



NOTUS

The AGCS Newsletter

Issue 1

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Editor's Introduction

Welcome to the first issue of Notus, the newsletter of the SCAR Antarctica and the Global Climate System (AGCS) research programme. (Why "Notus"? See Page 8!)

What is AGCS?

In case you haven't come across it before, AGCS is one of the five strategic research programmes operated by the Scientific Committee on Antarctic Research (SCAR). Each of these is designed to coordinate and advance research in specific areas of science relevant to Antarctica and the Southern Ocean, and AGCS, as the name suggests, is concerned with the role of high southern latitudes in global climate. It covers a range of scientific disciplines including (but not limited to) meteorology, climatology, oceanography and glaciology, and the intention is to bring together researchers from each of these areas to address key questions of global relevance.

AGCS is a 10-year programme, and will be subject to periodic reviews by SCAR to ensure the correct direction and progress. It is led by John Turner of the British Antarctic Survey, and is based around four inter-leaving themes:-

- 1) Decadal timescale variability in the Antarctic climate system (leader David Bromwich, Byrd Polar Research Center)
- 2) Global and regional signals in ice cores (leader Paul Mayewski, Climate Change Institute, University of Maine)
- 3) Natural and anthropogenic forcing on the Antarctic climate system (leader John Turner, British Antarctic Survey)
- 4) The export of Antarctic climate signals (leader Mike Meredith, British Antarctic Survey)

AGCS benefits from strong links externally, for example to the WCRP CLIVAR programme. It also has strong links within SCAR, including to ITASE, ASPeCt and JCADM. (ASPeCt and JCADM are represented by Tony Worby and Helen Campbell respectively—more details of their AGCS activities are on pages 5 and 6).

AGCS has a Steering Committee drawn from a wide cross section of the relevant science disciplines (see back page), and an embryonic website at www.scar.org/researchgroups/physicalscience/agcs/, where more details on AGCS, its plans and implementation, can be found.

Of prime importance to note is that AGCS is not just a research programme, but a community. As such, it can only flourish with the active participation of researchers from around the world. To this end, you are encouraged to get involved, and reap the benefits of collaboration with a broad section of scientists with similar and complementary interests.



Notus, the AGCS Newsletter

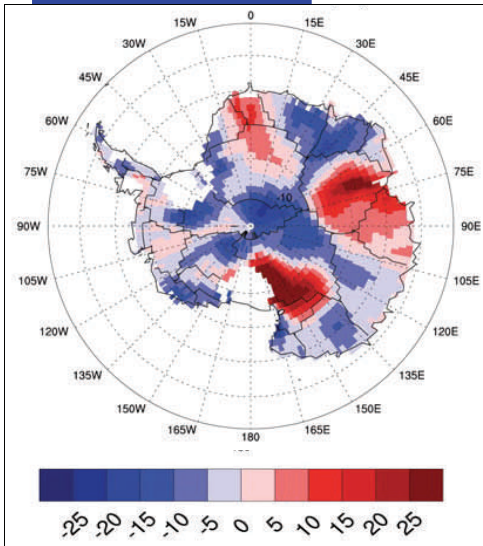
AGCS is relatively new (as are all the SCAR strategic research programmes) having started at the beginning of 2005. However, significant progress with some AGCS activities has already occurred, and the science areas we are working in are continuously advancing. It was therefore considered timely to create an AGCS Newsletter, to pass on details of the activities, developments and findings of the AGCS community, and to encourage participation in AGCS from the broadest possible section of researchers.

The intention is to produce issues of Notus a few times per year, and you are strongly encouraged to use it! If you have news, information or research findings that you feel are worth bringing to people's attention, please contact the editor (Mike Meredith, mmm@bas.ac.uk) with details, and I will happily include them.

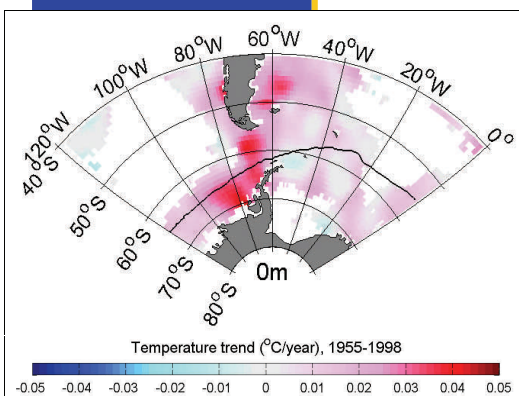
- Mike Meredith, Ed.

