about 250 km in dimension, being covered by an ice layer from less than 2 km up to more than 4 km thick. The lakes are located at several characteristic locations across Antarctica. Also the interaction between lakes and the surrounding ice sheet is highly variable ranging from likely closed systems with very little mass exchange to water bodies with extensive, rapid and possibly periodical water discharges. Here we provide a comprehensive summary of the principal conditions regarding the internal physical conditions influencing subglacial lakes, their mass exchange with the ice sheet above, and the consequences for both, lake and ice dynamics. Subglacial lakes occur in specific locations defined by subglacial topography and the related effective hydrostatic pressure distribution, ice dynamics and geothermal conditions. The lakes physical conditions depend on these parameters, which in return determine the interaction level of the lake. For example, lakes at the head of fast flowing ice streams could play a much stronger role in terms of ice-sheet dynamics than lakes in inner-continental basins. Also ice thickness plays an important role in the hydrodynamic regime of subglacial lakes. The generation of different lake categories, in relation to their specific settings, allows us to describe the overall physical conditions and the potential interaction level of subglacial lakes with their environment.

The El'gygytgyn Drilling Project, NE Siberia: Operational Success in 2008/09 and First Results

Martin Melles[1], Julie Brigham-Grette[2], Pavel Minyuk[3], Christian Koeberl[4], El´gygytgyn Scientific Party

[1]Institut für Geologie und Mineralogie, Universität Köln
[2]Department of Geosciences, University of Massachusetts, USA
[3]North-East Interdisciplinary Scientific Research Institute Magadan, Russia
[4]Center for Earth Sciences, University of Vienna, Austria

Lake El'gygytgyn is located 100 km north of the Arctic Circle (67°30' N, 172°05' E) in a crater of 18 km diameter that was formed 3.6 Ma ago by a meteorite impact event. From Oct. 2008 until May 2009 an international drilling campaign was conducted at Lake Elgygytgyn, achieving its three major objectives.

First of all, drilling from the ice cover in the lake center penetrated the entire, 315 m thick lake sediment succession in 170 m water depth. The sediments show no indications for hiatuses due to glaciation or desiccation. Hence, their temporal length and geologic significance is absolutely unprecedented, for the first time providing deep and widely continuous insights into the climatic and environmental evolution of the terrestrial Arctic since Pliocene times. This is particularly true for the lowermost 40 m and uppermost 150 m of the sequence, which were drilled with almost 100 % recovery and, taking the chronological information as yet available, likely reflect the initial lake stage during the Pliocene and the last ca. 3.0 Ma, respectively. In between, the quality of the record is restricted due to lower recovery in consequence of technical problems and/or sequences of coarse sand and gravel interbedded with lacustrine mud.

Second, a ca. 200 m thick, almost complete section of suevite was recovered underneath the lake sediments. Investigation of this core sequence promises new information concerning the El´gygytgyn impact event, including the composition and nature of the meteorite, the energy released, and the shock behaviour of the volcanic basement rocks.

And third, a 142 m long sequence was recovered from the permafrost deposits in the western lake catchment, only a few hundred meters from the lake shore. The core consists of sandy and gravelly alluvial fan deposits, which are continuously frozen and rich in ground ice. The sediment and ice composition promises to provide complementary information on the regional climatic history and lake-level fluctuations. Besides, a thermistor chain installed in the drill hole as part of the "Thermal

State of Permafrost Network" of the International Permafrost Association will contribute to the understanding of the permafrost behaviour under the currently changing climatic settings.
In summary, the drilling operation at Lake El´gygytgyn in winter 2008/09 has kept behind the expectations with regard to the quantity of core material, however, it is regarded as great success taking the potential the high-quality material has to address the three major scientific goals of the project. The presentation will summarize the operational success of the drilling campaign and highlight the scientific results obtained so far based on the limited onsite and ongoing offsite core processing.

Virtuelles Klassenzimmer – Unterricht von der AWIPEV Station

Sabine Motzkus, Conrad Kopsch

Oberschule Belzig

Im Rahmen des Internationalen Polarjahres 2007 / 08 wurde das Projekt Coole Klassen ins Leben gerufen, um die Bedeutung der Polarregionen im Schulunterricht zu thematisieren. Dieses Projekt soll dem Unterricht an den Schulen langfristig positive Impulse geben und eine Kooperation zwischen Schülern und Forschern auch zukünftig sicherstellen.
So sollen aktuelle und für unsere Gesellschaft wichtige Forschungsfragen und –ergebnisse auf direktem Weg in die Schulen gebracht werden.
Das Projekt „Coole Klassen" ist ein Gemeinschaftsprojekt des AWI –Potsdam unter der Beteiligung dreier Schulen im Fläming, im Landkreis Potsdam-Mittelmark.
Schüler aus dem brandenburgischen Fläming (Grundschule Belzig, Oberschule Belzig und das Burgwall Gymnasium Treuenbrietzen) hatten so zu Beginn des Schuljahres 2009/10 die Gelegenheit erhalten, das Nordpolargebiet hautnah zu erleben.
Ein virtuelles Klassenzimmer hat diese drei Schulen vom 10. bis 22. September 2009 täglich ab 10.00 Uhr für eine Stunde mit Ny Alesund auf Spitzbergen verbunden. Im Rahmen des Unterrichts wurde über eine Videoanlage direkter Kontakt in die Klassenzimmer dieser drei Schulen gehalten.
Die Mädchen und Jungen der Grundschule erhielten durch das virtuelle Klassenzimmer Gelegenheit, die arktische Flora und Fauna kennen zu lernen. Bei Ausflügen zu Wasser und zu Land wurden Pflanzen und Tiere gesammelt, um sie später in der Station zu bestimmen. So lernten die Kinder das Artenspektrum des arktischen Ökosystems und die Stellung der Organismen im Nahrungsnetz kennen. Die Belziger Oberschüler haben sich mit der Thematik Permafrostboden befasst. Zentrale Fragen der Untersuchungen waren beispielsweise; Was passiert, wenn Permafrostböden auftauen oder wenn Gletscher schmelzen? Die Gymnasiasten aus Treuenbrietzen beschäftigten sich mit dem Klima und der Atmosphäre. So wurden die täglichen Ballonaufstiege an der Station begleitet und auch über die Zusammensetzung der Atmosphäre wurde berichtet. Bei der anschließenden Datenanalyse lernten die Schülerinnen und Schüler, zwischen kurzfristigen Wetterphänomenen und langfristigen Trends des Klimas zu unterscheiden. Ziel des Projektes war es, den Kindern und Jugendlichen ein neues Bild der Polarregionen zu vermitteln und sie auch für Klimaveränderungen zu sensibilisieren, sie darauf aufmerksam machen.
Und dass es gelungen ist, zeigten auf einer Veranstaltung Anfang Oktober im AWI die Schülerinnen und Schüler bei einer beeindruckenden Präsentation. Vor Forschern und Wissenschaftlern stellten die Schüler ihre Erkenntnisse vor.
Die „Initiative Deutschland –Land der Ideen" hat das Projekt 2 Coole Klassen" aus mehr als 2200 Bewerbungen mit einem Preis ausgezeichnet.

Grounded Pleistocene Ice Sheets or Ice Shelves on the Medeleev Ridge and East Siberian Continental Slope (Arctic Ocean)

Frank Niessen, Rüdiger Stein, Anne Hegewald, Tanja Dufek, Jens Matthiessen, Wilfried Jokat

AWI Bremerhaven

During glacial periods of the Pleistocene, was the deep Arctic Ocean covered by perennial sea ice or by ice caps more than 1000 m thick? Debating this question goes back to the 70's of the last century and is still a key for understanding Quaternary climate changes on a global scale. About 10 years ago it was generally accepted that thick ice sheets of marine isotope stages (MIS) 2, 4 and 6 were restricted largely to continental Eurasia, Greenland and North America including the adjacent shelves of the Arctic Ocean. However, since then a growing body of evidence has

been found that grounding of ice has occurred in elevated areas of the Arctic Ocean since MIS 6 and/or before including the Lomonosov Ridge, Yermak Plateau and the Chukchi Borderland. During the last few years, speculations and discussions on large-sized glaciations and ice shelves were initiated by the results of detailed geophysical seafloor mapping in the Arctic Ocean from nuclear submarines and icebreakers, that identified a wide variety of glaciogenic geomorphic features in deep water including iceberg keel scours, most abundant at water depths shallower than ~350-400 m, and flutes and mega-scale glacial lineations extending as deep as ~1000 m below the present sea level. For example, Jakobsson et al. (2008) gave two mechanisms of glacial impact on the Chukchi Borderland causing the widespread erosion: (i) large-scale erosion by ice masses overriding the Chukchi Borderland from the east and southeast and related to floating ice shelves propelled by major ice streams of the Laurentide Ice Sheet, and (ii) impact of a drounded ice cap centred over the plateau or the entire borderland.
Based on swath bathymetry, sediment echosounding, seismic profiling and sediment coring we present additional results of the German RV „Polarstern" cruise ARK-XIII/3, which circumnavigated the North Pole through the Northwest and Northeast Passages in the Arctic summer of 2008. Massive ice stream activity from the Canadian Archipelago into the Arctic Ocean is evident from the M'Clure trough mouth fan, which has been formed by thick deposits of stacked glacial debris flows (Niessen et al. 2010). At the southern end of the Mendeleev Ridge, close to the Chukchi and East Siberian shelves, evidence is found suggesting the existence of Pleistocene ice sheets/ice shelves, which have grounded several times in up to 1300 m present water depth. We found mega-scale subglacial lineations and drainage pattern associated with deposition of till fans and stacked debris flows indicative of deposition close to the former grounding lines. Both on the Medeleev Ridge and the East Siberian Continental Slope, lineated areas are associated with large-scale seafloor erosion, accentuated by a conspicuous truncation of pre-glacial strata typically capped with a mostly thin layer of diamict sediment, in which the lineations are formed. The top about one metre of the diamicton could by sampled by a sediment core (PS72/342-1, Stein et al. 2010). These sediments are stiff and homogeneous and characterized by increased wet bulk density and increased shear strength values due to grounding of ice. Our tentative age model suggests that the youngest erosional event should be within MIS 5 (stadial MIS 5b or 5d?) (or older) and, thus, may have been contemporaneous with or linked to the event on the Chukchi Borderland (MIS 4-MIS 5d, POLYAK et al. 2007).
The findings suggest that the Pleistocene ice covers of the Pacific side of Arctic Ocean including the Chukchi Borderland, the Mendeleev Ridge and possibly the East Siberian Shelf have been a lot thicker and more complex in space and time than previously known. Although the exact mechanisms, timing and provenance of these ice masses are not yet well understood and still discussed controversely, these data indicate that very large glacial ice shelves extended into the Arctic Ocean from surrounding North American and Eurasian ice sheets several times during the Quaternary.

The effect of climate components on lichen symbiosis at habitats of North Victoria Land, Antarctica

Sieglinde Ott[1], Eva Ullrich[1], Jean-Pierre de Vera[2]

[1]Institut für Botanik, Universität Duesseldorf
[2]DLR Berlin

Lichens dominate the Antarctic flora in terms of species diversity and in terms of total biomass. Unlike higher plants, lichens are not a single organism, but a fungus, usually an ascomycete (the mycobiont) and a photosynthesizing organism (the photobiont), which can be either a cyanobacterium or a eukaryotic green alga. The research presented focuses on the characterisation of microclimate and photosynthetic activity by chlorophyll a fluorescence in correlation with atmospheric parameters to be able to describe environmental parameters which may influence and effect lichen species at respective habitats. The data will extend the knowledge on microclimate and atmospheric factors effecting lichen colonisation and their ecological amplitudes at continental antarctic terrestrial sites. Preliminary results will be presented on microclimate and metabolic activity in correlation with atmospheric factors (UV-B, ozone, aerosols etc.).The results will provide a baseline for the recognition and interpretation of the consequences of environmental change in this area in future decades.

Characteristics of the Antarctic herb tundra along two ecological gradients

Ivan Parnikoza[1], Smykla, J.[2],
Iryna Kozeretska.[3], Kunakh, V.A.[1]

[1]Institute of Molecular Biology and Genetics, National Academy of Sciences of Ukraine, Kyiv, Ukraine
[2]Institute of Nature Conservation, Polish Academy of Sciences, Krakow, Poland
[3]Taras Shevchenko National University of Kyiv, Ukraine

The Antarctic terrestrial vegetation is predominantly cryptogamic, comprising mostly mosses, liverworts and lichens. The vascular flora is represented by only two native species: *Deschampsia antarctica* Desv. (Poaceae) and *Colobanthus quitensis* (Kunth) Bartl. (Caryophyllaceae), which contribute to a plant community known as the Antarctic herb tundra formation. Several other plant communities have also been determined based mainly on species composition and physionomical criteria. These communities seem to be separated in their floristic composition and structural characteristics by their position along environmental gradients, with several environmental factors (e.g., moisture and nutrient availability, salinity, elevation, stability of substratum and microclimate) being recognized as critical determinants of distribution and species composition of particular plant communities.

There is many evidence that current climate changes may significantly alter the Antarctic plant communities. However, effects of these changes may be modified by local environmental factors and their heterogeneity. Therefore only detailed investigations of local environmental heterogeneity may allow to identify trends in vegetation changes that result from climatic changes.

Studies of the Antarctic herb tundra formation were conducted on King George Island, maritime Antarctic, in the neighborhood of the Polish Research Station "Arctowski" during the austral summer seasons 1995/96, 2001/02 and 2005/06. Changes in plant species composition and abundance were examined along two transects running (1) landwards from the sea coast to a glacier margin and (2) away from penguin colonies to sites distant from penguin influence. The selected transects represent two major ecological gradients, affecting the distribution of the Antarctic vascular plants from seacoast to glacier and away from penguin influence.

Plant communities in the investigated sites appear to be at the first stages of colonization and succession, therefore all the species forming these communities can be considered as pioneers. At some of the investigated sites vegetation did not demonstrate any changes during consecutive field surveys, they appear to be relatively stable remaining at the "pioneer" stages of their development. Analysis of the data from the transect running from the sea coast towards the glacier demonstrated occurrence of three different vegetation zones:

1. The costal zone which is moist, directly influenced by sea-spray, having vegetation cover from 56 to 98%.
2. The intermediate zone is also characterized by considerable water availability (mainly from snow melt and streams), with vegetation cover reaching 100%. Vegetation is dominated by bryophytes and flowering plants (*D. antarctica* always dominates over *C. quitensis* – 5:1, respectively). This zone appears to be the most optimal for development of the Antarctic herb tundra formation, which is usually represented by its most characteristic ascociation (i.e. *D. antarctica – C. quitensis* accociation).
3. The periglaciar zone, formed at the glacier foreland and moraines with vegetation cover reaching 56%, the majority of this is contributed by bryophytes and flowering plants indicating their ability to act as primary colonists.

The transect running away from penguin colonies can be divided in two different parts. First includes sites strongly affected by penguin derived nutrient input, where the Antarctic herb tundra formation is well-developed and vascular plants, in particular *D. antarctica*, may form lush, almost uniform, lawn-like swards covering more than 90% of the ground. Second includes sites distant from penguin influence, which are characterized by relatively low cover of vascular plants and are dominated by lichens and mosses. Some of these sites that were located at the glacier foreland (still covered with glacier in 1970's) corresponded with the perigracial zone of the seacoast–glacier transect.

These results indicate that penguin derived nitrification strongly affects cover of both vascular plants, and other plants, making difficult identification of vegetation zones described based on the data from seacoast–glacier transect. Such strong penguin derived influence has only relatively small range. In localities most strongly affected by penguin fertilization plant assemblages are formed that might be described as new *sociation* within the Antarctic herb tundra formation.

These results show that both species of native vascular plants, and the Antarctic herb tundra formation, are widely distributed in the studies area. Although both species of vascular plants occupy wide range of habitats, the most favorable conditions for their grow are in the intermediate zone of seacoast–glacier transect

and in nutrient-rich ornithogenic soils at active and relict penguin colonies. These patterns and ecological relations are not specific to the investigated area but can probably be generalized to other maritime Antarctic localities.

The field survey was made possible by the logistical and financial support of the Department of Antarctic Biology, Polish Academy of Sciences and National Antarctic Center of Ukraine. This work was also supported under the agreement on scientific cooperation between Polish Academy of Sciences (PAS) and National Academy of Sciences of Ukraine (NASU) within the project "*The effects of environmental changes on distribution, abundance and diversity of biota in terrestrial ecosystems of the Maritime Antarctic*" and grant no. NN305376438.

Migration, Phylogeographie und Nahrungsökologie antarktischer Skuas (Catharacta antarctica lonnbergi & C. maccormicki)

Hans-Ulrich Peter[1], Matthias Kopp[1], Simeon Lisovski[1], Markus Ritz[1], Richard Phillips[2], Steffen Hahn[3]

[1]Institut für Ökologie, University, Jena
[2]British Antarctic Survey, Cambridge, UK
[3]Centre for Limnology, Maarssen, The Netherlands

Während dreier Antarktischer Sommer (2007-2009) wurden auf King George Island (South Shetland Islands) 109 Südpolarskuas (Catharacta maccormicki) und Braune Skuas (C.antarctica lonnbergi) mit GLS-Loggern versehen. Mehr als 80% dieser Vögel wurden nach einem oder zwei Jahren wiedergefangen und die GLS-Daten ausgelesen sowie bearbeitet. Während alle Braunen Skuas im Südatlantik überwintern, ziehen die Südpolarskuas überwiegend zur Nordhemisphäre. Zum ersten Mal wird gezeigt, dass im Nordatlantik die Überwinterungsgebiete zwischen 40- 50°N und 30- 60°W liegen. Wenige Vögel überwintern vor Senegal bzw. vor Namibia. Etwa ein Drittel der Südpolarskuas überwintert aber im Nord- Pazifik zwischen Japan und dem Golf von Alaska, überwiegend in Bereichen, für die es keine publizierten Nachweise gibt.

Südpolarskuas verlassen ihr Brutgebiet zwischen Mitte März und Ende April. Sie erreichen die Überwinterungsgebiete zwischen 21. April und 4. Juni. Die Rückwanderung, die zwischen dem 15. September und 11. Dezember geschieht, ist schneller, dauert in manchen Fällen weniger als 3 Wochen. Nach unseren Daten verlassen die Vögel, die im Nordpazifik überwintern, die Brutgebiete 9 Tage eher und erreichen das Überwinterungsgebiet zwischen 21. April und 23. Mai. Die Rückwanderung wurde im Zeitraum zwischen 9. September und 6. Dezember registriert, d.h. kaum unterschieden von dem der atlantischen Vögel.

Die Entwicklung miniaturisierter GPS-Logger ermöglichte es, die Skuas während der Brutzeit auf einer gut aufgelösten Skala, bezogen auf die zeitliche und räumliche Ebene, zu verfolgen. Ziel war es, die Nahrungsflüge und Nahrungsgebiete der Brutvögel beider Arten detailliert zu erfassen.

Es zeigte sich, dass die untersuchten Südpolarskuas ausschließlich auf See Nahrung suchten, überwiegend in einem Umkreis von ca. 80 km um den Brutplatz.

Die meisten Braunen Skuas, die in der Nähe von Pinguin-Kolonien brüten, ernähren sich ausschließlich in diesen, während solche Paare, die entfernt von Pinguinen brüten, eine Präferenz für Pinguin-Kolonien auf entfernten Inseln zeigen, die keine Skua-Brutpaare aufweisen. Einzelne Paare haben sich auf andere Nahrungsquellen (Stationsabfälle, Kapsturmvögel) spezialisiert.

Während wir wissen, wie die Vergletscherung der Nordhalbkugel die Arten beeinflusst hat, sind unsere Kenntnis über die Prozesse auf der Südhalbkugel begrenzt. Auf der Basis von mtDNA-Daten wurde die Phylogeographie der südlichen Skua- Formen untersucht. Ausgangspunkt war die Nordhalbkugel. Die Diversifikation auf der Südhalbkugel vollzog sich in einem Zeitraum von 210.000 bis 150.000 Jahren vor heute und stimmt mit der Glazialperiode im Zeitraum von 230.000 bis 140.000 Jahren überein.

Skuas haben offenbar zuerst den Antarktischen Kontinent besiedelt, nach Abkühlung und wachsender Vergletscherung auch die subantarktischen Inseln und Tristan da Cunha erreicht, letztendlich auch während der Zeit der maximalen Vergletscherung Patagonien und die Falkland-Inseln. Der Genaustausch mit benachbarten Populationen und die Artbildung sind dabei nicht abgeschlossen. Die Besiedlungsgeschichte der Antarktis wird letztendlich mit dem rezenten Migrationsverlauf der Arten verglichen.

Gefördert von der DFG: PE 454/15 & 16

Heiße Prozesse in kalten Böden: Ein Überblick zur Boden bezogenen Forschung im sibirischen Permafrost

Eva-Maria Pfeiffer

Institut für Bodenkunde, Universität Hamburg

Klima relevante Prozesse in Permafrost-Landschaften, die im Zuge der beobachteten Erwärmung zu erheblichen Änderungen der regionalen und globalen Stoffflüsse – insbesondere C – führen, sind i.) die Zunahme der saisonalen Auftauzone, ii.) die Degradation des Permafrostes auf der Landschaftsebene, iii.) Bodenverluste im Zuge von Erosion arktischer Küsten und Ufer und iv.) Abnahme der Pemafrostmächtigkeit und ihrer „Schutzfunktion". Dabei ist derzeit unklar, was mit dem im Permafrost gespeicherten Kohlenstoff bei diesen Prozessen passiert. So führt tauender Permafrost zur Zunahme der saisonalen Auftauzone (active layer) und damit zu gravierende Änderungen hinsichtlich der mikrobiell gesteuerten rezenten C-Flüsse (Fixierung, Transformation, Freisetzung) in Permafrostböden. Insbesondere die Emission von klimarelevanten Spurengasen wie CO_2 und CH_4 aus dem Permafrost ist derzeit für die Bedeutung der regionalen und globalen Kohlenstoffflüsse unterbewertet. Weiterhin ist mit einer verstärkten Degradation des eisreichen tieferen Permafrostes auf Landschaftsebene im Zuge von Thermokarst- und Thermo-erosionsprozessen zu rechnen. Diese führt zur verstärkten Bildung von Seen, Auftauhügel, Schluchten, Taliks, Alassenken, und damit zur verstärkten Abtrag und Umlagerung von Organik-reicher Böden sowie erhöhter Methanfreisetzung. Ebenso führt die Erhöhung der Küsten- und Ufererosion durch steigende Luft- und Wassertemperaturen und durch den Rückgang der Meereisbedeckung zu verstärktem Austrag von terrestrischem Kohlenstoff in die Vorfluter und arktischen Meere. Neben der Gefährdung von Ansiedlungen, Pipelines, Öltanks etc. durch auftauenden Permafrost ist mit einer verstärkten Freisetzung von geogenem Methan (Gashydrate) in die Atmosphäre bei abnehmender Permafrostmächtigkeit und zersetzenden Permafrost zu rechnen. Um die Prozesse bewerten zu können, müssen verstärkte Forschungsanstrengungen im Permafrost angegangen werden. Im den Vortrag wird ein Überblick zu den notwendigen, offenen Forschungsfragen im Permafrost gegeben, die Grundlage für weiterführende internationale Kooperationen mit deutscher Expertise sein können. Diese umfassen:

1. Erweiterungen der Boden bezogenen Permafrostforschung zu Energie-, Wasser- und Spurengasflüsse an der Bodenoberfläche und in der aktiven Auftauzone (mikrobielle Prozessstudien, Ausbau der mikrometeorologischen Beobachtungen, up-scaling mittels remote sensing & flugzeugestützte Systeme)
2. Bilanzierung des alten Kohlenstoffs in tieferen Permafrostsedimenten, in Thermokarst-Niederungen und Aufschlüssen der Küstenerosion.
3. Analyse zur C-Freisetzung durch die Degradation des submarinen Permafrostes durch geophysikalischen Methoden und tiefere Bohrungen sowie Untersuchungen zu Permafrost assoziierten Gashydraten.
4. Festlegung und Freisetzung von Kohlenstoff in Abhängigkeit von biogen und abiogen gesteuerter Prozesse in terrestrischen und subaquatischen Permafrost-ablagerungen.
5. Reaktionen der am Kohlenstoffumsatz maßgeblich beteiligten Mikroorganismen auf Klimaveränderungen und ihre Rückkopplung auf Transformations- und Translokationsprozesse des im Permafrost fixierten Kohlenstoffs.

Comparative food web analyses with stable isotopes of Tardigrades in glacial ecosystems of Spitsbergen and the Alps

Barbara Post[1], Birgit Sattler[1], Martin Kainz[2], Hieronymus Dastych[3]

[1]Institut für Ökologie, Universität Innsbruck, Austria
[2]Donau-Universität Krems, Austria
[3]Zoologisches Institut, Universität Hamburg

Glaciers cover vast areas of the polar regions and are found in mountain ranges of every continent. Recently, they are recognized as active ecosystems, which harbour a diverse community of microorganisms and metazoa. Especially supraglacial communities and cryoconite holes contribute substantially to the carbon budget of cold ecosystems. Cryoconite holes are unique freshwater environments, which can cover 0,1-10 % of the ablation zone of a glacier. They are formed when solar heated dark debris melts down into ice. They occur globally in glaciated environments of polar and alpine glaciers. They are up to 60 cm deep and from a few millimetres to a metre or more in diameter. These individual ecosystems which resemble mini lakes with a sediment layer and

a water column have distinct boundaries, energy flow and nutrient cycling. The supernatant water in a hole is frozen throughout the winter or even during a day-night cycle implying harsh conditions for cryoconite communities.
This special environment is settled by mainly microbial communities (viruses, bacteria, microalgae and protozoa). Depending on the geographic region also metazoa such as tardigrades, rotifers, nematodes, copepods and insect larvae can be found. Both the microflora and -fauna are probably decomposed by fungi and bacteria. The secondary production within cryoconite holes plays a role in the biological colonization of ice-free areas. These holes may furnish refugia for microorganisms and metazoa during ice ages. Charlesworth (1957) speculated that some microorganisms, algae, protozoa, rotifers, and tardigrades probably persisted during the Pleistocene in cryoconite holes and on nunataks.
Tardigrades, part of the superphylum Ecdysozoa, are small invertebrates (0,1-1,0 mm in body length) found around the world in such diverse places as the deep sea and high altitudes and latitudes. These "water bears" have a high tolerance to a variety of extreme environmental conditions.
Some arctic Hypsibiidae can survive exposure to 20 degrees below zero, while an Antarctic *Diphascon sp.* can survive a short-term exposure to -80°C. Cold tolerance has been demonstrated in polar Echiniscidae and Macrobiotidae (e.g. Grùngaard et al. 1992; Sùmme and Meier 1995; Sùmme 1996). Cryoconite and accordingly glacial tardigrades are *not therefore* especially cold-tolerant; indeed, cold tolerance (as cryptobiosis) and aerial dispersal are common tardigrade attributes (e.g.Wright et al. 1992; Kinchin 1994).
Very little is known about tardigrades living in cryoconites. Macrobiotidae, Hypsibiidae and other families containing cosmopolitan tardigrades occur in a range of alpine, Arctic and Antarctic terrestrial and freshwater habitats. All of the cryoconite tardigrades belong to the family Hypsibiidae. Dastych (1985) described a subcosmopolitan species, *Hypsibius dujardini (DOYÈRE, 1840)* in cryoconites, but also in mosses from non-carbonate bed-rock of Svalbard (Spitsbergen). *Hypsibius arcticus MURRAY, 1907 was found in cryoconites*, at the altitude of 400 m from Prince Charles Forland and other localities of Svalbard. This species is also a cosmopolitan.
De Smet (1994) collected *Diphascon recamieri* RICHTERS, 1911 out of cryoconte holes from Svalbard. This is an arctic-alpine species with a holarctic distribution; hydrophilous and coldstenotherm. He could also identify *Isohypsibius granulifer* THULIN, 1928. It is a hydrophilous species with a cosmopolitan distribution, and is usually the most dominant taxon in submerged mosses from arctic freshwater habitats (VAN ROMPU and DE SMET, 1991).
On an Austrian glacier *Hypsibius klebesbergi Mihelčič, 1959* has been described. *Hypsibius janetscheki Ramazotti*, 1968 was found on a Himalayan glacier.
The importance of tardigrades and their food preference within the food web of cryoconite holes are still unknown. *Diphascon* and *Hypsibius spp.* (Hypsibiidae) are hydrophylic, bacteriophages and/or algivores (e.g. Hallas and Yeates 1972).
The objectives of this research is the identification of tardigrades in various glacial ecosystems and the investigation of dietary patterns and trophic relationships of tardigrades with stable isotopes. It is important to know, if the food web concept is working in this harsh environment as well.
The stable isotopes of nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) provide powerful tools to assess the trophic positions of and carbon flow to the consumer, the tardigrade, in food webs. For the analysis 0,1 mg dried tardigrades per sample are required. To get an appropriate isotopic baseline the food of the tardigrades must also be investigated.
Sampling of the cryoconite holes will be conducted in summer and autumn 2010. The main focus of sampling will be the alpine glaciers (Rotmoosferner, Stubacher Sonnblickkees, Gaißberg Ferner, Langtaler Ferner). Here *Hypsibius klebesbergi* is the only known water bear, which live in cryoconite holes. It is a fact, that those species have a dense population.
Samples from polar glaciers (Spitsbergen) will derive from the Kongsfjord glaciers. Here the tardigrade fauna is more diverse and more than one species per cryoconite hole is possible. In this case, it will be tricky to obtain sufficient biomass for stable isotope analysis.

Photobiont selection as a way of ecotypical differentiation in wide-spread lichens? A case study on Cetraria aculeata.

Christian Printzen[1,2], Stephanie Domaschke[1], Fernando Fernandez-Mendoza[1]

[1]LOEWE Biodiversität und Klima Forschungszentrum, Frankfurt am Main
[2]Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main

Lichens are highly specialized symbioses between heterotrophic fungi (mycobionts) and autotrophic green algae or cyanobacteria (photobionts). They are able to colonize the most extreme habitats on earth, including high alpine and polar regions, where they outcompete vascular plants and bryophytes in terms of biodiversity and often also biomass. Many lichens are also well known for their exceptionally wide geographical ranges and ecological niches. We studied arctic, antarctic and temperate populations of the shrubby lichen Cetraria aculeata in order to find out whether genetic differences in the mycobiont and photobiont are correlated with ecological differences. Our results are based on c. 250 individuals and sequences of three genes for each biont. They indicate that mycobionts of C. aculeata associate with genetically different photobionts in polar and temperate environments. In an ongoing study we try to find out whether these genetical differences go along with physiological adaptions. Our study also reveals that antarctic populations of both bionts are genetically depauperate. This is apparently not a result of strong selection under harsh environmental conditions but rather reflects demographic history or the isolated position of these populations. In the mycobiont, the highest genetic variability is found in arctic populations. The photobiont is most diverse in temperate regions but populations from Svalbard and Iceland still are considerably more variable than antarctic ones.

