NOTUS

The AGCS Newsletter

Issue 3 June 2009

Inside...

Editor's Column

Nancy Bertler
Victoria University & GNS Science, NZ

I hope you enjoy the third issue of NOTUS, the newsletter of the AGCS, or 'Antarctica in the Global Climate System'. I am delighted to take over from Mike Meredith, who established NOTUS and produced excellent previous issues. NOTUS aims to provide updates on AGCS science highlights and activities, as well as relevant conferences and meetings. For this reason we welcome and invite contributions from the wider science community. This can include relevant science highlights, an opinion piece, a discussion on knowledge gaps, as well as advertisements for conferences and graduate student projects. If you have something in mind - just drop me a line . I look forward to hearing from you.

A word from the new Chair

Alberto Naveira Garabato
Ocean and Earth Science National Oceanography Centre, UK

Dear AGCS Friends and Colleagues,

It is my pleasure to serve as the new chair of the AGCS Steering Committee. AGCS has come a long way since its research programme was first approved by SCAR over 4 years ago. Under the wise leadership of John Turner, whose remarkable legacy will be difficult to equal, the AGCS community has contributed to many important advances in understanding the Antarctic and Southern Ocean climate system; it has driven a range of scientific fieldwork, data recovery and outreach activities related to Antarctic climate; and it has stimulated a range of workshops and publications to further research in the field. The culmination of John's efforts as AGCS chair is the landmark report on Antarctic Climate Change and the Environment (ACCE). The ACCE report seeks to synthesize our present knowledge on the past and possible future changes in the physical environment of Antarctica and the Southern Ocean and their impact on the biota, and will be published by SCAR in 2009. To my relief as incoming chair, John will now serve as a member of the AGCS Steering Committee and will continue to drive AGCS science forward as actively as ever...

For those of you who may not be familiar with me, I'd like to take this opportunity to introduce myself. I'm a physical oceanographer based at the National Oceanography Centre, Southampton (U.K.) with a decade-long interest in the ocean circulation and climate of the Southern Ocean region. I have contributed to the promotion and strategic coordination of Antarctic climate research for the last four years through membership of the AGCS Steering Committee and of the CLIVAR / CliC / SCAR Southern Ocean Region Implementation Panel. As well as continuing to advance many of the fruitful research, data recovery and outreach activities that AGCS has promoted to date, my goals as chair of AGCS will be to support the design and establishment of an observing system of the Southern Ocean and Antarctic climate, building on the impetus provided by the International Polar Year; and to extend AGCS's remit to include several important aspects of the regional climate system (such as the carbon cycle) that have so far received little attention. I look forward to working with many of you to help make this new chapter of AGCS science as successful as its predecessor.

John Turner,
British Antarctic Survey, UK

Science Highlight "SASOCS" Status Quo and how Antarctica is Changing

State of the Antarctic and Southern Ocean Climate System (SASOCS)

Mayewski, P.A. Meredith, M.P., Summerhayes, C. P., Turner, J. , Worby, A., Barrett, P. J, Casassa, G., Bertler, N. A. N., Bracegirdle, T., Naveira Garabato, A. C., Bromwich, D., Campbell, H., Hamilton, G., Lyons, W. B., Maasch, K. A., Aoki, I, Xiao, C., van Ommen, T

