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Collaborative Research: Antarctic Climate Reconstruction Utilizing the US ITASE Ice Core Array (2009- 2012)

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Preview of Award 0837883 - Final Project Report

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Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	0837883
Project Title:	Collaborative Research: Antarctic Climate Reconstruction Utilizing the US ITASE Ice Core Array (2009- 2012)
PD/PI Name:	Paul A Mayewski, Principal Investigator Andrei V Kurbatov, Co-Principal Investigator Kirk A Maasch, Co-Principal Investigator
Recipient Organization:	University of Maine
Project/Grant Period:	06/01/2009 - 05/31/2013
Reporting Period:	06/01/2012 - 05/31/2013
Submitting Official (if other than PD\PI):	Paul A Mayewski Principal Investigator
Submission Date:	06/26/2013
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Paul A Mayewski

Accomplishments

* What are the major goals of the project?

The International Trans Antarctic Scientific Expedition (ITASE) is a multi-national, multi-disciplinary field research program

with the broad aim of understanding the recent environmental history of Antarctica. US ITASE is part of the ITASE multi-national effort to understand climate change over Antarctica and the Southern Ocean. ITASE is organized under the auspices of SCAR and now comprises twenty-one countries. An emerging compilation of all ITASE and other ice core sites is available through Ice READER (<http://www2.umaine.edu/itase/content/icereader/index.html>).

ITASE has and will continue to play a pivotal role in the understanding of Antarctic, Southern Hemisphere and global climate change. ITASE provides a framework for monitoring past and present and predicting future changes in the physical and climate system. ITASE data continues to emerge from national and international laboratories, and the necessity for ITASE researchers to exchange ideas and interact with ice core data users such as oceanographers, meteorologists, climate modelers, and other paleoclimate researchers heightens. Our objective in the current project has been to foster these interactions while taking advantage of the existing – and still growing – ITASE data sets to address several key scientific questions that have emerged from the results summarized in the two most recent Antarctic climate synthesis reports (Mayewski et al., 2009 and ACCE, 2009).

- 1) Is Antarctica entering a new climate regime?
- 2) What is the relationship between Antarctic and global climate on decadal to centennial timescales?
- 3) To what extent is Antarctic climate variability attributable to natural radiative forcings (i.e. changes in solar variability and volcanism)?
- 4) How strong is the human influence on the chemistry of the Antarctic atmosphere?

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

- Major Activities: Please see pdf attached entitled Major Activities.
- Specific Objectives: Key outcomes as demonstrated by contributions (project publications referenced below) to the major goals (listed below) of this project:
- Significant Results:
- Key outcomes or Other achievements:
- 1) Is Antarctica entering a new climate regime?
As demonstrated by the syntheses of Antarctic and Southern Ocean climate developed as part of this project ((Mayewski et al., 2009; ACCE, 2009; Hodgson et al., 2009; Turner et al., 2009a, b, 2013; Convey et al., 2009; Mayewski, 2012; 2013; Steig et al., 2013) much of interior Antarctica remains within the range of natural climate variability. However, the Antarctic Peninsula and coastal portions of West Antarctica are experiencing changes documented by this project that include: (a) contraction of the westerlies and intensification of the Amundsen Sea Low that is unprecedented in the last 5200 years (Mayewski et al., 2013), and (b) higher surface air temperature at Siple Dome than any documented over the last 100,000 years. Furthermore, Antarctica is currently experiencing unprecedented levels of several human source pollutants including uranium, cadmium, lead, bismuth, arsenic (Dixon et al., 2013; Potocki et al., near review).
 - 2) What is the relationship between Antarctic and global climate on decadal to centennial timescales?
Changes in the size and shape of the Antarctic ice sheet and surrounding atmospheric circulation systems have had a dramatic impact on the climate of Southern Hemisphere extra-Antarctic continents (Mayewski et al., 2013). Specific examples include sensitivity of: (a) water availability over southern Africa to changes in the latitudinal extent and strength of the westerlies (Stager et al., 2012),

and (b) wind speed and surface ocean currents along the east and west coasts of southern South America and the South Atlantic to changes in the latitudinal extent and strength of the westerlies (Mayewski et al., 2013; Birkel et al., in review).

3) To what extent is Antarctic climate variability attributable to radiative forcings?

Phasing of the most recent naturally forced abrupt climate change event and arguably the largest such event of the last several thousand years, the Little Ice Age, was demonstrated to be in phase between the hemispheres suggestive of solar forcing (Bertler et al., 2011) and a new ice core based high resolution volcanic emission record was developed in collaboration with Australian colleagues using the Law Dome ice core (Plummer et al., 2012). Changes in ozone and tropospheric greenhouse gases were demonstrated to have marked impacts on atmospheric circulation under both naturally and anthropogenically forced conditions (Mayewski et al., 2013).