Report to SCAR Delegates' Meeting in Hobart

Change in precipitation during 1995-2004, relative to the 50 year mean (1955-2004). See science highlight 1.



Warming of the ocean surface to the west of the Antarctic Peninsula (see AGCS science highlight 5)



At the recent SCAR Delegates' Meeting in Hobart (July 2006) I presented a progress report on AGCS and a forward look on the work we would undertake over the next two years. SCAR require us to put forward five science highlights that have come out of the programme and prior to the meeting I had consulted with the AGCS Steering Committee and we elected to use the following:-

1. An analysis of recent trends in Antarctic snow accumulation from ice core and model data showed that over the continent as a whole the annual trends are small and not statistically different from zero, suggesting that recent Antarctic snowfall changes do not mitigate current sea level rise. The work was carried out using the ERA-40 re-analysis and a suite of ice core accumulation records primarily from the SCAR ITASE program (Monaghan et al., *Science*, Vol. 313, no. 5788, pp. 827- 831, 2006).
2. An undocumented major warming of the Antarctic winter troposphere was discovered that is larger than any previously identified regional tropospheric warming on Earth. The warming was identified by a careful analysis of the balloon-launched radiosonde data for the Antarctic extending back into the 1950s that forms part of the SCAR READER data base. The warming is largest close to 5 km above sea level where temperatures have increased at a rate of 0.5 – 0.7°C over the last 30 years (Turner et al., *Science*, Vol. 311, no. 5769, pp. 1914-1917, 2006).
3. Ice core reconstructions of past atmospheric circulation suggest that modern atmospheric circulation intensity is within the range of variability of the last ~1000 years (Mayewski and Maasch, 2006). Ice core records also reveal increased penetration of marine air masses into the western coastal regions of West Antarctica as of the 1940s (Dixon et al., 2006).
4. Modelling studies have shown for the first time that the major, near-surface increase in temperature on the eastern side of the Antarctic Peninsula has been caused, at least in part, by increases in greenhouse gases. Over the last few decades the Southern Hemisphere Annular Mode (SAM) has shifted into its positive phase during the summer, resulting in a drop (increase) in atmospheric pressure over the Antarctic (mid-latitudes). This has resulted in a strengthening of the westerly winds around the Antarctic and more mild, maritime air masses crossing the Antarctic Peninsula. The warming has been instrumental in the disintegration of the ice shelves in this area (Marshall et al., *Journal of Climate*, 19, 5388-5404, 2006).
5. The climate of the Western Antarctic Peninsula (WAP) is the most rapidly changing in the Southern Hemisphere, with a rise in atmospheric temperature of nearly 3 °C since 1951 and associated cryospheric impacts. It has been demonstrated for the first time, that the adjacent ocean showed profound coincident changes, with surface summer temperatures rising more than 1 °C and a strong upper-layer salinification. Initially driven by atmospheric warming and reduced rates of sea ice production, these changes constitute positive feedbacks that will contribute significantly to the continued climate change. Marine species in this region have extreme sensitivities to their environment, with population and species removal predicted in response to very small increases in ocean temperature. The WAP region is an important breeding and nursery ground for Antarctic krill, a key species in the Southern Ocean foodweb with a known dependence on the physical environment. The changes observed thus have significant ecological implications (Meredith and King, *Geophysical Research Letters*, 32, L19604, 2005).

Report to SCAR Delegates' Meeting in Hobart (cont.)

Before the SCAR Delegates' Meeting in Hobart, the AGCS Steering Committee met and agreed to the following targets for the next two years:-

1. Assessment of the Antarctic element of the IPCC Assessment Round 4 model predictions for the next century
2. Investigation of the mechanisms responsible for changes in the SAM
3. Research into mechanisms behind the mid-tropospheric warming above the Antarctic that occurred over the last 50 years.
4. Investigation of the current state of the Antarctic climate in the context of the last several hundred years for purposes of assessing natural versus anthropogenic impact.
5. Interference between SAM and ENSO signals in Antarctica.
6. Teleconnections between Austral – Mid-latitudes* and the Antarctic (*Southern South America, Southern Ocean islands, and New Zealand)

The committee also agreed on the following additions of important and achievable targets:-

