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Report on SCAR Physical Sciences SSG Activities, June 2005

Scientific Research Programmes

Antarctica and the Global Climate System (AGCS)

The major effort has been the preparation of the AGCS Implementation Plan. Input has only been received from about half the SCAR nations. The remainder are being encouraged to indicate how they will contribute to the programme.

The AGCS Steering Committee will meet at the British Antarctic Survey on 30 July 2005.

AGCS science

An analysis of Antarctic tropospheric temperatures covering the last 50 years has been carried out and a paper is being prepared for a refereed journal.

Some recent publications :

Turner, J., Colwell, S. R., Marshall, G. J., Lachlan-Cope, T. A., Carleton, A. M., Jones, P. D., Lagun, V., Reid, P. A. and Iagovkina, S. 2005. Antarctic climate change during the last 50 years. International Journal of Climatology 25: 279-294.

Turner, J., Colwell, S. R., Marshall, G. J., Lachlan-Cope, T. A., Carleton, A. M., Jones, P. D., Lagun, V., Reid, P. A. and Iagovkina, S. 2004. The SCAR READER project: Towards a high-quality database of mean Antarctic meteorological observations. Journal of Climate 17: 2890-2898.

(2) Instrumental calibration of ice core climate proxies and application toward the understanding of past climate of the Antarctic and Southern Ocean over the last 1000 years.

See papers from joint ISMASS/ITASE Annals Pecial volume listed below plus:

Bertler, N.A.N., Barrett, P.J., Mayewski, P.A., Kreutz, K.J., and Shulmeister, J., 2004, ENSO's icy touch on Antarctica, Geophysical Research Letters 31, L15207.

Dixon, D., Mayewski, P.A., Kaspari, S., Sneed, S. and Handley, M., in press, Connections between West Antarctic ice core sulfate and climate over the last 200+ years, Annals of Glaciology 39.

Genthon, C., Kaspari,S. and Mayewski, P.A., in press 2005, Inter-annual variability of surface mass balance in West Antarctica from ITASE cores and ERA40 reanalyses, Climate Dynamics 21, DOI
10.1007/s00382-003-0329-1.

Goodwin, I.D., van Ommen, T.D., Curran, M.A.J., and Mayewski, P.A., 2004, Mid-latitude climate variability in the south Indian Ocean and southwest Pacific regions since AD1300, Climate Dynamics 22(8), 783-794.

Kaspari, S., Mayewski, P.A., Dixon, D., Spikes, V.B., Sneed, S.B., Handley, M.J., and Hamilton, in press, Climate variability in West Antarctica derived from annual accumulation rate records from ITASE firn/ice cores, Annals of Glaciology 39.

Mayewski, P.A., K. A. Maasch, J.W.C. White, E. Meyerson, I. Goodwin, V.I. Morgan., T. van Ommen, M.A.J. Curran, J. Souney, and K. Kreutz, in press 2005, A 700 year record of Southern Hemisphere extra-tropical climate variability, Annals of Glaciology 39.

Mayewski, P.A., Rohling, E., Stager, C., Karlén, K., Maasch, K., Meeker, L.D., Meyerson, E., Gasse, F., van Kreveld, S., Holmgren, K., Lee-Thorp, J., Rosqvist, G., Rack, F., Staubwasser, M., and Schneider, R., 2004, Holocene climate variability, Quaternary Research, Quaternary Research 62, 243-255.

Meyerson, E.A., Mayewski, P.A., Sneed, S.B., Kurbatov, A.V., Kreutz, K.J., Zielinski, G.A., Taylor, K.C., Steig, E.J., Yan, Y. and Maasch, K.A., in press, Examination of major Holocene climate change events in ice cores from West Antarctica (Siple Dome), East Antarctica (Taylor Dome) and Greenland (GISP2), The Holocene.

Shulmeister,J., I. Goodwin, J. Renwick, K. Harle, L. Armand, M. S. McGlone, E. Cook, J. Dodson, Hesse, P.P, Mayewski, P., and M. Curran, 2004, The Southern Hemisphere Westerlies in the Australasian sector: A synthesis, Quaternary International 118-119, 23-53.