4) How strong is the human influence on the chemistry of the Antarctic atmosphere?

The answer is clearly yes as demonstrated by the response to major goal (1) above.

*** What opportunities for training and professional development has the project provided?**

One post-doctoral fellow (Dan Dixon), four graduate students (Sharton Sneed (PhD), Peter Acton (MSc), Mariusz Potocki (PhD) and Elena Korotkikh (PhD) were involved in varying aspects of this project including collection of field data, clean sampling techniques, analysis and interpretation using statistical and climate analysis tools.

*** How have the results been disseminated to communities of interest?**

Project results have been disseminated through:

(1) student-faculty meetings, laboratory and field experiences, seminars and courses

(2) public lectures by PI, co-Is, post-doctoral fellow and graduate students, for example - <http://www.mpbnet.net/Home/tabid/36/ctl/ViewItem/mid/3456/ItemId/16925/Default.aspx>

(3) the ITASE website - <http://www2.umaine.edu/itase/>

(4) a web-based tutorial describing ice core contributions to the understanding of chemical and physical climate - <http://climatechange.umaine.edu/icecores/IceCore/Home.html>

(5) a web-based tool for climate analysis - the Climate Change Institute Climate Reanalyzer - <http://cci-reanalyzer.org/>

(6) a book (hard copy and electronic) describing changes in scientific thinking produced through ice core contributions - http://journeyintoclimate.com/Journey_Into_Climate/Journey_Into_Climate.html

(7) Climate Change Science Day at CCI - http://climatechange.umaine.edu/news/article/2013/04/25/climate_change_science_day

(8) Workshop on how to run a successful large project - http://climatechange.umaine.edu/news/article/2011/09/09/distinguished_climate_scholars_series_panel

(9) YouTube videos including - http://climatechange.umaine.edu/news/article/2012/10/05/youtube__40_years_of_climate_change_research__mayewski

Supporting Files

Filename	Description	Uploaded By	Uploaded On
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Products

Books

Hodgson DA, Abram N, Anderson J, Bargelloni L, Barrett P, Bentley MJ, Bertler NAN, Chown S, Clarke A, Convey P, Crame A, Crosta X, Curran M, di Prisco G, Francis, J.E., Goodwin I, Gutt J, Massé G, Masson-Delmotte V, Mayewski PA, Mulvaney R, Peck L, Pörtner H-O, Röthlisberger R, Stevens MI, Summerhayes CP, van Ommen T, Verde C, Verleyen E, Vyverman W, Wiencke C, Zane, L. (2009). *Antarctic climate and environmental history in the pre-instrumental period* In *Antarctic Climate Change and the Environment*, Scientific Committee for Antarctic Research J.T. Turner, R. Bindschadler, P. Convey, G. di Prisco, E. Fahrbach, D. Hodgson P.A. Mayewski, C. Summerhayes. Scientific Committee for Antarctic Research. Cambridge, UK. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: ISBN [978-0-948277-22-1](#), <http://www.scar.org/publications/occasionals/acce.html>

J.T. Turner, R. Bindschadler, P. Convey, G. di Prisco, E. Fahrbach, D. Hodgson P.A. Mayewski, C. Summerhayes (2009). *ACCE (Antarctic Climate Change and the Environment)* J.T. Turner, R. Bindschadler, P. Convey, G. di Prisco, E. Fahrbach, D. Hodgson P.A. Mayewski, C. Summerhayes. Scientific Committee for Antarctic Research. Cambridge, UK. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: ISBN [978-0-948277-22-1](#), <http://www.scar.org/publications/occasionals/acce.html>

John Turner, Jonathan Shanklin, Mike Sparrow, Rob Arthem, Andrew Fleming, David Bromwich, Gareth Marshall, Tony Worby, James Bockheim, Guido di Prisco, Cinzia Verde, Pete Convey, Zhaomin Wang, Howard Roscoe, Anna Jones, David Vaughan, Philip Woodworth, Ted Scambos, Alison Cook, Anthony Lenton, Adrian Jenkins, Josifino Comiso, Mauro Gugliemin, Colin Summerhayes, Mike Meredith Alberto Naveira-Garabato, Steve Chown, Mark Stevens, Adams, Roger Worland, Françoise Hennion, Ad Huiskes, Dana Bergstrom, Dominic Hodgson, Robert Bindschadler, Roberto Bargagli, Nicolas Metzl, Todd Arbetter, Kees van der Veen, Andrew Monaghan, Kevin Speer, Steve Rintoul, Hartmut Hellmer, Stan Jacobs, Karen Heywood, David Holland, Takashi Yamanouchi, Carlo Barbante, Nancy Bertler, Carole Boutron, Seok Hong, Paul Mayewski, Jim Fastook, Eberhard Fahrbach, David Webb, Andrew Clarke, Julian Gutt, Katrin Linse (2009). *Observations, data accuracy and tools* In *Antarctic Climate Change and the Environment* J.T. Turner, R. Bindschadler, P. Convey, G. di Prisco, E. Fahrbach, D. Hodgson P.A. Mayewski, C. Summerhayes. Scientific Committee for Antarctic Research. Cambridge, UK. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: ISBN978-0-948277-22-1, <http://www.scar.org/publications/occasionals/acce.html>