SASOCS is a review compiled by the AGCS team under the leadership of Paul Mayewski. It summarises current knowledge on major climate shifts at various time scales of Antarctic history. Five past and future time slices are discussed in detail – the climate of the past 65 Million years, the past 1 Million years, the past 12,000 years, the past 50 years, and provides an outlook for the next 100 years. During the past 65 Million years, Antarctica experienced predominantly a cooling trend and changed from a greenhouse world to a transition world to an icehouse world that dominated the past 15 Million years. During this time period the CO_2 concentration of the atmosphere dropped from ~2000-1000 ppm (parts per million) to below 400 ppm. The past 1 Million years was dominated by 100,000 year glacial-interglacial cycles that intensified during the most recent 4 cycles with CO_2 levels oscillates between a narrow range of 180 and 300 ppm. During the past 12,000 years Antarctica experienced a climatic optimum until 9,000 years ago that initiated the retreat of the Ross Ice Shelf to its modern position between 9,000 to 7,000 years ago. Two of the most prominent abrupt climate change events occurred between 6000 and 5000 years ago and since 1200-1000 years ago during which the circumpolar westerlies, as indexed by the Southern Annular Mode, intensified, which led to large scale cooling. Between 5,000 and 1,200 years ago the westerlies weaken and East Antarctica and Siple Dome experience milder conditions. This is associated with an increase in penguin population (penguin optimum) and decreased sea-ice extent. For the past millennium East and West Antarctica operate inversely on multidecadal and centennial time scales. Over the past 50 years, substantial climatic changes shaped the Antarctic continent. Atmospheric temperatures have increased markedly over the Antarctic Peninsula, linked to nearby ocean warming and intensification of the circumpolar westerlies. Furthermore, the stratosphere experienced a ~10K cooling, accompanied by a warming of the mid troposphere. The annual decay of the polar vortex shifted from December to November. While Antarctic deep water has warmed, the Ross Sea has freshened and cooled. In addition, the Antarctic and Arctic ozone holes develop in this most recent time period. Most recently we have seen the disintegration of a number of ice shelves at the Antarctic Peninsula and the break-up of large icebergs in the Ross Sea.

A full description of this work is given in: Mayewski, P.A. Meredith, M.P., Summerhayes, C. P., Turner, J. , Worby, A., Barrett, P. J, Casassa, G., Bertler, N. A. N., Bracegirdle, T., Naveira Garabato, A. C., Bromwich, D., Campbell, H., Hamilton, G., Lyons, W. B., Maasch, K. A., Aoki, I, Xiao, C., van Ommen, T. (2009): State of the Antarctic and Southern Ocean Climate System. Reviews of Geophysics, 47, RG1003 / 2009, 38p.

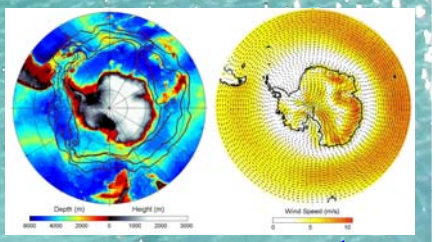


Fig: Key elements of the Antarctic and Southern Ocean climate system. Bathymetry and topography of Antarctica and the Southern Ocean and wind vectors at 10 m height, with wind speed coloured as background

Coming Soon: ACCE—Antarctic Climate Change and the Environment

Antarctic Climate Change and the Environment

ACCE

ACCE is a major report under the leadership of John Turner that synthesizes the present knowledge on the past and possible future changes in the physical environment of Antarctica and the Southern Ocean and their impact on the biota. A draft with 90+ contributors has been circulated to the whole SCAR community for comment and is now in its final editing states. We aim to complete the document and release it widely as a PDF by the end of 2009. We are also investigating getting a hard copy version printed so that it can be given to libraries. To keep the document topical we are considering loading it onto a wiki so that periodic updates can be carried out. For a pre-view check out: http://www.antarctica.ac.uk/met/SCAR_ssg_ps/ACCE.htm

Understanding the warming of Antarctic Bottom Water in the Atlantic

Mike Meredith 1 Alberto Naveira Garabato 2, Arnold Gordon 3, Greg Johnson 4.

1 BAS, UK; 2 MPCS, UK; 3 LDEO; 4 NOAA/PMEL

Science Highlight "Antarctic Bottom Water Warming"

The Southern Ocean hosts the formation of the densest layers of the oceanic overturning circulation, and provides a climatically sensitive element of deep ocean ventilation. The Weddell Sea is a key site for these dense water production processes, with the Antarctic Bottom Water (AABW) created being exported northward toward the abyssal Atlantic most directly via the Scotia Sea. AABW in the Atlantic has warmed significantly in recent decades, and whilst much progress has been made, the mechanisms involved have not been well determined.