Interhemispheric Conjugacy in Environmental, Solar-Terrestrial and Atmospheric Research (ICESTAR)

The programme is moving forward on several fronts:

* IPY: Kirsti Kauristie (Kirsti.Kauristie@fmi.fi) (Finnish Meteorological Institute) is leading a successful ICESTAR IPY effort. This includes coordination with IHY.

* Joint ICESTAR-CAWSES Campaign: We are working with Janet Kozyra and Larry Paxton on a CEADR/GEM workshop. New efforts at integrating ground-based observations, through global maps and data assimilation are being pursued as part of the CAWSES program, the ICESTAR program, and in preparation for the International Heliophysical Year 2007. This workshop seeks to find new ways of integrating observations from satellites, and ground-based facilities, assimilative models and large-scale simulations.

* ICESTAR Data Portal Workshop: The first ICESTAR workshop will take place July 23, 2005 during IAGA. We will focus on the Virtual Global Magnetic Observatory (http://mist.engin.umich.edu/mist/vgmo/vgmo.html). A prototype for the

ICESTAR Data Portal. An email group has been created for the ICESTAR Data Portal Working Group.

* The ICESTAR Steering Committee will meet in August 2005.

The ICESTAR website:
http://www.siena.edu/physics/ICESTAR/default.htm

is about to be updated.

Action Groups

Plateau Astronomy Site Testing in Antarctica (PASTA)

PASTA and AAA are currently active in the preparation of an IPY proposal titled "Astronomy from the Polar Plateaus AstroPoles)". This proposal involves countries from at least nine nations, and aims to conduct a coordinated series of experiments and theoretical studies of the conditions at Dome C and Dome A, Antarctica, and Summit Station, Greenland.

Modelling and Observational Studies of Antarctic katabatics (MOSAK)

The group at the University of Malaya in Kuala Lumpur is investigating the climatic teleconnections between the near Equator around Malaysia with the polar climate. They are looking at bipolar links, since one of the interests is the cold surges in the winter monsoon. The intensity and the variability of the cold surges are also linked to the ENSO cycle. The group have submitted an EoI for the IPY. One of the group at the moment is looking into the whole variability of "katabatic winds" in the Ross Sea areas. As a secondary part of her work she will be looking on ENSO and depressions in the Ross Sea region.

The following paper based on MOSAK work was published:

Lipzig, N. P. M., Turner, J., Colwell, S. R. and Van den Broeke, M. R. 2004. The near-surface wind field over the Antarctic continent. International Journal of Climatology 24: 1973-1982.

Cross-SSG Action Group on King George Island Science.

1. The SCAR King George Island Working Group (KGI WG) was created at the Open SCAR Conference (July, 2004, Bremen, Germany). The main aim of the KGI WG interdisciplinary activity is the coordination of environment studies and the exchange of data and results between all countries-operators at King George Island.
2. A climate data inter-comparison is taking place between long-term measurement time series of a wide range of synoptic observations (surface pressure, surface temperature, precipitation, wind speed, cloudiness, sunshine duration, snow cover and so on) for the Russian Bellingshausen and Polish Arctowski stations standard meteorological results. These results are published in the Journal “Polar Polish

Research". The revival of the meteorological measurement program at Arctowski station (interrupted in 2000) was declared by Polish Academy of Science official representative after an impulse from KGI WG.