The International Arctic Science Committee (IASC) - an Overview

Volker Rachold, Mare Pit

International Arctic Science Committee (IASC), Potsdam

The International Arctic Science Committee (IASC) is a non-governmental, international scientific organization established to encourage, facilitate and promote leading-edge multidisciplinary research to foster a greater scientific understanding of the arctic region and its role in the Earth system. IASC was established in 1990, began operations in 1991, and today comprises 19 member countries. The IASC member organizations are national science organizations covering all fields of arctic research.
Representatives of national scientific organizations from all 19 member countries form the IASC Council. The President of IASC is elected by Council, which also elects 4 Vice-Presidents to serve on the Executive Committee. Council usually meets once a year during the Arctic Science Summit Week, ASSW. IASC Executive Committee operates as a board of directors and manages the activities of IASC between Council meetings. The Chair is the President of IASC.
The IASC Secretariat, located in Potsdam (Germany) since January 2009, implements decisions of the Executive Committee and Council, manages IASC finances, conducts outreach activities and maintains international communication.
IASC is an international associate of the International Council for Science (ICSU), observer to the Arctic Council (AC) and ex-Officio Member of the International Polar Year (IPY) 2007/2008 ICSU/WMO Joint Committee (IPY JC). IASC has formal partnership agreements with various International Polar and Global Organizations.
To achieve its mission, IASC

- Initiates, coordinates and promotes scientific activities at a circumarctic or international level;
- Provides mechanisms and instruments to support science development;
- Provides objective and independent scientific advice on issues of science in the Arctic and communicates scientific information to the public;
- Seeks to ensure that scientific data and information from the Arctic are safeguarded, freely exchangeable and accessible;
- Promotes international access to all geographic areas and the sharing of knowledge, logistics and other resources;
- Provides for the freedom and ethical conduct of science;
- Promotes and involves the next generation of scientists working in the Arctic; and
- Promotes bipolar cooperation through interaction with relevant science organizations.

This presentation provides an overview of IASC´s activities and achievements, highlighting IASC´s role as the leading international organization of scientific expertise in the Arctic.

Roads, highways and trails to Antarctica: case ctudies of Crustaceans based on molecular markers

Michael J. Raupach[1], Johannes Dambach[2], Florian Leese[3]

[1]Forschungsinstitut Senckenberg, Deutsches Zentrum für Marine Biodiversitätsforschung, Wilhelmshaven
[2]Zoologisches Forschungsmuseum Alexander Koenig, Bonn
[3]Lehrstuhl für Evolutionsökologie und Biodiversität der Tiere, Ruhr-Universität Bochum

Biogeographic and phylogenetic studies on marine Antarctic species have been conducted for over 150 years and represent some of the most fascinating examples in ecology and evolutionary biology. As consequence of the unique tectonic history, the long isolation and recurrent large-scale glaciations of Antarctica, the Antarctic marine biota are unique in terms of their physiology, ecology, biogeography, and phylogeny.
In this context, the scarcity of decapod crustaceans is one of the most striking biodiversity characteristics of Antarctic waters when compared to other marine regions. Reptant crabs, apart from a couple of lithodid anomurans in the deeper waters off the Antarctic continental shelf, are completely absent, and caridean shrimps are represented by about a dozen benthic and a few pelagic species, of which some show a circum-Antarctic distributional pattern. From the high Antarctic continental shelf only five benthic shrimp species are known. The reason for the impoverished Antarctic decapod fauna might be caused by physiological as well as ecological constraints affecting their life history in the cold. In a recent study, the population structure of two decapod shrimps from various locations around Antarctica using molecular data was assessed and evaluated for the first time, testing whether disruptive or unifying ecological and evolutionary forces affect both species' gene pools. Furthermore, the authors assessed whether populations of the shallow-water species *Chorismus antarcticus* compared to the deep-sea species *Nematocarcinus lanceopes* show reduced genetic diversity and stronger signatures of recent expansions following a past population bottleneck or founding event. This can be expected as a feasible consequence o f recurring disturbances of the inhabited shelf areas by advancing grounded glaciers during the ice ages in the late Cenozoic, in particular during the Last Glacial period.
In contrast to the deacapod crustaceans, the per acarid crustaceans, especially the Amphipoda and Isopoda, have flourished in terms of diversity in Antarctic waters. Isopods belong to the most conspicuous crustaceans in Antarctic waters. Species of the families Serolidae, Chaetiliidae and Antarcturidae are of large size, many of them displaying lenghts over 5 cm. These families are abundant and are typical components of the marine benthic communities of the Antarctic shelf. However, species numbers are much higher in asellote isopods. Asellota are easily overlooked du ring sampling because of their small size; most species being less than 10 mm long. They represent one of the most numerous and important elements of the benthos in all oceans, especially in the deep sea, which they have colonized through several lineages. Within Antarctic waters, many blind species of typical deep-sea families (e.g. Munnopsididae, Desmosomatidae, Nannoniscidae or Ischnomesidae) can also be found in shallow waters, while on the other hand some eye-bearing shelf taxa (e.g. Stenetriidae, Paramunnidae or Munnidae) invaded deep waters. During the last years, the phylogeny and population structure of several Antarctic isopod species has been analysed using a broad range of different molecular markers, including mitochondrial and nuclear gene fragments as well as microsatellites, more in detail.
Based on all these studies, different ways of colonizing and recolonizing the Antarctic waters in response to climate oscillations are discussed.

The Mass Deficit of Outlet Glaciers on the Antarctic Peninsula after Disintegration of Northern Larsen Ice Shelf

Helmut Rott[1,2], Florian Müller[2], Thomas Nagler[2], Dana Floricioiu[3]

[1]Institute of Meteorology and Geophysics, University of Innsbruck, Austria
[2]ENVEO IT, Innsbruck, Austria
[3]DLR IMF, Oberpfaffenhofen

After disintegration of the northern sections of Larsen Ice Shelf (LIS) on the Antarctic Peninsula the outlet glaciers, previously feeding the ice shelves, turned into tidewater glaciers. The response of these glaciers is of basic interest to learn about the role of ice shelves for the stability of grounded ice. We report on studies of flow dynamics and ice export of the glaciers above the northernmost sections of Larsen Ice Shelf that disintegrated several years ago: the ice shelves Larsen-A and in Prince Gustav Channel (PGC) in January 1995, and Larsen-B ice shelf in March 2002. The flow field of the glaciers above the ice shelves was mapped with one-day repeat-pass interferometric SAR (InSAR) data of the ERS-1/ERS-2 tandem mission, acquired in 1995 to 1999. The data revealed the first evidence of widespread acceleration of the outlet glaciers

above Larsen-A and PGC after ice shelf collapse. After shutdown of ERS-1 the application of InSAR for ice motion analysis was no more possible because of the longer repeat pass intervals of the available radar missions, resulting in decorrelation of the complex radar signal.
Cross-correlation of templates in repeat-pass SAR images (also called feature tracking) offers an alternative option to map ice velocities using the incoherent amplitude signal. For 2004 to 2007 we applied this technique with Envisat ASAR repeat-pass images (spatial resolution 30 m) to map the motion of large calving glaciers in the Larsen B embayment. However, these motion maps lack the spatial detail of the interferometric analysis and could not be applied to narrow outlet glaciers. These constraints could be overcome by means of the TerraSAR-X satellite, launched in June 2007. The X-band radar sensor offers excellent opportunities for detailed mapping and monitoring the glacier flow due to the high spatial resolution and 11-day repeat cycle. In 2007-2009 more than 70 TerraSAR-X repeat pass images in strip-map mode were acquired over the outlet glaciers above the previous Larsen-A, Larsen-B and PGC ice shelves. The swath width of these images is 30 km, the spatial resolution is 1.0 x 3.0 metres (slant range x azimuth). Cross-correlation in incoherent amplitude images is applied to map glacier velocities. The method provides the slant range and azimuth components of the surface displacement at sub-pixel accuracy. All observed glaciers show significant acceleration. The velocity increase extends far upstream on the terminus of the glaciers, with the relative change in velocity decreasing with distance from the terminus. This suggests that the acceleration was triggered by stress perturbation at the glacier front. So far there are no signs of slow-down, so that glacier thinning and frontal retreat will go on.
Gates across the glaciers near the ice front were selected to compute the calving flux. The TerraSAR-X data are used to estimate the calving fluxes for the year 2008. As reference for pre-collapse conditions the mass flux through these gates to the ice shelf is estimated using ice motion maps derived from interferometric tandem data of the ERS-1/ERS-2 satellites in 1995. For the year 2008 the mass deficit of the outlet glaciers in the embayment of the disintegrated northern Larsen Ice Shelf sections is estimated at 13 Gt/yr, significantly lower than previously published estimates. This corresponds to about 3 % of the present cryospheric contribution to sea level rise. Because of the rather small glacier area above northern Larsen Ice Shelf this number is not significant in terms of global sea level rise. However, the detailed analysis of the dynamic behaviour of the glaciers is very relevant for understanding the processes governing glacier response to changing boundary conditions after ice shelf retreat.

Mikrobielles Leben in der Kryosphäre

Birgit Sattler[1], Alexandre Anesio[2], Michael Storrie-Lombardi[3], Wolfgang Sattler[1] und Roland Psenner[1]

[1]Institut für Ökologie, Universität Innsbruck, Austria
[2]Bristol Glaciology Centre, School of Geographical Sciences, Bristol University, UK
[3]Kinohi Institute, Pasadena, CA, USA

Eis und Schnee galten lange Zeit als unbelebte und lebensfeindliche Wüste. Doch dieses Bild hat sich grundlegend verändert - inzwischen ist weitgehend bekannt, dass die Kryosphäre über eine Vielzahl von Lebensräumen verfügt, welche von Spezialisten hauptsächlich mikrobiellen Ursprungs besiedelt werden. So beinhaltet die Kryosphäre eine Vielzahl an Habitaten in alpinen Hochgebirgslagen bis hin zu Polarregionen, welche von unterschiedlicher Lebensdauer geprägt sind, aber allesamt die Biodiversität und Funktionalität angrenzender Systeme beeinflussen.
Der am längsten bekannte Lebensraum ist das zirkumpolare Meereis, welches so genannten SIMSOs (sea ice microbial communities) innerhalb der Solekanälchen wertvolle Habitate liefert. Diese Gemeinschaften sind äußerst produktiv und stellen einen wichtigen link für höhere trophische Ebenen dar. Das Pendant im Süßwasser findet man in der Winterdecke von Hochgebirgsseen bzw. in den permanent zugefrorenen Seen der Arktis sowie Antarktis. Doch auch Gletscher stellen einen nennenswerten mikrobiellen Lebensraum dar, welcher sogar äußerst relevant in Bezug auf die Kohlenstoffproduktion und dessen Verfügbarkeit für tiefere Lagen, wie z.B. das Gletschervorfeld, ist. Mit der zunehmenden Eisschmelze beobachtet man gleichzeitig auch eine Stimulation des mikrobiellen Metabolis-mus, vor allem in den Kryokonitlöchern, welche wie Mini-Seen mit Sediment und Pelagial funktionieren. Vor allem während der Sommermonate ist die C-Produktion in diesen Schmelztrichtern vergleichbar zu temperierten Böden. Eine Besonderheit dieses Kryokonitmaterials ist auch die überaus effiziente Absorption künstlicher Radionuklide, welche von Atombombentests sowie dem Reaktorunfall in Chernobyl stammen. Besiedelt werden jene Eisökosysteme zum Teil auch über die

Atmosphäre, welche bereits wieder einen mikrobiellen Lebensraum für sich darstellt. Die Lebensbedingungen für die hauptsächlich mikrobiell dominierte Lebewelt in Schnee und Eis sind jedoch hart und erfordern entsprechende Anpassungen. Sie sind charakterisiert durch tiefe Temperaturen mit zum Teil großen Tagesschwankungen. Wiederholte Gefrier- und Tauzyklen über einen Tagesrhythmus stellen an den Stoffwechsel einer Zelle große Anforderungen. Die Kryosphäre ist zudem ein guter Marker für beträchtliche Mengen an Stickstoff-verbindungen, welche in vielen Teilen der Erde, z.B. in den Alpen, aus den Niederschlägen stammen. Der Großteil der Nährstoffe wird über Windverfrachtung bzw. über Schmelzwasser-kanäle bzw. schmelzende Schneeauflagen transportiert. Letzteres verlangt die Verfügbar-keit von flüssigem Wasser, wovon jede Lebensform in erster Linie abhängt. Im englazialen Lebensraum findet im gefrorenen Zustand auch kaum ein Austausch von Nährstoffen bzw. ein Abtransport von Stoffwechselprodukten statt. Bei sehr tiefen Temperaturen spricht man von einer „Cryobiose", was soviel wie einer Kältestarre entspricht. Flüssiges Wasser jedoch, und sei es auch nur ein Mikrofilm, welcher einen dunklen Partikel bzw. ein Konglomerat von mineralischem und organischem Material umhüllt, kann die mikrobielle Aktivität wieder initiieren. Diese verschiedenen Lebensformen bestimmen somit, ob es sich bei dem Eis-Ökosystem um eine „Oase" oder ein „Refugium" handelt. Die Messung des mikrobiellen Metabolismus im Eis war bislang eine große Herausforderung und die Suche nach non-invasiven Methoden stellt eine wertvolle Annäherung zur Abschätzung des Kohlenstoffbudgets der Kryosphäre dar. Mittels eines Lasers, welcher photosynthetisch aktive Pigmente anregt, ist man bislang in der Lage, in situ die Präsenz autotropher Organismen zu detektieren. Durch die vermehrte Verfügbarkeit von flüssigem Wasser findet ein höherer Kohlen-stoffumsatz auto- und heterotropher Organismen der Kryosphäre statt, welcher somit erstmals quantifiziert werden kann und zum besseren Verständnis alpiner und polarer Ökosysteme beiträgt.

Gezeitenmessungen in der Antarktis: Von historischen Messungen der Ozeangezeiten zur Gezeitengravimetrie im IPY-Projekt POLENET

Mirko Scheinert[1], Andrés F. Zakrajsek[2], Reinhard Dietrich[1], Lutz Eberlein[1], Sergio A. Marenssi[2]

[1]Institut für Planetare Geodäsei, TU Dresden
[2]Instituto Antártico Argentino, Dirección Nacional del Antártico, Buenos Aires, Argentina

Die Kenntnis der Ozeangezeiten ist von großer Bedeutung in den verschiedensten Bereichen des täglichen Lebens wie z.B. in der Schifffahrt, aber auch für breiteste wissenschaftliche Anwendungen. Der Einfluss der Ozeangezeiten muss bei vielen Verfahren, insbesondere bei wiederholten Satellitenmessungen, reduziert werden: z.B. bei der Erfassung von Veränderungen von Meereisbedeckungen oder Schelfeisen (Satellitenaltimetrie), bei der Ableitung von Fliessverhalten und Aufsetzzone beim Übergang des Inlandeises zum aufschwimmenden Eis (Satellitenfern-erkundung) oder bei der Erfassung von Massenänderungen des antarktischen Eis-schildes durch GRACE (Satelliten-Schwere-feldmission). In der Antarktis ist die Messung der Ozeangezeiten aufgrund der Meereis-bedeckung und der schwierigen Umwelt-bedingungen allerdings mit größeren Schwierig-keiten verbunden.
So soll der erste Teil des Vortrags einem historischen Rückblick gewidmet sein: Bereits am Anfang des 20. Jahrhunderts wurden während der schwedischen Südpolarexpedition unter Otto Nordenskjöld als auch während der ersten deutschen Südpolarexpedition unter Erich von Drygalski Messungen der Ozeangezeiten durchgeführt. Trotz widrigster Umstände bei der Realisierung dieser Expeditionen konnten so in bemerkenswerter Weise Informationen über die Ozeangezeiten an ganz verschiedenen Orten in der Antarktis gewonnen werden. Während bei der Nordenskjöld-Expedition die Messungen an der Küste der Snow-Hill-Insel im Gebiet der nordöstlichen Spitze der antarktischen Halbinsel durchgeführt wurden, fungierte bei der deutschen Expedition das ca. 90 km von der ostantarktischen Küste entfernt im Eis eingeschlossene Forschungsschiff „Gauss" als Observatorium. Die Umstände der Expedition werden in Hinblick auf diese Gezeiten-messungen kurz referiert. Die Ergebnisse dieser historischen Gezeitenmessungen werden mit heutigen Ozeangezeitenmodellen verglichen. Die bemerkenswerte Überein-stimmung unterstreicht die außergewöhnliche Leistung bei der Durchführung dieser Beobachtungen.
Die Messung der Ozeangezeiten in der Antarktis und die Verbesserung der Ozeangezeitenmodelle ist auch heute noch eine aktuelle wissenschaftliche Aufgabe. Insbesondere in der Antarktis haben die Ozeangezeitenmodelle Defizite. Dies liegt zum einen an den Beschränkungen der Satellitenaltimetrie, die die hauptsächliche Quelle für die globale Gezeitenmodellierung darstellt. In den antarktischen Ozeangebieten, insbesondere bei Meereisbedeckung und beim Übergang zu den

Schelfeisen bzw. Küsten können satellitenaltimetrische Daten nicht mehr verwendet werden. In-situ-Daten, wie z.B. Pegelmessungen oder kinematische GPS-Messungen auf den schwimmenden Schelfeisen, sind nicht in ausreichender Dichte verfügbar. Alternativ zu den GPS-Messungen stellt die Gezeitengravimetrie eine weitere Methode dar, Ozeangezeiten zu erfassen und damit Modelle zu validieren und schließlich zu verbessern. Die Einrichtung von geodätisch-geodynamischen Observatorien war auch ein Hauptziel des IPY-Projekts POLENET, das von geodätischer Seite vor allem auf GPS-Stationen und von geophysikalischer Seite auf seismologische Stationen in den Polargebieten fokussierte. Im Rahmen des POLENET-Projekts wurde eine argentinisch-deutsche Kooperation initiiert, um gravimetrische Observatorien in den argentinischen Antarktisstationen Belgrano II (Februar bis Dezember 2007) und San Martín (Februar 2008 bis Februar 2009) einzurichten und gravimetrische Zeitreihen aufzuzeichnen. Bei der Analyse der gravimetrischen Zeitreihe werden als ein Hauptergebnis die Parameter der Festerdegezeiten erhalten. Das Residuum (Restsignal) beinhaltet zum größten Teil den Effekt der Ozeanauflastgezeiten, so dass das residuale Signal mit Prädiktionen aufgrund von Ozeangezeitenmodellen verglichen werden kann. Die in diesem Projekt erfolgten Aktivitäten werden dargestellt und die erreichten Ergebnisse diskutiert. Außerdem soll eine Aussicht auf weiterführende Arbeiten, insbesondere für eine regionale Verbesserung des Ozeangezeitenmodells, gegeben werden.

Die Österreichische Gesellschaft für Polarforschung

Wolfgang Schöner[1], Birgit Sattler[2], Andreas Richter[3]

[1]Zentralanstalt für Meteorologie und Geodynamik, Wien, Austria
[2]Institut für Ökologie, Universität Innsbruck, Austria
[3]Institut für Chemische Ökologie und Ökosystemforschung, Universität Wien, Austria

Die Österreichische Gesellschaft für Polarforschung ÖGP ist 2008 durch Namensänderung aus der Payer-Weyprecht Gesellschaft hervorgegangen. Sie hat die Erforschung der Polargebiete zum Ziel und versucht dazu die Gesamtheit der verschiedenen Wissenschaftsdisziplinen der Polarforschung in Österreich vorantreiben. Durch das Internationale Polarjahr 2007/2008 hat die österreichische Polarforschung neuen Aufrieb und eine bessere institutionelle Verankerung erfahren. Diese Neubildung ist derzeit noch im Gange und beinhaltet unter anderem die Gründung eines Virtuellen Polarinstitutes und insbesondere auch die Förderung des wissenschaftlichen Nachwuchses. Dazu wurde 2010 erstmals das Julius Payer Stipendium vergeben. Die weiteren Ziele und Aktivitäten der ÖGP werden in dem Vortrag vorgestellt.

Linking polar research to school – experiences from Austria

Wolfgang Schöner[1], Birgit Sattler[2], Michaela Panzenböck[1], BIPOLAR Team[1]

[1]Zentralanstalt für Meteorologie und Geodynamik, Klimaforschung, Wien, Austria
[2]Institut für Ökologie, Universität Innsbruck, Austria

Within the frame of IPY the Austrian ministry of science and research initiated a 2-years research programme to link polar research to schools. From the national call for proposals in 2006 four projects were selected for funding, all with a strong component for science-education cooperation. In particular the programme asked for direct involvement of higher-level school children in the formulation of research questions. However, from the timeframe of the call and year-round school activities the involvement of school-children into the formulation of research questions was only possible after approval and implementation of projects. Within the project BIPOLAR three research institutes (two universities and the Austrian weather service ZAMG) together with different schools in Austria developed a curriculum for incorporation of research into schools for the example of polar research. The curriculum developed is organised by a 4-steps module structure from "bridging science with school" to "science into the classroom" to "scientist of the future" and finally with "science goes public". The 4-steps module structure attempts to introduce school children in the daily business of scientists from studying relevant literature, formulation of hypothesis, configuring experimental setups, interpretation of data, presentation of results in the relevant community and, finally, publication of results. A relevant milestone of the project was field work of scientists together with the school children, featuring a major point for students motivation. From financial and organisational constrains it was not possible to visit polar regions with all contributing schools, but it was possible to organise a series of field trips to Austrian glaciers and high-mountain landscape. The BIPOLAR schools (with different didactic concepts) formulated several interesting

research questions and experimental setups which were finally presented at the children's-conference "KINKONG" (Kinderkongress) in Vienna, with a highly stimulating ambience. From the highly motivated work the school children attracted a high interest of media, stakeholders and educational organisations and gained a significant added value for the public discussion on climate-change in Polar Regions via the snowball concept of module 4.

Ergebnisse der glaziologischen Feldkampagne 2007 und früherer Befliegungen zur Untersuchung der Struktur des Halvfarryggen, Antarktis

D. Steinhage[1], H. Oerter[1], J. Schwander[2], C. Wesch[1], M. Bock[1,2], P. Kaufmann[3], F. Wilhelms[1]

[1]AWI Bremerhaven
[2]Universität Bern
[3]ehemals Universität Bern

Zur Bestimmung der Massenbilanz der Antarktis werden zwei unterschiedliche Ansätze verfolgt: Die Betrachtung des gesamten Kontinentsmittels satellitengestützter Messungen, wie z.B. Bestimmung der Höhenänderung des Eisschilds und der Massenänderungen oder die Bilanzierung einzelner Einzugsgebiete von Eisströmen und Auslassgletschern. Für letzteren Ansatz sind Probennahmen und/oder Messungen vor Ort zur Bestimmung der Akkumulationsraten unabdingbar, denn die Fliessgeschwindigkeiten zur Bestimmung der abfließende Eismasse über die Aufsetzlinie können ebenso mit Fernerkundungsmethoden wie auch die Eisdicke an der Aufsetzlinie aus flugzeuggestützten Radarmessungen ermittelt wer den kann.
Daher hat das AWI 2007 mit Unterstützung der Universität Bern glaziologische Feldarbeiten auf dem Halfarryggen, Antarktis, dur chgeführt, um den aufgrund der Lage des Höhenzugs zwischen den beiden Schelfeisen Ekströmisen und Jebartisen zu erwar tenden Gradienten in der lokalen Akkumulationsverteilung detektieren zu können. Die Kenntnis der Verteilung der Akkumulation ist, wie schon eingangs erwähnt, neben anderen Parametern zur Bestimmung der Massenbilanz dieses Ausläufers der Rytscherflya ebenso unbedingt erforderlich, wie auch zur Auswahl einer möglichen Bohrpunktes auf dem Halvfarryggen. Im Rahmen einer mehrwöchige Traverse von der deutschen Überwinterungsstation Neumayer aus, wurde daher ein multidisziplinäres Arbeitsprogramm durchgeführt, um die Akkumulationsraten an ausgewählten Stellen zu bestimmen und mittels hochfr equenter Bodenradarmessungen lokale Variationen in den Akkumulationsraten zu detektieren. Dazu wurde Schneeschächte beprobt, ein flacher Eiskern und ein Firnkern gebohrt sowie mehrere Profile mit kinematischen GPS und einem hochfrequenten Radarsystem kartiert.
Bereits 1996/97 führten erste Messflüge der AWI Polarflugzeuge von der Neumayer Station aus mit dem speziell f ür den Einsatz in Polarregionen von der TU Hamburg-Harburg entwickelten Eisdickenradarsystem über den Halvfarryggen. Da Neumayer über Jahre hinweg Basis der Messflüge zur Kartier ung der Eisdicken und Struktur des Eisschilds in Dronning Maud Land geblieben ist, konnten aus diesen Flügen die Eisdicke und innere Struktur des Halvfarryggen in hoher regionaler Auflösung erfasst werden, ohne das eine groß angelegte Kartierung dafür durchgeführt werden musste.
Der Beitrag wird die durchgeführten Feldarbeiten vorstellen und einen Überblick über die Struktur des Halvfarryggen abgeleitete aus den Flugzeugradarmessungen gegeben.

Dynamically and thermally driven flows over and around Svalbard: A case study based on numerical simulations and airborne measurements

Elisabeth Stütz[1], Alexander Gohm[1], Friedrich Obleitner[1], Andreas Dörnbrack[2], Robert Baumann[2]

[1]Institute of Meteorology und Geophysics, University of Innsbruck, Austria
[2]Institut für Physik der Atmosphäre, DLR, Oberpfaffenhofen

The polar version of the Advanced Weather Research and Forecasting Model (Polar WRF) has been evaluated on the basis of a case study (15 March 2008). The goal was to test its applicability for studying airflow over and around Svalbard at the meso and micro scale. Specically, we were interested in boundary layer processes such as the interaction between the lowest air layer and the glacier, the sea surface, and the sea ice.
The airborne measurements taken during 15 March 2008 in the framework of the IPY THORPEX campaign provide an excellent possibility to improve the understanding of the atmospheric processes in the remote archipelago of Svalbard. The flow patterns over

and around Svalbard is worth being inspected, as there occur interesting features like coastal jets due to channeling effects or roll clouds during cold air outbreaks. This complex flow field, which also includes katabatic winds, can now be demonstrated with a 3-dimensional atmospheric model. Nonhydrostatic atmospheric models have already been applied to Antarctic and Arctic regions. However there are only few modelling studies with a small enough meshsize to resolve orographic effects of small archipelagos in detail. Although this region is sparsely populated and remote, the understanding of mesoscale atmospheric processes are important, due to the fact, that mesoscale winds have a great impact on sea ice coverage and play a role in the energy and mass balance of polar ice sheets (Greenland, Iceland, Svalbard, etc) via their impact on turbulent fluxes at the surface. Besides this climate factors it is important to continously validate high resolution models in arctic regions as they are used as virtual laboratories to improve the understanding of arctic phenomena such as polar lows.
The mesoscale Advanced Research WRF (ARW) Version 3.1.1 is used to examine the atmosperic situation in detail. Since the Svalbard archipelago is situated in a very specific, namely polar region, some model modifications developed by the Polar Meteorology Group of the Ohio State University are used. They include improved treatment of heat transfer for ice sheets and implementation of a fractional sea ice description in the NOAH land-surface model. For the event on 15 March 2008 the model is initialized with ECMWF analysis data. Sea surface temperature and fractional sea-ice distribution is based on OSTIA SST and SEAICE data (Operational Sea Surface Temperature and Sea Ice Analysis) from the National Center for Ocean Forecasting (NCOF), Met Office UK. The simulations are compared to measurements taken by the Deutsches Zentrum für Luft und Raumfahrt (DLR) on board of the Falcon aircraft which was operated during the IPY THORPEX field campaign in February and March 2008. These airborne observations, which include in-situ flight-level data, turbulence measurements, dropsondes, DIAL water vapor and aerosol backscatter intensity, are used to evaluate the mesoscale structure simulated by the model over and around Svalbard. Further, the model is validated against ground-based measurements from automatic weather stations on the Kongsvegen glacier and from routine stations like the Zeppelin station (NILU - Norsk institutt for luftforskning) and the Koldewey station (AWI - Alfred Wegener Insitut). From this station also the upper air soundings are used for verification. Results will show, amongst others, the sensitivity of the simulated boundary layer structure and the complex flow pattern on the model setup based on a comparsion of measured and simulated flow fields and turbulent fluxes.

Conceptual model of ice sheet - permafrost interaction (Last Glacial Maximum, Central - Western Poland)

I. Szuman, M. Ewertowski

Institute of Geoecology and Geoinformation, Adam Mickiewicz University of Poznan, Poland

This study presents a conceptual model of interactions between ice sheet and permafrost and the influence of permafrost on basal condition under the Weichselian Ice Sheet in the Central - Western Poland. Permafrost is defined as a ground with temperature ca. 0 °C or below 0 °C persisting during a significant amount of time. The considered time period covers the Last Glacial Maximum (LGM), with special regard to the ice sheet advance to its maximal extent. The purposes of this study are: (1) to examine a possible extent, depth and condition of permafrost under the southern margin of the Weichselian Ice Sheet in Poland and (2) to construct a viable scenario of permafrost influence on the ice sheet dynamic and sediments deposition.
It is suggested that at least the discontinuous permafrost could existed both in front of the advanced Weichselian Ice Sheet and under its margins. The ice-wedges and ice-cracks features founded under subglacial till substratum, as well as marginal forms and glacitectonic structures can be regarded to a certain degree as the indicators of permafrost presence in the research area. Although stratigraphical position of permafrost features suggests that the ice sheet advanced over at least partially frozen ground, the general lack of intense deformation features, with the exception of marginal zone, indicates polythermal basal conditions. Hence, the lubrication substratum or water layer were probably present in the transition zone between the permafrost and the ice sole. The extent of permafrost zone, from the margin toward the inner part of the ice sheet, was probably no wider than several dozen kilomiters with relatively small thickness. The geothermal flux together with the appropriate subglacial condition, surface temperatures, ice thickness and other factors, could be responsible for permafrost degradation before the recession phase.

The conceptual data model describes the entities (objects), their attributes and interactions symbolised respectively as rectangles, ellipses and diamonds. Model construction is based on three main questions: (1) What were the factors that controled the occurrence of permafrost under the ice sheet (input data)?, (2) How the subglacial conditions were changed when the permafrost occurred?, (3) How the permafrost influenced the ice sheet dynamic (output data)? The model is not time-dependent with the ice sheets polythermal condition at the base.
In the authors opinion existence of permafrost caused freezing of ice sole to its bed. This effect was restricted however to ice sheet margins. Cold, subglacial regime within the marginal parts of the ice sheet caused the occurrence of compressive flow and uplifting of basal ice layer, but only up to few kilometers from the ice sheet edge. Whereas, mainly in innermost parts, the existence of permafrost favored fast advance due to sliding. The fast ice sheet advance was probably possible because of water storage or lubrication layer in the transition zone. In case of the permafrost occurrence under the ice sheet, the water was unable to drain into the ground, so the sediment in active layer was completely oversatur ated, resulting in high porewater pressure and decoupling within the transition zone. Wet basal condition (within the inner zone of the ice sheet) results in faster rate of ice advance, generally without macroscale glacitectonics.