To investigate further the causes of AABW warming in the Atlantic, we used repeat hydrographic section data from the eastern Scotia Sea collected in 1995, 1999 and 2005. We found a reduction in the volume of AABW during 1995-2005, consistent with the warming seen downstream in the Atlantic, though such a reduction was only clear between 1995 and 1999 at the southern end of the section. The abyssal waters of the eastern Scotia Sea changed circulation between 1995 and 1999, with the dominant point of their entry to the basin shifting from the south to the northeast; by 2005, the former route had regained dominance.

The changes we observed are best explained by interannual variations in the deep waters exiting the Weddell Sea, superimposed on a longer-term (decadal) warming trend. The interannual variations are related to export processes associated with changes in the strength of the Weddell Gyre, reflecting large-scale atmospheric variability that may include forcing by coupled modes of climate variability such as ENSO. The decadal trend is also likely related to changes in the strength of the Weddell Gyre, but might also include a component due to variability in formation properties of AABW. This water mass fills the abyss of much of the world ocean, and the evolution of its properties represents a significant part of the changing global heat budget. The processes identified here need to be considered when attempting to predict the future of this pervasive water mass.

A full description of this work is given in:-

Meredith, M.P., A.C. Naveira Garabato, A.L. Gordon and G.C. Johnson. "Evolution of the Deep and Bottom Waters of the Scotia Sea, Southern Ocean, 1995-2005". Journal of Climate, 21, 13, 3327-3343, 2008.

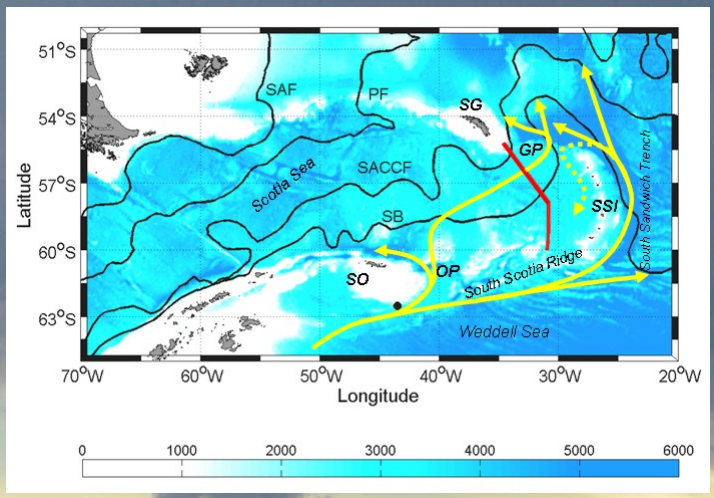
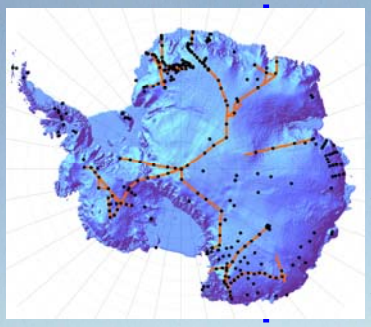


Fig : Schematic of the spreading of AABW (yellow lines) from the Weddell Sea toward the South Atlantic. The most direct route is via the Scotia Sea; the location of the repeat hydrographic section we have been using to document changes in AABW here is marked in red.

International Trans Antarctic Scientific Expedition (ITASE) Synthesis Workshop: Recent Change in the Climate and Atmospheric Chemistry over Antarctica

Daniel Dixon, Massimo Frezzotti, Elisabeth Isaksson, Thamban Meloth



The Ice Reader shaded relief map of Antarctica showing ITASE core locations (black dots) and GPR transects (orange lines)

Changing global climate is forcing scientists to vigorously test the existing paradigms and to find improved evidence of how the climate system really works at various time scales. With polar regions being the pacemakers of climate change, it is imperative to gain critical knowledge on the role and response of the cryosphere system in a warming scenario. However, due to the lack of long-term instrumental climate records in remote places like Antarctica, scientists are focusing on ice core proxy climate records buried in the vast ice sheets of Antarctica that provide valuable information on climate change from interannual to millennial scales. One such multi-national effort to obtain climate archives from Antarctica is the International Trans-Antarctic Scientific Expedition (ITASE). Operating since 1990, twenty one countries are now involved in ITASE programs to understand the impact of global change on the Antarctic continent and the influence of Antarctica on global change during the last ~200-1000+ years.