7. Production of a 200 year array of coastal cores from Antarctica, to facilitate work on sea ice extent
8. Investigation of marine productivity to understand sea-ice extent in proxy records
9. Quantification of oceanic heat, volume, and fresh water fluxes in the Southern Ocean in terms of its current mean state.
10. Interaction of the ocean with the ice sheet, ice shelves, and the atmosphere at the Antarctic margin
11. Understanding the driving mechanisms in the Southern Ocean overturning
12. Progress with drifting buoy deployment
13. Contribution to Reanalysis efforts
14. Increased efforts to address sea ice thickness
15. Developments of data bases, such as READER

Overall the Delegates were very pleased with the progress of our programme and the results that have been achieved over the last two years. The next main SCAR meeting will be held in conjunction with the third SCAR Open Science Conference in St Petersburg, Russia in July 2008. At that meeting there will be a more formal review of all five of the SCAR Science Programmes so please keep us informed of all your achievements that form part of AGCS.

— John Turner



AGCS at the European Geosciences Union



There will be a special AGCS session at the EGU General Assembly in Vienna, Austria, 15-20 April 2007, imaginatively titled "Antarctica and the Global Climate System". This will be convened by Alberto Naveira Garabato, John Turner and Paul Mayewski on behalf of the AGCS committee.

The conveners welcome contributions on all subjects relevant to AGCS, and would particularly like to use the session to



strengthen our community and to create linkages between the related disciplines.

More information on the meeting is available at <http://meetings.copernicus.org/egu2007/> and further information on the session (such as invited speakers) will be posted on this site as plans develop.

- Alberto Naveira Garabato

The Southern Ice Ocean Model Intercomparison Project (SIOMIP).

A new proposal for a Southern Ice Ocean Model Intercomparison Project is being developed by colleagues based at a number of centres with the impetus coming from the Antarctic sea ice community, following on from a meeting on Antarctic ice thickness in Hobart in July 2006 organized by ASPeCt. The timing has been driven by an increase in the quantity and quality of sea ice thickness data from the Antarctic that can be used to verify the models. The improvement in data is set to continue with more intense field programmes during IPY and data acquired from airborne and satellite sensors.



“The improvement in data is set to continue with more intense field programmes during the International Polar Year”

Cryospheric processes to be focussed on include ice formation in coastal polynyas, snow and snow-ice formation and the flux of ice shelf water into the ocean. It is intended that the intercomparison will be broader than sea ice and will include the needs of the ocean modelling community since many ice-ocean processes affect the dense water masses in the Southern Ocean.

As well as a focus on Southern Ocean water masses, the ocean model component will focus on the dynamics of the main ocean currents, their interaction with topography, and the representation of sub-grid scale processes such as down slope flows, eddy mixing and ocean convection. The ice and ocean model communities have close synergies; poor performance in one model component usually affects the performance of the other component. The aim is to include regional, circumpolar, and global ice-ocean models in different configurations, with atmospheric fluxes and stresses from the Large and Yeager data set. Discussions are currently underway with both the CLIVAR Southern Ocean Implementation panel and the Working Group on Ocean Model Development to co-ordinate project plans. Detailed plans will be discussed with potential participants in a meeting scheduled for early 2007.

We see AGCS as one of the user communities that will benefit from a detailed comparison of model performance and the increased understanding of the underlying processes that govern the ice and ocean interaction in the Southern Ocean and the export of signals to the global ocean. The project has strong relevance to theme 4 of AGCS and also to themes 1 and 3 as the ice and ocean components form the basis of many models that are used to decipher the signals of regional change and decadal variability in the Antarctic region.

If you are interested to know more about the project, or wish to participate, please contact siobhan.ofarrell@csiro.au or tea@bas.ac.uk.

- Siobhan O'Farrell and Todd Arbetter

A White Paper on the State of the Antarctic and Southern Ocean Climate System

Members of AGCS decided at the Hobart SCAR meeting in July to prepare a White Paper entitled: State of the Antarctic and Southern Ocean Climate System (SASOCS).

The SASOCS document will provide a synthesis of the last 10,000-1000 years of climate as underpinning for modern climate, with a focus on the state of understanding of changes in climate over the last 50-200+ years. It will have particular emphases on changes in atmospheric temperature, ice sheet surface mass balance, atmospheric circulation, atmospheric chemistry, ocean temperature and salinity, ocean circulation, sea ice and ice shelves, and glacier recession (Antarctic Peninsula, sub-Antarctic, South America, and New Zealand), and a description of model estimates for the next 100 years.