Strömungen im Nordpolarmeer – Vorstellungen im 19. Jahrhundert und deren Entwicklung

Erki Tammiksaar

Universität Tartu, Abteilung für Geographie, Estonia

Anfang des 19. Jahrhunderts waren die Kenntnisse über die Meeresströmungen im Nordpolarmeer fast unbekannt. Die Expeditionen der Engländer (Martin Frobisher, Henry Hudson), Russen (Wassili Tschitschagov) und Holländer (Willem Barents) hatten bewiesen, dass man bei günstigen Verhältnissen ziemlich weit ins Nordpolarmeer westlich von Spitzbergen und Nowaja Semlja vordringen kann. Ob es dort aber einen Durchgang zum Nordpol oder zur Beringstraße gibt, war nicht bekannt. Die Expeditionen von Ferdinand von Wrangell, Peter Anjou, John Franklin (besonders die Suche nach Spuren seiner Expedition), Friedrich Benjamin von Lütke, Alexander Theodor von Middendorff u.a. bis zu den 1860-er Jahren brachten viele neue Erkenntnisse über die Eisverhältnisse des Nordpolarmeeres mit sich. Dies ermöglichte die ersten zwei unterschiedlichen Theorien über die Strömungen des Nordpolarmeeres zusammenzustellen, deren Autoren der „Vater der deutschen Nordpolarforschung" August Petermann und der russische Marineoffizier Nikolai von Schilling waren. In meinem Vortrag werde ich diese zwei verschiedenen Theorien vergleichen und darstellen, wie sie zur Klärung der Fragen der physischen Geographie des Nordpolarmeeres bis zum Anfang des 20. Jahrhunderts beigetragen haben.

Subglacial Lake Vostok: Impact of the basal mass balance of subglacial lakes on the ice sheet

Malte Thoma[1,2], Klaus Grosfeld[1], Christoph Mayer[2], Frank Pattyn[3]

[1]AWI Bremerhaven
[2]BAdW München
[3]Département des Sciences de la Terre et de l'Environnement, Université Libre de Bruxelles, Belgium

Subglacial lakes are a widespread phenomenon across the Antarctic Ice Sheet, as became clear during the last few years. Most of these lakes are isolated from direct exchange with the atmosphere by several kilometers of ice since millions of years and provide unique environments for potential life forms. The role of the lakes for the subglacial hydrology is still not clear, but there are indications for an active hydrological system underneath the ice sheet, which has an impact on the general ice dynamics. The inaccessibility of this system increases the importance of numerical models to investigate the physical conditions in these environments.
We present model results of a coupled system, consisting of a lake-flow and an ice-sheet model for Subglacial Lake Vostok. The basal mass balance, estimated with a 3D lake-flow model is applied as a boundary condition to a Full-Stokes ice-sheet model and its impact on the flow and temperature regime of the ice sheet is analysed. Our results indicate the sensitivity of the ice flow and temperature to adjustments in various boundary conditions and indicate the importance of a Full-Stokes model to such a system.

Anomalous Changes of the Arctic Ocean and Siberian Seas During IPY 2007/2008 and Possible Consequences

L.A. Timokhov[2], I.M.Ashik[2], I. Dmitrenko[2], J. Hoelemann[3], H. Kassens[1], S. Kirillov[2], A. Novikhin[2], I.V. Polyakov[4], V.T. Sokolov[2]

[1]IFM-GEOMAR, Kiel
[2]Arctic& Antarctic Research Institute St. Petersburg, Russia
[3]AWI Bremerhaven
[4]International Arctic Research Center, Fairbanks, Alaska, USA

Meteorological and ice observations indicate that during the XX century the Earth underwent a process of warming, which during some periods was interrupted by cooling over large areas. The challenge of preventing adverse effects of climate change requires identification of the main causes of this phenomenon. Oceanographic observations carried out in the frame of International Polar Year (IPY 2007/2008) demonstrated unique processes in the Arctic Basin and Siberian seas in its entirety. The structure of surface temperature and salinity distribution was characterized by extremes. Positive surface temperature anomalies and surface layer freshening were observed on the significant area of the Canadian basin and eastern Siberian seas. In Eurasian basin from the Fram Strait to the Laptev Sea along the continental slope the surface layer salinization was revealed. The temperature of Atlantic water nearly everywhere was above the line and along the continental slope from Fram Strait to the Laptev Sea was extreme. Comparative analysis of Arctic Ocean state in summer 2007 and in summer period 1970 – 1979 revealed the considerable termohaline structure transformation for last 30 years. Many climatologists believe that it is caused by the accumulation of greenhouse gases of anthropogenic origin in the atmosphere. However, other recent studies suggest that ongoing climatic changes are a consquence of natural causes. Reasons of the Arctic Basin and Siberian seas changes are analyzed and possible consequences are discussed.

Scientific Deep-Sea Drilling in High Northern Latitudes

Jörn Thiede[1], Lester Lembke-Jene[2]

[1]Department of Geography and Geology, University of Copenhagen, Denmark
[2]AWI Bremerhaven

Some 30 years ago the regional aspects of the plate tectonic history of the Norwegian-Greenland Sea and the eastern Arctic Ocean became unraveled and showed that these ocean basins had opened in early Eocene, 55-56 my ago. Drilling by *Glomar Challenger* in Norwegian-Greenland Sea during Leg 38 of the Deep Sea Drilling Project confirmed the plate tectonic model and established a marine biostratigraphy framework for the region. The leg set the stage for three subsequent Ocean Drilling Program legs of thematically oriented drilling by the *Joides Resolution*. Leg 104 drilled a deep acoustic basement hole on the Vøring Plateau which has become a legacy hole for volcanic margin studies; and provided new key information on the Northern Hemisphere Glaciation and the history of the Norwegian Current. Legs 151 and 162 addressed the North Atlantic-Arctic gateways problems. During Leg 151 the *Joides Resolution* succeeded, with icebreaker support, to reach the ice-free waters north of Svalbard, thus for the first time bringing a scientific drill ship into the Arctic Ocean. In 2004, the Integrated Ocean Drilling Program organized the mission-specific Expedition 302 to the Lomonosov Ridge in the permanently ice-covered central Arctic Ocean. It was a major logistical venture, and a scientific success, comprising a flotilla of 3 icebreakers. It was able to prove that the Arctic acquired its first ice cover already 48 my ago. The same year the deep site on the Vøring Plateau was revisited and a thermal borehole observatory installed. During these legs a large quantity of core samples has allowed the scientific community to address fundamental questions in terms of continental margin development; plate tectonics; nature of basement; marine biostratigraphy; and the temporal and spatial evolution of the high-latitude northern climate and environments. However, major challenges remain, in particular related to the deep basins, ridges and margins of the Arctic Ocean proper. The next advance in knowledge is contingent on new technology and research infrastructure both for drilling and site surveying.

German-Russian Master Program for Applied Polar and Marine Sciences POMOR: A Unique International Experience in Educational Cooperation

Heidemarie Kassens[1], Vassily Dmitriev[2], Nadezda Kakhro[1], Nikolai Kaledin[2], Heidemarie Kassens[1], Eva-Maria Pfeiffer[3], Vladimir Troyan[2],

[1]IFM-GEOMAR, Kiel
[2]St. Petersburg State University, Russia
[3]Institut für Bodenkunde, Universität Hamburg

The master program POMOR is a joint initiative of the St. Petersburg State University, University of Bremen, Alfred Wegener Institute for Polar and Marine Research and the Leibniz Institute of Marine Sciences IFM-GEOMAR. The program has been offered since 2002 in cooperation with the universities of Hamburg, Bremen, Kiel, Potsdam and Rostock as well as the Baltic Sea Research Institute Warnemuende, Arctic and Antarctic Research Institute and the Otto Schmidt Laboratory for Polar and Marine Research (OSL).

POMOR imparts knowledge of modern fields of research in polar and marine sciences, combining oceanography, biology and marine geosciences with engineering and economical aspects. After two years of study, the students are awarded a Master of Science in applied polar and marine sciences. Teachers from the above-mentioned German and Russian institutions hold the courses and act as examiners; they also supervise the master theses.

During the first and second semesters the courses are held at the Faculty for Geography and Geoecology of St. Petersburg State University and at the cooperating OSL in St. Petersburg. The students spend their third semester in one of the German partner universities (funded by the German Academic Exchange Service DAAD). Between the second and third semesters they participate in international expeditions to the Arctic (also funded by the DAAD). In addition they are provided with the opportunity to prepare their master theses at one of the partner universities in Germany.

Natürliche Radionuklide im Südozean: ein Beitrag zu GEOTRACES

Michiel Rutgers van der Loeff[1], Celia Venchiarutti[1], Jana Friedrich[2]

[1]Institut für Geologie und Mineralogie, Universität Köln
[2]AWI Bremerhaven

Viel von unserem Wissen über biogeochemische Kreisläufe im Ozean basiert auf das erfolgreiche GEOSECS Programm vor über 30 Jahren. Seitdem sind unsere Methoden für saubere Probennahme und für Analytik sehr stark verbessert und haben auch unsere Modellierfähigkeiten gewaltig zugenommen. Viele Spurenstoffe, Elemente und deren Isotope, die zur Zeit von GEOSECS zum Teil noch gar nicht gemessen werden konnten spielen eine Rolle in den biogeochemischen Kreisläufen und hinterlassen Proxies im Sediment über Produktion, Zirkulation und Klima. Aber die dürftige Datenbasis über die Verteilung dieser Stoffe im Ozean macht die Interpretation dieser Proxies noch schwierig.
Bei einem Workshop in Toulouse, 2003, hat die Idee Fuss gefasst, ein neues Programm, GEOTRACES, auf die Beine zu stellen um die Verteilung solcher wichtigen Spurenstoffe im Ozean festzustellen. Nach einem intensiven Interkalibrationsverfahren ist das Programm Februar 2010 gestartet. Allerdings waren 2007 und 2008 im Rahmen des Internationalen Polarjahres schon GEOTRACES Projekte auf Polarstern Expeditionen in die Arktis und Antarktis durchgeführt worden. Auf der Antarktis Expedition ANT XXIV/3 wurden 5 Projekte in einem GEOTRACES Bündel von der DFG im Schwerpunktprogramm gefördert.
Am AWI arbeiten wir an natürliche Radionuklide, mit Schwerpunkt Thorium Isotope und Protactinium. Die Verteilung dieser Nuklide im Zirkumpolarstrom in der Drake Passage und auf der Null Meridiane wurde ermittelt. Mit dem kurzlebigen ^{234}Th verfolgen wir die geografische Verteilung der Exportproduktion. Die langlebigen Isotope ^{230}Th und ^{231}Pa zeigen mittlere Partikel Sinkgeschwindigkeiten und Auftrieb. Eine ^{231}Pa Anreicherung in der tiefen nördlichen Drake Passage deutet auf Advektion aus der Pazifik hin, aber die Quelle ist noch unbekannt. Durch die Einbindung in GEOTRACES wurden viele andere Parameter parallel gemessen und können weitere Tracer wie z.B. CFCs (Uni Bremen) oder Fe und Mn (NIOZ, Texel) in die Interpretation mit einbezogenen werden.

Acoustic ecology of marine mammals in the Antarctic coastal ocean

Ilse Van Opzeeland[1], Sofie Van Parijs[2], Lars Kindermann[1], Olaf Boebel[1]

[1]AWI Bremerhaven
[2]Northeast Fisheries Science Center, NOAA, Woods Hole, MA, USA

Acoustic data collection in polar areas which are (periodically) inaccessible to humans is often limited. However, long term recordings can provide important insights into the acoustic ecology of marine mammals inhabiting these remote regions. The PerenniAL Acoustic Observatory in the Antarctic Ocean (PALAOA)

was constructed to obtain realtime, year- round broadband underwater acoustic data from the Antarctic coastal ocean. The PALAOA-observatory is located at 70°31'S 8°13'W, on the Ekström ice shelf, Eastern Weddell Sea. Recordings contain vocalizations of four Antarctic pinnipeds (Weddell, leopard, Ross and crabeater seal) and various cetacean species. We investigated seasonal patterns in acoustic repertoire size, composition and call activity. For pinnipeds, vocal behavior differed between species, reflecting varying mating strategies and behavioral functions. Humpback whales were acoustically present over 9 months suggesting that part of the population winters on the Antarctic feeding grounds. The seasonal patterns in vocal behavior of other cetaceans such as blue and fin whales will also be presented. As the Antarctic Ocean is one of the least impacted areas of the world with respect to anthropogenic ocean noise, the PALAOA recordings are also used to map the acoustic scene and natural noise budgets. Preliminary results of this ongoing work will be discussed in the light of the acoustic ecology of polar regions.

Initiation of magmatism in the Ferrar Large Igneous Province: Insights from multidisciplinary research in North Victoria Land, Antarctica

Lothar Viereck-Götte[1], Robert Schöner[1], Benjamin Bomfleur[2], Jörg Schneider[1], Martin Elsner[1], Ulrich Berner[2], Michael Abratis[1], Reinhard Gaupp[1], Hans Kerp[4]

[1]Institut für Geowissenschaften, Universität Jena
[2]Institut für Geologie und Paläontologie, Universität Münster
[3]Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover
[4]Geologisch-Paläontologischen Institut, Universität Münster

The Ferrar Group is one of the mafic Large Igneous Provinces on Earth. Its eruption is related to early Gondwana breakup. Lava flows with a total thickness of about 1000 m overly the clastic deposits of the Devonian to Early Jurassic Beacon Supergroup, which represents the sedimentary fill of the continental Transantarctic Basin. Sills with a cumulative thickness of several hundreds of meters were emplaced into the sediments. The integration of new results regarding lithostratigraphy, biostratigraphy, depositional environment, petrological and (isotope) geochemical composition of the youngest Beacon and the basal Ferrar deposits allows to clarify the timing of events and the processes characterizing the initiation and petrological development of Ferrar magmatism in North Victoria Land, Antarctica.
The sedimentary succession in North Victoria Land can be subdivided into the Late Triassic (Norian) to Early Jurassic (Sinemurian) Section Peak Formation and the Early Jurassic (Pliensbachian) Shafer Peak Formation. The approximately 200 m thick siliciclastic deposits of the Section Peak Formation are heterogeneous in composition and derive from continental basement sources as well as from the contemporaneous magmatic arc along the Panthalassan (Palaeo-Pacific) margin of Gondwana. The sediments were deposited on an extensive, sand-dominated braid plain with local lacustrine and coal-forming back-swamp environments. There is no evidence for major syn-sedimentary tectonic activity. The well-sorted ash-sized material of the 50 m thick Shafer Peak Formation is composed of silicic shards and felsic detrital minerals and was reworked and deposited by fluvial processes. The source of these reworked silicic tuffs remains uncertain. However, the age of the Shafer Peak Formation coincides with the episode V1 of the ultraplinian volcanism of the silicic Antarctic Peninsula Igneous Province. Thus the Shafer Peak Formation could be a distal equivalent of this province. The earliest indications of Ferrar magmatism are andesitic volcaniclastic deposits occurring as vent complexes and as conformable deposits intercalated within the sedimentary succession. They originated from multiple explosive events triggered by the emplacement of low-Ti andesitic sills into wet sediments. Lithostratigraphic data provide evidence for at least two major pulses of shallow-level (< 300 m) sill emplacement and related phreatomagmatism. According to biostratigraphic data, the early pulse occurred in the latest Sinemurian or earliest Pliensbachian, at the base of the Shafer Peak Formation. Sills were exclusively emplaced into the sediments; Ferrar intrusives are unknown from the basement exposed in North Victoria Land.
The Beacon Supergroup sediment succession is capped by large-volume, plateau forming lavas (Kirkpatrick Lavas) in North Victoria Land. These magmas are of less differentiated basaltic andesitic composition and most probably Toarcian in age. However, the earliest effusive products of the Ferrar Group were deposited as either pillow lavas or lava flows of restricted spatial range from volcanic necks that are locally exposed. These intervening small volume lavas are of variable andesitic (as the preceding sills) or basaltic andesitic composition (as the succeeding plateau lavas). Biostratigraphic data from overlying fossiliferous sediments indicate a late Pliensbachian age for

these earliest lavas. Organic geochemical and petrological analyses of the organic matter embedded in the Beacon sediments enable to assess the thermal overprint owing to sill emplacement. These investigations also enable to approximate the amount of carbon dioxide released through thermally induced alteration of organic compounds. In addition, chemical analyses of the magmas allow to estimate the amount of sulfur released during the emplacement of Ferrar magmas.
In conclusion, continental siliciclastic sedimentation prevailed until the middle Early Jurassic, and was followed by a period of silicic ash deposition during (at least) the Pliensbachian. Contemporaneously, the first Ferrar magmas intruded in two major pulses as sills into wet sediments, generating phreatomagmatic eruptions and related volcaniclastic deposits. A new pulse of high magma production rate then led to lava effusion, which started with small volume effusions in the latest Pliensbachian, and continued with the eruption of large volume plateau lavas.

Volcanic Eruptions Under Ice - Eyjafjallajökull: Small Volcano – Large Impact

Lothar Viereck-Götte

Institut für Geowissenschaften, Jena, Germany

Like during most subaquatic or subaerial eruptions the magmas reaching the earth's surface during subglacial eruptions are of basaltic s.l. composition, have small volumes (< 0,1km³), and reach the earth's surface due to their own buoyancy. During their ascent dissolved gases CO_2, SO_2 und H_2O started to segregate successively and expend due to the decreasing pressure even during the eruption. The result of fragmentation processes are scoriaceous particles of intermediate vesicularity.
Without overburden of ice the basaltic magmas would exhibit eruptions that would be adressed as being of icelandic (fissure eruption, low gas content, low viscosity, high magma ascent rate), hawaiian (slight higher gas content, low viscosity, high magma ascent rate), or strombolian (higher gas content, higher viscosity, low magma ascent rate) type. The controlling variables of the classification being gas content, viscosity and ascent velocity of the magma as well as the extension of the eruptive vent. Associated with the increasing Volcanic Explosivity Index (VEI) from icelandic (VEI 1) to strombolian (VEI 3) the ratio of particles formed by fragmentation of magma *(tephra)* to the amount that forms lava flows increases from < 1 : 100 to > 1 : 10.
However, the fact that the magma hits an icecap at the earth's surface results in the drastic change in any of the types of eruption to phreatomagmatic. The transformation of thermal energy into kinetic energy results in melting of ice and the vaporization of the melt water. The volume increase by a factor of 1,000 during vaporization results in (a) an additional fragmentation of magma by about a factor of 100 and (b) expanding vapour loaded with minor amounts of fragmented magma, so-called *base surges*, which are *low-temperature wet low-density-currents.*
In this transport system and the type of sediment forming as well as in grain size and vesicularity of particles subglacial eruptions are most comparable to *surtseyan* eruptions, where shallow marine water constantly flows into the conduit of the "volcano". On the contrary, the clasts differ from those of *maar eruptions*, in (a) that they do not contain as many tiny rock fragments explosively "shooted" into the magma, and (b) in that they are more vesicular, as the point of eruption occurred under less overburden during subglacial eruptions.
The resulting sediments of subglacial eruptions are fine-grained lapilli- and block-bearing tuffs. They cannot form *tuff cones* as *surtseyan eruptions* for the surrounding ice of the melting pond inhibits any lateral transport of the base surges. The stratified sediments, exhibiting more irregular to chaotic stratification, rich in unconformities and rotation of blocks, pile up to nunataks in ice caps and later to table mountains (mesas). The sediments differ from those of Maars, in that the amount of non-juvenile lithic clasts is only a minor component.
Pillow lavas can only form during the initial phase of the eruption under thick ice covers (> 200m). In the course of the eruption the eruptive style will change from dominantly *phreatomagmatic* to *strombolian, hawaiian or icelandic* depending on the composition and dynamic of the magma. The resulting products being scoria cones and lava flows, that may extend outward subglacially. Timing of this change is determined by the options for drainage of the melt water. Thin ice favours an earlier drainage than thicker ice. The change in eruptive style generally occurs at a sediment thickness lower than the thickness of the ice. Thus, the height of *table mountains* cannot be taken as measure for paleo-ice thicknesses.
The stronger fragmentation during phreatomagmatic basaltic eruptions results in a strong increase of particles small enough to be carried over thousands of km as airborne dust, in the case of Eyjafjallajökull with diameters of

0,2-10µm. This contrasts with non-phreatomagmatic basaltic eruptions that dominantly produce dustfall and coarser grains. However, as thermal energy is consumed by melting of ice, the resulting volcanic plume is cooler and thus has a lower buoyancy.
These phreatomagmatic basaltic eruptions *should never have climatic effects* as their plumes do not reach the stratosphere. The dust will most likely only reach intermediate heights within the troposphere. However, with increasing SiO_2 content of the magma its gas content and viscosity increase, favouring higher explosivity and thus higher eruption columns, that may reach the stratosphere, thus having climatic effects, despite contact with melt water, e.g. during *phreato-plinian eruptions*.
Due to the contact with melt water the airborne clasts contain less acid-producing anions like Cl^-, $SO4^-$ or even F^-; e.g. during the change from a dominantly phreatomagmatic to strombolian activity during the Eyjafjallajökull eruption the amount of F^- adsorbed to the dust increased by a factor of 40, from 20mg/kg to 800 mg/kg. Airborne impacts of phreatomagmatic basaltic eruptions thus may in fact lead to a higher particle concentration - and higher relevance on air traffic - but to a lower impact on the tropospheric chemistry. They thus have lesser effects on weather and health of terrestrial fauna and flora.

Characterization of methane-producing microorganisms by stable isotope probing: Who is active in Siberian permafrost soils?

Dirk Wagner[1], Hendrik Frentzel[1], Christian Knoblauch[2]

[1]AWI Potsdam
[2]Institute of Soil Science, University of Hamburg

Wet tundra environments of the Siberian Arctic are natural sources of the climate relevant trace gas methane. Thawing of permafrost could release large quantities of greenhouse gases into the atmosphere, thus further increasing global warming and transforming the Arctic tundra ecosystems from a carbon sink to a carbon source. Trace gas flux es from permafrost ecosystems are influenced by a number of biotic and abiotic parameters. The decomposition of soil organic matter and the generation of greenhouse gases result from microbial activity, which is affected by habitat characteristics (soil parameters) and by climate-related properties (forcing parameters). The structure and reaction of microbial populations to environmental changes is largely unknown, which means that also an important part of the process knowledge on greenhouse gas fluxes in permafrost ecosystems is far from completely understood. This also hampers prediction of the effects of climate warming on Arctic methane fluxes. Further research on the stability of the methane cycling communities is therefore highly important for understanding the effects of a warming Arctic on the global climate. The aim of this study was to identify and characterize the methane producing microorganisms (methanogens) which are active under in situ conditions in permafrost-affected soils. Therefore, samples from a permafrost soil of Kurungnakh Island (Lena Delta, Siberia) were incubated with ^{13}C-labled substrates (acetate, CO_2/H_2) – so-called stable isotope probing (SIP) – to distinguish the active from the passive part of the methanogenic community by incorporation of ^{13}C -carbon into the DNA. The ^{13}C-DNA was separated from the ^{12}C-DNA by density gradient centrifugation and subsequently analyzed by clone library investigations. The methane production, which was measured during the SIP-incubation, revealed a vertical profile of methanogenesis with a maximum rate of about 0.8 nmol CH_4 h^{-1} g^{-1} soil in the bottom of the active layer close to the permafrost table. The clone library analyses showed a distinct diversity within the group of methanogens. The sequences affiliated with *Methanosarcina, Methanosaeta, Methano-bacterium* and species of the order *Methanomicrobiales.* Furthermore, members of *Halobacteriales, Thermo-plasmatales* and *Crenarchaeota* could be identified. Most of the sequences were found in the ^{12}C-DNA fraction as well as in the ^{13}C-DNA fraction, which indicated active and inactive species within most of the genera.
The results of this study suggest that in permafrost-affected soils of the Lena Delta a divers and well-adapted methanogenic community exist, that under in situ conditions is metabolically active and flexible enough to maintain under changing environmental conditions, their role in the anaerobic degradation of organic matter.

Ice-sheet retreat and paleo-oceanography in the Weddell Sea, Antarctica

Michael E. Weber[1], Gerhard Kuhn[2]

[1]Institute for Geology and Mineralogy, Cologne
[2]AWI Bremerhaven

To understand past ice sheet dynamics in Antarctica is a key to understand current and

future climate change, as pointed out by the Intergovernmental Panel on Climate Change. Specifically, detailed knowledge is required about both the timing of the last sea level rise and how much ice melt the Antarctic ice sheets have contributed since the end of the Last Glacial Maximum (LGM). Here, reconstruction faces uncertainties because only a few sectors of the Antarctic margin have been sampled so far. Current knowledge mostly comes from the West Antarctic Ice Sheet (WAIS), arguing for a late ice sheet retreat that started around 12 ka BP and ended around 7 ka BP with a rather large impact of an unstable WAIS and a small impact of the rather stable East Antarctic Ice Sheet (EAIS). However, we found evidence for a much earlier retreat of the EAIS around 19 ka, which has significant implications for ice-sheet and oceanic processes during the Last Glacial Maximum (LGM) and for the global reconstruction of the last sea-level rise.

Since two decades we investigate sediment sites from the Weddell Sea for their paleoclimate record, using a multi-proxy approach. Initial work concentrated on sediment cores from the southeastern Weddell Sea continental shelf and slope. Also, we collected high-resolution bathymetric, sediment-echosounding, and reflection-seismic data. Results revealed that the upper continental slope is quite steep displaying slope angles between 7° and 12°. In contrast, the lower slope is more subdued but is dissected by numerous submarine canyons. A gently inclined terrace of the continental slope north and northeast of Crary Trough in 2000 – 3000 m water depth contain sediment ridges that are up to 600 m thick and strike southwest northeast. The ridges stand up to 300 m above the terrace and are up to 100 km long. Channels, which are in part deeply furrowed, run parallel to the ridges on their southeastern side. These ridges provide a unique deepwater archive for past ice sheet dynamics through tracing the timing of bottom water activity in front of an grounded ice sheet.

During the LGM, either polynias in front of the ice sheet directly above the continental slope, injected high salinity waters (Weber et al., 1994), or, less likely, ice streams released super cooled bottom water onto the continental slope that reworked the sediment which was originally delivered by gravitational processes. The resulting bottom water mass was canalized in the channels and overspilled the western shoulders to form natural levees. Overspilling was restricted to the LGM and deposited fine-grained terrigenous varves, pointing to a seasonally-variable bottom-water injection. Numerical considerations ask for a southern source of deep-water formation to compensate for the reduced Atlantic meridional overturning in the northern hemisphere during the LGM. Accordingly, the Weddell Sea might have acted as such a source, thereby supporting the bi-polar seesaw theory. However, the potential transit routes of deep-water from the Weddell Sea into lower latitudes remain ambiguous.

The varvation mechanism operated over several millennia during the LGM and required an ice sheet at the shelf edge and. Around 19 ka BP a change to bioturbated sediment, deposited at substantially lower sedimentation rates, occurred, as indicated by AMS ^{14}C dating on marine carbonate shells of planktonic foraminifera (*Neogloboquadrina pachyderma sinistral*). This change reveals that the sediment supply to the ridges ceased along with the termination of gravitational sediment supply. Hence, there is sustained evidence that the shelf ice retreated from the shelf edge at that time. Moreover, the postglacial mud is bioturbated and contains higher amounts of planktonic and benthic life, a clear indication of at least partially open water above the sites, pointing to increased surface-ocean temperatures, whereas the laminated facies deposited earlier, indicates a close canopy of sea ice.

Around 20-19 ka BP the northern hemisphere experienced first meltwater pulses and global sea-level records indicated an initial rise of about 10 m. Since the WAIS has been inactive at that time, this initial rise must have received meltwater from the EAIS, based on our finding of shelf-ice retreat from the shelf edge at that time. In any way, about 20 – 30 % of the global meltwater required for the last sea-level rise, originated from Antarctic ice sheets. The 19 ka BP timing raises several questions. Did the rapid global sea-level rise cause the retreat of the EAIS or did the melting of the EAIS cause the retreat and the global sea-level rise (considering the fact that the EAIS is the largest ice sheet on the planet)? Interestingly here is that northern hemisphere temperature records show a much later increase, whereas ice cores from the interior of the East Antarctic continent also show that temperature started to rise right around that time.

The ridges document a second, minor retreat phase around 16 ka BP, a time when global sea level started to rise more rapidly and glaciers in Patagonia also retreated. Our findings indicate that the Antarctic deglaciation history might have been substantially different than previously argued, with potentially severe impacts on future modeling studies, because the timing and the extent of the retreat alters the global fresh-water balance, i. e., it adds more melt water, and also modifies the post-glacial isostatic adjustment of land masses. In summary, we want to emphasize that the EAIS was an active component of the global melting

history of the last sea-level rise and not a passive candidate as it has been considered so far.

Ice sheet variations in the western Amundsen Sea Embayment as depicted in seismic data

Estella Weigelt[1], Karsten Gohl[1], Gabriele Uenzelmann-Neben[1], Robert Larter[2]

[1]AWI Bremerhaven
[2]British Antarctic Survey (BAS), Cambridge, United Kingdom

The glacial history of the Amundsen Sea sector of the West Antarctic Ice-Sheet (WAIS) is of particular interest with its response to climate changes. A potential deglaciation and collapse of the Thwaites and Pine Island glacier drainage basins alone would result in a global sea level rise of approximately 1.5 m. Multichannel seismic reflection profiles offer a record of the glacial development in the western Amundsen Sea Embayment during the Neogene. We identify pronounced northwest-dipping reflector series of more than 1 s TWT thickness (> 800 m) on the middle shelf indicating well layered sedimentary units. The dipping strata reveal a striking alternation of reflection-poor, almost opaque units and sequences of closely spaced, continuous reflectors. We suggest that the distinct change in reflection pattern represents marked episodes of ice sheet advance and retreat. Due to the similarity with the seismic stratigraphy and lithology in bore-hole records of the distant Ross Sea, we suggest that these dipping strata to developed since the onset of glaciation in the Miocene. Numerous reflection-poor vertical pipes with sharp vertical boundaries are located mostly in the shallow part of the middle shelf. We identify reflection signals below them and, hence, exclude gas bearing chimneys but interpret the structures to present dewatering veins. We take the occurrence of dewatering pipes as further evidence for a glacial origin and overprint of the sedimentary sequences.