Data are now available on line—ICE Reader — at http://www.icereader.org

At the idyllic coastal Maine village of Castine, Prof. Paul Mayewski and his group from the Climate Change Institute at University of Maine collected 32 glaciologists, geophysicists and climate modelers to discuss and synthesize the results obtained thus far from the ITASE programs. This synthesis workshop generated many fruitful discussions on the data, and also future directions.

By combining available meteorological data from the Antarctic and Southern Ocean with firn/ice core proxies for a variety of climate parameters (e.g., moisture balance, atmospheric circulation and temperature) ITASE is actively working to extend the Antarctic climate and atmospheric chemistry records back at least ~200 years. This offers the temporal perspective needed to assess the multi-decadal variability of natural Antarctic climate.

Participants at the ITASE Synthesis Workshop, held at the Manor Inn Castine, Maine from 2-5 September, 2008

The main focus for this workshop was to get an updated overview of newly collected firn/ice cores and available data sets. A large effort is planned to make the data available online in order to facilitate a number of synthesis products. In addition, we had a number of presentations from the participants with information both on syntheses of previously collected data and also new developments from the many participating countries. One of the important new results discovered by members of the ITASE group is that the climate of West Antarctica appears to have warmed during the last several decades.

Other interesting aspects discussed were the importance of the Southern Annular Mode (SAM) in Antarctic climate change as well as climate teleconnections related to extra-tropical systems like the El Nino Southern Oscillation (ENSO). It was also concluded that firn/ice core records should be interpreted in combination with snow Ground Penetrating Radar (GPR) surveys to ensure continuous chronology and climate data from the cores. Based on the available data and our current state of knowledge we agreed that the following synthesis products from the ITASE community will be created in the near future:

- Temporal variability of snow accumulation using well-dated firn/ice cores with reference horizons such as sulphur peak from the eruptions of Tambora 1815 as well as the atomic bomb tests of 1964/65.
- Sea ice proxy reconstruction using a combination of sea salt and methanesulphonic acid (MSA) records from coastal ice cores around Antarctica.
- Proxy Atmospheric Reanalysis of AnTarctica (PARAT).
- Temperature reconstruction during the past 200 years using ice core proxy data.
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In addition to the interesting talks and discussions, we also enjoyed an afternoon of sailing in Penobscot Bay on the polar-class schooner Bowdoin which has sailed many times to Greenland. ITASE is jointly sponsored by the Scientific Committee on Antarctic Research (SCAR) and the Past Global Changes (PAGES) project of the International Geosphere Biosphere Program (IGBP). The next workshop is planned to take part in connection with the SCAR meeting in Buenos Aires (Argentina) in July 2010.

Reconstructing sea ice variability and primary productivity of the Ross Sea from methylsulphonate snow record

Rachael H. Rhodes, Nancy A. N. Bertler, Joel A. Baker, Sharon B. Sneed, Hans Oerter, Kevin R. Arrigo

Science Highlight "Antarctic Sea ice and primary productivity"

The Ross Sea contains the most biologically productive continental shelf in Antarctica and is a region where the annual formation of sea ice drives substantial amounts of bottom water formation. Knowledge of sea ice behaviour in the Ross Sea is currently limited to thirty years of satellite data. An accurate sea ice proxy, extending the observational data set, is crucial in order to establish the response of Antarctic sea ice to oceanic and atmospheric forcings.

We report snow pit chemistry data from Mt Erebus Saddle, Ross Island. The chemical species methylsulphonate (MS) has a single source in the Southern Ocean; it is a by-product of a chemical produced by phytoplankton and diatoms found in close association with sea ice. The methylsulphonate record is strongly correlated with changes in the area of open water ($R^2 = 0.903$, $p < 0.05$) indicating that an increase in open water area leads to a proportional increase in MS concentration in the snow pit record and vice versa.