SASOCS is intended to capture the current understanding of the Antarctic and Southern Ocean climate system in a form valuable for scientists and policymakers. Once completed it will be available on the SCAR website. AGCS will periodically update SASOCS to include evolving information.

- Paul Mayewski

News from **ASPeCt**

Sea ice processes are a key component of the global climate system, and the Antarctic Sea Ice Processes and Climate (ASPeCt) programme provides an important link between the sea ice community and a number of key themes within the AGCS programme. The programme was originally established by SCAR in 1998, to focus on the basic physical properties of sea ice that are important to air-sea interaction as well as the key processes at the coast, interior and outer edges of the pack ice zone.

ASPeCt recently co-sponsored the International Workshop on Antarctic Sea Ice Thickness, held in Hobart, Australia in July 2006. The goals of the workshop were to assess the current state of knowledge on Antarctic sea ice thickness, examine the state of technology available to measure sea ice thickness from the surface, ships, under-ice vehicles and moorings, airborne sensors and satellite sensors, and to explore new techniques to extract ice thickness information from these sources. Given the observed reduction in the Arctic sea ice cover in recent decades, there is concern that changes in the thickness of Antarctic sea ice may currently

be going unnoticed. Since ice growth and decay is a major component of the salt and freshwater flux for the Southern Ocean region, signals generated by a change in sea ice conditions will be propagated into the deep ocean. This contributes directly to the AGCS goal of understanding the export of climate signals from Antarctica.

ASPeCt also provides an important link between the sea ice community and AGCS on global and regional climate signals in ice cores. The relationship between sea ice formation processes, biological activity and MSA signals in continental ice cores suggests that observed signals in continental ice cores may be a measure of sea ice extent in past climates. A great deal of work remains to be done in this area, to determine regional variability in biogenic gas production as a function of ice age, type and the ice growth/decay conditions, and to assess frost flower formation on new ice in coastal polynyas for interpretation of sea salts in ice cores. The SCAR AGCS programme, in conjunction with the ITASE and ISMASS programmes are planning a joint workshop on this topic in conjunction with SCAR 2008 in St Petersburg, Russia.

A key output of ASPeCt over the past decade has been the establishment of a data archive of ship-based sea ice observations in the Antarctic pack ice. This archive now contains more than 25,000 individual observations of the physical sea ice and snow cover characteristics, collected from 81 individual voyages starting in 1980. The data have been quality controlled and converted to a standardised format and are now publicly available via the ASPeCt website. Future comparisons of satellite-derived altimetry data of ice thickness with prior ship observations will provide some possibility of determining interdecadal variability in sea ice thickness, which also addresses a key objective of the AGCS programme.

During the International Polar Year, ASPeCt will play a coordinating role for Antarctic sea ice zone research under IPY Proposal No. 141 "Antarctic Sea Ice in IPY". The field work proposed during the IPY period will focus on validation of remote sensing data using surface airborne measurements, continued investigation of sea ice and snow cover thickness characteristics from all available data sources, measurements of ice dynamics and thermodynamics for validation of sea ice models, and investigating relationships between the physical sea ice environment and biogeochemical and biological processes in the sea ice zone.

The ASPeCt programme has a steering committee which is co-Chaired by Prof Steve Ackley (University of Texas at San Antonio, USA) and Dr Tony Worby (Australian Government Antarctic Division).

Visit <http://www.aspect.aq> for more details on the programme.

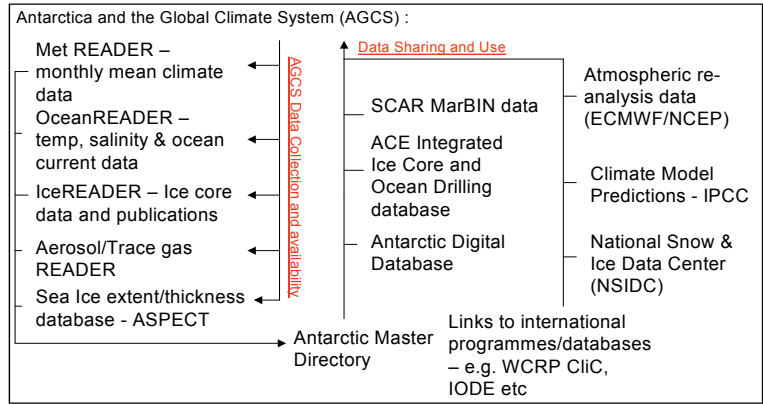
- Tony Worby

Attendees of the sea ice workshop held in Hobart, July 2006



Data Management for AGCS

The AGCS programme involves collection and synthesis of data from a variety of science disciplines covering a large spatial area. The SCAR/COMNAP Joint Committee on Antarctic Data Management (JCADM) is working with AGCS to help coordinate the management of its data and to facilitate co-operation between scientists and nations, and the international data management community.