John Turner, Rob Arthem, David Bromwich, Gareth Marshall, Tony Worby, James Bockheim, Guido di Prisco, Cinzia Verde, Pete Convey, Howard Roscoe, Anna Jones, David Vaughan, Philip Woodworth, Ted Scambos, Alison Cook, Andrew Lenton, Josifino Comiso, Mauro Gugliemin, Colin Summerhayes, Mike Meredith, Alberto Naveira-Garabato, Steve Chown, Mark Stevens, Byron Adams, Roger Worland, Françoise Hennion, Ad Huiskes, Dana Bergstrom, Dominic Hodgson, Robert Bindschadler, Roberto Bargagli, Nicolas Metzl, Kees van der Veen, Andrew Monaghan, Kevin Speer, Steve Rintoul, Hartmut Hellmer, Stan Jacobs, Karen Heywood, David Holland, Takashi Yamanouchi, Carlo Barbante, Nancy Bertler, Carole Boutron, Seok Hong, Paul Mayewski, Jim Fastook, Kevin Newsham, Sharon Robinson, Jaume Forcada, Phil Trathan, Victor Smetacek, Julian Gutt, Hans-Otto Pörtner, Lloyd Peck, Josep-Maria Gili, NN (Pollution), Christian Wiencke, Eberhard Fahrbach, Angus Atkinson, David Webb, Enrique Isla, Covadonga Orejas, Sergio Rossi, Jon Shanklin (2009). *The instrumental period* In *Antarctic Climate Change and the Environment*, J.T. Turner, R. Bindschadler, P. Convey, G. di Prisco, E. Fahrbach, D. Hodgson P.A. Mayewski, C. Summerhayes. Scientific Committee for Antarctic Research. Cambridge, UK. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: ISBN [978-0-948277-22-1](#), <http://www.scar.org/publications/occasionals/acce.html>

Mayewski, P.A. and Morrison, M.C. (2011). *Journey Into Climate: Exploration, Adventure and the Unmasking of Human Innocence* A Dauntless Press. Santa Fe, New Mexico. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: ISBN: [978-0-9836302-0-3](#); -1-0;-2-7

Book Chapters

Conference Papers and Presentations

Korotkikh, E., Mayewski, P.A., Dixon, D., Potocki, M., Kurbatov, A. and Handley, M. (2013). *Evidence of hemispheric- and local-scale atmospheric pollution in a South Pole ice core*. Climate Change Institute Mini Paper Series. Orono, Maine. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Mayewski, P.A., Birkel, S., Maasch, K. and Kurbatov, A. (2013). *Recent increase in wind speed and precipitation over the west coast of southern South America: cause and implications*. Climate Change Institute Mini Paper Series. Orono, Maine. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Birkel, S., Mayewski, P.A., Maasch, K. and Koons, P. (2013). *The Climate Reanalyzer*. Climate Change Institute Mini Series. Orono, Maine. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Inventions

Nothing to report.

Journals

Alencar, A.S., Evangelista, H., Corrêa, S.M., Wainer, I., Jaña, R., Potocki, M., Kurbatov, A.V., Mayewski, P.A. and Simões, J.C. (2013). A prospective analysis of VOC and aerosol compositions at Detroit Plateau, Antarctic Peninsula. *N/A. N/A. N/A.* Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Bertler, N.A.N., Mayewski, P.A. and Carter, L. (2011). Cold conditions in Antarctica during the Little Ice Age – Implications for abrupt climate change mechanisms. *Earth and Planetary Science Letters*. 308 41-51. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Birkel, S.D., Mayewski, P.A. and Maaasch, K.A. (2013). Exploring the consequences of poleward-shifted westerly winds in the Southern Hemisphere over recent decades. *N/A. N/A. N/A.* Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Convey, P., Turner, J., DiPrisco, G., Mayewski, P.A., Hodgson, D.A., Fahrbach, E., Bindschadler, R., Gutt, J. and Summerhayes, C. (2009). Antarctic climate change and the environment. *Antarctic Science*. 21 541-563. Status = PUBLISHED; Acknowledgment of Federal Support = No ; Peer Reviewed = Yes ; DOI: doi:[10.1017/S0032247413000296](https://doi.org/10.1017/S0032247413000296)