3. Presently similar comparative studies are taking place between the Russian (Bellingshausen) and Chilean (Frei) stations results, including surface air temperature, maximum and minimum temperatures, surface wind and total surface radiation data. These data are used for spatial data quality control procedure and for applied and logistic activities at KGI scientific bases.
4. Data collected by KGY working group at Polish and Chilean stations multiyear meteorological data can be added to SCAR READER data set.
5. Created by AARI's scientists (Saint-Petersburg, Russia) multiyear catalogue of prevailing macro-scale atmospheric circulation forms in Southern Hemisphere was distributed via Internet (http://south.aari.nw.ru) and by e-mails. These data were used for KGI background conditions forecast for local marine expedition support.
6. In Bellingshausen station surrounding area there was created the cryogeological polygon based on international CALM (Circumpolar Active Layer Monitoring) Program methodic for re-starting of permafrost parameters measurements program which was stopped in 1974. This polygon will be one more additional point in Antarctic the net for permafrost dynamics investigation in the framework of leading IPY Antarctic permafrost study Project named "Antarctic Permafrost and Periglacial environment".
7. Important greenhouse gases (CO_2, CH_4 and N_2O) concentration sampling by flasks method and surface fluxes measurement by camera methods was started at KGI at nearest Russian and China stations. Surface GHG concentrations are corresponding to global background level, but camera measurement demonstrates the presence of small positive GHG fluxes from ornitogenic soils.
8. A joint interdisciplinary project has been developed as CliCoPen IPY Project (http://lists.wdc-mare.org/mailman/listinfo/clicopen. These studies have shown that KGI regional surface warming is accompanied by changes in biological systems. Two workshops were held at AWI on April, 2005. CliCoPen Project will investigate different effects of local air warming on coastal ecosystems over a gradient along the Western Antarctic Peninsula, using a network of Antarctic bases as research platforms.
9. A joint research program devoted to zooplankton dynamic study based on Bellingshausen and Jubany stations facilities is planned. The main objective of this work is the analysis of warming influence on coastal zooplankton community near Antarctic Peninsula. Previous biological investigations were too fragmentary and do not reveal all shifts in marine ecosystems. Numerous observations conducted in the Northern Hemisphere for a long time show a lot of signs of global warming and its influence on life. Probably the most interesting indicator of this process is plankton due to its high mobility and susceptibility to external signals. The analysis of abiotic factors (temperature, salinity, water transparency, dissolved nitrogen, phosphorus, oxygen etc.) and biotic factors (zooplankton (food and predators), phytoplankton (food)) will be estimated using new experimental data.
10. Regular measurements of surface albedo were re-started at Bellingshausen station. New parameterization of albedo was created and suggested for use in MGO Global circulation model and in German energy balance model for numerical study of terrestrial glacier sheet over King George Island.

11. Round Table discussions about King George Study are planned in the framework of the 5th All Russian Symposium "Antarctic Meteorological Study", which will be organized at AARI (November, 14-16, 2005). We have obtained preliminary agreement from Polish, Czech, German, Estonian and Finnish polar scientists to participate in this Antarctic meeting.
12. A special KGI WG web-site will be created at AARI's web-portal 'Antarctica' (http://south.aari.nw.ru) soon.

Publications

Kejna M., Lagun V. 2004. Comparison of the climate of the stations Arctowski and Bellingshausen (King George Island, South Shetland Islands) in the years 1977-1999. Polish Polar Studies. Gdynia. pp. 149-166.

Jagovkina S.V., Lagun V.E. 2004. Climatology of Antarctic upper-air parameters. Polish Polar Studies. Gdynia. pp. 131-142.

Expert groups

SCAR/SCOR Expert Group on Oceanography

This is a new Expert Group and there has been considerable effort since Bremerhaven to develop its mode of operation and membership.

The following is reproduced from the SCAR web site:

Terms of reference:

- to encourage an inter-disciplinary approach to Southern Ocean observations, modelling and research, recognizing the inter- dependence of physical, chemical and biological processes in the ocean at present and in the past;
- to facilitate coordination between the physical oceanographic research groups currently active and those planning research in the Southern Ocean;
- to identify historical and reference data set of value to researchers, focusing initially on physical oceanography data
- to encourage the exchange of information with operational agencies.

The group recognizes the need to develop initiatives for education and training.

The initial focus of the Group will be on physical oceanography, to ensure that a comprehensive view is obtained of the physical processes on which biological and chemical processes ultimately depend. The activities of the Group are complementary to, and do not duplicate, the activities of other groups currently active in Southern Ocean research, such as Southern Ocean GLOBEC, the CLIVAR/CliC/SCAR Southern Ocean Implementation Panel, iAnZone (which is affliated to both SCAR and SCOR), and future projects sponsored by SCOR, such as GEOTRACES, the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project, and the Surface Ocean-Lower Atmosphere Study (SOLAS).

We plan to hold the first meeting of the Group on Friday and Saturday October 7 and 8, in Venice, Italy, to capitalize on the fact that the Third International Conference on the Oceanography of the Ross Sea takes place there form 10 to 14 October, and that iAnZone will be holding it's 9th Coordination Meeting there as well.