Furthermore, MS and phytoplankton net primary production correlate significantly ($R^2 = 0.927$, $p < 0.01$) demonstrating that the annual mean MS is a direct measure of the rate of marine primary productivity. The interannual variability of the record is caused by differences in atmospheric circulation and the sea-ice-damming effect of large icebergs, B-15 and C-19, which calved from the Ross Ice Shelf in 2000 and 2002 respectively.

Our results demonstrate the potential of the 180 m deep Mt Erebus Saddle ice core to reconstruct sea ice and primary productivity variability in the Ross Sea beyond the observational record. Together, these longer-term records would improve our understanding of the past, and possible future, influence of ice dynamics on bottom water formation and of primary production on CO_2 uptake in a key region of the Southern Ocean.

A full description of this work is given in:
Rhodes, R. H., N. A. N. Bertler, J. A. Baker, S. B. Sneed, H. Oerter, and K. R. Arrigo (2009), Sea ice variability and primary productivity in the Ross Sea, Antarctica, from methylsulphonate snow record, Geophys. Res. Lett., 36, L10704, doi:10.1029/2009GL037311.

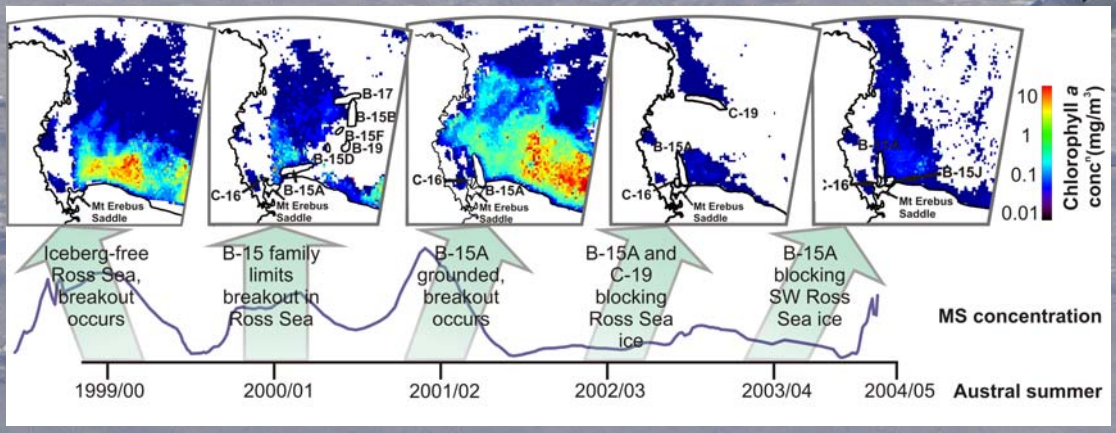

Fig. : MS time series with images showing distribution of photosynthetic pigment, chlorophyll a, concentrations in the south-western Ross Sea in mid-December . High concentrations of chlorophyll a in the surface ocean indicate primary production is high. Iceberg locations are indicated and the effect on sea ice is described.

Report on the International Workshop on Antarctic Sea Ice in IPY

Tony Worby and Steve Ackley

International Workshop on Antarctic Sea Ice in IPY

The International Workshop on Antarctic Sea Ice in IPY was held over 2½ days in Barga, Italy, a village in Tuscany. It followed the 2009 Gordon Conference on Polar Marine Science "Beyond IPY: Crossing Boundaries", a multi-disciplinary bi-annual meeting that brought together scientists from both polar regions.