Eisberge und Meereis in SAR Bildern

Christine Wesche, Wolfgang Dierking

AWI Bremerhaven

Die Beobachtung von Eisbergen mit Hilfe von Satelliten ist nicht nur für die Schifffahrt von großer Bedeutung, sondern auch für die Berechnung der Massenbilanz der polaren Eisschilde. Das Kalben von Eisbergen ist der größte Beitrag zum Massenverlust der Antarktis. Ein Problem ist, dass für die Antarktis bisher keine systematischen Zählungen kleinerer Eisbergen (mit Kantenlänge unter 10-20 km) vorgenommen wurden. Es wird vermutet, dass der Beitrag der kleineren Eisberge zum Massenverlust der Antarktis ähnlich hoch ist wie der der größeren, deren Identifizierung in Satellitenbildern weniger schwierig ist.
Zur Bestimmung der Größe von Eisbergen werden Bilder verschiedener Satelliten benutzt, wobei sich Radarsatelliten besonders eignen, da sie aktive Mikrowellen aussenden und damit wetter- und tageszeitunabhängig aufzeichnen können. Zudem sind Bilder verfügbar, die eine gute räumliche Auflösung (im Bereich von 10m) aufweisen, bei allerdings geringer Flächenabdeckung (zwischen 50-150km). Eine mögliche Strategie ist deshalb die Kombination dieser Bilder mit solchen, die größere Gebiete (400-500 km) bei gröberer Auflösung (im Bereich von 100m) abdecken. Um kleine Eisberge in Radarsatellitenbildern automatisch identifizieren zu können, wurde ein Detektionsalgorithmus entwickelt. Der Algorithmus basiert auf Schwellwerten, welche aus statistischen Analysen der Rückstreuung von Eisbergen, Meereis und offenen Wasserflächen gewonnen wurden. So können über 95% der Eisberge detektiert und deren Fläche berechnet werden. Mit Hilfe dieser Ergebnisse und unter der Zuhilfenahme von öheninformationen der Schelfeise, von denen die Eisberge gekalbt sind, kann die Massenbilanzrechnung um den Anteil des Verlustes durch kleinere Eisberge verbessert werden.
Aus einer Abfolge von Bildern lässt sich der Driftweg der Eisberge nachvollziehen. Diese Bildanalyse soll mit der Anwendung eines Eisbergdriftmodels gekoppelt werden, um Lücken in der zeitlichen Bildfolge zu schließen und eine Rückverfolgung zum Kalbungsort zu ermöglichen. Zur Überprüfung und gegebenenfalls Korrektur der Modellergebnisse werden wiederum die Ergebnisse der Eisbergdetektion verwendet. Durch Verfolgen des Abschmelzprozesses von Eisbergen kann auch der resultierende Süßwassereintrag in den Südozean berechnet werden.

Hemisphärische Unterschiede im Verlauf der Schneeschmelze auf Meereis. Eine Analyse kombinierter Modell- und Fernerkundunsgstudien

Sascha Willmes[1], Christian Haas[2], Marcel Nicolaus[3]

[1]Umweltmeteorologie, Universität Trier
[2]AWI Bremerhaven
[3]Norwegian Polar Institute, Polar Environmental Centre, Tromsø, Norway

Der Verlauf der sommerlichen Schneeschmelze auf mehrjährigem Meereis zeichnet sich durch deutliche Unterschiede zwischen Arktis und Antarktis aus. Feldmessungen zeigen, dass in der Antarktis Schmelz-Gefrier-Zyklen auf Tagesbasis auch während des Sommers dominieren, während ein komplettes Abschmelzen des Schnees in der Arktis vorzufinden ist. In dieser Studie wird eine Kombination aus einem thermodynamischen Schneemodell (SNTHERM) und einem Mikrowellenemissionsmodell (MEMLS) verwendet, um zu zeigen, wie einzelne Schmelz-und Metamorphoseprozesse im Schnee sich auf die am Satelliten beobachtbaren Mikrowellensignale auswirken. Die Ergebnisse bestätigen, dass das Auftreten von Schmelz-Gefrier-Zyklen sich in den Mikrowellen-Satelliten identifizieren lässt. Eine fernerkundungsbasierte Erkennung detaillierter Prozesse, wie der Bildung von Aufeis und internen Eisschichten, ist jedoch aufgrund der komplexen Signalüberlagerung nicht auf der Basis passiver Mikrowellendaten alleine möglich.

POSTERKURZFASSUNGEN

- alphabetisch nach Name der/des Erstautorin/s sortiert -

Ableitung von Dünneisdicken in der Laptev See Polynya aus hochaufgelösten Eisoberflächentemperaturen

Susanne Adams[1], Sascha Willmes[1], Thomas Krumpen[2], Jens Hölemann[2], Günther Heinemann[1,2]

[1]Umweltmeteorologie, Universität Trier
[2]AWI Bremerhaven

Schätzungen der Eisproduktion zeigen, dass die Laptev See beträchtlich zu der winterlichen Neueisbildung der arktischen Schelfmeere beiträgt. Deshalb ist es von großer Bedeutung die Verteilung und das Wachstum des dünnen Eises innerhalb der Laptev See Polynya zu beobachten, um den Wärmeverlust und damit Eisbildungsraten bestimmen zu können. Während Feldmessungen im März / April 2009 haben wir Profile hochaufgelöster Eisoberflächentemperaturen über der Polynya mit einem Infrarotradiometer an Bord eines Helikopters gemessen. Dieser Datensatz wird verwendet, um Dünneisdicken in der Polynya abzuleiten. Dazu wird ein existierendes Oberflächen-Energie-Bilanzmodell, das zur Ableitung von Dünneisdicken aus Satellitendaten im thermalen Infrarot verwendet wird, modifiziert. Zusätzlich führen wir im Hinblick auf die Berechnung der turbulenten Flüsse und der verwendeten atmosphärischen Daten eine Sensitivitätsstudie durch.

Long term CTD Observations Under the Ekström Ice Shelf at the PALAOA Acoustic Observatory

Olaf Boebel[1], Lars Kindermann[1], Holger Klinck[1,2], Gerd Rohardt[1]

[1]AWI Bremerhaven
[2]Cooperative Institute for Marine Resources Studies, Oregon State University, USA

In December 2005, the AWI installed PALAOA (Perennial Acoustic Observatory in the Antarctic Ocean), an energetically autonomic, hydroacoustic listening station on the Eckström ice shelf, eastern Weddell Sea, Antarctica. PALAOA is located close to the ice shelf edge, adjacent to the north-eastern seaward corner of Atka Bay, some 20 km north of the Neumayer station, to which it is linked by wireless communication, allowing real time data access and remote control.
A hydrophone array and a CTD were deployed through 4 boreholes driven by hot-water boring (Nixdorf, 1994) through the approximately 100 m thick floating ice shelf and placed about midway in the water column at a depth of about 155 m, i.e. 70 m below the ice shelf and 90 m above the seafloor. As the boreholes refroze shortly after, the instruments are physically inaccessible.
Instruments are permanently connected by cable with the PALAOA container, which hosts the energy system (batteries, fuel cell, solar panels and wind generator), system control (control computer and relay banks), recording (filters, preamplifiers, analogue-digital converters, network attached storage), communication (serial terminal server, wireless local area network bridge), and ancillary (GPS, Webcam) equipment.
CTD data (which is needed in the acoustic context for sound speed estimates) is sampled at half hourly intervals and recorded internally. The provision of power had to be arranged externally from PALAOA, as the open ended nature of this under-ice CTD deployment conflicts with the limited capacity of internal batteries. Data is remotely accessible through a serial interface connected to a terminal server. A script running on a server at Neumayer station collects and backups the data daily and automatically creates plots for system monitoring using an online web interface.
Starting in December 2005, the CTD time series now spans more than 4.5 years. Data are continuous with the exception of a 10-month gap between April 2006 and January 2007, which was caused by a breakage in the surface segment of the connecting cable.
Temperature and salinity time series clearly depict a strong seasonal cycle. Wintertime temperatures are typically less then -1.8°C, with lowest temperatures reached in early spring. During summer, a pulsed warming is observed, reaching peak temperatures of typically -1.4°C. Salinity reaches its minimum by mid-summer, with values ranging between 33.2 and 33.6. Thereafter, salinity slowly increases towards values of 34.2 which are reached in November. Salinity is then observed to decrease slightly to 34.1, before the next summer minimum is obtained abruptly.
The pressure record is dominated by tidal signatures. Generally, regardless of its direction, any flow past the CTD results in its vertical displacement. At slack water, the CTD hangs straight down at its cable at a maximum depth of 160 m. At regular intervals however, the CTD is significantly displaced upwards, which is indicative of strong oncoming currents. Unfortunately, the pressure data record only provides an uncalibrated measure of current strength and no information on its direction.
Overlaid to the pressure record's diurnal and fortnightly tidal patterns, a seasonal cycle

exhibits increased upward displacements (hence maximum flow strengths) during summer. This is possibly due to reduced tidal friction or an increased Ekman transport with waning fast ice. These summertime upward CTD displacements appear to increase each year, probably reflecting the slow northward motion of the ice shelf (600m over the past 4 years), which, coupled with its calving, leads to the CTD being progressively placed into higher velocity regimes of the Antarctic Coastal Current [Núñez-Riboni and Fahrbach, 2009].
Comparison of the pressure record with expected tidal amplitudes from the TPXO7.1 tidal model [Egbert and Erofeeva, 2002] did not immediately reveal an obvious interrelationship, which probably is due to a complex superposition of tidal flow, the Antarctic Coastal Current, deflection effects from the ice shelf and icebergs grounded in Atka Bay, and the wind driven Ekman transport.
This contribution will present the described data and provide a detailed analysis of possible sensor drifts, noting that the instrument is permanently inaccessible for recalibration. Ongoing analysis of the data, focussing on a correlation of the temporal evolution of the CTD data with seasonal ice formation and melting aims at a first interpretation of the data in terms of the underlying driving forces.

Interpretation gravimetrischer und magnetischer Daten in der Region Nordviktoria-Land, Antarktis, hinsichtlich der Krustenstruktur und der Geometrie der wesentlichen Störungssysteme

Detlef Damaske[1], Gerhard Jentzsch[2], Andreas Läufer[1], Peter Schindler[2]

[1]Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover
[2]Institute of Geosciences, University of Jena

Nordviktoria-Land (NVL) mit dem benachbarten Rossmeer, Antarktis, ist ein bedeutendes Forschungsgebiet der Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover (BGR). Im Rahmen der bisherigen neun GANOVEX-Expeditionen (German Antarctic North Victoria Land Expedition) wurden luft- und bodengestützte geophysikalische Messungen durchgeführt, wie auch strukturgeologische Studien an Land. Das wichtigste Forschungsziel der Expedition GANOVEX IX (2005/2006) betraf die Beziehungen des antarktischen Kontinents zu den Fragmenten von Gondwana, speziell zu Australien und Neuseeland, sowie die möglichen Verbindungen tektonischen Lineamente auf dem Kontinent mit den Bruchzonen im Boden des südlichen Pazifischen Ozeans. Während dieser Expedition wurden viele neue magnetische Profile um das Cape Adare abgeflogen. Das Ziel der hier vorgestellten Forschungsarbeiten ist die Beantwortung der Frage, ob, warum und wie weit die Bruchzonen im Ozean in den antarktischen Kontinent eindringen.
Das Forschungsprojekt basiert auf der engen Kooperation zwischen der Universität Jena und der BGR hinsichtlich der Analyse der seitens der BGR erhobenen Daten sowie der Bearbeitung neuer Daten im Bereich von NVL. Diese Daten gestatten die gemeinsame Interpretation der Struktur der Kruste und der Moho-Tiefe in einem Schlüssel-Gebiet für die Erforschung der Verbindungen zwischen den Fragmenten des früheren Gondwana: der Antarktis, Australiens und Neuseelands. Seitens des Dänischen Raumfahrtzentrums (Danish Space Center) steht ein neues Schwerefeld zur Verfügung, das aus Satelliten-Altimetrie-Daten abgeleitet worden ist. Zur Ableitung geologischer Strukturen auf dem Kontinent und im Schelfbereich verwenden wir auch frühere Daten. Die für einige Gebiete vorliegenden 2-D Modelle werden eine Grundlage für die neuen 3-D Modelle sein, die unter Berücksichtigung aller vorhandenen geophysikalischen Daten und geologischer Randbedingungen entwickelt werden.

Aeromagnetic Anomalies over northern Ellesmere Island, Canadian Arctic, and their Geological Interpretation

Detlef Damaske[1], Solveig Estrada[1], Bernd Schreckenberger[1], Gordon Oakey[2]

[1]Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover
[2]Geological Survey of Canada, Ottawa, Canada

The CASE11-Pearya expedition led to the northernmost part of Ellesmere Island, which consists of an exotic terrane or microcontinental plate called "Pearya". Onshore geological work combined with an onshore/offshore aeromagnetic survey was carried out to understand the structural architecture of the North American continental margin from the accessible onshore areas to the offshore areas of the shelf.

The aeromagnetic survey was designed in a way to fully capture magnetic sources close to the surface as well as to cover a sufficient large area to follow magnetic structures over a reasonable distance. As a compromise a survey-line separation of 2 km was considered to be sufficient. The survey area covered a 40 to 50 km wide swath offshore about parallel to the north coast of Ellesmere Island from Yelverton Inlet in the west to a little east of Cape Columbia, the northernmost point of Canada. Between Yelverton Inlet and the western boundary of the Quttinirpaaq National park at the M'Clintock Inlet the survey extended about 40 to 50 km inland. This section of mountaineous terrain was flown in a "draped" mode trying to keep the distance to ground at approximately 1500 ft, same as over the offshore areas.
The aeromagnetic component of CASE11-Pearya took place in a 4-week period in May/June 2008 prior to the geological work, to make use of the in general more favourable weather conditions for the anticipated helicopter survey. Altogether close to 8000 km on aeromagnetic line data were acquired, covering an area of 12000 km².
The map of the anomalies of the total magnetic field shows distinct units of different magnetic character. The western part of the survey area divides into two major units, an offshore part with strong broad positive anomalies and a magnetic low mainly over the onshore area. The magnetic low comprises the Mesoproterozoic to Neoproterozoic crystalline basement of Pearya (Succession 1) and Neoproterozoic to Ordovician metasediments of Pearya Succession 2 (Trettin and Mayr 1997). Within this inland region some small, but occasionally very strong positive anomalies correlate with Paleozoic intrusive rocks as the Cape Fanshaw Martin Pluton and the M'Clintock West body. A broader magnetic high between Cape Richards, Bromley Island, the innermost Ayles Fiord and the northern part of M'Clintock Inlet comprises Ordovician units of Pearya Successions 3 and 4 dominated by volcanic rocks and includes the Cape Richards Intrusive Complex. This magnetic pattern (magnetic low with smaller magnetic highs) continue offshore to the east. Thus, an offshore continuation (more than 50 km to north) of the Pearya successions can be assumed. It seems that the offshore units are offset from the Pearya onshore units by a dextral tectonic feature that runs E-W parallel to the coast line.
The most conspicuous feature is a chain of small positive anomalies curving approximately along the coast from Yelverton Inlet to the northeast and forming the boundary between the broad offshore magnetic high and the onshore magnetic low. In parts these anomalies can be identified with outcrops of the Cretaceous (about 80 Ma) Hansen Point volcanics east and west of the Yelverton Bay, but over the larger part they overly non-magnetic crystalline basement rocks of Pearya and at northeast Wootton Peninsula Tertiary sediments. These anomalies point to small-scale sources at shallow depth while the broad positive anomalies further to the northwest originate from larger and deeper lying magnetic bodies.
The broad offshore magnetic high has not equivalents over the onshore area. Thus it cannot be caused by Pearya rock units. Similar high-amplitude anomalies exist off the coast of North Greenland in the southern Lincoln Sea (e.g., Damaske et al. 1997). They were compared with anomalies over the Morris Jesup Rise that is considered as an oceanic plateau (e.g., Dawes 1990) and interpreted as part of a large flood basalt province on the passive margin off North Greenland (Damaske and Estrada 2006). The magnetic high off the northern coast of Ellesmere Island most likely is caused by thick igneous rock units which were formed contemporaneous with the Hansen Point volcanics or somewhat earlier and which probably are related to the Alpha Ridge as part of the Cretaceous High Arctic Large Igneous Province.

Analysis of helicopter- and ship-borne magnetic data in the Amundsen Sea Embayment, West Antarctica

Astrid Denk[1,2], Karsten Gohl[2], Florian Wobbe[2]

[1]Univerität Köln
[2]AWI Bremerhaven

In the last years, the Amundsen Sea-sector of West Antarctica has attracted increasing attention due to the role of the marine-based West Antarctic Ice Sheet which partly drains into the Amundsen Sea. For instance, the Pine Island and Thwaites glacier systems exhibit an amplifying ice-flow velocity and a retreat of their grounding zones. Arising questions concern the regime of the underlying tectonically and magmatically formed basement which forms the controlling morphology geometry for past ice-sheet dynamics.
Accurate models of the geodynamic-tectonic evolution contain some of the most important parameters for understanding and reconstruction of the paleoenvironment. The objective comprises the identification of the boundaries between suspected crustal blocks

and volcanic zones in Pine Island Bay. The glacier troughs and Pine Island Bay are thought to have developed along such tectonic boundaries.
During two expeditions with RV Polarstern in the years 2006 and 2010 to West Antarctica continental margin, a considerable amount of magnetic data has been acquired in the Amundsen Sea, particularly in Pine Island Bay.
In both years, the data acquisition was conducted with a permanent ship borne magnetometer system and a variable helicopter borne magnetometer system.
Helicopter borne magnetic measurements were performed with a caesium vapour magnetometer, towed 30m below the helicopter to avoid magnetic disturbances. During the flight campaign of 2010, in which 15000 km of flight data was gathered, a densification and supplement of the grid of 2006 containing 20000 km flight data, was achieved. The resulting grid covers an area of about 20 000 km² and ranges from Pine Island Bay on the inner shelf to the outer shelf and above continental slope.
Shipborne magnetic measurements were made by two fluxgate vector magnetometers, which are permanently mounted at the crow's nest of RV Polarstern.
The data were sampled at one-second intervals. To take account of the influence of the metallic bulk of the ship, the ship undertook compensation loops. In the small area of a compensation loop the variation of the magnetic field due to the crustal magnetization are assumed to be negligible. The loops thus provide coefficients that relate the ship's heading, roll, and pitch movements to the variations in magnetometer measurements that they cause. Using these coefficients it is possible to correct the ship borne magnetic measurements in the wider area around the compensation loop. A fundamental division exists between the magnetic styles of the inner, middle and outer shelf. Short wavelength anomalies characterize the inner shelf and adjacent land. These short wavelength anomalies can be associated with the existence of magmatic structures which also can be observed in several magmatic exposures on small islands. In contrast, long wavelength anomalies are visible on the outer shelf.
Parallel belts of similar magnetic signature can be identified here. These linear features are up to 500 km long and strike approximately southwest-northeast.
Similar, but less distinct features strike in a direction perpendicular to these. The magnetic anomaly pattern shows at least two phases of tectonic and magmatic processes in the Amundsen Sea Embayment.

Anisotropic backscatter in ice-penetrating radar data: potential mechanisms and implications

Reinhard Drews[1], Olaf Eisen[1], Wolfgang Rack[2], Daniel Steinhage[1], Ilka Weikusat[1]

[1]AWI Bremerhaven
[2]Gateway Antarctica, University of Canterbury, Christchurch, New Zealand

Airborne and ground-based radar have been used extensively in the past to measure ice thickness and to investigate the internal structure of ice sheets in terms of layering. The main reflection mechanisms for internal reflections are changes in density, conductivity, and crystal orientation fabric, which alter the permittivity of the ice. Linking the different mechanisms to the individual reflection horizons enables the deduction of glaciological parameters like accumulation rates or age-depth estimates. If no sample material from snow pits or ice-cores are available, multi-frequency and multi-polarization measurements must be
applied to distinguish between the different reflection mechanisms. The backscattered power of horizons caused by changes in conductivity varies with the center frequency whereas in the case of horizons originating from changing crystal orientation the backscattered power is dependent on the polarization plane of the carrier signal.
In this study we examine a sample data set near the German summer station Kohnen (drill site for the EPICA-EDML ice core) on the Antarctic plateau. The data were acquired with an airplane sliding on ground, producing varying incident polarization with a circular profile and several cross profiles with different headings. We find that the backscattered power changes with varying antenna orientation (i.e. polarization). In the upper third of the ice column the backscatter has two maxima with a 180° symmetry. The maxima align with the direction of minimal surface strain. At approximately 900 m depth the anisotropy is shifted by 90° in heading azimuth, with the maxima now being parallel to the maximum in surface strain. This dataset is unique, as airborne systems (primarily designed for the sounding of ice thickness) are usually not used for ground-based applications. The observed anisotropy appears clearly and is intriguing as the reason for it is entirely unknown.
As primary suspects we consider the role of changing crystal orientation and ellipsoidal shaped air bubbles. The effect is visible from 200 – 1400 m. It appears distributed along the entire interval, and not restricted to individual

layers. It seems that the polarization dependence becomes visible by a changing background level of the acquired signal, which is otherwise largely dominated by layer-like, polarization independent reflections. Hence we apply a (semi-analytical) volume scattering model in order to understand the different reflection mechanisms better. From ice-core measurements it is known that the crystals in the upper hundred meters are only weakly aligned (if at all), and it is unclear how the crystal orientation changes over short depth intervals (~10m). The rotation of the anisotropy coincides with the clathrate transition in the ice core and thus we first focus on the effect of anisotropic air bubbles. In an in-coherent approach we treat the ice matrix as a random medium and use the vector radiative transfer theory to incorporate boundary conditions. In a second step we model the effect of crystal orientation to estimate both, the degree of alignment and the statistical variance in the permittivity tensor needed to generate the observed pattern in backscatter. Doing so, we eventually aim at pinning down the mechanisms for the anisotropy in the upper interval, lower interval and the interrelation of the two by a shift of 90°.
Anisotropic air bubbles as well as aligned crystal orientation allow to deduce stress and strain rates and a potential change thereof along depth. So far it is largely unclear, how surface strain rates relate with strain rates within the ice. If one of the two suspected mechanisms can be excluded or confirmed, this study may serve as a case study for future polarimetric surveys with low-frequency radars, in order to supply ice-sheet
modelling with adequate boundary conditions - including changes in the internal structure of ice sheets along depth.

Mesocyclone tracking and sensivity studies in the Antarctic region

Lars Ebner, Martin Bauer, Günther Heinemann

University of Trier

A general, objective method for the identification of mesoscale cyclones in the Antarctic is applied to global GME model analyses with a high temporal and spatial resolution over three years. While there have been several studies on synoptic scale cyclone tracking, the detection and tracking of mesoscale cyclones in the Antarctic is still a challenge. The different types of formation processes of polar lows in the southern polar region require a sophisticated strategy for an automatic detection of these phenomena. The resolution of operational analyses has improved during the last decade in such a way that tracking of mesocyclones becomes applicable. Here we use GME data with 40km resolution and a variety of remote sensing datasets for case studies and the investigation of mesocyclone activity in the Antarctic. Our tracking algorithm uses the 850hPa vorticity field to detect mesoscale cyclones after a high-pass filtering eliminating synoptic scale cyclones. However, the tracking algorithm tends to track not only the centers of the mesocyclones, but also fronts and other features of mesoscale and synoptic cyclones as multiple, independent centers. This yields to an overestimation of the number of mesocyclones and errors in the mesocyclone statistics (such as genesis and lysis density). Therefore, statistics of automated tracking algorithms should be regarded carefully when these techniques are applied on the mesoscale. Hence, we utilized different filter options to remedy these deficiencies. The filtering is done by taking into account e.g. the detection of fronts. The efficiency of our method is proved through case and sensitivity studies.

Investigation of polynya dynamics in the Weddell Sea region using remote sensing data

Anica Friedrich, Günther Heinemann, Sascha Willmes

Universität Trier

Remote sensing data from Advanced Microwave Scanning Radiometer (AMSR-E), Scanning Multichannel Microwave Radiometer (SMMR) and Special Sensor Microwave/Imager (SSM/I) passive microwave sensors are used to investigate coastal polynyas in the Weddell Sea for the last 30 years. First, the entire coastal area of the Weddell Sea is divided into different regions of interest (ROI). For each ROI the polynya area (POLA) is determined by applying an ice concentration threshold on daily averaged sea-ice concentrations from remote sensing data. Another variable is the open water area (OWA), which is calculated from the fraction of open water for each pixel in a ROI. Time series of POLA and OWA are computed for the period of 1979-2009 (SMMR, SSM/I) and 2002-2009 (AMSR-E).
Current sea-ice concentration retrievals show errors over polynya areas because of the presence of thin ice. Therefore, we employ two different methods to infer thin-ice thicknesses

up to 20 cm from AMSR-E and SSM/I microwave data. This yields a more comprehensive understanding of the polynya dynamics such as the distribution of open water and thin ice, as well as shape and size of the coastal polynyas in the Weddell Sea.
Our results are case studies and quantitative polynya statistics for the polynyas in front of the Ronne-Filchner ice shelf and along the eastern coast of the Weddell Sea, mainly at Brunt ice shelf. Because of the coarse grid and improper land mask of the microwave data, the small-scale polynyas along the east coast of the Antarctic Peninsula, particularly Larsen-B ice shelf, are barely detected.

Are High Arctic stream food webs linked to catchment properties?

Leopold Füreder[1], John E. Brittain[2]

[1]Institute of Ecology, Univ. of Innsbruck, Austria
[2]Natural History Museum, Univ. of Oslo, Norway

Little is known about the relationship between food resources and food web structure in high arctic running waters. Food webs in these systems differ from most other streams because the harsh climate (low temperature, long snow and ice cover, very short growing season) limits both autochthonous and allochthonous inputs, considered as drivers for diversity and benthic production. On the island of Vest-Spitsbergen at 79°N several streams, comprising different water sources, like glacier or spring-fed and in different catchment types were investigated in order (a) to evaluate the availability of organic matter, (b) to characterise the structure and function of the benthic fauna. We investigated the physico-chemical conditions, food resources (DOM, CPOM, FPOM, seston, Aufwuchs) and the benthic fauna in the different streams. Stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$) was also used to estimate food consumption and assimilation of the dominant species. The fauna was found to be composed mainly of Chironomidae (60->90 %), but also other aquatic and semi-aquatic taxa were found (Oligochaeta, micro-crustaceans, Collembola and Tardigrada). Species number, abundance and food web complexity followed a gradient of catchment properties (e. g. degree of glaciation, nutrient input from bird-cliffs).

Landscape controls of organic C content andfraction composition in permafrost soils, Central Siberia

Norman Gentsch

Institut für Geographie, Universität Leipzig

Soils of arctic and boreal regions are expected to respond sensitively to possible climatic changes. Although scientific interests in high latitude ecosystems rose in recent years, the amount of available data regarding variability and composition of soil organic C (SOC) pools is still sparse (Khvorostyanov *et al.*, 2008; Rodionow *et al.*, 2006; Hobbie *et al.*, 2000; Michaelson *et al.*, 1996). During a field campaign in summer 2009, three Catena sequences was investigated, in cooperation with scientists from Russian Academy of Sciences (SiberianBranch), V.N. Sukachev Institute of Forest, Krasnojarsk. The study site resided near the small settlement Tura (N64 17', E100 13') at the confluence of Upper Tunguska and Kochechum River in Central Siberia (Russian Federation). Purpose of this study was, to (I) assess SOC and total Nitrogen stocks (TN),(II) quantify the proportion of heavy fraction and light fraction in soil organic matter, and (III) point out the influence of landscape position (and thus the distinct in hydrothermal regimes) on composition and distribution of SOC. The ubiquity of homogeneous parent material and vegetation strongly influence the selection our study site. As a part of the Siberian Trapp Province soils developed on igneous rocks (basalts and tuffs) respectively their loose derivatives of colluvial or solifluctional origin. These backgrounds outlined the importance of relief position and hydrothermal conditions on SOC distribution and turnover. We compared three pairs of north and south aspected slopes, with mean active layer depth of 0.40 m on north facing and 1.09 m on southfacing slopes. On well drained, warmer south aspected slopes occured shallow to moderately deep Inceptisols (USDA, 2006), sometimes Gelisols, with thin (6-10 cm) organic horizons. Soils on wet and colder north aspected slopes, were Gelisols with shallow, ice rich permafrost table, strongly cryogenic features and thick organic layers, up to 25 cm. Our results show that, relief position and abundance of permafrost in the study area is an important factor for SOC storage respectively distribution and fraction composition. Carbon (C) and nitrogen (N) concentrations were strongly correlated with soil temperatures and clay content. The concentrations decreased with soil depth, while C/N ratios did not exhibit significant changes along soil profiles. In

general, significant higher C and N concentrations were found in horizons on north aspected slopes; whereas those on south faced positions contain lower concentrations. Organic C stocks to a soil depth of 0.6 m in mineral soil varied between 4.30 and 32.81kg m^{-2}. Highest SOC stocks has been found in midslope positions with north aspect and in valleys. Average C stocks on north slopes were calculated to11.08 kg m^{-2}, in valleys to 9.15 kg m^{-2} and 7.23 kg m^{-2} on south aspected slopes. Soil materials were physically fractionated into light- (LF) and heavy fractions (HF) with different stages of decomposition and protection. The proportion of relatively undecomposed LF C decreases with depth in the profiles and achieve highest values on south slopes. By contrast highest amounts of HF C, associated with mineral particles, could be detected on north slopes and increased with soil depth. Both of the fractions were positively related to clay content on both aspects, while a correlation with decreasing soil temperatures only show for LF significant positive relationship. Additionally we recognized high amounts of recalcitrant pyrogenic C in all profiles. The results outlined the importance of landscape position as key factor for soil formation and carbon storage in high latitude soils. We could show, that temperature and moisture regime affect strongly composition and distribution of SOC pools. The abundance of shallow permafrost creates suitable conditions, to store larger C stocks in the soils we investigated.