Assessing existing and potential data management requirements for the AGCS programme

The above figure shows a schematic of the existing and potential data management requirements of the AGCS programme. On the left side of the diagram are the data systems which AGCS have developed or plan to develop. On the centre and right of the diagram are some of the other SCAR and international data sources which AGCS have identified as important sources of data, or potential data sharing partners.

AGCS and JCADM plan to actively develop their data access and data sharing resources. One example is to investigate the feasibility of extending OceanREADER from a portal providing links to data available on other websites, to providing direct access to the data. This will be done through consultation with the international oceanographic data management community.

See <http://www.jcadm.scar.org/> for more information about JCADM, or contact Helen Campbell (aedc@bas.as.uk) for more information about data management for AGCS.

- Helen Campbell

Antarctic Climate Data

Results From The SCAR READER Project



Monthly and annual mean surface and upper-air meteorological data

READER databases

READER stands for Reference Antarctic Data for Environmental Research. It began as a meteorological data initiative, with the goal of creating a high quality, long term dataset of mean surface and upper air measurements from *in-situ* Antarctic observing systems. The primary sources of data for this were the Antarctic research stations and automatic weather stations. Data

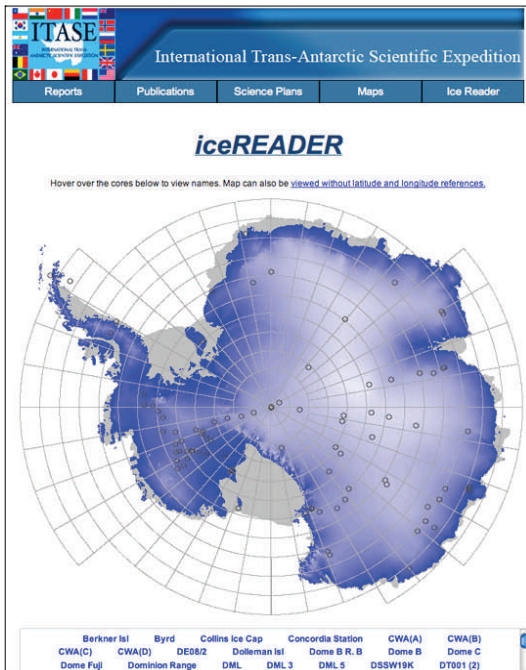
from mobile platforms (such as ships and drifting buoys) were not included since the goal was to derive time series of data at fixed locations. Monthly and annual means were produced, with daily data not provided in order to keep the data set to a manageable size. A key set of meteorological variables (surface temperature, mean sea level pressure and surface wind speed, and upper air

READER databases (cont.)

temperature, geopotential height and wind speed at standard levels) were assembled and a definitive set of measurements presented for use by researchers. To be included, the record from a given station needed to extend for 25 years, although not necessarily in a continuous period, or be currently in operation and have operated for the last 10 years. Only data from year-round stations were used. Metadata are provided, where possible, to indicate the type of observing systems used to make the measurements, changes of observing

site, changes of observing practice etc. The structure of the metadata is deliberately flexible and will vary considerably between stations, depending on what information is available. The READER data set is being disseminated on CD-ROM and at <http://www.antarctica.ac.uk/met/READER/>. The first release of the data set covered the period up to the end of 2000 and contained all the data collected so far. The data set will be kept up to date on a regular basis via the web site and new versions of the CD released periodically.

More information on the READER project can be found in Turner et al., *Journal of Climate*, 2004—"The SCAR READER Project: Toward a High-Quality Database of Mean Antarctic Meteorological Observations". The importance of the READER database is seen by the quality of the science that has resulted, for example the Turner et al. paper in *Science* concerned tropospheric warming in the Antarctic (AGCS Highlight, page 2).



Building on the success of READER, and further developing the concept, AGCS has initiated IceREADER. This is hosted at <http://www2.umaine.edu/itase/content/icereader/index.html> by the Climate Change Institute at the University of Maine, as part of the SCAR ITASE (International Trans Antarctic Scientific Expedition) website.