The workshop was co-sponsored by SCAR AGCS and attracted 47 attendees, 30 of whom participated in the 2009 Gordon Conference and 17 of whom travelled to Italy solely to attend the workshop. Many of the attendees were participants in one of the two major sea ice research voyages which took place in the Antarctic sea ice zone in spring 2007. These were the Australian-led "Sea Ice Physics and Ecosystem eXperiment (SIPEX)" program which focused on the region between 110-130°E, and the US-led "Sea Ice Mass Balance in the Antarctic (SIMBA)" program which took place in the Bellingshausen Sea, around 90°W. While many of the in situ measurements conducted on the two programs were similar, the sampling strategies differed in that the SIPEX program conducted 15 separate ice stations at different locations within the pack ice, while the SIMBA program focused primarily on one station to conduct long time-series measurements for almost 1 month. The goal of the workshop was therefore to explore synergies between the programs in terms of data analysis and to discuss opportunities for preparing joint or complementary publications.

The workshop sessions explored the different data sets collected on each voyage, including physical, biological and biogeochemical parameters, and in situ and airborne measurements. The voyage data sets provide a unique opportunity to compare contemporary information on snow and ice processes and characteristics from west and east Antarctica and sessions focused on questions such as the temporal-spatial evolution of the snow cover, the physical processes affecting the vertical distribution of biota in the ice, the transfer processes of tracers within the sea ice and the accumulation of iron, the limiting nutrient for Southern Ocean primary productivity.

In addition to the participants of the SIPEX and SIMBA voyages, other members of the sea ice community also attended. They brought expertise in different aspects of Antarctic sea ice processes, modelling and remote sensing. Ground truthing of remotely sensed data was a major emphasis of both voyages and the workshop, since specific RADARSAT and ICESat missions coincided with the field programs as well as an archival campaign for Envisat ASAR imagery.

A key output of the workshop was a final list of almost 40 papers confirmed for a special volume of Deep Sea Research-II. An editorial committee was identified, including Tony Worby (Chief Editor), Petra Heil, Klaus Meiners, Chris Fritsen, Lisa Miller and Cathy Geiger. A submission deadline of October 31st 2009 was agreed to ensure the volume can be published in late 2010.

The full report is available on the AGSC web pages (see Whiteboard for url)

SCAR Delegates approve extension of AGCS

Nancy Bertler

We are pleased to announce that the SCAR Delegates Meeting in Moscow in July 2008 approved the extension of the AGCS programme for another 4 years. In addition, a recently conducted review by SCAR (working paper 19, available online on the SCAR webpage) concluded that the programme was highly successful and effective. It further noted that the programme could strengthen its public outreach effort as well as its public visibility. As AGCS has a large outreach component (60 Minutes documentary, AGCS webpage, AGCS logo, SASOCS publication, EOS publications, newsletter NOTUS, school visits), the AGCS steering committee believes the apparent underachievement is to a significant proportion due to incomplete reporting on outreach efforts. However, we feel strongly that public outreach is a critical component of any successful science programme. If you have suggestions on how we could improve our public visibility and outreach efforts, or have contributions which you would like to include, please drop me or Alberto (AGCS Chair) a line. You find our contacts on the Whiteboard (last page). Many thanks

SCAR Delegates approve extension of AGSC

Ozone Depletion causing Increase in Antarctic Sea Ice

J. Turner,1 J. Comiso, G. Marshall, T. Lachlan-Cope, T. Bracegirdle, T. Maksym, M. Meredith, Z. Wang, A. Orr

Antarctica and the Arctic have experienced remarkably different trends in sea ice extent since the 1970. While in the Antarctic sea ice has increased by about 0.97% per year, in particular in the Weddell Sea, Pacific Ocean, and the Ross Sea sectors, the Arctic has experienced a substantial loss with record minima during 2005 and 2007. In September 2007 sea ice extent was 39% lower than average. Here we used passive microwave satellite data, that demonstrate that the largest increase has been during autumn in the Ross Sea sector. We propose that this is caused primarily by stronger cyclonic circulation, which in turn is caused by stronger atmospheric flow over the Amundsen Sea. We show that stratospheric ozone depletion has strengthened the Amundsen Sea Low enhancing atmospheric flow around steep coastal orography. However, the observed sea ice increase might still lie within natural climate variability.