Simulationen von Küstenpolynjas und damit verbundenen Ozeanprozessen im westlichen Weddellmeer

V. Haid[1], R. Timmermann[1], G. Heinemann[2], L. Ebner[2]

[1]AWI Bremerhaven
[2]Umweltmeteorologie, Universität Trier

Die Oberflächenprozesse von Eisbildung und -schmelze sind von großer Bedeutung für die Bildung und Modifikation von Wassermassen in den Polarmeeren. Ein großer Teil der jährlichen Meereisproduktion in den hohen Breiten findet in Küstenpolynjas statt, da sie gewöhnlich mechanisch offen gehalten werden, meist durch Winde, und die Temperatur der Meeresoberfläche am Gefrierpunkt ist. Die sehr dünne Meereisbedeckung oder ihr gänzliches Fehlen ermöglicht lokal verstärkte Austauschprozesse zwischen Ozean und Atmosphäre, insbesondere einen Anstieg des Wärmeflusses, was zu sehr hohen Gefrierraten und dem damit verbundenen starken Salzausstoß führt. Innerhalb einer Polynja werden sehr kalte und saline Wassermassen gebildet und daher haben die zeitliche und räumliche Ausdehnung von Polynja-Ereignissen einen wesentlichen Einfluss auf die Bodenwasserbildung. Im westlichen Weddellmeer bilden sich wiederholt Polynjas an der Kante des Filchner-Ronne-Eisschelfs und im Gebiet des zerbrochenen Larsen A/B-Eisschelfs.
Simulationen der polynjaverbundenen Ozeanprozesse wurden mittels FESOM (Finite-Element Sea-ice Ocean Model) auf einem globalen Gitter mit hoher Auflösung (< 3 km) entlang der Küste des Weddellmeeres durchgeführt. FESOM ist ein vollständig gekoppeltes System aus einem hydrostatischen Ozeanmodell auf Basis der primitiven Gleichungen und einem dynamisch-thermodynamischen Meereismodell. Das Modell wurde mit Daten der NCEP Reanalyse, GME und hochauflösenden COSMO-Simulationen angetrieben. Diese Experimente ergeben sehr deutliche Polynjacharakteristika. Wir können entlang der Ostküste der Antarktischen Halbinsel und vor dem Ronne-Eisschelf, wie auch vor dem Brunt-Eisschelf und Riiser-Larsen-Isen, wiederkehrende Gebiete mit stark reduzierter oder nicht vorhandener Eiskonzentration und hohem negativen Süßwasserfluss (d. h. großem Salz-Input) sehen. Vergleiche mit grobaufgelösten Modellläufen zeigen recht verwischte Anzeichen von Polynja-Ereignissen. In Simulationen mit 1.5° lateraler Auflösung ist lediglich die wiederkehrende Polynja über dem Ronne-Becken und die hohen Gefrierraten über dem Berkner-Rücken sichtbar als lokale Maxima im negativen Süßwasserfluss und entlang der Ostküste der Antarktischen Halbinsel kann eine sehr schwache Reduzierung der Eisdicke gesehen werden.
An einer Stelle am äußeren Rand des Ronne-Beckens werden die Unterschiede zwischen den Simulationen offensichtlich, wenn man die vertikalen Profile der Temperatur und des Salzgehaltes betrachtet. Es ist ein Gebiet wiederkehrender Polynjenbildung, was im hochauflösenden Fall zu starkem Salz-Input und der Bildung von Hochsalinem Schelfwasser (HSSW) führt und in der Folge starke Konvektion und eine nahezu homogen durchmischte Wassersäule nach sich zieht, während das grobe Gitter die Polynja nicht auflösen kann und einen geschichteten Ozean mit einer kalten oberflächennahen Schicht über Modifiziertem Warmen Tiefenwasser (MWDW). Desweiteren zeigt die hochauflösende Simulation Kaltwasserplumes, die sich in der südwestlichen Ecke des Kontinentalschelfs

bilden und den hang hinab fließen. Sie mischen sich mit den umgebenden wärmeren Wassermassen, während sie nordwärts driften. Anzeichen solcher Kaltwasserplumes wurden im Zuge der ISPOL-Kampagne im Sommer 2004/2005 beobachtet.

Postgraduate education: The Helmholtz Graduate School for Polar and Marine Research (POLMAR)

C. Hanfland, T. Michler-Cieluch, C. Sprengel, J. Bijma

AWI Bremerhaven

The Helmholtz Graduate School for Polar and Marine Research (POLMAR) at the Alfred Wegener Institute Bremerhaven was founded in 2008. It is exclusive in its focus on high latitude marine ecosystems and polar climate change. It aims to improve the qualification of the participating Ph.D. students and provides an optimal research environment towards their doctoral degree. The students will be prepared for taking over leading positions in research, management and policy, technology development, or consulting and education.
Membership is open to all PhD students of the AWI and its cooperating institutions. Within its first year, POLMAR attracted more than 70 members, some of them being in their second or third year of the PhD project. Furthermore, eleven stipends are financed by POLMAR (period 2009 – 2012), a second call will be launched at the end of 2011.
A structured postgraduate education program started in 2009. It consists of scientific courses, soft and transferable skill trainings as well as a monthly seminar and invited guest speakers. The program is set up in close co-operation with the Helmholtz Research School on Earth System Science (ESSRES) at AWI and our partner institutions (University of Bremen, Max Planck Institute for Marine Microbiology, Bremen, Jacobs University, University of Potsdam, Bremerhaven University of Applied Sciences, Institute for Marine Ressources). Courses at the partner institutions are mutually open to all students. In consequence, students have a wide choice of up-to-date disciplinary and interdisciplinary courses and can tailor their study program according to their specific needs, interests and time constraints.
Also, students find support in all matters concerning their PhD, notably contract and insurance issues, help with their PhD committee, support during maternity or parental leave and child care. Financial support is offered as travel grants and short-term outgoing scholarships in order to foster collaborative research with international partners at an early stage of the scientific career.
POLMAR welcomes national and international scientists to contribute to its educational program. Lectures, workshops, method trainings or research projects in joint co-operation with our students are possible ways of interaction. All logistic support will be arranged by the POLMAR office. For more information please contact the authors or info.polmar@awi.de

Formation and Dynamics of Holocene Syngenetic Ice-Wedge Polygons in Adventdalen, Svalbard, Norway

Stefanie Härtel[1, 2], H.H. Christiansen[2]

[1]University of Leipzig
[2]Geology Department, The University Centre in Svalbard, UNIS, Norway

Ice-wedge polygons are a widespread periglacial landform used as a key climatic indicator. The understanding of the dynamics and formation of ice-wedges is a prerequisite for their application in palaeoenvironmental reconstructions. In order to improve the understanding of the Holocene dynamics of the ice-wedge activity, the characteristics of four ice-wedge study sites in Adventdalen, Svalbard (Table 1) have been studied, including stratigraphic investigations.
Table 1.: Site characteristics and applied methods for the four study sites in Adventdalen, Svalbard.

Site	site A	site B	site C	site D
ice-w. activity	inactive	active	active	active
polygon morph.	flat terr.	low-centr.	low-centr.	high-centr.
Polygon type	orthog.	hexag.	orthog.	orthog
crack map	-	x	-	x
central pit	x	x	-	x
trench/width i-w	x / 1m	x / 3m	-	-
ice-w. exposure	x	-	-	-
Cliff section	x	x	-	-
permafr.core	1.75m	1.79m	-	-
network map	x	x	x	x

During summer 2009, soil pits were dug in the centre and across the troughs of the four ice-wedge polygon sites to study the sediments and for soil sampling. Crack mapping performed in the field and together with the analysis of stratigraphical data from site B

(Christiansen manus) contribute to the understanding of local cracking dynamics. Two permafrost cores from central ice-wedge polygons were collected by hand drilling and sampled at 10 cm intervals. Two river cut cliff sections, exposing ice-wedge host sediments, allowed detailed studies of the sediments and one ice-wedge (Fig.1). 53 samples were analysed with respect to ice content, magnetic susceptibility, pH-value, electric conduc-tivity and grain-size. High resolution remote sensing data were used to map and study the crack network (DLR 2008).

Significant inter ice-wedge site variations were detected, regarding ice-wedge morphology, network geometry and the host sediment, in particular the stratigraphy, soil moisture and active layer depth. The ice-wedges found at the base of the active layer indicate eather recent syngenetic activity or recently increasing active layer depths. The general stratigraphy shows a glacio- fluvial or organic unit covered by a 1.5 m loess unit. OSL dates (UNIS report) suggest that sedimentation continued during the Late Holocene with higher rates at site A than at site B. The ice-wedge exposure shows intensively deformed host sediments covered by 10-30 cm undisturbed loess. Desiccation crack structures are found in the upper 50 cm in the studied active layer pits. An OSL age from one of the pits indicates that drier soil conditions prevailed since the onset of the Little Ice Age (LIA). Cooler temperatures, as existing during the LIA, appear favourable for thermal contraction cracking, followed by a period of less ice-wedge activity at site A. The observation of modern nearby inactive and active ice-wedges suggests that site-specific conditions such as primarily soil moisture, are decisive for the ice-wedge dynamics in a maritime arctic environment. For a more comprehensive understanding, site-specific studies are necessary for improving our understanding of the key climatic/ meteorological ice-wedge controlling factors.

The arctic ice alga Ancylonema nordenskiöldii – ultrastructure and physiological potential

Andreas Holzinger, Daniel Remias, Cornelius Lütz

Institute of Botany, University of Innsbruck

In search for cold-adapted phototrophic organisms living on bare ice we were successful with the detection of a green alga, *Ancylonema nordenskiöldii* (Zygnematales) on glaciers in Svalbard. This species exclusively thrives on wet icy surfaces during summer and was collected at two arctic glaciers at Svalbard (Longyearbreen near Longyearbyen, Midtre Lovenbreen near Ny Alesund, ~79° N). Similar samples had been collected also previously in Svalbard[1] and the distribution seems to be focused in the northern hemisphere, with abundant appearances in Greenland and Alaska[2]. Only sparse observations of this extremophile have been made in central Europe (Switzerland)[2], the species has not been found in the Austrian Alps[3].

Ancylonema cells are distinct in their life form compared to classical snow algae, like e.g., the unicellular cysts of *Chlamydomonas nivalis* (Chlamydomonadales), the origin of the "red snow" phenomenon[4]. *A. nordenskiöldii* is filamentous organized with smooth, poreless cell walls typical for "sarcoderm desmids". No signs of cyst formation have been observed so far. It belongs to the family Mesotaeniaceae, giving ultrastructural features that are astonishing for an organism living directly on ice. The cytoarchitecture acquired by TEM points towards physiologically very active cells with numerous mitochondria, Golgi bodies, a peroxisome and two pyrenoid-containing chloroplasts. The nucleus is situated in the cell centre, surrounded by organelles like Golgi bodies and mitochondria. Approximately half of the cell volume is occupied by vacuoles with electron dense contrast.

The cells are physiologically active in their harsh habitat and we measured a temperature optimum close to 1°C, as shown by photosynthesis measurements under different temperatures. The storage of high amounts of brownish, water-soluble secondary pigments in cytoplasmic compartments is regarded as a protection against excessive irradiation. Given these observations, the arctic *A. nordenskiöldii* appears quite similar to *Mesotaenium berggrenii*, a Mesotaeniaceae found on Alpine glaciers[5]. *A. nordenskiöldii* appears to be a strictly cryophilic organism, well adapted to its habitat, namely the thin water film directly on ice. A molecular characterisation of *A. nordenskiöldii* has not yet been performed but is ongoing.

Reproductive Structures in Bryophyta from the Argentine Islands as Regional Warming Indicators

Viktoria Ivanets[1], Oksana Tyshchenko[3], Ivan Parnikoza[2], Iryna Kozeretska[3], Peter Convey[4]

[1]National University of Kyiv-Mohyla Academy, Ukraine
[2]Institute of Molecular Biology and Genetics NAS of Ukraine

[3]Taras Shevchenko National University of Kyiv, Ukraine
[4]British Antarctic Survey, Cambridge, UK

The development of sexual reproductive organs and the sporophytes in Bryophyta is generally linked with temperature or photoperiod. Capsule development and sporogenesis occur under conditions of cold Antarctic only at less than 25% of moss species. Sporophyte production in the maritime Antarctic is unusual, however overall 40% of species in this region have at least once been recorded with sporophytes. The rarity of successful sporophyte production is consistent with our recent observations on the Argentine Islands region. Thus, no signs of spore production was revealed in 147 specimens of 14 species of Bryophyta collected by V.Bezrukov (2002, 8 specimens), L.Manilo (2004, 28 specimens), V.Polishchuk (2005, 20 specimens), I.Dykyy (2006, 6 specimens) and V.Trokhymets (2007/08, 85 specimens). Fruiting bryophytes were collected during southern summer seasons 2006/07 by I.Dyyky. In particular, spore production in the dominating moss *Bryum archangelicum* Bruch & Schimp. has been documented from two locations on Galindez Island. Both locations are interesting. One location is right near the station close to diesel generator windows and is influenced by the warm air (S 65°14.439′, W 64°14.580′). The second one is no less interesting in that it represents the only known place where *Colobanthus quitensis* (Kunth) Bartl. grows on Galindez Island (S 65°14.528′, W 64°14.332′). Based on data available so far, it is difficult to evaluate the anthropogenic influence on spore production in Bryophyta, specifically the activity at the station or local favorable conditions which probably is the case with the only location of *Colobanthus quitensis* on Galindez Islands.
During the 2007/08 season (V.Trokhymets) spore production was not revealed in any of the bryophyte specimens from Galindez Island in spite of the fact that geographic representation of the samples was broad, and the number of samples being perhaps the largest ever collected by any of Ukrainian polar expeditions. However, it should be noted that in this case, just like during all previous seasons, the polar winterer did not have any special task to search for mosses with sporophytes, and their presence was estimated based on analysis of the whole pool of specimens collected for diverse goals. During the 2009/10 season I.Dykyy, a winterer, was oriented to survey this trait and has registered several successful spore production events in bryophytes (the species still to be identified) on Galindez Island, as well as a series of such events in the Argentine Islands region. It is interesting that one of the spore production events was found, again, at the only location of *Colobanthus quitensis* on Galindez Island.
The existing records of sporophyte occurrence, including the proportion of species and sporophyte characteristics, demonstrate a similar pattern to that of vascular plants in that no clear connection with their position within overall geographic distributions is evident. However, it is also known that differences in microclimate between two distant sites in this region can be equal to those between sites that are close by, thus influencing the frequency of sporophyte generation. Nevertheless, the latitudinal transect represented by the Antarctic Peninsula and Scotia arc is currently affected by rapid regional climatic changes the impact of which may be either positive or negative for components of terrestrial vegetation, including sporophyte production. Vegetation responses to warming will therefore develop as a mosaic strongly dependent on the microclimate of any specific site, and the influence of warming may be masked by inter-seasonal variation, microclimate heterogeneity, and inappropriate spatial scaling during studies.
We admit that regular monitoring of reproductive structures and traits in bryophytes at selected locations throughout the maritime Antarctic is needed in order to provide currently lacking robust data on biological responses to environmental variability and change. Our field work was supported by National Antarctic Scientific Center of Ukraine.

Porifera (Sponges) of the deep Weddell Sea, Antarctic: Preliminary results from the ANDEEP-SYSTCO expeditions, 2002-2008 with RV "Polarstern"

Dorte Janussen[1] and Christian Göcke[1]

[1]Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main

The Antarctic deep-sea Porifera fauna is systematically documented, described and analyzed for the first time. We present some of the new, mostly still preliminary, results from the investigations on the ANDEEP and SYSTCO campaigns.
During the ANDEEP I-III and SYSTCO expeditions (2002-2008), sponges were sampled from the deep Weddell Sea and surrounding areas by various benthic sampling gears, especially Agassiz trawl, epibenthic sledge and Rauschert-dredge. Taxonomy and ecological analysis was done, using several

computer programs including MS excel and Past.
So far, we identified more than 110 sponge species, of which c. 25 % are new to science and 40 % new to the Southern Ocean. They belong to the Porifera classes: Demospongiae, 77 spp. (15 new), Hexactinellida, 26 spp. (7 new) and Calcarea, 7 spp. (4 new). On the Antarctic shelf and slope, species of the circum Antarctic genus *Rossella* are dominant, whereas at Bathyal and abyssal depths they are replaced by *Bathydorus*, members of the family Euplectellidae and the deep-sea genus *Caulophacus*. Contrary to the largely endemic shelf fauna, the Antarctic deep-sea Porifera comprise several cosmopolitan species, and show affinities to the deep Atlantic fauna. In the case of the rediscovered genus *Lonchiphora* sp. nov., collected at 2180 m in the Eastern Weddell Sea, the closest relative is a poorly documented species from the Pacific Sagami Bay (Göcke & Janussen, accepted). The rediscovery of the poorly known genus *Lonchiphora* in the Antarctic Ocean was a big surprise, as it was formerly known only from one collection in the Sagami Bay, Japan. This distribution may be explained by a concept on the evolution of Cenozoic seaways by Lawver & Gahagan (2003). According to this hypothesis, a circumglobular current existed throughout almost the entire cenozoic, bringing equatorial waters from regions near Japan southwards through a passage east of Africa into the Antarctic area of the Weddell-Sea and then northward towards the Equator. Thus, there was a strong inflow from northerly seas towards the Weddell-Sea throughout a prolonged period of time, and it is likely that *Lonchiphora* followed this current.According to our hypothesis, the Antarctic species is probably the younger, derived from a northern species that migrated southwards through the deep-sea basins surrounding Japan. The recent records of *Lonchiphora* may represent relics of formerly widespread occurrences, which were decimated due to changes of environmental factors on smaller and bigger scale, , important for hexactinellid sponge societies Gutt and Koltun (1995).
Many of the Cladorhizidae (carnivore sponges) are new to science and most of them new to the SO. The same is true the first bathyal and abyssal Calcarea discovered in the Antarctic Ocean (Rapp et al. in press). Cluster-analysis of the sponges sampled during SYSTCO expedition exhibit some distinct tendencies: The deepest station (5000 m) shows no species overlap with others, whereas the Stations between 500 and 3000 m show some similarities. The composition of the Antarctic sponge fauna changes successively with increasing depth, but keeps cohesive similarities down to ca. 3000 m. In the depth zone of about 4000-5000 m, a very distinct abyssal fauna is found. Despite the low sampling density, for most sponge taxa, our results point towards various zoogeographic links to other deep oceans.
The results of the ANDEEP-SYSTCO-campaigns brought first detailed insight into the structure, ecology and distribution of Antarctic sponge faunas. The key concept in our new findings is the successive change in sponge fauna composition with increasing depth. Zoogeographic links are found with different regional affinities for several deep-sea sponge taxa. These are still preliminary results, detailed analysis will be a major part of our upcoming work

Geodynamics of North-Victoria-Land, Antarctica, derived from GPS and micro-gravity measurements

Gerhard Jentzsch[1], Alessandro Capra[2], Robert Ricker[1], Peter Schindler[1]

[1]Institute of Geosciences, University of Jena
[2]Dipartimento Ingeneria Meccanica è Civile, Modena, Italia

The micro-gravity measurements in North-Victoria-Land (NVL) are based on the Italian programme of repeated GPS measurements being carried out at well installed points in that area (VLNDEF: Victoria Land Network for Deformation Control). Although the deformations obtained over a period of four ye are quite small (seasons 1999-2000, 2000-2001, and 2002-2003) we expect from gravity observations additional information about on-going tectonic processes and/or mass changes caused by possible changes in the ice cover. Of course, such information will be available only by repeated measurements not before some years. With our measurements we have now prepared the basis for such investigations.
Micro-gravity monitoring has been applied successfully in areas of active volcanism. The advantage is that these measurements do not require a topographic reduction because the measurements are always carried out at the same points. Thus, the instrumental resolution and the measurement conditions, resp., are the only limits for the resolution and accuracy of such measurements. In order to receive a reliable data base we used three well calibrated gravimeters in parallel and repeated the measurements several times. Generally, the points were so exposed that local effects due to changing snow cover are not expected.

The first campaign was carried out within the expedition GANOVEX X based at Gondwana station in the Terra Nova Bay, North-Victoria-Land. The aims of our work are to determine variations of the gravity field and velocities of the surface deformations. The results should lead to boundary conditions for the detection of ice-induced mass changes and deformations of the crust (visco-elastic response).
The first results show that the gravity differences between the points relative to Gondwana reach up to more than 750 mGal. Basically, such measurements based on helicopter transport are possible, although the meteorological conditions were sometimes not very favourable: Catabatic winds were so strong that the access of some points was not possible. Where we could land despite the conditions, the wind caused a high noise level. The measurements were performed in the way that we first measured at the Gondwana base point. After completing measurements at several points a second reference measurement at the Gondwana base station completed the day. Each measurement consisted of at least three measurements of each gravimeter. Thus, the complete measurements at one point lasted at least 45 minutes. In total, 14 stations were measured, and about 180 measurements were carried out. The obtained experiences showed that the schedule of the measurements is totally depending on the wind conditions.
The analyses of the data are still under consideration, and the general noise level of all measurements is not yet clear.

The Permian Beacon Supergroup of North Victoria Land, Antarctica: Evolution of a fluvial system

Nadine John, Robert Schöner, Reinhard Gaupp

Institut für Geowissenschaften, Universität Jena

The Permian of North Victoria Land is part of a large continental basin system of south eastern Gondwana that may have extended from South Victoria Land to Tasmania. The existing knowledge on Permian deposits in North Victoria Land is mainly based on field-campaigns carried out during the 70s and 80s of the last century (e.g., Walker, 1983; Collinson et al., 1986). However, these studies do not provide a consistent sedimentological model, and do not allow a correlation between outcrops occurring in the various mountain ranges in the northern part of North Victoria Land. Our field investigations aimed towards a detailed description of the spatial and temporal evolution of the depositional system occupying a sedimentary basin of uncertain origin. The satellite-camp based field period during Austral summer 2009/2010 enabled detailed sedimentological investigations in the Helliwell Hills, the Morozumi Range, the Alamein Range and the Neall Massif. Supported by Helicopter additional outcrops could be investigated in the southern Freyberg Mountains, the Lanterman Range and the Retreat Hills.
The studied deposits rest unconformably on metamorphic or igneous intrusive basement. Glacial and fluvio-glacial deposits, which occur at the base of the section, are interpreted as the infill of a pre-existing paleo-relief. These unnamed deposits are represented by predominantly conglomerates with a great variety of clasts, but also by fine-grained deposits containing different amounts of carbonate that are of questionable origin. The contact between Permo-Carboniferous fluvio-glacial sediments and fluvial Permian deposits is locally sharp, but occurs predominantly transitional. A characteristic vertical pattern of the Permian fluvial deposits could be recognized within all mountain ranges. The fluvial succession starts with a unit of coarse-grained, pebbly sandstones and clast-supported fine-grained conglomerates that are interpreted as typical braided stream deposits. This lower part of the succession contains sporadically *Glossopteris*-bearing fine-grained sandstones and siltstones that occur in very shallow, dm- to m-scale troughs. The fluvial succession grades into a series of fining upward units that commonly start with pebbly, coarse-grained sandstone beds at the base, which are typically through-cross bedded with set thicknesses of dm-scale. The unit merges into a heterolithic succession comprising medium-grained to fine-grained sandstones and siltstones showing predominantly ripple-lamination. Sporadically intercalations of coarse-grained small erosive sandstone bodies occur within the fining-upward units that commonly comprise thin coal horizons at the top. Distinct sets of large inclined heterolithic stratification occur in the upper part of the succession, which are traceable over distances often exceeding the lateral outcrop-scale of a few hundred meters. The base of these sets is often strongly erosive and forms large, concave-up depressions that are filled with medium-grained sandstones showing a weak fining-upward trend. The topmost unit, dominated by coarse-grained and medium-grained sandstone beds, is characterized by spotted whitish-grey weathering surfaces and abundant *Skolithos*-like burros as well as dolomitic concretions. Despite local differences

in the depositional evolution, a lithostratigraphic correlation seems to be reasonable along and across the basin. Analysis of fluvial architectural elements on outcrop scale together with the measured sedimentary logs enable a detailed description of lithofacies and stacking patterns and permit a subdivision of the Permian succession into several members. These results will be stepwise verified by systematic compositional and biostratigraphic investigations.
The distribution of different lithofacies types allows distinguishing proximal and distal parts of the fluvial system. Successions that are coarse-grained and comprise a less intense variation in fluvial style were probably deposited close to the basin margin. Whereas sedimentary successions showing a great variety of facies, grain-sizes and fluvial architecture most likely represent a more distal sedimentation close to the basin axis. At the basin margins the river system appears to have remained highly energetic only with minor potential to preserve fine-grained deposits. Towards the basin axis the depositional environment is more variable, showing a pronounced development of the members mentioned above.
Further conclusions regarding the development of the fluvial system, possible tectonic as well as climatic controls on sedimentation will be drawn based on further petrographical and geochemical analysis of the sediments. These investigations will focus on sediment provenance and diagenesis. Furthermore the collected samples contain partly very well preserved plant fossils, which will be used to study the macoflora and the palynological inventory throughout the stratigraphic range.

Response of Lakes to Half Century Human Impact - Schirmacher Oasis, Antarctica

E. Kaup[1], B. Sharma[2]

[1]Institute of Geology, University of Technology, Tallinn, Estonia
[2]Shriram Institute for Industrial Research, Delhi, India

Human impact began in 1961 with construction Novolazarevskaya Station and represented mainly sewage and casual oil inflows into two neighbouring lakes and rubbish removal onto one lake ice cover. The latter activity ceased in 1976 and after 1980 only purified sewage started to enter one lake. In 1976 the two lakes revealed clear eutrophication symptoms: much higher than natural lakes DRP and inorganic N, higher Chl *a* and phytoplankton production, anoxia due to anthropogenic meromixis. The symptoms were weakened in 1983/84 due to reduced sewage and increased meltwater inflows and enhanced vertical circulation. In 2009 the water in impacted and natural lakes differed only a little in the above indicators but earlier pollution was retained in sediments.
Maitri Station was built in the watershed of Lake Zub in 1989. Purified sewage is directed into specially built basin next of station. Analysis of nutrients in water in 2009 showed only minor increases compared with the results of 1976 and 1983 (Kaup, unpubl.).

Detection and Tracking of Whales Using a Ship-Borne, 360° Thermal Imaging System

Lars Kindermann, Daniel P. Zitterbart, Elke Burkhardt, Olaf Boebel

AWI Bremerhaven

Ship-borne, quasi-continuous visual marine mammal observations for mitigation or research require, while being restricted to daylight hours, utmost concentration by observers as well as large teams when conducted during month-long cruises. To overcome such limitations, the use of thermal imaging has first been examined in the context of offshore oil exploration by Greene and Chase [1987]. The approach exploits the thermal signature of a whale's blow, which, at least at high latitudes, is warmer than the environment. Their study and additional research by Cuyler et al. [1992] recorded thermal images of both odontocete and mysticete blows at ranges of up to 100 m. Significantly larger detection ranges were achieved by Perryman et al. [1999] who detected grey whale blows at several kilometers range in thermal images taken from ashore. Most recently, Baldacci et al. [2005] tested a handheld naval IR camera in the Mediterranean, reporting detections of various species at typically 1-2 nm.
However, the limited field of view of infrared cameras used in these studies poses a significant constraint when continuous monitoring of a ship's entire perimeter is required. This problem is overcome in this study by using a ship-borne, 360°, cooled thermal imager, FIRST-Navy, mounted on an actively stabilized gimbal. The sensor, developed by Rheinmetall Defense Electronics, Germany, provides a continuous 5 Hz video stream of the ship's perimeter with a horizontal resolution of 0.05°/pixel and a vertical resolution of

0.03°/pixel. The system was installed on the crow's nest of RV Polarstern's in autumn 2009, and has been tested during two expeditions to the Greenland Sea and the Southern Ocean, generating thermal imaging streams which allow detection, locating and tracking of whales in the ship's vicinity.

The FIRST Navy sensor so far was operated for a total of 837 hours. As the significant data rates (3.5 Tbyte/day) prohibit continuous saving of data, independent information on the presence of marine mammals was used to trigger archiving of relevant video sequences (spanning the – speed dependent – relevant period of +/-3 to 60 minutes around each sighting). This ensured the acquisition of video data sequences with whales known to be present. Retrospectively, the ensuing data set of 35 h duration was visually screened for IR signatures of whale spouts, so far revealing over 300 spouts (i.e. Fig. 1, top) at ranges of up to 3 km.

From a blow's position within a given thermal image, the relative distance of the blow to the ship is calculated using simple triangulation, similar to the methods used with distance sampling techniques [*Lerczack and Hobbs*, 1998]. The bearing under which the blow is detected can be extracted from the image with an extremely high resolution of 0.05 angular degrees. The vertical resolution of 0.03 angular degrees surpasses those of "Big Eye" binocular (small) reticules (0.06 – 0.08 angular degrees) and is comparable to angular resolutions that may be achieved by visual interpolation when using "Big Eyes" under ideal conditions. However, the fact that the FIRST Navy sensor is stabilized against the ship's roll and pitch and the possibility to scroll forth and back in the recorded video material allows to avoid overlooking blows while providing highly accurate and objective relative blow positions. Concurrent 1s resolution records of the ship's navigational data then allows calculation of absolute, geo-referenced whale tracks. Fig. 1 exemplifies such results for an encounter with a minke whale, while similar tracks have so far been processed for 19 events, including humpback, sperm, minke, fin, and bowhead whales. This provides a unique opportunity of documenting in detail the locomotive behavior and blow rates of cetaceans in the near vicinity of ships equipped with such systems.

Langzeitige Eisoberflächenhöhenänderungen aus wiederholten geodätischen Beobachtungen im Einzugsgebiet des Hays-Gletschers, Enderby-Land/Antarktis

Christoph Knöfel[1], Jens Hartmann[1], Yurij M. Ryvkin[3], Yurij V. Orlov[3], Valery V. Lukin[2], Reinhard Dietrich[1], Alexey Yu. Matveev[3], Valery P. Grebnev[3]

[1]Institut für Planetare Geodäsie, TU Dresden
[2]Arctic and Antarctic Research Institute, St.Petersburg, Russland
[3]Aerogeodeziya, St.Petersburg, Russland

Im Jahre 1972 wurde beginnend an der antarktischen Küstenstation Molodezhnaya (68°S, 46°O) eine Geodätisch-Glaziologische Traverse angelegt. Die Traverse verläuft über das Einzugsgebiet des Hays-Gletschers, wurde mit ca. 30 Zieltafeln signalisiert und endet etwa 100km südöstlich der Station in den Bergen der DSF auf anstehendem Fels. In der Zeit von 1972-1978 wurde die Traverse 3 Mal beobachtet. Als geodätisches Messverfahren zur Ermittlung der gesuchten Eisoberflächenhöhen diente das Verfahren der trigonometrischen Höhenübertragung. In deutsch-russischer Zusammenarbeit erfolgte in der Saison 2008/2009 die wiederholte Vermessung dieser Traverse, um Veränderungen der Eisoberflächenhöhe über einen Zeitraum von 37 Jahren zu bestimmen. Die historischen Signallokationen wurden zu diesem Zweck erneut besetzt. Die Absteckung der Signalpositionen des historischen Netzes erfolgte mit Hilfe des Globalen Positionierungssystems GPS, für die Bestimmung der Eisoberflächenhöhen kam wiederum das Verfahren der trigonometrischen Höhenübertragung zur Anwendung, um mögliche systematische Fehler zu minimieren und so frühere und aktuelle Messergebnisse miteinander vergleichbar zu machen.

Als Resultat liegen aktuelle Eishöheninformationen an den historischen Signalpositionen vor, die im Vergleich mit den früheren Ergebnissen Aufschluss über das langzeitige Verhalten der Eisoberfläche im Einzugsbereich des Hays-Gletschers geben. In der Präsentation werden Messverfahren und Fehlerbudget ausführlich erläutert und die erhaltenen Ergebnisse detailliert vorgestellt. Zusätzlich erfolgt ein Vergleich mit Messergebnissen aus der Region der Station Mirny (66°S, 93°E), wo während der Saison 2006/2007 identische Beobachtungen durchgeführt wurden.

Was verbindet die Arktis mit dem Fläming?