Co-sponsored and affiliated ocean programmes:

The iAnZone programme is affiliated to the SCAR Oceanography Group and to SCOR.

SCAR co-sponsors with the World Climate Research Programme (WCRP):

- the Climate and Cryosphere Programme (CliC);
- the Southern Ocean Implementation Panel (with CLIVAR and CliC);
- the International Programme on Antarctic Buoys (IPAB).

SCAR co-sponsors with the Global Ocean Ecosystems Dynamics Programme (GLOBEC) the GLOBEC Southern ocean activity (SO-GLOBEC).

SCAR co-sponsors with the Sloan Foundation the Circum-Antarctic Census of Marine Life (CAML) of the global Census of Marine Life (CoML)

SCAR co-leads with WCRP the Cryosphere Theme component of the Partnership for an Integrated Global Observing System (IGOS).

SCAR co-sponsors with SCOR the interdisciplinary Southern Ocean component of the joint IAPSO/IABO meeting in Cairns in August 2005.

SCAR co-sponsors with SCOR the Integrated Analyses of Circumpolar Climate Interactions and Ecosytem Dynamics in the Southern Ocean ICCED

Plans for Ocean Observing Systems in the Arctic and Antarctic

The scientific community has been actively preparing plans to make observations in both oceans as contributions to the International Polar Year (2007-9). These plans could provide the basis for polar contributions to the Global Ocean Observing System (GOOS). The IPY plan calls for emplacement of observing systems that will provide a legacy long after IPY is over.

i. The Arctic Ocean Science Board, led by Bob Dickson, has produced a comprehensive plan, which can be found on the web at: http://www.aosb.org/ipy.html (you should see three paragraphs on that page, with a clickable plan at the end of the third paragraph).
ii. the CLIVAR/CliC/SCAR Southern Ocean Implementation panel, led by Steve Rintoul, has also produced a comprehensive plan, which can be found on the web at: http://www.clivar.org/organization/southern/index.htm#NEWS (go down to international polar year, in which the SO Panel strategy document is downloadable.

iii. the iAnZone group, which is affiliated to both SCOR and SCAR has also produced a plan, for Antarctic coastal seas, which can be found at: http://www.ldeo.columbia.edu/res/fac/physocean/ianzone/, see iAnZone proposal for international polar year, on home-page at left.

Solar-Terrestrial Processes and Space Weather (STEPS)

The main effort here has been in preparing the ICESTAR proposal.

Antarctic Astronomy and Astrophysics (AAA).

See the report under the PASTA Action Group.

Operational Meteorology in the Antarctic

Information relating to the Expert Group on Operational Meteorology in the Antarctic is presented at the web site

http://www.antarctica.ac.uk/met/jds/met/SCAR_oma.htm

This includes updates on ships operating or transmitting meteorological observations during 2004/05, news on improvements to or problems with transmission of meteorological data on the GTS, and a draft copy of the BAS weather forecasting manual. It also provides a link to the WMO Executive Committee Working Group on Antarctic Meteorology.

ISMASS Expert Group

Joint ITASE/ISMASS Symposium during SCAR XXVIII

Papers presented at this symposium are to be published as Annals of Glaciology 41. The list of papers to be published is …….

41A001 Kaspari et al.
Sources and transport pathways of marine aerosol species into West Antarctica

41A002 Arcone et al.
Phase structure of radar stratigraphic horizons within Antarctic firn

41A003 Jacobel and Welch
A Time Marker at 17.5 KYBP Detected Throughout West Antarctica

41A004 Schneider et al.
Interpretation of high resolution ice core stable isotopic records from Antarctica: towards interannual climate reconstruction

41A005 Mayewski et al.
Solar Forcing of the Polar Atmosphere: Data, Mechanism, and Implications

41A006 Van den Broeke et al.
Seasonal cycle of the Antarctic surface energy balance using data of Automatic Weather Stations

41A007 Turner et al.
A Positive Trend in Western Antarctic Peninsula Precipitation Over the Last 50 Years Reflecting Regional and Antarctic-wide Atmospheric Circulation Changes

41A008 Van de Berg et al.
Characteristics of the Antarctic surface mass balance (1958-2002) using a Regional Atmospheric Climate Mode.