A full description of this work is given in: J. Turner,1 J. Comiso, G. Marshall, T. Lachlan-Cope, T. Bracegirdle, T. Maksym, M. Meredith, Z. Wang, A. Orr: Non-annular atmospheric circulation change induced by stratospheric ozone depletion and its role in the recent increase of Antarctic sea-ice extent. Geophysical Research Letters, Vol.36, L08502, doi:10.1029/2009GL037524, 2009

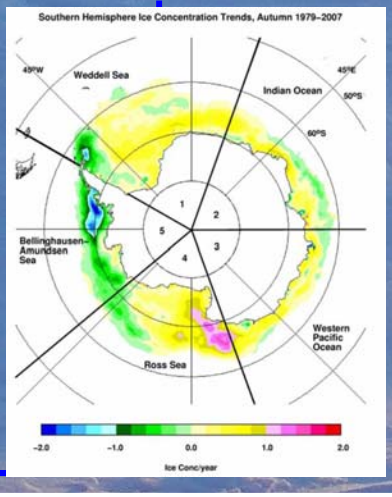

Fig: Spatial pattern of autumn sea ice concentration changes over 1979-2007

Science Highlight: "Ozone Depletion and Sea Ice Extent"

Internal melting in Antarctic sea ice: Development of "gap layers"

S. F. Ackley, M. J. Lewis, C. H. Fritsen, and Hongjie Xie

Science Highlight "Antarctic Sea ice and gap layers"

"An internal "gap" layer of deteriorated sea ice containing a significant microbial biological community is found in Antarctic sea ice in summer. Gap layer formation was modeled using a thermal flux model based on summer reversal in thermal gradient and the thermal conductivity found in the upper ice column. The internal melt rates for this process give good agreement when summed and compared to the cumulative melted layer thicknesses seen in field observations. These conditions are commonly found in the Antarctic sea ice zone during summer, and support a significant contribution of gap layers to the ice mass balance and productivity on a circumpolar basis. Inclusion of this process in both air-ice-ocean interaction and biogeochemical models should therefore improve model fidelity for sea ice response to climate forcing and lend confidence to their predictions under global change for Antarctic sea ice, and perhaps for future conditions at both poles.

A full description of this work is given in: Ackley, S. F., Lewis, M. J., Fritsen, C. H., and Xie, H. (2008): Internal melting in Antarctic sea ice: Development of "gap layers". Geophysical Research Letters, Vol. 35, L11503,

Fig: Photo of a "gap layer"

AGCS related Student Projects

- **PhD Project**: Recent Climate and Volcanic History of Mt Erebus, Antarctica. The project will analyse shallow ice cores recovered from around the active Mt Erebus volcano and correlate trace element concentration with measurements made from within the grater. For more information contact: Nancy.Bertler@vuw.ac.nz

- **MSc Project**: Ocean Heat Flux under Antarctic Sea Ice. Ocean Heat Flux is being calculated from measurements of under-ice salinity and temperature and ice growth and melting rates. These measurements were obtained from drifting buoy sensors deployed in the Bellingshausen and Amundsen Seas in 2007 and 2009. Contact: Elizabeth Murphy (eliz.a.murphy@gmail.com) and Stephen.Ackley@utsa.edu

- **MSc Project**: Determining Ice Thickness Distribution and Concentration for Sea Ice in Antarctica using Automated Devices: The proxy for ice thickness distribution and concentration for the sea ice in the Bellingshausen Sea during the austral winter season 2007 is being calculated by the use of ship-based observations, video monitoring camera devices, and an electromagnetic induction device. This will determine the best automated method that can be used to collect datasets to provide validation for satellite products improve accuracy in large-scale models. Contact: Penelope Wagner (penelopewagner@live.com) and Stephen Ackley (stephen.ackley@utsa.edu)

- **PhD Project**: Inter-comparisons of Antarctic Sea Ice Properties derived from Ship Observations and Microwave Satellite Data. Both active and passive satellite microwave remote sensing data were used in this study in addition to insitu observations to obtain detailed information on different sea ice properties (multiyear, firstyear, leads, and marginal). Contact: Burcu Ozsoy-Cicek (burcu@drcicek.com), Stephen.Ackley (Stephen.Ackley@utsa.edu) and Hongjie Xie (Hongjie.Xie@utsa.edu)

