1998, No. 3 ISSN: 1028-2114

ACSYS ARCTIC FORECAST

NEw FACES, NEw PlACES

Roger Colony, Director, IAPO

As many of you have already heard, I will leave the IAPO at the end of the year and take a new position at the International Arctic Research Center at the University of Alaska. I have greatly enjoyed my stay in Norway, my work at the IAPO, and my association with ACSYS colleagues. I can only say to my successor that the IAPO enjoys a high standard of collegiality with the Joint Planning Staff in Geneva and the ACSYS Scientific Steering Group. Furthermore, the Norsk Polarinstitutt has given the IAPO a remarkable combination of autonomy and intellectual support.

The search is on for a new director. The selection committee now has a short list of candidates and will interview on 14 December. With some good luck, the new director will be named by the end of the year.

The new year also marks the move of the IAPO to Tromsø, where we will be housed in the new Polar Environmental Centre. The IAPO staff inspected the building last August. Although still under construction, it was clear that the new offices will be first rate. The physical move will take place during the last part of December or early January 1999. So, look for a new director and a new address soon.

❄❄❄

INTERNATIONAl SYmPOSIum ON POlAR ASPECTS OF GlObAl ChANGE

Howard Cattle

This symposium, sponsored by IASC and SCAR and co-sponsored (amongst others) by ACSYS, was held in Tromsø, Norway from 24-28 August 1998. The meeting, attracted some 240 participants and included sessions on: Climatic trends in the Arctic and Antarctic; Teleconnections Linking the Polar Regions to Low and Mid-Latitudes; Terrestrial Systems and Feedback on Climate Change; Ice Sheet and Glacier Mass Balance and Sea Level; The Circumpolar Arctic/Antarctic Paleoenviron-mental Record; Atmospheric Chemistry, Ozone and UV-B Effects, as well as Regional and Socio-Economic Impacts of Global Change. On the final morning session, chairs summarised the results and highlights of the Symposium, some of which included:

- notable improvements to global and regional models and to Arctic databases, leading to wider appreciation of the key models of climate variability, including the North Atlantic/Arctic Oscillations and the Antarctic circumpolar wave;
- firmer evidence of longer term trends with all seasons showing reduced sea ice extents in the Arctic and emphasis on the warming of the Arctic Peninsula and the associated break up of ice shelves there;
- the marked warming of the Atlantic layer of the Arctic Ocean, sea ice variability and export and possible links with the NAO;
- new work on southern hemisphere deep convection and the influences of decadal time scale variability on it;
- progress in work on permafrost, snow accumulation and redistribution studies and on work on the current balance of ice sheets, West Antarctic ice streams and ice sheet modelling;
- the Barents and Greenland seas as sinks for atmospheric CO2 and developing work on the terrestrial trace gas studies;

INSIDE

- the wealth of new data coming from polar regions in respect of the paleo-record; here the current focus being on high resolution archives from marine and terrestrial sediments and ice cores though chronology remains a problem especially for the older parts of the record, and there is a need to improve the relationship between modelling and data studies
- the clear separation now emerging between the role of chemical and other processes; e.g., dynamics, for ozone depletion;
- the complexity of regional and social impacts of change; clear evidence for regime shifts and wide discussion on issues of mitigation versus adaptation, global versus regional change, and the role of stakeholders in the regional response.

The Norwegian Polar Institute plans to publish papers from the Symposium (both oral and poster presentations) in a special volume of *Polar Research*.

❄❄❄

INTERNATIONAl ARCTIC buOY PROGRAmmE

Roger Colony

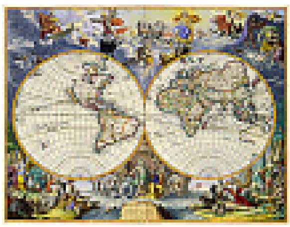
The Conference for the Arctic Buoy Programme — *Scientific Achievements from the First 20 Years* — was convened to recognise and celebrate the scientific contributions of arctic buoys to our understanding of ice motion, ice state, and surface meteorology in the Arctic Basin. The scientific impact of the several arctic buoy programs can be readily seen in research literature, and the range of scientific/operational utility is illustrated in the conference proceedings.