Am Beispiel eines Schülerprojektes: „Coole Klassen in Brandenburg Potsdam Mittelmark"

Conrad Kopsch

AWI Potsdam

Im Rahmen des Internationalen Polarjahres unterstützte das AWI das Projekt „Coole Klassen", welches zum Ziel hat, die Polargebiete wegen ihrer großen Bedeutung des Klimawandels in den Schulen zu thematisieren. Schüler kennen teilweise elementare Unterschiede zwischen Arktis und Antarktis nicht, sie nehmen die Polargebiete normalerweise nur bedingt oder kaum wahr. In den Schulbüchern der Sekundarstufen taucht das Wort „Permafrost" noch nicht einmal auf. Ein wesentliches Ziel des Internationalen Polarjahres (IPY) ist daher neben den wissenschaftlichen Forschungsarbeiten der Wissenstransfer auf breiter Basis in die Öffentlichkeit und speziell in die Schulen. Damit sollen vor allem junge Menschen erreicht und für das System Erde sensibilisiert werden.
Die Wissenschaftler in Potsdam führen Expeditionen in die Antarktis und Arktis durch. Verstärkt widmen sie sich der Arktisforschung - insbesondere den Dauerfrostgebieten Sibiriens und der arktischen Inselgruppe Spitzbergen, da hier der Schlüssel zum Verständnis des Klimageschehens in Europa liegt.
Mittels eines virtuellen Klassenzimmers wurden die Schüler und Lehrer vom 10. bis 22. September 2009 täglich ab 10.00 Uhr für eine Stunde mit der Lehrerin auf Spitzbergen in Verbindung gebracht. Im Rahmen des Unterrichts konnte sie so über eine Videoanlage direkten Kontakt in die Klassenzimmer dieser drei Schulen halten.
Die Mädchen und Jungen der Grundschule erhielten durch das virtuelle Klassenzimmer Gelegenheit, die arktische Flora und Fauna kennen zu lernen. Während sich die Belziger Oberschüler mit der Thematik Permafrostböden befassten, haben sich die Gymnasiasten dem Klima und der Atmosphäre widmet.
Ziel des Projektes war es, den Kindern und Jugendlichen ein neues Bild der Polarregionen zu vermitteln und sie auch für Klimaveränderungen zu sensibilisieren, sie darauf aufmerksam machen. Die Wirkung des Projekts sollte dem Unterricht an den Schulen langfristig positive Impulse geben und eine Kooperation zwischen Schulen und Forschern auch zukünftig sicherstellen.
Ob uns das gelungen ist, konnte man am 5. März 2010 im Alfred Wegener Institut Potsdam erfahren. Vor Forschern und Wissenschaftlern des AWI's stellten alle drei Schulen ihre Erkenntnisse vor, so z.B. Was verbindet die Arktis mit dem Fläming? Wir glauben, man war beeindruckt von dem was die Schüler zeigten.
Das AWI –Potsdam unterstützte das Projekt in allen Belangen der Logistik, stellte die Internetseite zur Verfügung, übernahm die Satellitenübertragung.

The Influence of Natural and Anthropogenic Agents on the Chemical Composition of Soils in the Maritime Antarctic

Svitlana Korsun[1], Iryna Kozeretska[2], Ivan Parnikoza[3]

[1]Institute of Agriculture of the Ukrainian Academy of Agrarian Sciences, Kyiv region, Ukraine
[2] Taras Shevchenko National University of Kyiv, Ukraine
[3]Institute of Molecular Biology and Genetics NAS, Ukraine

One characteristic feature of Antarctica is the initial stages of its primary soil formation, when the upper layer of the pedosphere engaged in soil formation is thin and the properties characteristic of mature soils have still not formed. Soil formation processes on King George Island, as well as on other maritime Antarctic islands, are peculiar in that it is connected with:

- cryogenesis – permafrost-affected soil formation;
- soil forming rocks – sea alluvium, eluvium, and slide-rocks of magmatic or sedimentary bedrocks;
- biological characteristics of microbial, phyto- and zoocenoses;
- global and local technogenic influences caused by distant and direct impacts of human activity;

Up to date, there still persists the question of the role of natural and anthropogenic agents during soil formation processes on ice-free areas in the maritime Antarctic.
Eight stationary experimental 4 to 9 m^2 areas were established during the 30th Polish and 10th Ukrainian expeditions (11/09/2005 – 02/09/2006) at two ice-free locations near Admiralty Bay (Point Thomas oasis, near the polish base "Arctowski") and Keller Peninsula near the Brazilian station "Ferraz" on King George Island, the South Shetland Islands). The main area selection criterion was the distance to ocean and glacier edge, so that we expected to obtain some information on soil properties in different ecological conditions. Based on anthropogenic load, these eight areas

were divided into two groups. The first group included areas not exposed to any direct anthropogenic or technogenic load. The second group contained areas under uncontrolled extensive anthropogenic and technogenic load – fuel and architectural material unload sites, areas transformed by building, etc.
To assess the role of natural agents in the formation of the chemical properties of soils, a modeling experiment with artificial guano and water supply was launched on an area without any direct anthropogenic load. The experimental plots were as follows:
1 – control;
2 – daily one-time watering with 1 L of sea water;
3 – treatment with 1 L guano solution (approx. 100 g dry guano per 1 L of water).
The area of each plot was $1m^2$. Treatment lasted for one month.
Soil analysis of the studied stationary areas revealed significant fluctuations in the chemical composition. The causes of such fluctuations become more evident from the modeling experiment with sea water and guano. Both agents led to an increase (compared to control) in the organics content, total nitrogen and phosphorus, as well as active forms of nitrogen, phosphorus, potassium and sodium. Besides, there was a tendency towards lower contents of alkaline-earth metals that are soluble in ammonium acetate buffer. The most profound changes in soil fertility were observed as a result of systematic guano treatments, and the high increase in alkaline metals (potassium and sodium) during the experiment led to lower acidity with pH 3.6 (plot 6a) through pH 4.2.
Both sea water and guano solution were found to alter soil trace elements and microelement contents. Acid-soluble forms of iron decreased by 26-38%, and lead, cadmium, nickel and zinc increased significantly. Sea water treatment resulted in zinc accumulation and lower copper content, which appears to stem from the chemical composition of the water and a higher intensity of phytocenosis development.
Technogenic aspects cannot be excluded as potential agents of soil chemical composition alterations. To assess putative technogenic influence, we used soil from an area that had just become free of ice and, at the time of the experiment, was still not covered with vegetation. Comparison of this area with a nearby one that became free of ice back in the 1970s revealed that with time, beside changes in the contents of the most common nutrients resulting from their biological turnover, the soil contents of copper, zinc, iron, manganese, lead and cadmium had increased. Inasmuch as the acid-soluble fraction of trace elements and microelements is thought to be the most informative in regard to technogenic effects on soil quality, an increase in their contents in areas far away from the zones of direct anthropogenic influence may indicate an increase in global technogenic effects.
Soil analysis of samples from areas with high anthropogenic impact (fuel and building material unload and storage places, as well as areas affected by building) revealed elevated concentrations of soil lead, zinc, alkaline-earth metals, as well as the respective acidity alteration (pH 7.2). Such anthropogenically induced changes in soil chemistry may provide for migration of trace elements all the way up to higher trophic levels, which is in accordance with data on trace element content in the feathers of Antarctic penguins. Therefore, the soil heterogeneity within the studied oases on King George Island seems to result from concerted effects of natural and anthropogenic agents isolation of which requires further studies.
Our field work was supported by the Antarctic Biology Department of Polish Academy of Sciences and by National Antarctic Center of Ukraine.

Variations of a large, high elevation glacier during the last century: Fedchenko Glacier, Pamir

Astrid Lambrecht[1], Christoph Mayer[2], Arzhan Surazakov[3], Dana Floricioiu [4], Vladimir Aizen[3]

[1]Institut für Meteorologie und Geophysik, Universität Innsbruck, Austria
[2]BAdW München
[3]Department of Geography, University of Idaho, Moscow, USA
[4]DLR- IMF Oberpfaffenhofen

The high Pamir is extensively coverd by glaciers and the most prominent, Fedchenko Glacier is one of the largest mountain glaciers in the world. Observations date back to 1928, when a Russian/German expedition carried out a detailed survey of the entire region. Since then repreated surveys allow direct comparisons of glacier changes,at least for large parts of Fedchenko Glacier. Based on recent remote sensing data and results of geodetic/geophysical measurements in 2009, the evolution of the glacier can be reconstructed for the last eight decades. Ice thickness was determined on several cross profiles in the accumulation zone and the surface velocity was determined by repeated GPS observations and feature tracking techniques. The geometry changes derived from these new investigations and the old surveys are related to the

meteorological measurements from Fedchenko Station, situated at 4200 m elevation close to the glacier margin. Also the ice flux can now be estimated from the ice thickness distribution and observed surface velocities in the accumulation zone. Changes in the glacier geometry are rather minor during the last eight decades, which probably is related to the rather high elevated accumulation basin. Still the lower ablation zone shows a considerable downwasting of the glacier surface below the extensive debris cover.

Exhumation and deglaciation history of Marie Byrd Land and Ellsworth Land, West Antarctica – First constraints from apatite (U-Th-Sm)/He dating

Julia Lindow[1], Cornelia Spiegel[1], Joanne Johnson[2], James Alexander Smith[2], Frank Lisker[1], Karsten Gohl[3]

[1]Department of Geosciences, University of Bremen
[2]British Antarctic Survey, Cambridge, UK
[3]AWI Bremerhaven

The West Antarctic terrane is characterised by one of the largest active continental rift systems, resulting from a late Mesozoic to Cenozoic extension between East and West Antarctica. This geodynamical active area is comparable in size with the East African Rift System and is accompanied by high heat flow, still ongoing magmatic activity since late Oligocene times and a relatively hot lithosphere.
In further association with active rifting, the average bedrock surface of West Antarctica lies at 500 to 1000m below sea level. Therefore, the West Antarctic Ice sheet (WAIS), covering large parts of the West Antarctic coast, including Marie Byrd Land (MBL) and Ellsworth Land (EL), is mainly grounded below sea level. While it is still adjusting to Holocene temperatures, the WAIS is drained by fast flowing ice streams, and rapid thinning, together with grounding line retreat is observed along several glaciers surrounding the Amundsen Sea Embayment. This is one of the reasons why the transition area between MBL and EL is considered to be a potential site for the initiation of collapse of the two million km2 WAIS, resulting in a global sea-level rise of 5 to 6 m.
Due to remoteness and challenging accessibility basically no thermochronology data exist and only little is known on the long-term thinning rates from the study area, but it is assumed that the geodynamic evolution of the underlying bedrock may have a strong influence on ice sheet dynamics. However, since the coupling between these mechanisms is yet to be understood, our work follows two main objectives:
1) Reconstruction of the exhumation history of MBL and EL using apatite (U-Th)/He (AHe) and apatite fission track (AFT) dating, and 2) Understanding the deglaciation history of MBL and EL by using cosmogenic nuclides for surface exposure dating in combination with thermochronological analyses.
Based on these targets, sampling priority was on altitudinal profiles from the coastal mountain ranges of MBL and EL, as they allow to directly derive both, glacial-thinning and exhumation rates. The temperature-senstive apatite thermochronometer enables us to reconstruct vertical movements in the upper 4 to 5 km of the lithosphere and to date near-surface geodynamic processes. Cosmogenic nuclides dating, in turn, provides information on the duration of exposure to cosmogenic irradition. By sampling surfaces affected by a former ice cover at different altitudes, it allows reconstructing glacial-thinning rates.
Additionally, two low-elevation horizontal profiles were sampled, one 100km north-south oriented and a second of the same length perpendicular to it, to give insights on lateral glacial retreat rates, and also on potential fault movements in the Pine Island Bay (PIB) area and crustal tilting of the MBL block.
Over short distances alternating lithologies, cross cutting dykes, minor faults and strongly deformed gneisses testify to the eventful geodynamic history and at least two different stress regimes can be suggested. Combining these field observations with the first AHe data from the PIB area, derived by samples taken in 2006 (during RV Polarstern expedition ANT-XXIII/4), we here present first results on the exhumation history of MBL and EL.

Reconstruction of ice-flow patterns in central western Poland

Ewelina Lipka, Izabela Szuman

Institute of Geoecology and Geoinformation, Adam Mickiewicz University, Poznan, Poland

The extent of the Scandinavian Ice Sheet in Poland during the Last Glacial Maximum (LGM) is well known – it has been defined mainly on the basis of geomorphological criteria. However, its ice-flow patterns have not been unquestionably reconstructed yet. Usually when reconstructing ice-flow patterns either geo-

morphological evidence (e.g. Ewertowski, Rzeszewski 2006; Przybylski 2008) or alternatively merely clast-compositional data (e.g. Böse 1990) were taken into account. Nevertheless, there exist studies composing geomorphical with petrographical evidence (Kjær et al. 2003) in order to reveal ice-flow patterns. In this contribution we attempt to reconstruct the ice-flow patterns on the basis of geomorphological evidence as well as till fabric and clast-compositional data. In our opinion combining all those observations can give valuable and more precise evidence for ice-flow patterns.

The study area concerns the Wielkopolska region and is located in central-western Poland, within the range of the Last Glacial Maximum. It is limited by Odra river on the West, Notec river on the North and East and the Leszno (Brandenburger) Phase - maximal extent of the LGM - on the South. This area extends between 14°30'E and 18°20'E longitude and 51°52'N and 52°52'N latitude. Our investigation took place in several test areas located along marginal zones of both Leszno and Poznan Phase and within interior till plains.

In this study an extensive data set including directional indicators of ice sheet activity, both positive and negative geomorphological traces , till fabric (a-axes of at least 30 elongated clasts) and clast-compositional data (derived from 4-10 mm gravels) is used in order to reveal ice-flow patterns. Moreover, an attempt was made to include petrographic data (indicator erratics) obtained from 20-60 mm gravels into this data set. The geomorphological analysis of Digital Elevation Model (DEM) covered interpretation of directional landforms were done in the GRASS GIS free software, using the Digital Terrain Elevation Data Level 2. Other indicators like till fabric and petrographic composition were examined in test areas, within subglacial tills. We also adopted kinematic indicators of ice flow direction from glacitectonic structures on the basis of literature studies.

Basing on DEM a few groups of lineations were distiguished. Within till plains the lineations are common and well defined, and show the general ice flow direction from NW towards SE. Although forms perpendicular to this main direction are also clearly visible. Subglacial landforms, as well as till fabric properties within the Leszno Phase marginal zone imitate radial arrangement. Using these criteria a few lower-scale paleo ice-lobes could be distinguished. Our attempt to combine these directional evidence together with petrographic composition resulted in demonstrating clear differences between particular areas only to some extent. Thus we infer that clast-compositional data can play only a supporting part in reconstructing ice-flow patterns. The considered study area may constitute a branch of the hypothetical B2 ice stream (Stokes, Clark 2001) with mean ice flow direction NW towards SE (with exception to the marginal zone, where ice flow direction is more dispersed).

Regional characteristics of extremes and variability in Arctic temperature

Heidrun Matthes, Annette Rinke, Klaus Dethloff

AWI Potsdam

Arctic temperature is analyzed in view of its extremes based on climate indices derived from daily mean, maximum, minimum temperature. This analysis is done for the pan Arctic domain and region-specific for east and west Russian Arctic. The variability of temperature-related indices over the last four decades is presented, in which the spatial distribution and regional differences as well as its temporal trends are discussed. The analysis is based on ERA40 data and station data in the Russian Arctic as well as the output of the regional climate model HIRHAM.

The intra-seasonal extreme temperature range (ETR; defined as the hottest daily maximum temperature in the season minus the coldest daily minimum temperature in the season) was analyzed. ETR is a simple but useful measure of the extreme temperature variability. To analyzes its temporal development, two 22 year long time periods (1980-2001 versus 1958-1979) were compared. We found a statistically significant decrease in the ETR by 2 to 7°C in the second period over the northern North Atlantic (Greenland Sea, Fram Strait, Kara Sea) in winter and the transition seasons. Another statistically significant change was the decrease of ETR by 2 to 5°C over the East Siberian Sea and land in winter. In the regional, station based analysis, an interesting pattern appears for GSOD west in autumn. It was the only case where positive ETR trends were dominant in all analyzed time slices, and where the trend magnitude increased towards recent years (0.8°C decade^{-1} in 1958 to 2001; 2.6°C decade^{-1} in 1980 to 2001). The station observations, ERA40, and HIRHAM agreed on this behaviour, which can be attributed to warmer September temperatures, which also prolong the growing season.

Growing degree days describe the intensity of the growing season. Their spatial distribution reflects the north-south temperature gradient in the Arctic and distinguishes the high mountain ranges in Alaska and eastern Siberia. Areas

with high mountains can be identified by up to 300°C lower values compared with regions of same latitudes. Positive trends were calculated over most parts of the Arctic and are significant in some areas like northern Alaska and northeastern Canada. This is confirmed by the regional, station based analysis over Russia, though some of the calculated trends are not significant. Growing degree days are systematically underestimated by HIRHAM over the Arctic domain. However, the calculated spatial patterns as well as the trends and decadal-scale variability in the time series are well reproduced. Positive trends found in the regional analysis of the station data are calculated similar from model output.
The large variability of the Arctic temperature and its extremes, which is inherent in the analysis period, demonstrates that natural variability is an important factor in the Arctic climate. The interannual variability of both indices shows a pronounced decadal variability and considerable regional and seasonal differences. Differences in the index magnitudes between station data and the gridded data of ERA40 and HIRHAM were found, as the models do not fully represent the topography and local effects that influence the station data. However, variability, temporal development and trends in the indices are well reproduced.

Prospect and limitations in radiocarbon dating of Alpine ice

Barbara May[1], Dietmar Wagenbach[1], Peter Steier[2], Wilfried Haeberli[3]

[1]Institut für Umweltphysik, Universität Heidelberg
[2]Institut für Isotopenforschung und Kernphysik, Universität Wien, Austria
[3]Geographisches Institut, Universität Zürich, Switzerland

Deploying glacier archives for the investigation of climate and environmental changes evidently needs to establish an adequate chronology. For cold mountain glaciers and particularly for the small scaled ones of the Alpine realm this task is a great challenge, especially where the depth-age relationship becomes highly non-linear. Thus for such sedimentary ice archives the use of stratigraphical standard dating methods are limited to some 100 years, whereas theoretical age models are too uncertain for any practical application, especially when approaching the basal layer. Moreover, other cold ice bodies, like miniature ice caps, ground ice or cave ice do not necessarily contain a consecutive stratigraphy and thus call for alternative dating methods as well. Radiometric dating would be the obvious tool to partly overcome these dating problems. However, the only radioisotope readily available for this application is radiocarbon (^{14}C), but its analysis in small ice samples is not settled yet.
Here we report on our radiocarbon dating attempt specifically dedicated to our ice cores drilled to bedrock at: (i) the high Alpine glacier Colle Gnifetti (Monte Rosa summit range, 4500m asl), being suspected to contain climate information probably over the entire Holocene and (ii) the (cold) miniature ice cap Vadret dal Corvatsch at much lower altitude (Upper Engadin, 3400 m asl), which has recently become of interest with respect to reconstructing past stages of minimal Alpine glacier extent.
In order to tackle radiocarbon dating we developed a method to extract organic impurities, both the particulate organic carbon (POC) as well as the dissolved organic carbon (DOC) fraction, from the ice for subsequent ^{14}C analyses by accelerated mass spectrometry (AMS). We expected that the DOC fraction, being present in larger quantities than POC and free of reservoir effects, would provide more correct ages for ice samples that small. However, based on the respective ice core ^{14}C data, we unexpectly identified an additional ^{14}C source contributing to the DOC fraction, which we can not explain by a blank contribution but most likely by ^{14}C in situ production.
Nonetheless, for the Vadret dal Corvatsch glacier POC ^{14}C dating was successful leading, most important, to a first age constrain on the basal section in the order of 7500 years . Also, for the Colle Gnifetti saddle a maximum POC ^{14}C age for the basal ice does not strictly exclude ice from the last glacial period.
We will discuss these findings and their implications for past climate conditions and also assess the problems and possibilities of ^{14}C analysis on organic carbon in ice.

Comparison of TerraSAR-X Ice Motion Retrieval with In-Situ GPS Data at Breidamerkurjökull, Iceland

Florian Müller[1], Eyjólfur Magnússon[2], Helmut Rott[1, 3], Thomas Nagler[1], Dana Floricioiu[4]

[1]ENVEO IT, Innsbruck, Austria
[2]Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland
[3]Institute of Meteorology and Geophysics, University of Innsbruck, Austria
[4]DLR- IMF, Oberpfaffenhofen

Repeat pass synthetic aperture radar (SAR) data are of great interest for studying glacier dynamics because of the capability to deliver

spatially detailed maps of ice motion. Interferometric radar techniques (InSAR) enable to map surface motion at centimetre and sub-centimetre accuracy. However, the need for temporal stability of the phase (coherence) of the repeat pass radar signal is a major limitation for the application of InSAR data on glaciers. This deficiency can be overcome by means of template matching in incoherent SAR amplitude images (also called feature tracking). This technique requires distinct and stable surface features, as usually available on ice surfaces of glaciers. The method delivers two components of the velocity vector (in slant range and azimuth) and can measure shifts at fractions of a pixel.
The TerraSAR-X satellite, launched in June 2007, with its high resolution X-Band SAR sensor and 11-day repeat cycle offers excellent opportunities for mapping glacier velocities with great spatial detail. Over the 11 day repeat cycle the backscatter signal usually decorrelates so that feature tracking in incoherent amplitude images is applied. Due to the high spatial resolution of the TerraSAR-X images in strip map mode, which is on the order of 1 to 3 m, spatially detailed fields of glacier motion can be derived. We applied TerraSAR-X images to map the motion of Breidamerkurjökull, Iceland, an outlet glacier of Vatnajökull and compared the data with GPS measurements recorded at three stations on the glacier tongue. Breidamerkurjökull is located near the coast and exhibits significant melting during summer. Due to the low elevation and the location next to the Atlantic coast melt events may occur during winter as well. A data stack of TerraSAR-X Stripmap mode images with a swath width of 30 km and a horizontal resolution of about 2 m was acquired over the glacier terminus between August 2008 and September 2009. The dataset covers different seasons, enabling to study seasonal effects on ice motion and the impact of ablation for the SAR data analysis.
Effects of various combinations of SAR image pre-filtering and search window size on the quality of the retrieved ice motion fields were investigated and procedures for transforming the SAR measurements to surface motion were studied. SAR measures the surface displacement in slant range and azimuth coordinates relative to the sensor position. In order to transform the SAR derived measurements to motion at the ice surface, effects of surface melt and emergence of submergence of the ice have to be taken into account. To study these effects we obtained the vertical displacement of the ice surface at a GPS station that was fixed to the glacier ice by stakes. The vertical displacement of this station is a net result of surface lowering by ablation, emergence of the ice due to dynamic effects, and shift along the surface slope.
For retrieving the velocity at the glacier surface from the TerraSAR-X displacement measurements, a point wise ablation model was used and the forward calculation of the ablation related ice motion component was performed. Taking into account ice ablation and extrapolating the emergence at the single GPS stations across the glacier terminus, the TerraSAR-X ice motion data agree with measurements at other GPS stations is within a few percent. The investigations show that sub-metre accuracy can be achieved with TerraSAR-X for displacement measurements in radar coordinates. In order to transform these measurements to surface velocities, corrections for vertical displacement of the surface have to be applied.

Surface velocities and mass flux in the vicinity and hinterland of the Neumayer III station (Antarctica)

N. Neckel, R. Drews, O. Eisen, W. Rack, D. Steinhage

AWI Bremerhaven

Surface velocities of grounded ice are an important input parameter for mass flux calculations and ice-sheet modelling. As on-site measurements in remote areas are sparse, satellite-based measurements have to be used to obtain area-wide surface velocities. For this purpose synthetic aperture radar data from various sensors are routinely employed. Depending on the availability of adequate SAR image pairs, the surface velocity is derived by radar interferometry, speckle or feature tracking. The accuracy of the applied methods heavily depends on external input parameters (e.g. elevation model) and the processing history. In this case study we aim to put error margins on the evaluated surface velocities by comparing the data with available on-site GPS measurement. The study focuses on the hinterland of the German overwintering station Neumayer III (Antarctica) and complements pre-site surveys for a future deep drill site.
We analyse the dependency of external elevation models for the interferometric approach by comparing surface velocities based on Antarctic-wide elevation models (from satellite altimetry and photoclinometry), with surface velocities based on local elevation models (from differential SAR interferometry). The interferometric approach is restricted to the availability of coherent SAR image pairs and

does not cover the floating ice shelves. We fill these gaps with data from lower-resolved speckle and feature tracking.
The main goal is to point out the inaccuracy/accuracy of surface velocity fields. As a geophysical product a map of surface velocities next to the German overwintering station Neumayer III is presented. In combination with ice-thickness measurements in the area the mass flux and its uncertainties are estimated. In the future we aim to use these velocities for the derivation of stress and strain rates in complex flow regimes, such as triple points on the nearby ice domes. These areas are of particular interest for ice coring, ice sheet modelling, radio-echo sounding and seismic studies.

Observations of spectral albedo and transmittance of sea ice and its snow cover

Marcel Nicolaus[1], **Fehler! Kontakt nicht definiert.**[2], Sebastian Gerland[2]

[1]AWI Bremerhaven
[2]Norwegian Polar Institute, Tromsø, Norway

The surface energy budget of the sea-ice covered polar oceans is determined by atmosphere–ice–ocean interaction. The vertical transfer and partitioning of solar (short-wave) radiation through snow and sea ice is one of the key processes that need to be quantified to improve our understanding of polar climate processes. Increasing our knowledge about the amount of energy reflected to the atmosphere (albedo), absorbed in snow and sea ice, and transmitted into the upper ocean (transmittance) will help to improve our understanding of various physical, biological, and geochemical processes. Here we present a modern setup and its application for synchronous measurements of spectral irradiance over and under sea ice. The observations are also combined with sea-ice mass balance studies and meteorological observations. Our quantify radiation fluxes, albedo, and transmittance. Observations from different locations during the last years will highlight key aspects the seasonality optical properties of snow and sea ice and their implications for various physical and biological processes in sea-ice environments.

Snow-stake measurements in the surroundings of the Georg-von-Neumayer and Neumayer-II stations during the years 1982 through 2008.

Hans Oerter

AWI Bremerhaven

Snow accumulation in the surroundings of the two wintering-over bases Georg-von-Neumayer (GvN, 1982-1992) and Neumayer II (1993-2008) was determined by means of two stake arrays. These arrays have been maintained by the meteorologists who wintered over at the Neumayer stations. One of the stake arrays was located close to the base and therefore it was possible to make weekly stake readings. In 1991 a second stake array was established 15 km south of the base GvN. Since then it was not relocated and has been visited once in a month for stake readings. The density values needed to calculate accumulation values from stake readings were taken from snow pit studies. Usually a density value of 350 kg/m^3 was used. This value may be discussed. In addition, the results of two shallow firn cores were available for comparison with the stake readings. The first firn core was drilled on Dec. 12, 1989 approximately at that location (70.658610° S, 8.25250° W), where it was planned to construct the Neumayer II station two years later. The core contains the annual snow layers from 1975- 1988. The second firn core was drilled on Jan. 03, 2002 adjacent to the stake array of the Neumayer II station at 70.655700° S, 8.25363° W. This core contains the annual layers from 1980- 2001. The firn cores were mainly dated by means of the seasonal signals of the content of the stable isotope ^{18}O.
The paper compares the data resulting from the three stake arrays with the accumulation data from the firn cores. Also the yearly snow pits were taken into consideration. The absolute values of the different time series differ from each other. However, in the coinciding periods the patterns are very similar. It is remarkable, that in the period 1980-1994 all time series show declining accumulation rates. For the period in which Neumayer II had been in operation no trend of the accumulation rates can be seen. Only significant variation of the single annual values can be observed.
For the three stake arrays the following annual mean values and standard deviations were found: stake array GvN (1982-1992) 277 ±52 kg m-2 a-1, stake array Neumayer-II (1993-2008) 235 ±84 kg m^{-2} a^{-1} and stake array South (1991- 2008) 320 ±122 kg m^{-2} a^{-1}. The firn core from 2002 (1980-2001) yields a value of 329

±109 kg m^{-2} a^{-1} and the firn core from 1989 (1975-1988) a value of 353 ±109 kg m^{-2} a^{-1}. It can be observed that the accumulation rates are lower in the surroundings of the bases than at the array located further south and at greater distance to the coast. In addition, the values calculated by means of stake readings are lower than those calculated from firn cores.

Terrestrial Vegetation Analysis on the Argentine Islands Archipelago

Ivan Parnikoza[1], Iryna Kozeretska[2], I. Andreev[1], Victor Kunakh[1]

[1]Institute of Molecular Biology and Genetics of NAS, Ukraine
[2]Taras Shevchenko National University of Kyiv, Ukraine

Maritime Antarctica experiences one of the steepest regional climate warming trends, which makes it necessary to establish monitoring of the influence of climatic changes on terrestrial habitats. One of the most appropriate sites to launch such monitoring is the Ukrainian Vernadski station (Argentine Islands region) located in the epicenter of the warming processes. Supported by National Antarctic Scientific center of Ukraine, we have launched a long-term program to monitor the status of Antarctic herb tundra formation on the Argentine Islands region. The fundamental basis in this program should be a complete inventory of the existing distribution locations of the Antarctic herb tundra formation in which *Colobanthus quitensis* as yet remains rare in the region. All inhabited areas are described in detail using a special blank form which includes detailed orographic, geobotanic, and population characteristics of the habitat. The form also contains information on natural (birds, pinnipeds) and anthropogenic impacts. Besides, forms for the biometry of both vascular plants have been prepared. The detailed geobotanic composition of a cenosis is studied by sampling its different constituents with indication of their role in the total vegetation cover according to the Braun-Blanquet method. Concurrently, a system of study areas have been defined on Galindez Island for which the abovementioned parameters will be monitored annually. In perspective, it is planned to monitor, based on a set of defined indicator traits, some species representing cryptogam formations.
Genetic monitoring, specifically investigation of the influence of habitat on cytological and molecular genetics traits of Antarctic vascular plants, constitutes a separate part of the monitoring program.

We invite all who is interested for collaboration and its concurrent implementation in other regions of the Antarctic.

Trace metals in Antarctic bivalve shells - Indicators of environmental change

Harald Poigner[1], Dorothee Wilhelms-Dick[2], Doris Abele[1]

[1]AWI Bremerhaven
[2]Universität Bremen

Contrary to paleo-climatic events the ongoing climate change scenario is well documented by current environmental measurements for many areas of the world. Especially in remote regions such as coastal and shelf areas of the Antarctica Peninsula conditions to conduct field studies, especially those requiring long-term uninterrupted recordings, are still very problematic. For these systems archives may be excellent alternatives. In the present study bivalve shell archives will be investigated with the aim to document changes of near shore biogeochemistry caused by glacial alteration during the last century.
The Antarctic Peninsula including the study area Potter Cove on King George Island (Isla 25 de Mayo, South Shetland archipelago) are characterized by melt water driven sediment mineral discharge into the near shore environment. Owing to its origin from glacial ablation, the marine sediment of Potter Cove is labeled with the chemical signature of the eroded parent rock material. Due to high sedimentation rates, sediment cores in this region are applicable proxies for detection of recent and sub recent environmental change in the geochemical environments. But these archives are strongly disturbed by bioturbation by the abundant macro benthic infauna, mainly bivalves and polychaetes. Further in the shallow coastal areas, sediments are dramatically disturbed through frequent iceberg scouring. We are looking for new additionally archive types to improve environmental documentation for the past decades.
The Antarctic soft shell clam, Laternula elliptica, was chosen as a possible source of such undisturbed geochemical archives, because it generates a new shell growth ring each year. It is composed of an organic and an inorganic matrix in each annual growth layer. Laternula elliptica is extremely abundant, tolerates high sediment loads and has become a dominant faunistic component within the benthic communities in the sediment impacted zones.