41A009 Welch and Jacobel
Bedrock topography and wind erosion sites in East Antarctica, observations from the 2002 US-ITASE traverse

41A010 Becagli et al.
Spatial distribution of bigenic sulphur compounds (MSA, nssSO4 2-) in the northern Victoria Land - Dome C, Wilkes land area (East Antarctica)

41A011 Steig et al.
High-resolution ice cores from US ITASE (West Antarctica): development and validation of chronologies and determination of precision and accuracy

41A012 Benassai et al.
Sea spray deposition in Antarctic coastal and plateau areas from ITASE traverses

41A013 Rivera et al.
Glacier wastage on southern Adelaide Island and its impact on snow runway operations

41A014 Gallee et al.
Temporal and spatial variability of Antarctic Ice Sheet surface mass balance assessed from a comparison between snow accumulation rate measurements and regional climate modeling

41A015 Eisen et al.
Spatial temporal characteristics of accumulation in the vicinity of the EPICA deep-drilling site in Dronning Maud Land, Antarctica

41A016 Dixon et al.
A 200-year sulfate record from sixteen Antarctic ice cores and associations with Southern Ocean sea ice extent

41A017 Patterson et al.
ENSO variability in the deuterium excess record of a coastal Antarctic ice core from the McMurdo Dry Valleys, Victoria Land

41A018 Stearns and Hamilton
A new velocity map for Byrd Glacier, East Antarctica, from sequential ASTER satellite imagery

41A019 Yan et al.
An ice core proxy for Antarctic circumpolar zonal wind intensity

41A020 Lange et al.
Numerical model studies of Antarctic ice sheet-ice shelf-ocean systems and ice caps

41A021 Hamilton et al.
Spatial patterns in mass balance of the Siple Coast and Amundsen Sea Basin, West Antarctica

41A022 Bertler et al.
Solar forcing recorded by aerosol concentrations in coastal Antarctic glacier ice, McMurdo Dry Valleys

41A023 Mayewski et al.
The International Trans-Antarctic Scientific Expedition (ITASE) – An Overview

Publication of papers from SCAR Symposium on Antarctic Glaciology

Papers from the Seventh SCAR International Symposium on Antarctic Glaciology (ISAG 7) held in Milan from 25 to 29 August 2003, many of which are the results of research instigated by ITASE, ISMASS, ASPeCT and READER Expert Groups of the SCAR Physical Sciences SSG and the SALE Expert Group of the Geosciences SSG, are to be published in Annals of Glaciology 39, due within the next month.

ISMASS/ANTEC Special Issue of Global and Planetary Change on Ice Sheet Mass Balance and Neotectonics

The July 2004 issue of Global and Planetary Change (which was issued in the week of SCAR XXVIII) is a Special Issue on Ice Sheet Mass Balance and Neotectonics. This issue was a joint effort between ISMASS and the Antarctic Neotectonics (ANTEC) Scientific Programme Planning Group of the Geosciences SSG.

The lead paper in the Special Issue is the report from the ISMASS Committee meeting in Annapolis, Marylands, USA, Recommendations for the collection and synthesis of Antarctic ice sheet mass balance data.

Other Ice Sheet Mass Balance papers in the issue include ……..

Spatially distributed surface energy balance and ablation modelling on the ice cap of King George Island (Antarctica) - Matthias Braun and Regine Hock

Simulation of the Eurasian ice sheet dynamics during the last glaciation – Pirjo-Leena Forsstrom and Ralf Greve.

The evolution of a coupled ice shelf – ocean system under different climates states – Grosfeld and Sandhager.

Evaluating a satellite altimeter-derived digital elevation model of Antarctica using precision kinematic GPS profiling – Gordon Hamilton and Blue Spikes.