Dixon, D. A., Mayewski, P.A., Goodwin, I., Freeman, R., Maasch, K.A., Sneed, S.B., and G. Marshall (2012). An ice core proxy for northerly air mass incursions (NAMI) into West Antarctica. *International Journal of Climatology*. 32 1445-1465. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: DOI: [10.1002/joc.2371](https://doi.org/10.1002/joc.2371)

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Goodwin, I.D., Browning, S., Lorrey, A., Mayewski, P.A., Phipps, S.J., Bertler, N.A.N., Edwards, R., Cohen, T., van Ommen, T., Curran, M., Barr, C. and Stager, S. (2013). A reconstruction of the Indo-Pacific extratropical atmospheric longwave patten during the Medieval Climate Anomaly. *Climate Dynamics*. *N/A. N/A.* Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Korotkikh, E. V., Mayewski, P.A., Dixon, D., Potocki, Handley, M., Introne, D. and Kurbatov, A.V. (2013). Recent decrease in Ba and As concentrations as recorded in a South Pole ice core. *N/A. N/A. N/A.* Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Korotkikh, E., Mayewski, P. A., Handley, M., Introne, D., Sneed, S., Kurbatov, A., Dunbar, N. and McIntosh, W. (2011). The last interglacial as represented in the glaciochemical record from Mount Moulton Blue Ice Area, West

Antarctica. *Quaternary Science Reviews*. 30 1940-1947. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Mahowald, N., Kloster, S., Engelstaedter, S., Moore, J.K., Mukhopadhyay, S., McConnell, J., Abani, S., Doney, S., Bhattacharya, A., Curran, M., Flanner, M., Hoffman, Lawrence, F., Lindsay, K., Mayewski, P.A., Neff, J., Rothenberg, D., Thomas, E., Thornton (2010). Observed 20th century desert dust changes: implications for climate and biogeochemistry. *Atmospheric Chemistry and Physics*. 10 10875-108. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi:[10.5194/acp-10-10875-2010](https://doi.org/10.5194/acp-10-10875-2010)

Mayewski, P.A. (2012). Ice core reconstruction of Antarctic climate change and implications, in Climate Change in the Magellan and Antarctic Regions: Evidence and Challenges for the Future. *Special Edition of Anales del Instituto de la Patagonia*. 40 (1), 97-104. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Mayewski, P.A. (2012). Invited review of Science in the snow: fifty years of international collaboration through the Scientific Committee on Antarctic Research. *Polar Research*. 31 19275. Status = PUBLISHED; Acknowledgment of Federal Support = No ; Peer Reviewed = Yes ; ISBN: ISBN [978-0-948277-25-2](https://doi.org/978-0-948277-25-2)

Mayewski, P.A. (2012). State of the Antarctic Climate System, in Climate Change in the Magellan and Antarctic Regions: Evidence and Challenges for the Future. *Special Edition of Anales del Instituto de la Patagonia*. 40 (1), 25-30. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Mayewski, P.A., M. Meredith, C. Summerhayes, J. Turner, S. Aoki, Barrett, P. N.A.N. Bertler, T. Bracegirdle, D. Bromwich, H. Campbell, G. Casassa, A. N. Garabato, W.B. Lyons, K.A. Maasch, A. Worby, C. Xiao (2009). State of the Antarctic and Southern Ocean Climate System (SASOCS). *Reviews of Geophysics*. 47 (RG1003), 1-38. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi: [10.1029/2007RG000231](https://doi.org/10.1029/2007RG000231)

Mayewski, P.A., Maasch, K.A., Dixon, D., Sneed, S.B., Oglesby, R., Kurbatov, A.V., Korotkikh, E., Potocki, M., Grigholm, B., Kreuz, K., Taylor, K.C., Steig, E., White, J., Bertler, N.A.N., Goodwin, I., de Mello Monques, M., Tholin, I. U., Simoés, J.C., Ja (2013). West Antarctica's sensitivity to natural and human-forced climate change over the Holocene. *Journal of Quaternary Science*. 1 (28), 40-46. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: DOI: [10.1002/jqs.2593](https://doi.org/10.1002/jqs.2593)

Plummer, C. T., M. A. J. Curran, T. D. Van Ommen, S. O. Rasmussen, A. D. Moy, T. R. Vance, H. B. Clausen, B. M. Vinther, and P. A. Mayewski (2012). An independently dated 2000- year volcanic record from Law Dome, East Antarctica, including a new perspective on the dating of the c. 1450s eruption of Kuwae, Vanuatu. *Climate Change of the Past Discussions*. 8 1567-1590. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi:[10.5194/cpd-8-1567-2012](https://doi.org/10.5194/cpd-8-1567-2012)