- **PhD Project**: Remote Sensing of Snow Ice Interface Temperature and Sea Water Flooding. The study investigates the use of time-series of passive microwave brightness temperature, in situ temperature data collected from ice mass balance buoys in Antarctica, and microwave emission modeling to identify emissivity changes at the snow/ice interface due to sea water flooding events. Contact: Michael Lewis (mlewis@swri.org), Stephen Ackley (Stephen.Ackley@utsa.edu) and Hongjie Xie (Hongjie.Xie@utsa.edu)

The Whiteboard

Dates for your diary

- IPICS Steering Committee Meeting, 5-7 July 2009, Covallis, USA
- AGSC Steering Committee Meeting, 24 July, Montreal, Canada
- X SCAR International Biology Symposium, 26-31 July 2009, Sapporo, Hokkaido, Japan
- First Antarctic Climate Evolution (ACE) Symposium, 7-11 September 2009, Grenada, Spain
- 4 Degrees and Beyond - International Climate Conference, 28-30 September 2009, Oxford, UK
- United Nations Climate Change Conference, 7-18 December 2009, Copenhagen, Denmark
- International Symposium on Sea Ice, 31 May - 4 June 2010, Tromsø, Norway
- IPY Oslo Science Conference, June 2010, Oslo Norway
- XXXI SCAR and Open Science Conference, 30 July - 11 August 2010, Buenos Aires, Argentina

Your AGCS Steering Committee Contacts

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- David Bromwich (Leader of Theme 1), Byrd Polar Research Centre, Ohio State University, USA (Bromwich.1@osu.edu)
- Helen Campbell (SCADM representative), British Antarctic Survey, UK (hcamp@bas.ac.uk)
- Gino Casassa, Centro de Estudios Cientificos, Chile (GC@cecs.cl)
- Siobhan O'Farrell, Commonwealth Scientific and Industrial Research Organisation, Australia (Siobhan.O'farrell@csiro.au)
- Paul Mayewski (Leader of Theme 2), Climate Change Institute, University of Maine, USA, (paul.mayewski@maine.edu)
- Mike Meredith (Leader of Theme 4), British Antarctic Survey, UK (mmm@bas.ac.uk)
- Azizan Hj. Abu Samah, University of Malaya, Malayasia (azizans@um.edu.my)
- John Turner, British Antarctic Survey, UK (Leader of Theme 3) (jtu@bas.ac.uk)
- Tas van Ommen, Australian Government Antarctic Division, Australia (tas.van.ommen@utas.edu.au)
- Cunde Xiao, Chinese Meteorological Administration, Beijing (cdxiao@cams.cma.gov.cn)

To Contact NOTUS please email:

Nancy.Bertler@vuw.ac.nz. Please type 'NOTUS' into the subject line. Many thanks.

Useful Data Bases

AGCS produced data can be found in a range of data bases. However, we would like to point in particular to the following:

- AGCS data portal – part of the Antarctic Master Directory, this portal provides searchable information on projects and data associated with AGCS - http://gcmd.gsfc.nasa.gov/KeywordSearch/Home.do?Portal=agcs
- Met Reader (REference Antarctic Data for Environmental Research) is a project of the Scientific Committee on Antarctic Research (SCAR) and has the goal of creating a high quality, long term dataset of mean surface and upper air meteorological measurements from in-situ Antarctic observing systems. Access via: http://www.antarctica.ac.uk/met/READER/
- Ice Reader: This data base is also sponsored by the Scientific Committee on Antarctic Research (SCAR), and hosts basic data from ice cores of the Antarctic Continent. The goal is to compile a complete list of cores by name, site, location and as much other information as possible. Access via: http://www.icereader.org/icereader/
- Southern Ocean Reader is a portal for links to temperature, salinity and ocean current data from the Southern Ocean. Access via: http://www.antarctica.ac.uk/met/SCAR_ssg_ps/OceanREADER/)

For more information on AGCS please visit our webpage:

http://www.antarctica.ac.uk/met/SCAR_ssg_ps/AGCS.htm