A modelling study of the response of Hatherton Glacier to Ross Ice Shelf grounding line retreat – Brian Anderson, Richard Hindmarsh and Wendy Lawson

Modelling Antarctic and Greenland volume change during the 20th and 21st centuries forced by GCM time slice integrations – Huybrechts, Gregory. Janssens and Wild

Antarctic ice sheet shape response to changes in outlow boundary conditions – Rémy and Legrésy

Spatial characteristics of snow accumulation in Dronning Maud Land, Antarctica – Cecilia Richardson-Näslund

ICE DRILLING

EPICA Dome C ice core completed

On the 21st December, 2004, the drilling team at Dome C reached a depth of 3270.2 m, which is 5 m from the bedrock. The ice is melting at the bed and the drillers decided to stop before the drill contacted water. During this season, the last 70 m of the ice core was drilled with great difficulty due to the warm ice temperatures near the bottom. The age of the bottom is estimated to be more than 900 000 years old and is the oldest ice ever recovered from deep ice cores. The basal ice has ice crystals, some bigger than 40 cm and there are many inclusions of brown/reddish material between the ice crystals. This brings to an end eight years of drilling at Dome C, part of the European Project for Ice Coring in Antarctica (EPICA), a joint European Science Foundation/European Commission (EC) scientific programme, funded by the EC and by national contributions from Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Sweden, Switzerland and the UK. Drilling will continue at a second EPICA site in Dronning Maud Land (DML) in 2005/6, when it is hoped to reach the bed at 2782 +/- 10 m. The DML drilling reached 2565 m in February 2004, with a break planned for 2004/5, and continuation in 2005/6.

The initial results spanning the first 740 000 years were published during the year: Eight glacial cycles from an Antarctic ice core, EPICA community members, Nature, 2004, 429, 623-628. Numerous other publications have resulted from the EPICA project, and a list is maintained at:

http://www.phys.uu.nl/~wwwimau/research/ice_climate/epica/publications/home.html

948-metre ice core to bedrock on Berkner Island

During the 2004/05 field season a joint British/French team succeeded in drilling an ice core to the bed on Berkner Island. This project was a collaboration between scientists and engineers from the British Antarctic Survey (BAS), the Laboratoire de

Glaciologie et Géophysique de l'Environnement (LGGE), and the Institut Polaire Français - Paul Emile Victor (IPEV). Drilling began in 2002/03 with the construction of the drilling camp and the drilling of a cased pilot hole, and continued in 2003/04 reaching 526 m in the second season. On January 12th, 2005, from a depth of 948.5 m below the surface, the drill brought up sediment from beneath the ice sheet, making this one of very few Antarctic ice core projects ever to reach the very base of the ice sheet and retrieve sub-ice sediment. Analysis will provide a regional climate history of at least the past 40,000 years, a period in which Antarctic climate has passed from deep within the ice age, through the c. 8°C transition into a warmer post ice age Holocene climate. The core will provide a climate history of the Weddell Sea region (source of cold bottom water to the Atlantic) and reveal what was happening to the climate of Antarctica when Greenland was experiencing a series of abrupt climate changes. The sediment itself should also reveal whether Berkner Island was ever over-ridden by the West Antarctic Ice Sheet, and provide a limit to the extent of the ice sheet during the glacial period. Analysis of this core is now underway in BAS and LGGE, and other collaborating laboratories.

TALDICE project begins

A deep ice drilling project at Talos Dome (TALDICE) is one of the major components of the scientific programme envisaged for the Italian and French Glaciology communities in the next future with the collaboration of other European countries (Germany, Switzerland, UK). Talos Dome (elevation 2316 m, T – 41.0 °C, 72°48'S; 159°06'E) is an ice dome on the edge of the East Antarctic plateau and adjacent to the Victoria Land mountain in western Ross Sea. Planned activities during the ice core recovery project involve setting up a temporary drilling camp over 3 austral summer season (2004-2007), including trench for drilling, processing and storage of ice core. Drilling at Talos Dome should reach depths greater than 1500 m, giving the possibility of investigating palaeoclimate spanning about 120 kyr, complementing the palaeorecord collected at the "near-coastal sites" EPICA- DML, Berkner Island, Taylor Dome, Siple Dome and Law Dome DSS etc., and at other Antarctic deep drilling sites (EPICA-Dome C, EPICA-DML, Vostok, Dome Fuji).

During the 2004/5 season, the camp and drilling infrastructure was put in place, the drilling trench excavated, and a pilot borehole drilled, reamed and cased to a depth of 127.6 m.

Dr John Turner
Chairman, SSG/PS
7 July 2005