Sneed, S.B., Mayewski, P.A., and Dixon, D. (2011). Multi-ice core sodium, nss-sulfate, and methylsulfonate correlations with Antarctic sea ice extent - an enhanced ice core sea ice extent proxy. *Annals of Glaciology*. 52 347-354. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Stager, J.C., Mayewski, P.A., White, J., Chase, B.M., Neumann, F., Meadows, M.E., King, C. and Dixon, D.A. (2012). Precipitation variability in the winter rainfall zone of South Africa during the last 1400 years linked to the austral westerlies. *Climate of the Past*. 8 877-887. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi:[10.5194/cp-8-877-2012](https://doi.org/10.5194/cp-8-877-2012)

Steig,E.J., Ding,Q., White, J.C., Küttel, M., Rupper, S., Neumann, T.A., Neff, P., Gallant, A., Mayewski, P.A., Taylor, K., Hoffan, G., Dixon, D.A., Schoenmann, S., Markle, B., Fudge, T.J., Schneider, D.P., Schauer, A.J., Teel, R.P., Vaughn, B.H., Burgene (2013). An assessment of of recent climate and glaciological changes in West Antarctica. *Nature Geosciences*. N/A 1-4. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi: [10.1038/NGEO1778](https://doi.org/10.1038/NGEO1778)

Turner, J., Barrand, N., Bracegirdle, T., Convey, P., Hodgson, D., Jarvis, M., Jenkins, A., Marshall, G., Roscoe, H., Shanklin, J., Wolff, E., French, J., Goose, H., Guglielmin, M., Gutt, J., Jacobs, S., Kennicutt, C., Masson-Delmotte, V., Mayewski, P., N (2013). Antarctic Climate Change and the Environment – An Update. *The Polar Record*. N/A 1-

23. Status = PUBLISHED; Acknowledgment of Federal Support = No ; Peer Reviewed = Yes ; DOI:
doi:[10.1017/S0032247413000296](https://doi.org/10.1017/S0032247413000296)

Licenses

Nothing to report.

Other Products

Databases.

All US ITASE data collected, sampled and analyzed to date is available at:

http://nsidc.org/data/docs/agdc/nsidc0273_mayewski/index.html

(final data submitted to NSIDC 15 June 2013)

<http://www.icereader.org/icereader/>

(this site was previously only available to ITASE members, but will shortly be open to the public)

The foregoing comes from surface snow, snow pit and ice core and includes: location, mean annual temperature, net mass balance, major soluble ions and trace elements.

Audio or Video Products.

Interview with Dr. Paul Mayewski

- See more at: <http://www.superconsciousness.com/topics/environment/interview-dr-paul-mayewski#sthash.SCvND181.dpuf>

Audio or Video Products.

CCTV - Climate Change Portraits - Paul Mayewski

<http://english.cntv.cn/special/climatejourney/20111124/111178.shtml>

Audio or Video Products.

Paul Mayewski - 40 Years of Climate Change Research

<http://www.youtube.com/watch?v=1VWQd2sTPCY&feature=youtu.be>

Audio or Video Products.

Paul Mayewski - Rio+20 United Nations Conference

<http://www.youtube.com/watch?v=xTmPSKipUtE>

Published on Nov 18, 2012

Dr. Paul A. Mayewski, director of the University of Maine's Climate Change Institute, explains the impact that ice core records have had on the current understanding of Earth's climate history.

Audio or Video Products.

Science Poles

http://www.sciencepoles.org/articles/article_detail/paul_mayewski_climate_variability_abrupt_change_and_civilization

Paul Mayewski: Climate Variability Abrupt Change and Civilization

A veteran of over 50 research expeditions in Antarctica, the Arctic, the Himalayas and the Tibetan Plateau, Professor Paul Mayewski is one of the world's leading glaciologists and climatologists. Also Director of the [Climate Change Institute](#) at the [University of Maine](#), he has published over 300 papers on climate-related research and co-authored *The Ice Chronicles*, a book that captures the adventure of scientific research in remote reaches of the Earth and relates important new breakthroughs in the understanding of climate change.

In this interview, Professor Mayewski answers questions about the difference between natural and human induced climate change, as well as about the potential severity of the human impact on global climate.

Audio or Video Products.

The International Polar Year

<http://ipy.arcticportal.org/news-a-announcements/item/2189>

In the first interview published on SciencePoles, Professor Mayewski answers questions about the difference between natural and human induced climate change, as well as about the potential severity of the human impact on global climate.

In the second, Professor Mayewski answers questions about two of the most significant projects he has worked on in the Polar Regions: The Greenland Ice Sheet (GISP 2) project and the ongoing International Trans Antarctic Expedition (ITASE).