The network of buoys in the Arctic Ocean is presently managed through the *International Arctic Buoy Programme*. The IABP is self supported by its Participants: operational agencies; meteorological and oceanographic institutes; research agencies; and non-governmental organisations. The buoy array and data management are operated as a no-cost service to the scientific and operational communities. Another conference objective was to provide a forum for considering the future of the IABP. Several possible changes were reviewed: transferring funding responsibilities to a single operational agency; mergers with the International Program for Antarctic Buoys; stronger connections to climate monitoring programs; higher technology; a broader assortment of sensors; and a pro-active oceanographic program. The consensus of those participating was that: 1) the buoys are required for the foreseeable future; 2) that IABP is an effective manager; and 3) no substantial technological changes are advised.

❄❄❄

hISTORICAl SEA-ICE ChARTS OF ThE ARCTIC

Roger Colony



The Workshop for Sea Ice Charts of the Arctic – *Scientific Achievements from the first 400 Years* – was convened because of the perception that information contained in ice charts was under-utilised by the scientific community. Participants of the workshop distinguished the ice charts of the historical era (1200 through 1930) when information was primarily limited to ice extent, from ice charts of the modern era (1930-present) when information about the ice pack interior is more generally available. Several workshop reports illustrated the quantity and quality of the ice chart information and suggested that the data are adequate to support scientific investigations of the historical era (e.g., the Historical Ice Chart Archive Project) and from the modern era (e.g., Global Digital Sea Ice Data Bank).

Participants of the workshop divided into three working groups. The Historical Data WG acted as an advocacy group for the use of early ice edge data. Their primary recommendations included studies to illustrate the robustness of the historical data; e.g., covariance of ice edge with other geophysical variables. The Data Management WG focused on issues of data format, meta data, data archives, and international co-operation. Many of their recommen dations were carried to the meeting on sea-ice charts sponsored by the Commission on Marine Meteorology held during 10-14 August in Boulder, Colorado.

The Science/Operations WG was formed in recognition of the partnership necessary for the effective preparation and use of ice chart information. The research community was interested in having a voice in the preparation of the ice charts, and the operations community was interested in improving their products and supporting scientific research.

The consensus of the participants was that ice-chart information is the basis for the long-term observational understanding of ice state and ice extent. Certainly, the workshop was a grand opportunity to establish ties between the research and operational communities.

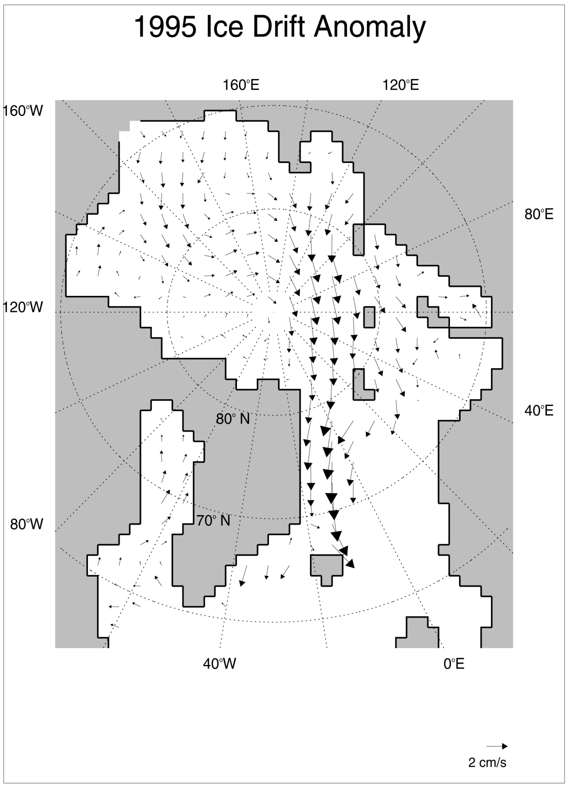
❄❄❄

SIMULATED SEA ICE TRANSPORT THROUGH THE FRAM STRAIT

Markus Harder, Michael Hilmer, and Peter Lemke, Institute of Marine Research, University of Kiel, Germany

The sea ice volume transport out of the Arctic into the Greenland/Iceland/Norwegian (GIN) Sea is estimated with a dynamic-thermodynamic sea-ice model. Forty years of atmospheric forcing data (wind, air temperature) from the NCEP/NCAR Reanalysis Project are applied to simulate the ice volume transport for the period 1958-97. The long-term mean ice-volume export through the Fram Strait amounts to 2870 km^3 per year. Compared to river run-off, this is one of the largest freshwater fluxes on Earth. Another export of sea ice, usually smaller, yet significant, occurs east of Spitsbergen.