Both shell compartments are characterized by the incorporation of different trace metals during calcification of the shell, controlled by the geochemical properties of the tracers. Hence, we hypothesize that the bioavailable trace metal content originating from glacial sedimentary input should be closely linked to the trace metal content in each shell layer.
Due to the small layer dimensions, an analytical method offering high spatial resolution is needed. LA-ICP-MS (laser ablation inductively coupled plasma mass spectrometry) constitutes the modern standard approach in trace element analysis of environmental archives and we suggest a modified LA-ICP-MS procedure optimized for trace metal analysis of calcareous shells. As well as we present preliminary results of spatial and temporal trace metal distributions of individuals collected in three areas of Potter Cove, affected by different melt water driven sediment load. The aim is to calibrate and test the applicability of the shell of the soft-shell clam Laternula elliptica as geochemical archive in the Antarctic melt water zone.

Werkzeuge zur Untersuchung antarktischer Hebungsprozesse und deren Grenzen

Jannis Prenzel, Frank Lisker

Institut für Geowissenschaften, Universität Bremen

Bis vor ca. 180 Ma Jahren bildete die Antarktis zusammen mit Afrika, Indien, Australien und Südamerika den Superkontinent Gondwana. Heute gilt die Antarktis durch ihre damalige zentrale Position auf dem Urkontinent als Schlüsselregion für die Bearbeitung vieler geowissenschaftlicher Fragestellungen. Die Untersuchung von Hebungs- und Erosionsvorgängen ermöglicht dabei neben der Rekonstruktion des Gondwana-Zerfalls auch Rückschlüsse auf tektonisch bedingte globale klimatische Veränderungen.
Traditionell erfolgt eine zeitliche Einordnung von Hebungs- und Erosionsvorgängen indirekt durch die relative Altersbestimmung von Sedimentschichten. Solche Datierungen, basierend auf der Korrelation von Gesteinsschichten mittels Fossilien und zeitgleich abgelagerten Gesteinstypen (Stratigraphie), liefern jedoch keine absoluten Alter von Bildungsprozessen. Des Weiteren wird die stratigraphische Anwendung an der Antarktis durch eine großflächige Eisbedeckung von ca. 98% sowie dem weitgehenden Fehlen von Sedimentschichten erschwert.
Daher wird der Zeitrahmen antarktischer Hebungsprozesse heute hauptsächlich durch die Thermochronologie bestimmt. Über den natürlichen Zerfall von Uran in Mineralen wie Apatit und Zirkon, ermöglicht die Thermochronologie die Darstellung der Abkühlungsgeschichte der oberen 2-10 km der Erdkruste. Mit Hilfe von Modellierungen können dann gebirgsbildende Prozesse sowie die Bildung und Entwicklung von Sedimentbecken nachvollzogen werden. Da die Thermochronologie bei landschaftsprägenden Prozessen oberhalb einer Krustentiefe von 2 km auf ihre methodische Grenze stößt, ist eine Kombination der thermochronologischen Ergebnisse mit Beobachtungen und Daten der Strukturgeologie, Geomorphologie und Geophysik wichtig um ein vollständiges Gesamtbild der geodynamischen Entwicklung der Antarktis zu erhalten.

Ammonia oxidizing Bacteria and not Archaea dominate in the permafrost-affected soils on Samoylov Island in the Lena River Delta, Siberia

Tina Sanders, Claudia Fiencke, Eva-Maria Pfeiffer

Institute of Soil Science, University of Hamburg

Permafrost soils (Gelisols) cover about a quarter of the Earth´s land surface. Gelisols are in subsoils continuously frozen throughout the year and only the active layers th aw during the short vegetation period. The main characteristic of these soils covered by polygonal carex-sedge tundra vegetation is the extreme soil moisture and temperature regime which ranges from -30°C to +18°C. Element cycles like carbon (C) and nitrogen (N)-cycle, which are mostly driven b y microorganisms, are influenced b y these extreme environment parameters. In this study nitrification as one important part of the microbial controlled N-cycle, was investigated in typical wet arctic tundra sites of the Lena River Delta, Northeast Siberia, Russia. During nitrification ammonia is oxidized in two steps via nitrite to nitrate. These steps are catalyzed by two groups of organisms the ammonia and nitrite oxidizing bacteria (AOB and NOB). Recently it was shown that not only *Bacteria but also Archaea* of the group of *Crenarchaeota* (AOA) are able to oxidize ammonia to nitrite.
In this study different permafrost soils on the Island Samoylov in the Lena River Delta were analyzed: water saturated and organic rich soils

of the polygonal tundra and dry san dy soils of the floodplain areas of Samoylov island in the river Lena. Dissolved inorganic nitrogen (DIN, ammonia, nitrite and nitrate) were analyzed in different soil depths over the vegetation period, additionally potential nitrification rate were determined. For molecular biological analysis, DNA was extracted from each soil sample and DGGE and antibody methods were used.
In soil samples from the river floodplain areas, characterized by neutral pH, high mineral content and aerobic conditions due to low water content, higher potential nitrification activities were found than in the water saturated peaty soils. In order to differentiate *Bacteria* and *Archaea* ammonia oxidizing activities different antibiotics were tested. Only in soil samples taken from the beach, AOA activities dominated. Via the functional gene of ammonia oxidation, the *amo*A (A subunit of ammonia monoxygenase), AOB are verifiable in nearly all soils of the Island Samoylo with exception of the water saturated peaty soils of the polygon center. In contrast AOA are only verifiable in the dry sandy soils of floodplain areas.
In all investigated enrichment cultures of the soil samples the genus *Nitrosospira* (AOB) was detected using DGGE and polyclonal antibodies.

Schwerefeld und Geoid in der Antarktis

Mirko Scheinert

Institut für Planetare Geodäsei, TU Dresden

Die Bestimmung des globalen, äußeren Schwerefeldes und des Geoids ist eine der Hauptaufgaben der Geodäsie. Für diese Aufgabe werden verschiedenste Messverfahren angewandt, von satellitengeodätischen über flugzeuggestützte bis zu terrestrischen Verfahren. Während für den weitaus größten Teil der Erde das Schwerefeld mit einer hohen Genauigkeit und Auflösung bekannt ist, ist dies in der Antarktis nicht der Fall. Bis heute sind große Gebiete in der Antarktis noch nicht durch gravimetrische Messungen erfasst. Satellitengeodätische Messungen können dieses Defizit nicht ausgleichen. Zwar stehen der Geodäsie die speziell der Schwerefeldbestimmung gewidmeten Satellitenmissionen CHAMP, GRACE und GOCE zur Verfügung. Diese weisen aber eine polare Datenlücke auf, die durch die Abweichung der Neigung der Satellitenbahnebene von 90 Grad entsteht. Zum anderen ist die Auflösung auf lang- bis mittelwellige Anteile beschränkt.

Um diese Situation zu verbessern, bestehende gravimetrische Daten zu kompilieren und neue Messungen zu initiieren, wurde innerhalb der Internationalen Assoziation für Geodäsie (IAG) das „IAG Commission Project 2.4 Antarctic Geoid" (AntGP) ins Leben gerufen. Dieser geodätischen Arbeitsgruppe steht auf Seiten der Polarforschung das Projekt 3 „Physical Geodesy" des Programms „Geodetic Infrastructure in Antarctica" (GIANT) des Scientific Committee on Antarctic Research (SCAR) gegenüber. Bei beiden Arbeitsgruppen hat der Autor den Vorsitz inne.
In diesem Beitrag soll der aktuelle Stand der gravimetrischen Messung und regionalen Geoidbestimmung in Antarktika dargestellt werden. Dabei ist die Aerogravimetrie von besonderem Interesse, da diese eine leistungsfähige Methode zur Verfügung stellt, auch große Gebiete unter den schwierigen logistischen und Umweltbedingungen der Antarktis zu vermessen. Besonders im Verlauf des Internationalen Polarjahres 2007/2008 konnte eine Reihe von aerogeophysikalischen Projekten realisiert werden, die in den meisten Fällen auch die Aerogravimetrie beinhalteten. Schließlich werden neue Projektideen diskutiert wie z.B. die Anwendung des neuen deutschen Forschungsflugzeugs HALO für eine aerogravimetrische Befliegung in der Antarktis.
Im Rahmen von AntGP werden am Institut des Autors die gravimetrischen Daten der Antarktis kompiliert. Ziel wird es sein, gegitterte Schwereanomalien für die wissenschaftliche Öffentlichkeit bereit zu stellen. Auf Grundlage der Schweredaten kann eine Bestimmung des regionalen Geoids. Diese beruht auf der sog. „Remove-Compute-Restore"-Methode, bei der die langwelligen Anteile durch ein globales Schwerefeldmodell und die kurzwelligen Anteile durch ein Topographiemodell erfasst werden. Dabei spielt die Behandlung der eisbedeckten Gebiete ein spezielle Herausforderung dar. Der residuale Anteil in den Schweredaten wird in ein entsprechendes Geoidsignal transformiert, und die lang- und kurzwelligen Geoidanteile der Modelle werden aufaddiert. Beispiele für die regionale Geoidbestimmung werden vorgestellt und diskutiert.
Schließlich soll dargestellt werden, in welcher Weise die Information über das antarktische Geoid und Schwerefeld in anderen Wissenschaftsdisziplinen wie z.B. der Ozeanographie und Glaziologie benötigt wird.

The precipitation regime of Dronning Maud Land, Antarctica – implications for ice core interpretation

Elisabeth. Schlosser[1], Jordan. G. Powers[2], Elisabeth. Isaksson[3], Hans Oerter[4]

[1]Institute of Meteorology and Geophysics, University of Innsbruck, Austria
[2]National Center for Atmospheric Research, Boulder, Colorado, USA
[3]Norwegian Polar Institute, Tromso, Norway
[4]AWI Bremerhaven

To assess the present or future possible climate changes the understanding of the climate of the past is indispensable. Valuable information about former climates is derived from ice cores drilled into the large ice sheets of Greenland and Antarctica. For a correct climatic interpretation of ice core properties, in particular the stable isotope ratios of water, a thorough understanding of both the atmospheric processes that lead to precipitation at the drilling site and post-depositional processes is required.
In this study we focus on atmospheric processes, especially the precipitation regime of Dronning Maud Land. We started with an investigation of DML precipitation using an archive of numerical weather model forecasts from AMPS (Antarctic Mesoscale Prediction System), which has been run by the National Center for Atmospheric Research (NCAR), Boulder, CO since September 2000. AMPS employs the Polar MM5, a mesoscale atmospheric model that has been optimized for use over ice sheets. It was found that the EPICA drilling site "Kohnen Station" in DML is affected by synoptic activity in the circumpolar trough much more than previously thought. Precipitation is highly episodic with about eight "high-precipitation events" per year that can yield about 50% of the total annual accumulation. Only about one fifth of these events are connected to frontal systems of low pressure systems. In most cases the precipitation is created by orographic lifting of relatively warm and moist air masses in a strong north-westerly to north-easterly flow due to amplification of Rossby waves. A preliminary investigation of the influence of sea ice on precipitation showed that both negative and positive anomalies in sea ice concentration/extent can lead to a warm bias in the isotope signal of an ice core. Accumulation rates and stable isotope records from 65 shallow firn cores taken during the EPICA pre-site survey expeditions are being investigated at present, using the results of the previous study to explain the firn core records that might be biased due to meteorological influences other than air temperature. A challenging question is that of a possibly changing influence of precipitation seasonality on stable isotope ratios and accumulation rates.

Physical properties of sedimentary rocks from the AND-2A borehole, ANDRILL Southern McMurdo Sound Project, Antarctica

Henning Schröder[1], Stefan Hoffmann[2], Gerhard Kuhn[3], Frank Niessen[3], Douglas Schmitt[4], Thomas Wonik[1]

[1]Leibniz Institute for Applied Geophysics, Hannover
[2]Sedimentology and Environmental Geology, Geoscience Center Goettingen (GZG)
[3]AWI Bremerhaven
[4]Department of Physics, University of Alberta

During the 2007-2008 austral summer, the Antarctic geological Drilling program (ANDRILL) recovered a core of sedimentary rock from an 1138-m-deep borehole in the Southern McMurdo Sound. This study focuses on the interval between 400 meters below seafloor (mbsf) and 1000 mbsf, which contains sediments from the Lower Miocene (20 Ma to 16 Ma). Within the borehole well logging measurements of several physical parameters were conducted including in-situ density, neutron porosity, sonic velocity, magnetic susceptibility, formation temperature and spectrally resolved gamma radiation. Apart from this, results from lab measurements are used. They contain X-ray fluorescence (XRF) analyses of major elements (Al, Ti, Ca, Si), determination of petrophysical parameters (grain density, porosity, thermal conductivity, acoustic velocity) and structural investigations by means of X-ray tomography.
Analyses of these parameters show that the standard processing procedures fail to characterize the present lithofacies, which are roughly described as diamictites, sandstones and mudrocks. The properties of each facies change throughout the borehole and altogether they cannot be used to distinguish the different facies from each other. Those changes cannot be explained only by changes in the facies' mineralogical composition, clast content, grain size distribution and consolidation state. Therefore post-depositional processes which are able to affect the physical parameters have to be taken into account.
A multivariate statistical approach and frequency analysis are used to obtain information on depositional conditions. Rates of sediment accumulation are derived from cyclicity determination in gamma radiation using

a Blackman-Tukey algorithm and linking the spectra to Milankovitch cycles of long and short eccentricity, obliquity and mean precession. An important parameter is the acoustic velocity. It was measured at ultrasonic frequency for both shear and compressional waves. A conventional pulse transmission method was used with a pair of transducers that can record vs and vp in the same run without changing the experimental assembly. All tests were run in a pressure vessel filled with hydraulic oil that allowed hydrostatic confining pressures ranging from 5 MPa to 50 MPa to be applied to the samples. Investigating an upward and downward pressure cycle enables conclusions on the rock's general elastic behaviour and yields information on the changes of its structure caused by pressure increase. For calculation of the elastic properties and for relations between these properties and the rocks' internal structure porosity, grain density and the distribution of the pore diameters were measured.

In general, the ultrasonic velocity of a solid rock displays hysteresis when the rock is subjected to the pressure cycle described above. This behaviour is highly non linear. At a given pressure the velocity is usually greater on depressurization than at the same pressure during pressurization, due to consolidation effects mainly related to the closure of microcracks. For the AND-2A samples this is valid at higher pressures. For some samples, however, at lower pressures the depressurization velocity drops below that during pressurization. Additionally, the upward leg of most samples does not have the typical concave shape. With increasing pressure, the velocity increases in a convex manner. This indicates an additional process of consolidation during the pressure increase, which is not completely reversible. The expected concave drop of velocity is, however, seen on the depressurization cycle. The pressure dependent change of the velocity ranges from only a few meters per second to a few hundred meters per second for both v_p and v_s.

Temperature has a high impact on chemical alteration processes. It was measured on four logging trips of which one reached the final depth of the hole. A correction based on data from two intermediate runs shows that the temperature regime almost returned to an equilibrium state when temperature was measured. This is in good agreement with measurements made with a core orientation tool inside the borehole. The bottom-hole temperature at a depth of 1138 mbsf is about 59°C. The average thermal conductivity amounts to 1.57 W/mK and the average gradient to 50 K/km.

Methane cycling in sediments of the Beaufort-Sea (Arctic Ocean): Potential impacts of Global Change

Johanna Schweers[1], Stefan Krause[1], Leila Hamdan[2], Tina Treude[1]

[1]Leibniz Institute of Marine Sciences (IFM-GEOMAR), Kiel
[2]US Naval Research Laboratory, Washington, DC, USA

During the last decades, the high latitudes received much attention, because these regions are and will experience the greatest impact from global change. In addition to ice-melting, sea-level rise and ocean acidification, increasing water temperatures will become one of the major problems for such sensitive regions as the Arctic. One of the top scientific questions is the impact of temperature rise on the stability of submarine gas hydrates and permafrost, which enclose large amounts of fossil methane gas in Arctic sediments. Furthermore, ongoing methane production, as a result of microbial organic matter degradation in sediments, could be boosted by temperature rise. Because methane is a very strong greenhouse gas, nearly 25 times stronger than CO_2, it is crucial to understand if a rise of temperature could lead to an overall increase in methane releases from the sediments into the hydrosphere and atmosphere.

In order to better understand methane cycling in Arctic sediments we retrieved methane-rich sediment cores from the Beaufort Sea and measured ex-situ and in-vitro rates of microbial sulfate reduction, methanogenesis and anaerobic oxidation of methane (AOM). Ex-situ rates were determined on board the research vessel at in-situ temperatures using radioactive isotopes ($^{35}SO_4^{2-}$ and $^{14}CH_4$). In-vitro rates were determined in closed sediment slurry experiments at ten different temperatures above and below the in-situ conditions, applying both direct measurements of sulfide and methane development as well as radiotracer techniques. In addition, catalyzed reporter deposition fluorescence in situ hybridization (CARD-FISH) was applied to identify bacteria and archaea involved in the processes. Our results provide new insights into microbial methane cycling (including methane production and consumption) in Arctic sediments under different scenarios of temperature increase.

Bacterial biodiversity in ice and glacier caves in the Alps and Antarctica

Birgit Standhartinger, Birgit Sattler, Roland Psenner

Institut für Ökologie, Universität Innsbruck, Austria

Ice and glacier caves can serve as refugia for microbial life. They represent a unique environment characterized by harsh and lightless conditions such as nutrient limitation, continuous low temperature, no primary producers except at the cave entrance.
In this investigation we compare 2 different systems of caves such as rock ice caves in the Austrian Alps and glacier caves from Antarctica. The two habitats differ substantially since rock ice caves show relatively stable conditions whereas glacier ice caves are characterized by a continuous dynamics. This difference is also mirrored in the composition of microbial communities which has been proofed by molecular biological methods (clone libraries and subsequent sequencing). The least diversity has been found in the rock ice cave whereas in the glacier caves other fertilization effects (nearby penguin colonies) have been expressed by a high diversity. Due to the relative translucent characteristics of ice caves of glacial origin the vast majority have been cyanobacteria. Cave ecosystems are described as a refuge for microbial communities and can hence be understood as analogues for possible extraterrestrial life.

Aktuelle Tendenzen zur Veränderung des Inlandeises im Bereich des Swiss Camps (West Grönland) und zur Fließgeschwindigkeit des Eqip Sermia Gletschers.

Manfred Stober

Hochschule für Technik Stuttgart

1. Inlandeis beim Swiss-Camp and ST2
Seit 1991 wird ein geodätisches Projekt zur Bestimmung von Höhenänderung und Fließgeschwindigkeit im Bereich des Swiss Camps (West Grönland) durchgeführt. Bis 2008 haben nun 10 Messkampagnen stattgefunden. Es handelt sich somit um ein Langzeitprojekt. In einem weiteren Messgebiet (ST2), das 170 Meter tiefer liegt, wurden seit 2004 bis 2008 bisher 4 Kampagnen gemessen.
Die neuesten Ergebnisse zwischen 2006 und 2008 zeigen in beiden Messgebieten extrem große Höhenabnahmen von -1.04 bzw. –1.40 m/a. Die aktuelle Eisdickenabnahme ist mehr als dreimal so groß wie im langfristigen Trend der früheren Jahre.
Am Swiss Camp ist eine Zunahme der Fließgeschwindigkeit zu beobachten, die vermutlich auf vermehrte Schmelzwasserführung am Untergrund zurück zu führen ist.
Die digitalen Höhenmodelle des umliegenden Geländes eignen sich zur Validierung von Satellitendaten. Es wird ein Beispiel von ICESat gezeigt, bei dem im Durchschnitt aus 5 Fußpunkten die Höhenabweichung 0,13 ± 0,06 m beträgt.
2. Fließgeschwindigkeit des Eqip Sermia Gletschers
Ausflussgletscher in Westgrönland zeigen teilweise extreme Veränderungen in der Fließgeschwindigkeit. Vor allem der Jakobshavn Isbrae hat seit 2000 seine Fließgeschwindigkeit fast verdoppelt. Es ist nun zu untersuchen, ob auch andere Ausflussgletscher in dieser Region dasselbe Verhalten zeigen.
Als Beispiel wird der Eqip Sermia untersucht. Er liegt nur ca. 80 km nördlicher als der Jakobshavn Isbrae. Wir bestimmten die Fließgeschwindigkeit in den Sommern 2005 und 2008. Als Messverfahren wurde die digitale terrestrische Fotogrammetrie angewandt. Als Ergebnis ergab sich 2005 eine Fließgeschwindigkeit von 3,1 m/d und in 2008 eine um 30% erhöhte Geschwindigkeit von 4,1 m/d. Im Vergleich zu älteren Messergebnissen von 1959, wo sich 3,5 m/d ergab (BAUER 1968) und 1971 mit 3,6 m/d (ZICK 1972), ist hier im Mittel nur wenig Änderung in der Fließgeschwindigkeit festzustellen. Ergebnisse anderer Autoren (und anderer Messverfahren), z.B. RIGNOT et al. 2006, deuten aber ebenfalls auf eine Beschleunigung um ca. 30% von 1,9 m/d im Oktober 2000 bis zu 2,5 m/d im April 2005, die zwar in der Tendenz, nicht aber im Betrag mit unseren Messungen bestätigt werden können.

Tipping temperatures within Subglacial Lake Ellsworth, West Antarctica

Malte Thoma[1,2], Klaus Grosfeld[1], Christoph Mayer[2], Andrew M. Smith[3], John Woodward[3], Neil Ross[3], Martin Siegert[3]

[1]AWI Bremerhaven
[2]BAdW München, Germany
[3]School of GeoSciences, University of Edinburgh, United Kingdom

One of the most remote and undiscovered regions on Earth are subglacial lakes. More

than 275 of these lakes have been identified so far. However, from most lakes little more is known but the location or the lateral extent. Their inaccessibility increases the importance of numerical models to investigate the physical conditions in these environments. During the Southern Summer 2008/09, the British Antarctic Survey (BAS) performed field measurements in the Ellsworth Mountains, West Antarctica to survey Subglacial Lake Ellsworth. We apply a three-dimensional fluid-dynamics lake model on the geometry of this lake. We present results, indicating that Subglacial Lake Ellsworth has a unique temperature profile, constituted by the pressure induced by the ice thickness above as well as the slope of the ice-lake interface and compare this with the previously modelled Subglacial Lakes Vostok and Concordia. While Lake Vostok and Lake Concordia show a clear convective regime, driven by geothermal heating from the lakes bottom for the overall lake, the ice load on Lake Concordia constitutes a regime where the line of maximum water density crosses through the lake. This divides the lake into branches with completely different convective regimes Sensitivity studies for glacial and probable future scenarios, where the ice coverage might thin, are discussed.

On the importance for climate science communication – the climate office for polar regions and sea level rise

R. Treffeisen[1], P. Lemke[1], K. Dethloff[2]

[1]AWI Bremerhaven
[2]AWI Potsdam

Climate change presents a major challenge for national and international action and cooperation. A wide variation in the vulnerability is to be expected across different regions, due to regional differences in local environmental conditions, preexisting stresses to ecosystems, current resource-use patterns, and the framework of factors affecting decision-making including government policies, prices, preferences, and values. Thus, considerable regional impact differences will be faced as a result of climate change. Being aware will help to prepare for these inevitable consequences in time.
The major goal of the climate office is to encourage the communication and dialogue between science and public. Primarily, this is done by the unique close contact and cooperation to the research center scientists. A continuous exchange is supported beyond the research center towards universities and authorities at state and federal level. The climate office represents polar aspects of climate related research based on the scientific expertise from the hosting research institute e.g. the understanding of the ocean-ice-atmosphere interactions, the animal and plant kingdoms of the Arctic and Antarctic, and the evolution of the polar continents and seas. The climate office translates the scientific work into English, making complex issues accessible to policymakers and the public. It compiles, evaluates, comprehensively process and transparently communicate the latest findings from polar related climate research. The paper will present different aspects of this work.

The Mesoscale Structure of Polar Lows - Simulations and Airborne Measurements

J. Wagner[1], A. Gohm[1], A. Dörnbrack[2], A. Schäfler[2]

[1]Institute of Meteorology and Geophysics, University of Innsbruck, Austria
[2]DLR Oberpfaffenhofen

Polar lows are subsynoptic-scale cyclones that are observed in cold air masses poleward of the main baroclinic zone. Little is known about the mesoscale structures and development mechanisms of these intense, maritime weather phenomena and their predictability is still a great challenge for most numerical models. To improve the understanding of polar lows, arctic fronts and terrain induced flow disturbances in high latitudes, the field campaign IPY THORPEX took place in February and March 2008 in Andenes, Norway. For the first time in history high resolution active remote sensing (LIDAR) and in-situ observations of a polar low have been collected by the German research aircraft Falcon of the Deutsches Zentrum für Luft und Raumfahrt. Scientists succeeded in flying directly through the center of a developing polar low on third and fourth of March 2008 over the Norwegian Sea.
The presented work uses these observation data and satellite images to study flow structures in and around the polar low to investigate development and formation mechanisms and to verify numerical simulations. The ECMWF integrated forecast system was rerun to produce analysis fields of an one-hourly interval. These fields were used as initial and boundary conditions to drive the Weather Research and Forecasting model WRF, version 3.1.1. To adapt the WRF model to arctic conditions, special polar modifications

developed by the polar meteorology group of the Ohio State University were integrated. These modifications include adaptions to the polar boundary layer, implementation of fractional sea ice, fractional snow cover, frozen soil physics, improved heat transfer and surface energy balance for ice sheets. Since polar lows are maritime phenomena that are highly influenced by air-sea interactions, a new, daily and global gridded sea surface and sea ice data set with a horizontal resolution of 0.05 degrees, called OSTIA, was used in the WRF model.

To obtain the best agreement between observations, ECMWF analysis and WRF mesoscale simulations, several sensitivity tests, with different horizontal grid resolutions, initialisation times and boundary conditions, were performed. The reference run is able to capture the development of the polar low as shown by the verification with LIDAR and dropsonde pro les. However the model's solution is strongly dependent on the initialisation time: When the simulation is started 12 to 36 hours before the initiation of the polar low, the trajectory of the cyclone's center diverges from the true track and the polar low makes landfall at the Norwegian coast about 350 km to far north. Furthermore, WRF simulations driven by ECMWF model-level data produce better results compared to runs driven by pressure-level data.

Future work will try to analyse the lifecycle of this polar low event in more detail. Further sensitivity tests and the calculation of mass, water and heat budget terms in lower and upper levels of the mesocyclone can help to understand key mechanisms and probably enable a classifycation of the polar low.

Comparison of Antarctic total water vapour from measurements, reanalyses and regional climate simulations

Connie Walther[1], Annette Rinke[1], Christoph Knöfel[2], Reinhard Dietrich[2], Klaus Dethloff[1]

[1]AWI Potsdam
[2]Institut für Planetare Geodäsie, TU Dresden

Total water vapour (TWV) measurements are rare in Antarctica, and therefore our knowledge about the spatial and temporal TWV variability is limited. Model simulations can help to close this gap and to understand the driving factors (like storm strength and variability). Measurements are available from radiosounding and can be derived indirectly from ground based GPS observations. The regional climate model HIRHAM4 is used to get a better insight on the Antarctic climate in the last four decades. This model is driven at its boundaries by ERA40 reanalysis data. A comparison of Antarctic TWV between measurements (radiosounding and GPS), reanalysis data (NCEP, ERA40 and ERA Interim) and HIRHAM4 simulations is presented. Additionally the uncertainties in both measurements and simulations are quantified. On the Antarctic Peninsula the correlation between the different data is high. Contrary for continental stations, HIRHAM tends to be too dry. To explain the differences between the different data sets, the synoptic activity and the wind direction is analyzed.

Interannual Variabilty of Sediment Transport Dynamics on the Laptev Sea Shelf (Siberian Arctic)

Carolyn Wegner[1], Dorothea Bauch[1,3], Jens Hölemann[2], Igor Dmitrenko[1], Sergeij Kirillov[4], Heidemarie Kassens[1], Leonid Timokhov[3]

[1]IFM-GEOMAR, Leibniz Institut für Meereswissenschaften, Kiel
[2]AWI Bremerhaven
[3]Mainz Academy of Siences, Mainz
[4]State Research Center- Arctic and Antarctic Research Institute, St. Petersburg, Russia

The Laptev Sea is one of the largest Siberian shelf seas and characterized by a strong seasonality in freshwater discharge and riverine sediment input of several Siberian rivers, mainly the River Lena. The interannual variability in the distribution of river discharge and thereby surface salinity is mainly associated with positive and negative phases of atmospheric vorticity over the adjacent Arctic Ocean during the ice-free period. The surface distribution of suspended particulate matter (SPM) in summer in turn is closely connected to the distribution of the freshwater plume. A key component that controls the freshwater transport on the Siberian shelf environment is the Arctic cyclonicity that plays a central role in the shelf-atmosphere interaction. During the last two decades there is a positive trend in mean cyclone depth and radius over the Eurasian Basin. However, the implications for the SPM transport on the Siberian shelf seas are unknown so far, but it is assumed that changes in atmospheric circulation and associated shifts in SPM transport dynamics might have severe consequences for the sensitive ecosystem on the shelf due to altered nutrient availability and light penetration. A detailed knowledge of the

pathways of SPM and the possible response to climate change is thus of critical importance to understand and to forecast the impact of environmental changes on the land-shelf-ocean interaction.
During the project "Laptev Sea System" detailed oceanographic (CTD-Conductivity Temperature Dept-measurements) and hydrochemical (nutrient and SPM measurements) process studies during summer conditions have been carried out continuously from 2007-2009 to study the interannual variability of SPM on the Laptev Sea shelf. During years with prevailing westerly winds in the ice-free period (summer 2007 and 2009), the so-called "on-shore years" (Dmitrenko et al. 2008; Bauch et al. 2009), the freshwater of the River Lena is transported eastwards and partly exported to the East Siberian Sea. The surface salinity is low on the eastern inner Laptev Sea shelf and increases towards the shelf edge. The SPM concentration are elevated near the surface on the eastern inner shelf. Part of the riverine derived material is exported to the East Siberian Sea. In the mid- and outer shelf the surface SPM concentration is negliable. However, on the outer shelf, north of the island Kotelny'I, the water column is less stratified during "on-shore years" and vertical mixing is taking place, causing resupsension of bottom sediments. Highest near-bottom SPM concentrations along the Laptev Sea shelf break were recognized in this area. During "off-shore" years (Dmitrenko et al. 2008; Bauch et al. 2009) when southerly winds prevail, the freshwater plume stretches up to 76°N, the SPM is transported onto the mid-shelf area within the surface layer, where it sinks down and is transported back onto the inner shelf by bottom currents (Wegner et al., 2005). The water column on the outer shelf north of Kotelny'I is during "off-shore" years stratified due to the relatively far northward cross-shelf transport of the freshwater plume. Less vertical mixing is taking place and the SPM concentration near the bottom is smaller; less bottom material is resuspended and transported along the shelf break.
We can therefore conclude that there are significant differences in SPM transport and distribution between "on-shore" and "off-shore" years. If the trend towards more „on-shore years" on the Laptev Sea shelf continues (Simmonds and Keay, 2009), this might not only impact the sediment budget of the Laptev Sea shelf but as well the sensitive ecosystem.