Internet Dissemination of publications.

Global Change Master Directory listings:

<http://gcmd.nasa.gov/getdif?NSIDC-0273>

NSIDC listings:

<http://nsidc.org/data/nsidc-0273>

Other Publications

Patents

Nothing to report.

Technologies or Techniques

Information about the climate system can be readily obtained from vast online archives of weather station data and general circulation models. But few people except climate scientists and meteorologists know how to access these sources. Even these researchers may struggle to sift through dozens and dozens of data repositories. That is why the [Climate Change Institute](#) at the [University of Maine](#) is developing *Climate Reanalyzer* — to make finding and visualizing climate data easy.

With *Climate Reanalyzer*, in only a few clicks it is possible to explore state-of-the-art climate reanalysis, general circulation and weather forecast models, and a global archive of daily station data. *Climate Reanalyzer* even has a [daily climate summary](#), which shows how current temperature across the globe departs from a long-term average.

Climate made simple.

For tips on how to use *Climate Reanalyzer*, please visit our [examples](#) page. Find out where *Climate Reanalyzer* gets data and model output by viewing [data sources](#).

Thesis/Dissertations

Websites

Ice Core Perspectives

<http://climatechange.umaine.edu/icecores/IceCore/Home.html>

Description of ice core contributions to climate change, expeditions, videos, links and selected references assembled by graduate student Bjorn Grigholm, Climate Change Institute, University of Maine.

The Climate Reanalyzer

<http://climatechange.umaine.edu/insights/climate-reanalyzer>

Information about the climate system can be readily obtained from vast online archives of weather station data and general circulation models. But few people except climate scientists and meteorologists know how to access these sources. Even these researchers may struggle to sift through dozens and dozens of data repositories. That is why the [Climate Change Institute](#) at the [University of Maine](#) is developing *Climate Reanalyzer* — to make finding and visualizing climate data easy.

With *Climate Reanalyzer*, in only a few clicks it is possible to explore state-of-the-art climate reanalysis, general circulation and weather forecast models, and a global archive of daily station data. *Climate Reanalyzer* even has a [daily climate summary](#), which shows how current temperature across the globe departs from a long-term average.

Climate made simple.

For tips on how to use *Climate Reanalyzer*, please visit our [examples](#) page. Find out where *Climate Reanalyzer* gets data and model output by viewing [data sources](#).

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Mayewski, Paul	PD/PI	2
Kurbatov, Andrei	Co PD/PI	2
Maasch, Kirk	Co PD/PI	1
Steig, Eric	Co-Investigator	0
Birkel, Sean	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Dixon, Daniel	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Handley, Michael	Technician	2
Introne, Douglas	Technician	2

Sneed, Sharon	Technician	2
Acton, Peter	Graduate Student (research assistant)	9
Grigholm, Bjorn	Graduate Student (research assistant)	0
Haines, Skylar	Graduate Student (research assistant)	12
Korotkikh, Elena	Graduate Student (research assistant)	0
Potocki, Mario	Graduate Student (research assistant)	12
Lambert, Justin	Undergraduate Student	4
Bertler, Nancy	Other	0
Goodwin, Ian	Other	0
Jana, Ricardo	Other	0
Mahowald, Natalie	Other	0
Oglesby, Robert	Other	0
Simoos, Jefferson	Other	0
Turner, John	Other	0

Full details of individuals who have worked on the project:

Paul A Mayewski

Email: paul.mayewski@maine.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Oversight for all activities.

Funding Support: One month from this project. Remainder fro University of Maine.

International Collaboration: No

International Travel: Yes, United Kingdom - 0 years, 0 months, 21 days

Andrei V Kurbatov

Email: akurbatov@maine.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Oversight for ice core processing and cyberinfrastructure.

Funding Support: This project.

International Collaboration: No

International Travel: No

Kirk A Maasch

Email: kirk.maasch@maine.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Oversight for climate modeling.

Funding Support: This project.

International Collaboration: No

International Travel: Yes, United Kingdom - 0 years, 0 months, 10 days

Eric Steig

Email: steig@uw.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 0

Contribution to the Project: Ice core reconstructions based on stable isotope data series. Joint publication of results.

Funding Support: None from the UM portion of this collaborative project.

International Collaboration: No

International Travel: No

Sean Birkel

Email: sbirke61@maine.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Developed the Climate Change Institute Climate Reanalyzer (TM)

Funding Support: None from this project.

International Collaboration: No

International Travel: No

Daniel Dixon

Email: daniel.dixon@maine.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Ice core data series coordination and interpretation.