IceREADER contains metadata for Antarctic ice cores (name, site, location, types of measurements) and data links where available.

IceREADER is a work in progress, and will be refined and developed as time progresses. However, you are invited to view the site, and to please contact Ann Zielinski (annz@maine.edu) with additions, corrections and comments.

AGCS has also commenced an oceanographic data management initiative, Southern Ocean READER. This is a portal that includes links to relevant sources of oceanographic temperature, salinity and velocity data, with a separate section for gridded data fields. This site was constructed by Eleanor Tomlinson at BAS, and is available at http://www.antarctica.ac.uk/met/SCAR_ssg_ps/OceanREADER/. The idea is to keep this up to date as a service to the community, so please keep us informed if there are data sources you are aware of that are not currently listed. JCADM are investigating the feasibility of developing this system further to provide direct access to data, and to link in with other Southern Ocean data management initiatives within SCAR and elsewhere (see also article by Helen Campbell, page 6).



Southern Ocean READER



[Home](#)
[Background](#)
[Temperature](#)
[Salinity](#)
[Currents](#)
[Other Links](#)
[Acronyms](#)
[Extras](#)



Southern Ocean READER is a portal for links to temperature, salinity and ocean current data from the Southern Ocean.

READER: REference Antarctic Data for Environmental Research

- [Temperature \(All\)](#) is located under temperature
- [Temperature with salinity](#) is located on the salinity page
- [Currents](#) are located on the currents page
- On the [Extras](#) page there is a table of specific links to the AADCP, and a table of [gridded data sets](#)

A note on Notus ...

Notus is the God of the South Wind, which brings with it fog and rain. He is the son of Eos and Astraeus (or of Aeolus, according to others), and brother to Zephyrus, Boreas and Eurus.

Being the wind of fog and mists, Notus was dangerous to shepherds on the mountain-tops or to mariners at sea, for he hindered visibility. For the same reason, the South Wind was a friend of thieves, enabling them to do their dastardly work unseen.

- contributed by Tony Worby

Your Contacts: the AGCS Committee

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- Nancy Bertler, Victoria University of Wellington, New Zealand (nancy.bertler@vuw.ac.nz)
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- Helen Campbell, British Antarctic Survey, UK (hcamp@bas.ac.uk) (JCADM representative)
- Gino Casassa, Centro de Estudios Cientificos, Chile (GC@cecs.cl)
- Paul Mayewski, Climate Change Institute, University of Maine, USA (Leader of Theme 2) (paul.mayewski@maine.edu)
- Mike Meredith, British Antarctic Survey, UK (Leader of Theme 4 and Editor of Newsletter) (M.Meredith@bas.ac.uk)
- Alberto C. Naveira Garabato, National Oceanography Centre, UK (acng@noc.soton.ac.uk)
- John Turner, British Antarctic Survey, UK (Chair of AGCS and Leader of Theme 3) (j.turner@bas.ac.uk)
- Tony Worby, University of Tasmania, Australia (a.worby@utas.edu.au) (ASPeCt representative)
- Cunde Xiao, Chinese Meteorological Administration, Beijing (cdxiao@cams.cma.gov.cn)

Dates for your diary

- Dynamics and Impacts of the Southern Annular Mode (SAM). Adelaide, Australia, February 7-8, 2007. A workshop to be held as part of the 14th Australian Meteorological and Oceanographic Society (AMOS) National Conference during 5-8 February, 2007. <http://www.cedl.unsw.edu.au/news/2007/disam.html>
- Gordon Research Conference on Polar Marine Science, Harbortown, Ventura, CA : "An Interdisciplinary Look at Processes Over Multiple Scales of Variability", 25-30 March 2007. <http://www.grc.org/>
- Autonomous Underwater Vehicles in Extreme Environments, 11-13 April 2007, Scott Polar Research Institute, Cambridge, UK. <http://www.noc.soton.ac.uk/CASEE/CASEE2/pages/Science.html>
- EGU General Assembly 2007, including special session on Antarctica and the Global Climate System (see page 3). 15-20 April 2007, Vienna, Austria. <http://meetings.copernicus.org/egu2007>
- XXX Antarctic Treaty Consultative Meeting, 30 Apr - 11 May 2007, New Delhi, India. <http://www.ats.aq>
- XXIV IUGG 2007: Earth - Our Changing Planet. 2-13 July 2007, Perugia, Italy. <http://www.iugg2007perugia.it/>