Vereisungsgeschichte von Queen Maud Land (Antarktis) – neue Daten zum Freilegungsalter von Nunatakern südöstlich des Wohlthat Massivs

H. Wiesel[1], G. Delisle[1], B. Kuczewski[1], U. Herpers[1], M. Altmaier[2]

[1]Abteilung Nuklearchemie, Universität Köln
[2]Forschungszentrum Karlsruhe

Eine jüngst publizierte Arbeit zur Vereisungsgeschichte von Queen Maud Land legt auf Basis von gemessenen Freilegungs-altern von Gesteinsaufschlüssen im Wohlthat Massiv (Altmaier et al., 2010) nahe, dass dessen höchste Erhebungen seit ca. 1 – 4 Ma über die regionale Eisbedeckung herausragen und diese Region bis vor ca. 0.5 Ma von einer 200 – 400 m höheren Eisschicht im Vergleich zu heute bedeckt war. Es liegen nunmehr weitere Ergebnisse von Messungen zur Freilegung von Gesteinsflächen von zwei Nunatakern vor, die am Rande des Polarplateaus, ca. 100 km südöstlich des Wohlthat Massivs aufgeschlossen sind und in 2007 erstmals von der BGR-Expedition Queenmet aufgesucht wurden. Zwei Proben von der durch Winderosion stark angewitterten Flanke und Spitze des einen Nunataks (ca. 16°00.179'S, 72° 21.248'E) ergaben Freilegungsalter von 277 und 715 ka. Die von der Leeseite des Nunataks gewonnenen Daten legen eine ursprüngliche Freilegung der Nunatakspitze (ca. 100 m über heutigem Eisstand) vor ca. 1922 ka und der Flankenregion (ca. 20 m über heutigem Eisstand) vor ca. 400 ka nahe. Die Ergebnisse vom zweiten Nunatak (ca. 16°03.8'S, 72°13.72'E) deuten auf eine Freilegung von ca. 50 m über heutigem Eisstand exponierten Gesteinsflächen vor ca. 500 ka hin. Damit deutet sich auch hier tendenziell wie im Wohlthat Massiv eine bis vor ca. 0.5 Ma höhere Eisschicht im Vergleich zu heute an. Die Daten deuten entweder auf eine langzeitliche regionale Landhebung, eine Reduzierung der Eismächtigkeit des ostantarktischen Eisschildes oder aber eine Kombination von beiden Effekten hin.

Nitrogen cycling in aquatic ecosystems in the high Arctic: Contribution of microbial communities in periglacial lakes and cryoconite holes

Jakub Zarsky

University of Innsbruck, Institute of Ecology

Our scientific focus aims at one of the most vital interdisciplinary problems of the climatic change and future development of Arctic ecosystems: Namely biological activity and the potential capacity for nutrient cycling in glacial ecosystems. Our research is a part of Marie-Curie ITN - NSINK (Sources, sinks and impacts of atmospheric nitrogen deposition in the Arctic) and our goal is to assess the contribution of microbial life to the mosaic of the fate of atmospheric nitrogen deposited in the arctic ecosystem. We want to improve our knowledge about the development of microbial biodiversity in cryoconite with emphasis to the effect of nutrient availability and estimate the metabolic capacity potentially available for transformation of nutrients or pollutants.

AUTORENVERZEICHNIS

R

S

T

U

V

W

Y

Z

GeoUnion
Alfred-Wegener-Stiftung

TERRA NOSTRA

Schriften der GeoUnion Alfred-Wegener-Stiftung

Übersicht über die erschienenen Hefte seit 1993

2010/3 **2nd International Sclerochronology Conference, 24-18th July, 2010,** Mainz, Germany. Program and Abstracts. Edited by Bernd R. Schöne and Elizabeth V. Nunn. – 169 S. – *Verkaufspreis: € 17,-*

2010/2 **15th Conference of the International Work Group for Palaeoethnobotany, Wilhelmshaven, Germany, May 31 – June 5, 2010.** Programme and Abstracts. Edited by Felix Bittmann. – 207 S. – *Verkaufspreis: € 19,-*

2010/1 **Potrok Aike Maar Lake Sediment Archive Drilling Project.** Program and Abstract Volume of the 2nd International ICDP Workshop PASADO, Vienna, 1-2 May, 2010. Edited by Bernd Zolitschka. – 94. S. – *Verkaufspreis: € 12,-*

2009/5 **Klima im System Erde. Klimawandel – Antworten und Fragen aus den Geowissenschaften.** Zusammenfassung der Konferenzbeiträge, dbb-forum Berlin, 2. und 3. November 2009. – 89 + 36 S. – *Verkaufspreis: € 5,-*

2009/4 **Annual Meeting of the German Association of Stable Isotope Research (GASIR). Abstract Volume. –** Jahrestagung der Arbeitsgemeinschaft Stabile Isotope e.V. (ASI). Tagungsband. – AWI Potsdam, 5.-7. Oktober 2009. – 86 S. – *Verkaufspreis: € 10,-*

2009/3 **Paläontologie. Schlüssel zur Evolution. 79. Jahrestagung der Paläontologischen Gesellschaft,** Bonn, 5.-7. Oktober 2009. Kurzfassung der Tagungsbeiträge. – 126 S. – *Verkaufspreis: € 14,-*

2009/2 **System Erde – Mensch. Handlungsoptionen und Managementstrategien**. Dokumentation der Strategiekonferenz am 12. und 13. Juni 2008 in Berlin. Herausgegeben von Rolf Emmermann, Gerold Wefer und Volker Mosbrugger. – 118 S. – *Verkaufspreis: € 5,-*

2009/1 **KALMAR – First Bilateral Workshop on Russian-German Cooperation on Kurile-Kamchatka and the Aleutean Marginal Sea-Island Arc Systems.** Programme and Abstracts. Petropavlovsk-Kamchatka, Russia, April 27 - May 1, 2009. – 73 S. – *Verkaufspreis: € 10,-*

2008/2 **12th International Palynological Congress / 8th International Organisation of Palaeobotany Conference.** Bonn, Germany, August 30 – September 5, 2008. Abstract Volume. – 357 S. – *Verkaufspreis € 21,-*

2008/1 **23. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Münster, 10.-14. März 2008. Programm und Zusammenfassung der Tagungsbeiträge. – 107 S. – *Verkaufspreis: € 14,-*

2007/1-2 **The Oceans in the Earth System.** International Conference 2007 and 97th Annual Meeting of the Geologische Vereinigung e.V. (GV), Bremen, Germany, October 1-5, 2007. – 267 S. – *Verkaufspreis: € 21,-*

2006/3a **Geomagnetic Field Variations: Space-Time Structure, Processes, and Effects on System Earth. International Final Colloquium of the German Science Foundation Priority Programme 1097.** Jointly organized by the Deutsche Forschungsgemeinschaft and the Deutsche Akademie der Naturforscher Leopoldina. October 4-5, 2006. – 120 S. – *Verkaufspreis: € 14,-*

2006/3 **Shaping the Earth's Surface: Dynamics and Changing Environments.** GV International Conference 2006 and 96th Annual Meeting of the Geologische Vereinigung e.V. September 25-29, 2006, Potsdam, Germany. – 118 S. –*Verkaufspreis : € 14,-*

2006/2 **150 Years of Neanderthal Discoveries. Early Europeans – Continuity & Discontinuity.** Congress, July 21st-26th, 2006 in Bonn, Germany. – 170 S. – *Verkaufspreis: 17,-*

2006/1 **ICDP-Workshop PASADO. Potrok Aike Lake Sediment Archive Drilling Project.** Scientific Programme – Abstract Volume – Excursion Guide – Participants. March 15-19, 2006, Rio Gallegos, Santa Cruz, Argentina. – 90 S. – *Verkaufspreis : € 11,50*

2005/5 **DFG-SPP 1135. Dynamics of the Central European Basin System.** 4th Rundgespräch. November 30 - December 02, 2005, Eringerfeld, Germany. 136 S. – *Verkaufspreis: € 14,-* **vergriffen**

2005/4 **2nd International Alfred Wegener Symposium.** Programme and Abstract. October 30 - November 02, 2005, Bremerhaven, Germany. – 115 S. – *Verkaufspreis: € 13,-* **vergriffen**

2005/3 **22. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Programm und Zusammenfassung der Tagungsbeiträge. 18.-24. September 2005, Jena. – 151 S. – *Verkaufspreis: € 14,50*

2005/2 **2nd European Conference on Permafrost.** Programme and Abstracts. June 12-16, 2005, Potsdam, Germany. – 224 S. – *Verkaufspreis: € 20,-*

2005/1 **19th Colloquium on Latin American Geosciences.** April 18-20, 2005, Potsdam. – 147 S. – *Verkaufspreis: € 14,-*

2004/5 **Proceedings of the XI SCALOP Symposium. "Towards the International Polar Year and Beyond".** 28 July, 2004, Bremen, Germany. – 242 S. – *Verkaufspreis: € 21,-*

2004/4 **XXVIII SCAR & COMNAP XVI.** SCAR Open Science Conference. "Antarctica and the Southern Ocean in the Global System". XI SCARLOP Symposium. "Towards the International Polar Year and Beyond". Abstract Volume. July 25-31, 2004, Bremen, Germany. – 480 S. – *Verkaufspreis: € 26,-*

2004/3 **A.M.S.El. Workshop 2004. "Analytik als Werkzeug für die Klima- und Geoforschung".** Programme und Zusammenfassungen der Tagungsbeiträge. 7.-8. Juni 2004, Alfred-Wegener-Institut, Bremerhaven. – 42 S. – *Verkaufspreis: € 7,-*

2004/2 **18th International Senckenberg Conference. VI International Palaeontological Colloquium in Weimar.** Late Neogene and Quaternary Biodiversity and Evolution: Regional Developments and Interregional Correlations. Conference Volume. April 25-30, 2004, Weimar, Germany. – 289 S. – *Verkaufspreis: € 21,-*

2004/1 **TSK X. 10. Symposium Tektonik, Struktur- und Kristallingeologie.** Kurzfassungen der Vorträge und Poster. 31.03.-02.04.2004, Aachen. – 108 S. – *Verkaufspreis: € 11,50*

2003/7 **DFG - SPP 1135.** Dynamics of Sedimentary Systems under Varying Stress Conditions by Example of the Central European Basin System. 2. Rundgespräch. 3.-5. Dezember 2003, Bonn. – *Verkaufspreis: € 13,-*

2003/6 **Klimavariabilität. 6. Deutsche Klimatagung 2003.** Programm und Kurzfassungen der Vorträge. 22.-25. September 2003, Potsdam. – 473 S. – *Verkaufspreis: € 25,-*

2003/5b **Biodiversität. 73. Jahrestagung der Paläontologischen Gesellschaft.** Kurzfassungen der Vorträge und Poster. 29. September - 3. Oktober 2003, Mainz, Germany. – 289 S. – *Verkaufspreis: € 21,-* **vergriffen**

2003/5a **9th International Symposium on Antarctic Earth Sciences.** Antarctic Contributions to Global Earth Sciences. Exkursionsführer / Field Guide. September 8-12, 2003, Potsdam, Germany. – 133 S. – *Verkaufspreis: € 13,-*

2003/4 **9th International Symposium on Antarctic Earth Sciences.** Antarctic Contributions to Global Earth Sciences. Program and Abstracts. Sept. 8-12, 2003, Potsdam, Germany. – 354 S. – *Verkaufspreis: € 25,-*

2003/3 **Sediment 2003.** Programme, Abstracts and Field Trips. June 10-14, 2003, Wilhelmshaven, Germany. – 200 S. – *Verkaufspreis: € 16,50*

2003/2 **18. Geowissenschaftliches Lateinamerika-Kolloquium.** Zusammenfassungen der Tagungsbeiträge/Abstracts. 3.-5. April 2003, TU Bergakademie Freiberg. – 94 S. – *Verkaufspreis: € 11,50*

2003/1 **21. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Programm und Zusammenfassung der Tagungsbeiträge. 17.-22. März 2003, Kiel, Germany. – 97 S. – *Verkaufspreis: € 11,50*

2002/6 **DEUQUA-Tagung 2002.** Program and Abstracts. August 26-28, 2002. Potsdam, Berlin. – 438 S. – *Verkaufspreis: € 25,-*

2002/5 **Climate Drivers of the North.** Program and Abstracts. Kiel, May 8-11, 2002. – 120 S. – *Verkaufspreis: € 13,-*

2002/4 **IAMG 2002. 8th Annual Conference of the International Association for Mathematical Geology.** Program and Abstracts. Volume 2. Sept. 15-20, 2002, Berlin. – 582 S. – *Verkaufspreis: € 25,-*

2002/3 **IAMG 2002. 8th Annual Conference of the International Association for Mathematical Geology.** Program and Abstracts. Volume 1. Sept. 15-20, 2002, Berlin. – 524 S. – *Verkaufspreis: € 25,-*

2002/2 **nicht erschienen**

2002/1 **Loess Units and Solcomplexes in the Niederrhein and Maas Area.** Joint Symposium of the DEUQUA, BELQUA and Deutsche Bodenkundliche Gesellschaft/Arbeitskreis für Paläontologie, Neuss, May 09-12, 2002. Heinrich Heine University Düsseldorf. – 104 S. – *Verkaufspreis: € 10,-*

2001/8 **Exkursionsführer. 3,5 Milliarden Jahre Biodiversität.** Carl-von-Ossietzky-Universität Oldenburg 2001. – 77 S. – *Verkaufspreis: € 7,50* **vergriffen**

2001/7 **"Klimaweißbuch".** Klimainformationen aus geowissenschaftlicher Forschung (Fallstudien). Stand und notwendige Erfordernisse der Paläoklimaforschung. Hrsg.: Prof. Dr. J.F.W. Negendank. GeoForschungsZentrum, Potsdam, Juli 2001. – 189 S. – *Verkaufspreis: € 17,-*

2001/6 **Tagungsführer. 3,5 Milliarden Jahre Biodiversität.** Carl-von-Ossietzky-Universität Oldenburg 2001. – 230 S. – *Verkaufspreis: € 17,-* **vergriffen**

2001/5 **5. Geochemie-Tagung.** Zusammenfassungen der Tagungsbeiträge. 21.-23. Juni 2001, Tübingen. – 90 S. – *Verkaufspreis: € 11,50*

2001/4 **Evolution des Systems Erde während des jüngeren Paläozoikums im Spiegel der Sediment–Geochemie.** 3. Kolloquium im DFG-Schwerpunktprogramm "SPP 1054". Zusammenfassung der Tagungsbeiträge. 28.–30. März 2001, Neustadt a. d. Weinstraße. – 84 S. – *Verkaufspreis: € 11,50*

2001/3 **High-Resolution Lake Sediment Records in Climate and Environment Variability Studies.** 6th Workshop of the European Lake Drilling Programme ELDP. Progamme, List of Participants, Abstracts, Excursion Guide. May 11-16, 2001, GFZ Potsdam, Germany. – 162 S. – *Verkaufspreis: € 17,-*

2001/2 **nicht erschienen**

2001/1 **20. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Programm und Zusammenfassungen der Tagungsbeiträge. 26.-30. März 2001, Dresden. – 80 S. – *Verkaufspreis: € 6,-*

2000/10 **From Secular Variation to Paleomagnetism.** A New View of the Dynamic Geomagnetic Field. Abstracts. November 9-12, 2000, GFZ Potsdam, Germany. – 121 S. – *Verkaufspreis: € 11,50*

2000/9 **Erstes Erdwissenschaftliches Symposium.** Geotectonic Activities and Climate Change in the Baikalian region. 1st BAIKAL-SED International Workshop. Abstracts. November 18-22, 1999, Gesellschaft für Erdkunde zu Berlin. – 254 S. – *Verkaufspreis: € 14,50*

2000/8 **6th Workshop on Russian-German Cooperation: Laptev Sea System.** Program and Abstracts. St. Petersburg, Russia, October 12–14, 2000. – 81 S. – *Verkaufspreis: € 9,-*

2000/7 **The Record of Human/Climate Interactions in Lake Sediments.** 5th Workshop of the European Lake Drilling Programme ELDP. October 7-12, 2000, Pallanza, Italy. – 157 S. – *Verkaufspreis: € 11,50*

2000/6 **International Maar Conference 2000.** Program and Abstracts. Daun, Vulkaneifel (Germany) August 20-23, 2000. – 549 S. – *Verkaufspreis: € 22,-* **vergriffen**

2000/5 **8. Symposium "Tektonik, Struktur- und Kristallingeologie".** Tagungsprogramm und Zusammenfassungen der Tagungsbeiträge. 4.–6. Oktober 2000, Freiburg i. Br. – 68 S. – *Verkaufspreis: € 11,50* **vergriffen**

2000/4 **70. Jahrestagung der Paläontologischen Gesellschaft. Exkursionsführer.** 24.-30. September 2000 in Coburg. – 158 S. – *Verkaufspreis € 14,-*

2000/3 **70. Jahrestagung der Paläontologischen Gesellschaft. Vorträge und Poster.** 24.-30. September 2000 in Coburg. – 184 S. – *Verkaufspreis: € 16,-*

2000/2 **4. Geochemie-Tagung.** Zusammenfassungen der Tagungsbeiträge. 31. Mai - 3. Juni 2000, GFZ Potsdam. – 138 S. – *Verkaufspreis: € 11,50*

2000/1 **GEOLOGY 2000.** Geologische Vereinigung e.V., 90th Annual Meeting. Geological Society of Austria. Vienna, April 14-17, 2000. – 152 S. – *Verkaufspreis: € 11,50*

1999/11 **Fifth Workshop on Russian - German Cooperation.** Laptev Sea System. Program and Abstracts. November 25-29, 1999, St. Petersburg, Russia. – 89 S. – *Verkaufspreis: € 9,-*

1999/10 **4th Workshop of the European Lake Drilling Programme ELPD.** Programme, List of Participants. Excursion Guide, Abstracts. September 22-26, 1999, Lund, Sweden / GFZ Potsdam. – 122 S. – *Verkaufspreis: € 11,50*

1999/9 **69. Jahrestagung der Paläontologischen Gesellschaft. Exkursionsführer.** 20.-26. September 1999, Zürich, Schweiz. – 127 S. – *Verkaufspreis: € 11,50*

1999/8 **69. Jahrestagung der Paläontologischen Gesellschaft. Vorträge und Poster.** 20.-26. September 1999, Zürich, Schweiz. – 128 S. – *Verkaufspreis: € 16,50*

1999/7 **Processes and Consequences of Deep Subduction.** Alfred Wegener Conference. Abstract Volume. September 5-11, 1999, Verbania, Italy. – 136 S. – *Verkaufspreis: € 11,50* Also available: Field Excursion Guide Ivrea Zone. – 18 S. – *Verkaufspreis: € 3,30*

1999/6 **ECROFI XV. European Current Research On Fluid Inclusions.** Abstracts and Program. June 21-24, 1999, GFZ Potsdam. – 334 S. – *Verkaufspreis: € 21-*

1999/5 **Alfred-Wegener-Symposium "Klima aus geowissenschaftlicher Sicht".** Kurzfassungen der Vorträge. 11. Juni 1999, Kongress Center Düsseldorf. – 55 S. – *Verkaufspreis: € 9,-*

1999/4 **Sediment '99.** 14. Sedimentologentreffen am FB Geowissenschaften der Universität Bremen. Kurzfassungen und Poster. 26.-18. Mai 1999, Bremen. – 320 S. – *Verkaufspreis: € 18,-*

1999/3 **Begleitprojekte zu DEKORP NE-Deutschland.** Rundgespräch zum DFG-Bündelantrag. Zusammenfassungen der Vorträge. 7.-8. Januar 1999, GFZ Potsdam. – 45 S. – *Verkaufspreis: € 9,-*

1999/2 **14th Himalaya-Karakoram-Tibet Workshop.** Abstracts. March 24-26, 1999, Kloster Ettal, Germany. – 191 S. – *Verkaufspreis: € 14,50*

1999/1 **Old Crust – New Problems: Geodynamics and Utilization.** Geologische Vereinigung e.V., 89th Annual Meeting. Abstracts and Programme. February 22–26, 1999, Freiberg/Saxony. – 225 S. – *Verkaufspreis: € 20,-*

1998/6 **"Mediterranean Lacustrine Records".** 3rd Workshop of the European Lake Drilling Programme ELDP. Zusammenfassung der Tagungsbeiträge. 14.-18. Oktober 1998, Ptolemaris, Greece. – 150 S. – *Verkaufspreis: € 11,50*

1998/5 **"16. Geowissenschaftliches Lateinamerika-Kolloquium".** Zusammenfassung der Tagungsbeiträge. 14.-16. Oktober 1998, Bayreuth. – 200 S. – *Verkaufspreis: € 11,50*

1998/4 **"Geo-Berlin´98: Exkursionsführer".** 6.-9. Oktober 1998, Berlin. – 184 S. – *Verkaufspreis: € 11,50*

1998/3 **"Geo-Berlin´98: Programm und Zusammenfassung der Tagungsbeiträge".** 6.-9. Oktober 1998, Berlin. – 678 S. – *Verkaufspreis: € 25,-*

1998/2 **"Orogene Prozesse, ihre Quantifizierung und Simulation am Beispiel der Varisziden".** 7. Kolloquium im DFG-Schwerpunktprogramm. Beitragszusammenfassungen. 16.-17. April 1998, Gießen. – 180 S. – *Verkaufspreis: € 16,50*

1998/1 **Geological Dynamics of Alpine Type Mountain Belts Ancient and Modern.** 88. Jahrestagung der Geologischen Vereinigung. 25.-28. Februar 1998, Bern. – 95 S. – *Verkaufspreis: € 9,-*

1997/12 **Russian and International Bryozoan Conference "Bryozoa of the World".** A Field Excursion Guide. St. Petersburg. – 60 S. – *Verkaufspreis: € 7,-*

1997/11 **Trans-European Suture Zone - EUROPROBE TESZ Meeting.** 3.-5. November 1997, GFZ Potsdam. – 171 S. – *Verkaufspreis: € 9,-*

1997/10 **Proceedings of the Alfred Wegener Conference - Sediment and Aerosol.** 10.-12. März 1997, Leipzig. – 89 S. – *Verkaufspreis: € 9,-* **vergriffen**

1997/9 **1. Treffen der deutschsprachigen Paläoherpetologen.** Extended Abstracts. 21.-23. Februar 1997, Düsseldorf. – 38 S. – *Verkaufspreis: € 9,-*

1997/8 **7th International Symposium on Paleolimnology.** Exkursionsführer. Excursion B: "The Crater Lake of the Laacher See Volcano and the Maar Lakes of the West Eifel Volcanic Field", Excursion C: "Lake Federsee", Excursion D: "Lake Constance", Excursion F: "Lacustrine Environmental Archives of Central Switzerland". 24. August - 05. September 1997, Heiligkreuztal. – 251 S. – *Verkaufspreis: € 16,50*

1997/7 **67. Jahrestagung der Paläontologischen Gesellschaft.** Exkursionsführer. 21.-28. September 1997, Daun/Vulkaneifel. – 202 S. – *Verkaufspreis: € 16,50*

1997/6 **67. Jahrestagung der Paläontologischen Gesellschaft.** Vortrags- und Posterkurzfassungen. 21.-28. September 1997, Daun/Vulkaneifel. – 184 S. – *Verkaufspreis: € 11,50*

1997/5 **Orogene Prozesse - ihre Quantifizierung und Simulation am Beispiel der Varisciden.** 6. Kolloquium im DFG-Schwerpunktprogramm. Beitragszusammenfassungen. 13.-14. Juni 1997, Berlin. – 222 S. – *Verkaufspreis: € 11,50*

1997/4 **The 13th Meeting on The Dead Sea Rift as a Unique Global Site.** Tagungsunterlagen. 23.-27. Februar 1997, Dead Sea, Israel. – 360 S. –**vergriffen**

1997/3 **12. Sedimentologentreffen.** Exkursionsführer. 21.-24. Mai 1997 am Geologischen Institut der Universität zu Köln. – 186 S. – *Verkaufspreis: € 16,50*

1997/2 **12. Sedimentologentreffen.** Kurzfassungen der Vorträge und Poster. 21.-24. Mai 1997 am Geologischen Institut der Universität zu Köln. – 283 S. – *Verkaufspreis: € 9,-*

1997/1 **87. Jahrestagung der Geologischen Vereinigung e.V. "Elementare Geologische Prozesse".** 27. Februar - 1. März 1997. – 38 S. – *Verkaufspreis: € 9,-*

1996/10 **Alfred-Wegener-Konferenz "Geowissenschaften in Lehrerbildung und Schule".** 28.-30. Oktober 1996, Leipzig. – 115 S. – *Verkaufspreis: € 11,50* **vergriffen**

1996/9 **Third Workshop on Russian-German Cooperation: Laptev Sea System.** Programm and Abstracts. 16.-19. Oktober 1996, St. Petersburg. – 110 S. – *Verkaufspreis: € 11,50*

1996/8 **15. Geowissenschaftliches Lateinamerika-Kolloquium.** Zusammenfassung der Tagungsbeiträge. 16.-18. Oktober 1996, Hamburg. – 181 S. – *Verkaufspreis: € 11,50*

1996/7 **Geologische Stoffkreisläufe und ihre Veränderungen durch den Menschen.** 148. Hauptversammlung der Deutschen Geologischen Gesellschaft. Exkursionsführer. 29. September - 4. Oktober 1996, Bonn. – 212 – S. *Verkaufspreis: € 16,50* **vergriffen**

1996/6 **66. Jahrestagung der Paläontologischen Gesellschaft.** Abstracts und Poster. 22.-28. September 1996, Leipzig. – 167 S. – *Verkaufspreis: € 9,-*

1996/5 **66. Jahrestagung der Paläontologischen Gesellschaft.** Exkursionsführer. 22.-28. September 1996, Leipzig. – 167 S. – *Verkaufspreis: € 11,50*

1996/4 **First EuroColloquium of the Ocean Drilling Program.** 28. Februar - 1. März 1996, Oldenburg. – 93 S. – *Verkaufspreis: € 11,50*

1996/3 **18. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Zusammenfassung der Tagungsbeiträge. 18.-22. März 1996, Universität Potsdam. – 87 S. – *Verkaufspreis: € 9,-*

1996/2 **"Orogene Prozesse - ihre Quantifizierung und Simulation am Beispiel der Varisziden".** 5. Kolloqium im DFG-Schwerpunktprogramm. Beitragszusammenfassungen. 14.-15. März 1996, Gießen. – 216 S. – *Verkaufspreis: € 16,50*

1996/1 **"Prediction in Geology - Vorhersage in der Geologie - Voorspellen in de Geologie".** 86. Jahrestagung der Geologischen Vereinigung e. V. Koninklijk Nederlands Geologisch Mijnbouwkundig Genootschap. Abstracts. 21.-24. Februar 1996, Amsterdam. – 37 S. – *Verkaufspreis: € 9,-*

1995/8 **"Orogene Prozesse, ihre Quantifizierung und Simulation am Beispiel der Varisziden".** 4. Kolloquium im DFG-Schwerpunktprogramm. Beitragszusammenfassungen. 29.-30. März 1995, Jena. – 140 S. – *Verkaufspreis: € 11,50*

1995/7 **11th Meeting on Geodynamics of the European Variscides - 2nd Symposium on Permocarboniferous Igneous Rocks.** Extended Abstracts. October 27-29, 1995, GeoForschungsZentrum Potsdam. – 148 S. – *Verkaufspreis: € 11,50*

1995/6 **"Geologie des südlichen Ostseeraumes - Umwelt und Untergrund ".** 147. Hauptversammlung der Deutschen Geologischen Gesellschaft. Exkursionsführer. 4.-6. Oktober 1995, Greifswald. – 226 S. – *Verkaufspreis: € 11,50*

1995/5 **65. Jahrestagung der Paläontologischen Gesellschaft.** Exkursionsführer. 25.-30. September 1995, Hildesheim. – 229 S. – *Verkaufspreis: € 16,50* **vergriffen**

1995/4 **65. Jahrestagung der Paläontologischen Gesellschaft.** Abstracts und Poster. 25.-30. September 1995, Hildesheim. – 84 S. – *Verkaufspreis: € 9,-*

1995/3 **Alfred Wegener Conference "Plume 2".** Extended abstracts. July 17-21, 1995, Schloss Ringberg/Rottach-Egern. – 171 S. – *Verkaufspreis: € 11,50*

1995/2 **14. International Congress - International Union for Quaternary Research (INQUA).** Abstracts. August 3-10, 1995, Berlin. – 318 S. – *Verkaufspreis: € 11,50*

1995/1 **"Global Change and Marine Geology".** 85. Jahrestagung der Geologischen Vereinigung e.V. Zusammenfassungen der Tagungsbeiträge. 22.-25. Februar 1995, Bremen. – 84 S. – *Verkaufspreis: € 11,50* **vergriffen**

1994/3 **1. "Orogene Prozesse, ihre Quantifizierung und Simulation am Beispiel der Varisziden".** 3. Kolloquium im DFG-Schwerpunktprogramm. Beitragszusammenfassungen. 29.-31. März 1994, Würzburg. – 112 S. –
2. "Modeling of Orogenic Processes at Lithospheric Scale". Workshop. Beitragszusammenfassungen. 21.-23. März 1994, Berlin. – 29 S. –
Verkaufspreis: € 11,50 **vergriffen**

1994/2 **14. Geowissenschaftliches Lateinamerika-Kolloquium.** Zusammenfassungen der Tagungsbeiträge. 16.-18. November 1994, Tübingen. – 88 S. – Anhang: Poster des SFB 267. Deformationsprozesse in den Anden. – 24 S. – *Verkaufspreis: € 11,50*

1994/1 **Alfred Wegener Conference "Climate Dynamics Recorded in Long Continental High Resolution Time Series since the Last Interglacial".** Abstracts. GFZ Potsdam, September 28 - Oktober 2, 1994, Berlin. – 154 S. – *Verkaufspreis: € 11,50* **vergriffen**

1993/1 **"Aktive Kontinentalränder in Gegenwart und Vergangenheit - Active Continental Margins Present and Past".** 83. Jahrestagung der Geologischen Vereinigung e.V. Zusammenfassungen der Tagungsbeiträge. 25.-27. Februar 1993, Berlin. – 59 S. – *Verkaufspreis: € 7,-*

Bestellungen online über www.gfeshop.de

oder an

Terra Nostra
Schriften der GeoUnion Alfred-Wegener-Stiftung
Arno-Holz-Str. 14
12165 Berlin

Tel.: +49 30 7900660
Fax: +49 30 79006612
infos@geo-union.de
www.geo-union.de