Funding Support: This project

International Collaboration: No

International Travel: Yes, United Kingdom - 0 years, 0 months, 14 days; New Zealand - 0 years, 0 months, 14 days

Michael Handley

Email: handley@maine.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 2

Contribution to the Project: ICP-MS analysis

Funding Support: This project

International Collaboration: No

International Travel: No

Douglas Introne

Email: introne@maine.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 2

Contribution to the Project: MS analysis

Funding Support: This project

International Collaboration: No

International Travel: No

Sharon Sneed

Email: sharon.sneed@maine.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 2

Contribution to the Project: IC analysis, ice core sea ice extent reconstruction

Funding Support: This project

International Collaboration: No

International Travel: Yes, New Zealand - 0 years, 0 months, 14 days

Peter Acton

Email: Peter.Acton@uky.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 9

Contribution to the Project: Started with the project, but left graduate school within first year.

Funding Support: This project

International Collaboration: No

International Travel: No

Bjorn Grigholm**Email:** bjorn.grigholm@maine.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Developed a web-based description of ice core research and contributions**Funding Support:** None from this project.**International Collaboration:** No**International Travel:** No**Skylar Haines****Email:** skylar.haines@maine.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 12**Contribution to the Project:** Ice core processing and interpretation**Funding Support:** This project**International Collaboration:** No**International Travel:** Yes, Antarctica - 0 years, 0 months, 3 days**Elena Korotkikh****Email:** elena.korotkikh@maine.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Data interpretation**Funding Support:** University of Maine fellowship**International Collaboration:** No**International Travel:** No**Mario Potocki****Email:** mariusz.potocki@maine.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 12**Contribution to the Project:** Ice core processing and interpretation**Funding Support:** This project**International Collaboration:** No**International Travel:** No**Justin Lambert****Email:** Justin_Lambert@umit.maine.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 4

Contribution to the Project: Ice core processing, general laboratory duties

Funding Support: This project

International Collaboration: No

International Travel: No

Nancy Bertler

Email: nancy.bertler@vuw.ac.nz

Most Senior Project Role: Other

Nearest Person Month Worked: 0

Contribution to the Project: Provided ice core data.

Funding Support: None from this project.

International Collaboration: Yes, New Zealand

International Travel: No

Ian Goodwin

Email: ian.goodwin@mq.edu.au

Most Senior Project Role: Other

Nearest Person Month Worked: 0

Contribution to the Project: Provided ice core data. Joint publication of results.

Funding Support: None from this project.

International Collaboration: Yes, Australia

International Travel: No

Ricardo Jana

Email: rjana@inach.cl

Most Senior Project Role: Other

Nearest Person Month Worked: 0

Contribution to the Project: Provided ice core data. Joint publication of results.

Funding Support: None from this project.

International Collaboration: Yes, Chile

International Travel: No

Natalie Mahowald

Email: nmm63@cornell.edu

Most Senior Project Role: Other

Nearest Person Month Worked: 0

Contribution to the Project: Joint publication utilizing our ice core dust results for climate modeling.

Funding Support: None from this project.

International Collaboration: No**International Travel:** No**Robert Oglesby****Email:** roglesby2@unl.edu**Most Senior Project Role:** Other**Nearest Person Month Worked:** 0**Contribution to the Project:** Provided training to students for specialized climate modeling.**Funding Support:** None from this project.**International Collaboration:** No**International Travel:** No**Jefferson Simoes****Email:** jefferson.simoes@ufrgs.br**Most Senior Project Role:** Other**Nearest Person Month Worked:** 0**Contribution to the Project:** Provided ice core data. Joint publication of results.**Funding Support:** None from this project.**International Collaboration:** Yes, Brazil**International Travel:** No**John Turner****Email:** jtu@bas.ac.uk**Most Senior Project Role:** Other**Nearest Person Month Worked:** 0**Contribution to the Project:** Provided access to climate reanalysis data from the UK Met. Office. Provided selected synoptic reconstructions.**Funding Support:** None from this project.**International Collaboration:** Yes, United Kingdom**International Travel:** No**What other organizations have been involved as partners?**

Name	Type of Partner Organization	Location
British Antarctic Survey	Other Organizations (foreign or domestic)	Cambridge, UK
Cornell University	Academic Institution	Ithaca, New York
Institute for Antarctic Research (INACH)	Other Organizations (foreign or domestic)	Punta Arenas, Chile

Macquarie University	Academic Institution	North Ryde NSW, Australia
New York University	Academic Institution	New York, New York
Ohio State University	Academic Institution	Columbus, Ohio
Universidade Federal Do Rio Grande Do Sul	Academic Institution	Rio Grande Do Sul, Brazil
University of Nebraska	Academic Institution	Lincoln, Nebraska
University of Washington	Academic Institution	Seattle, WA
Victoria University	Academic Institution	Wellington, New Zealand

Full details of organizations that have been involved as partners:

British Antarctic Survey

Organization Type: Other Organizations (foreign or domestic)

Organization Location: Cambridge, UK

Partner's Contribution to the Project:

In-Kind Support

Facilities

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Provided access to ERA-Interim climate reanalysis data before it was made public. Developed synoptic meteorological reconstructions for discussion.