The wind-driven inter-annual variability of sea-ice transport is strong. Some years show more than twice the exported sea-ice volume as other years. The strongest exports of 4040 km^3 per year through the Fram Strait are derived for both 1968 and 1995. The strong simulated export in 1968 coincides with the observed '*Great Salinity Anomaly*' in the GIN Sea. It is enhanced by an abnormally high export east of Spitsbergen. The sea-ice transport anomaly in 1968 explains about 75% of the estimated freshwater volume in the *'Great Salinity Anomaly'*. There was also an unusually strong ice transport through the Fram Strait in 1995 (see figure), which agrees with the measurements of Vinje et al. *(ACSYS Arctic Forecast, June 1998).*

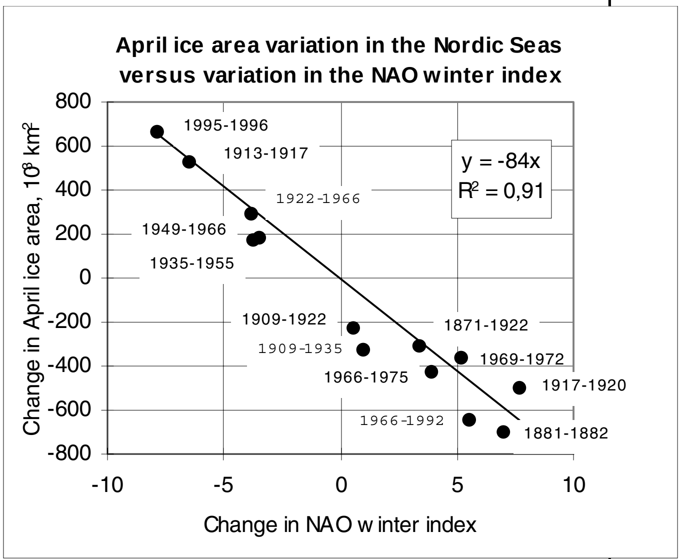


More information and references are available from the WCRP/ACSYS Sea Ice Model Inter-comparison Project (SIMIP) web site http://www.ifm.uni-kiel.de/me/SIMIP/simip.html or by contacting Markus Harder via e-mail at: *mharder@ifm.uni-kiel.de.*

NAO wINTER INdEx ANd ThE NORdIC SEA ICE AREA IN APRIl

Torgny Vinje

The Atlantic Approach to the Arctic (AAA) comprises the Greenland, Iceland, Norwegian,



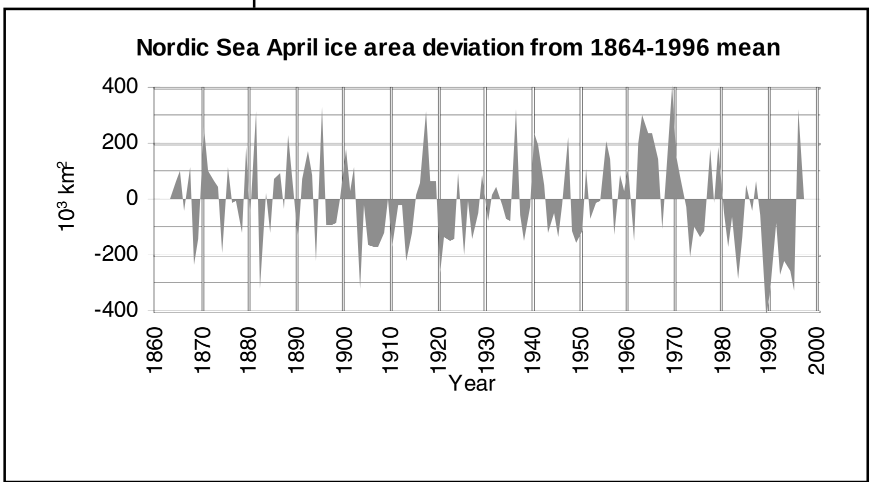
Barents and Kara Seas, here referred to as the Nordic Seas.