Cornell University

Organization Type: Academic Institution

Organization Location: Ithaca, New York

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Joint publication of dust-climate model.

Institute for Antarctic Research (INACH)

Organization Type: Other Organizations (foreign or domestic)

Organization Location: Punta Arenas, Chile

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Provided ice core data. Joint publication of results.

Macquarie University**Organization Type:** Academic Institution**Organization Location:** North Ryde NSW, Australia**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution: Provided ice core results. Joint publication of results.

New York University**Organization Type:** Academic Institution**Organization Location:** New York, New York**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution: Provided climate modeling advice.

Ohio State University**Organization Type:** Academic Institution**Organization Location:** Columbus, Ohio**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution: Provided climate reanalysis consultation.

Universidade Federal Do Rio Grande Do Sul**Organization Type:** Academic Institution**Organization Location:** Rio Grande Do Sul, Brazil**Partner's Contribution to the Project:**

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Provided ice core data. Joint publication of results.

University of Nebraska**Organization Type:** Academic Institution**Organization Location:** Lincoln, Nebraska**Partner's Contribution to the Project:**

Financial support

In-Kind Support

Facilities

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Provided training and access for students to learn WRF. Provided computer time for running climate models.

University of Washington

Organization Type: Academic Institution

Organization Location: Seattle, WA

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Collaboration concerning ice core reconstructions and joint papers.

Victoria University

Organization Type: Academic Institution

Organization Location: Wellington, New Zealand

Partner's Contribution to the Project:

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Provided ice core data. Joint publication of results.

What other collaborators or contacts have been involved?

YES

Impacts

What is the impact on the development of the principal discipline(s) of the project?

ITASE and more specifically US ITASE now provides the highest spatial and temporal resolution framework for understanding past chemical and physical change in climate over the Antarctic and the Southern Ocean. It has contributed substantially to IPCC like syntheses of Antarctic climate change through a series of seminal papers including: Mayewski et al. (2009, Reviews of Geophysics) and ACCE (2009, SCAR Special Publication). In addition, results from this project demonstrate the critical linkages between changes in atmospheric circulation associated with Antarctic climate change and impacts on the hydrology, surface ocean currents and winds of the extra-Antarctic Southern Hemisphere.

What is the impact on other disciplines?

As noted above this project has demonstrated significant linkages between changes in Antarctic climate and changes in hydrology, ocean surface currents and wind systems in extra-Antarctic regions. The latter impact human populations and the ecosystem and as a consequence many disciplines outside of the field of ice core glaciology. In addition, this project has demonstrated that human source emissions emanating from South America, Australia and some Antarctic stations are changing the chemistry of the atmosphere over Antarctica - the human fingerprint on Antarctica is evolving.

What is the impact on the development of human resources?

Two post-doctoral fellows and four graduate students (3 PhD, 1 MSc) received training in field, laboratory and interpretational tools as a consequence of direct involvement in this project.

What is the impact on physical resources that form infrastructure?

As a consequence of this project the Climate Change Institute developed a new climate analysis tool - The CCI Climate Reanalyzer (TM) that allows researchers and the public to easily access and examine climate reanalysis data.

What is the impact on institutional resources that form infrastructure?

Same as above.

What is the impact on information resources that form infrastructure?

US ITASE retrieved an unparalleled 47 ice cores from throughout West and East Antarctica. All data analyzed as part of this project is now available to the public at data centers - NSIDC and IceReader.

What is the impact on technology transfer?

As a consequence of this project the Climate Change Institute developed a new climate analysis tool - The CCI Climate Reanalyzer (TM) that allows researchers and the public to easily access and examine climate reanalysis data.

What is the impact on society beyond science and technology?

In the late 1960s through 1980s Antarctica was thought to be a timeless, relatively non-dynamic, highly remote region that had little to no connection with the rest of the planet. By the 1990s and continuing to the present it has become clear through the efforts of programs like ITASE and its 21 national partners including US ITASE that Antarctica is: (1) impacted by human activity from global sources, (2) significantly more complex climatically and glaciologically than previously thought and, (3) experiencing climate and glaciological changes that have regional to hemispheric to global reach.

Changes/Problems

Changes in approach and reason for change

N/A

Actual or Anticipated problems or delays and actions or plans to resolve them

None

Changes that have a significant impact on expenditures

None

Significant changes in use or care of human subjects

N/A

Significant changes in use or care of vertebrate animals

N/A

Significant changes in use or care of biohazards

N/A