The AAA area is influenced by passing low pressures forming the Northeast Atlantic trough which extends further onto the margins of Siberia (Thresnikov 1980, *AARI Atlas*). The pressure distribution in this trough is highly dependent upon the frequency of blocking highs over Iceland; thus, also on the strength of the westerlies or the zonal flow between Iceland and Portugal as characterised by the North Atlantic Oscillation (NAO) index (Hurrel 1996, *GRL*).

Based on a series of ice maps depicted from available historical ice information (*ACSYS Arctic Forecast No 1, 1998),* the *meridional* effect of the westerlies (indexed by NAO winter index) on the April ice area is evaluated. Considering the largest ice area fluctuations (above ~ 200 km^2 from season to season), a strong linear correlation (R^2 = 0.91) is found between the year-to-year change in the NAO winter index and the corresponding change in the April ice area in the Nordic Seas. (A second order polynomial regression gives an even stronger correlation, R^2 = 0.96, and reads: $y = 3.33x^2 - 83x - 159$).

The NAO winter index is given as a deviation from the mean over the period 1864-1996, and when applying the above relationship on the NAO winter index series, we get a new series showing the deviation of the April ice area from its 1864-1996 mean (figure).

Over the past 35 years, the April ice area has varied from a marked positive anomaly during the 1960's to a marked negative anomaly during the first part of the 1990's. This corresponds with the decreasing frequency of winter high's over Iceland/Greenland (Dickson 1997, *Nature*). An unprecedented large positive anomaly change occurred from 1995 to 1996. Previously frequent negative anomalies are observed at the beginning of this century during the period when the significant Arctic warming occurred. Relatively cold winters are reflected by large positive anomalies such as in 1881 and 1896, 1917, 1937, 1942, 1966, 1969 and 1996; and relatively warm winters by large negative anomalies such as in 1882, 1903, 1921, 1989 and 1996.



❄❄❄

FRAm STRAIT ICE FluxES ANd ENvIRONmENTAl EFFECTS

Torgny Vinje, ACSYS Project Office.

The mean annual ice flux through Fram Strait represents the mean annual net ice production in the Arctic Ocean as well as the major input of fresh water to the Nordic Seas. Because of the markedly higher drift speed of ice as compared with the mean velocity of the ocean mixed layer, the highly variable freezing and subsequent melting may cause a highly variable exchange of salt between the two aquatories and affect the thermo-haline forcing from year to year.

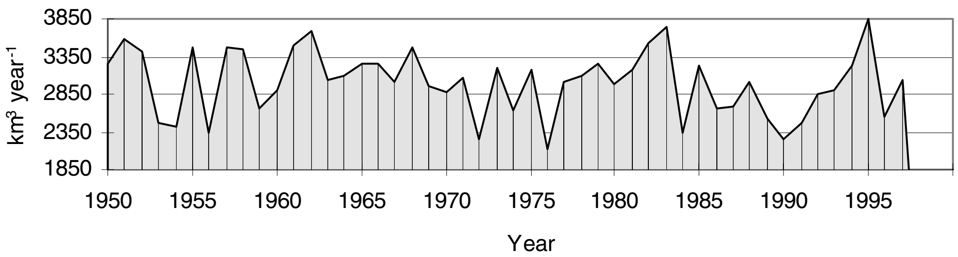
A series of the annual ice volume flux through Fram Strait has been calculated for the period 1950-1997 using the observations and relationships derived by Vinje et al. (1998, *JGR*). Monthly values have been calculated according to the formula:

Volume flux (km^3 $month^{-1}$) $= 18.9\Delta P + 154$,

where ΔP is the monthly mean difference in air pressure between 80ºN10ºW and 73ºN20ºE as read from *Grosswetterlagen Europas*. The annual mean ice thickness has been held constant, 2.6 m, as is also the observed annual mean current speed in Fram Strait, 0.11 m s^{-1} introducing an error of the order of 10 % in the calculated volume fluxes. The net ice production in the Arctic Ocean or the efflux of ice through Fram Strait varies considerably from year to year with maxima in 1995, 1983 and the 1960's (Figure and Harder et al., above). According to the 1995 Ice Drift Anomaly given by Harder et al., a major ice production, and thereby increased brine release, took place in the mid-Eurasian Basin this year, concurrent with an increased salinity observed in the upper layers in this area (Steele and Boyd 1998, *JGR*). A persistently increased efflux is observed for the years 1961-1968 (see figure). This is contemporary with the observed "*Great Salinity Anomaly*" in the Greenland, Iceland and Norwegian Seas assumed to be caused by an increased efflux of ice from the Arctic Ocean (Aagaard and Carmack, *JGR* 94, 1989). During this decade, there also occurred an extreme April ice area extension in the Nordic Seas together with a minimum in the NAO winter index (Vinje, this issue).

❄❄❄

Annual ice volume flux through Fram Strait



Annual mean: 3009 km^3, annual current induced drift 1850 km^3, stdev.: 430 km^3

NORdIC SEAS wORkShOP

Roger Colony

The Joint Scientific Committee of the WCRP asked ACSYS to consider expanding its oceanographic studies to understand the links between processes/circulation in the Arctic Basin and processes/circulation in the Nordic Seas better. Such studies would focus on the consequences of water exchange between the Arctic Basin and the Nordic Seas; e.g., convection in the Greenland Sea associated with buoyancy fluxes from the Arctic Basin, and possible warming of the Atlantic Water found in the Arctic Basin.

ACSYS and the European Boards for Marine and Polar Science (EMaPS) recognised that the Nordic Seas research is presently only weakly coordinated by international programs (e.g.,The International Council for the Exploration of the Sea). They further recognised the many ongoing national and European programs for Nordic Sea research (VEINS, ESOP-2, and various ocean monitoring activities in support of fisheries). To establish the correct placement of ACSYS within ongoing (and future) research, ACSYS and the EMaPS secretariat sponsored a one day workshop on 23 August 1998. The question "Will Nordic Seas research significantly benefit from co-ordination provided by one of the (global) international programmes?" was addressed. Representatives from institutes, agencies, and projects were invited to participate or to send written statements. After reviewing a broad range of scientific questions, the meeting reached the following consensus:

- that there are clearly a number of key large-scale scientific issues related to the role of the Nordic Seas for the wider global climate system;
- that some of these issues are being addressed by existing projects, but that there is no overarching strategy for developing programmes in the Nordic Seas beyond the current informal arrangements between institutes (which to a large extent works well);
- however, there are apparently a number of key questions which are not yet being pursued in relation to the role of the Nordic Seas for global climate and which more formal international co-operation could play a role in fostering. This could be developed through; for example, the programmes EMaPS or the Arctic Ocean Sciences Board (AOSB).

❄❄❄

ACSYS' new address as of 15 January 1999:

ASYS -- Polarmiljøsenteret
Postboks 399
Hjalmar Johansensgt. 14
N-9001 Tromsø
Norway
Ph: +47 77 75 05 00 (switchboard)
Fx: +47 77 75 05 01 (main fax)

Help make this a great newsletter!

Many thanks to those of you who have contributed to the *ACSYS Arctic Forecast* this time around. This issue is focussed on sea-ice; so, I hereby challenge the scientists involved in other ACSYS issues to make contributions to our newsletter. Also, if you have photos, drawings, etc., of Arctic topics, how about letting us use them in our publication? Please help us to make this a newsletter we can be proud of. – *Tordis*

❄❄❄❄❄❄❄❄❄❄❄❄❄❄❄❄

This newsletter is published by the International ACSYS Project Office (IAPO)
Fax: +47 22 95 96 01
Tel: +47 22 95 95 73
Middlethuns gate 29 or Post Box 5072 Majorstua
N-0301 Oslo, Norway
http://www.npolar.no/acsys/

Roger Colony, Director; *acsys@npolar.no*
Christoph Oelke, Deputy Director; *oelke@npolar.no*
Tordis Villinger, Editor
tvilling@npolar.no

Printed by Jans Trykkeri, Hvalstad, Norway – An equal-opportunity company that hires the handicapped.