



SCARnewsletter

issue 26

march 2011

Welcome to the new SCAR quarterly Newsletter!

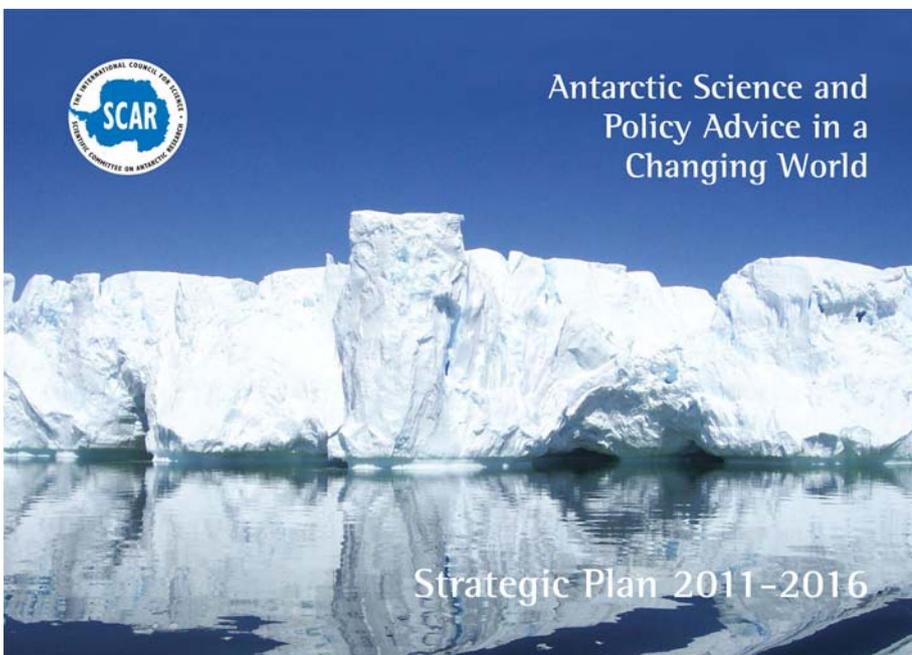
We felt that as part of our communication strategy it would be good to improve the look and content of the Newsletter, while still keeping it as electronic copy only. You will notice some additions to previous Newsletters: For example, we intend to include a "SCAR Focus on..." in each Newsletter to highlight a particular SCAR group, programme or activity. In this edition it is the new Scientific Research Programme "Astronomy and Astrophysics from Antarctica". We also want to encourage people to email us (at info@scar.org) with suggestions for articles to include in the next issue (deadline May 20th). Please do also let us have any gen-

eral comments or suggestions for improvement.

SCAR's new Strategic Plan 2011-2016 "Antarctic Science and Policy Advice in a Changing World" is now being widely circulated. The Plan is the culmination of community-wide consultations and discussions aimed at developing a consensus view of future directions for SCAR. The plan stresses SCAR's dual mission of facilitating Antarctic and Southern Ocean science and providing advice to the Antarctic Treaty and other policy makers such as the IPCC. A pdf is available from <http://www.scar.org/strategicplan2011/> and hard copies (subject to availability) can be requested from info@scar.org.

The next SCAR Open Science Conference, also entitled "Antarctic Science and Policy Advice in a Changing World" will take place on Monday 16 to Thursday 19 July 2012 in Portland, USA. The chairs of the scientific organising committee are Pete Convey (UK) and Rasik Ravindra (India), with the local organizing committee being headed by Christina Hulbe (US) and Andrew Fountain (US). Planning for the conference is currently underway and a website is being developed at <http://scar2012.geol.pdx.edu/>. For further details contact scar2012@pdx.edu. We look forward to welcoming you all to Portland!

Mike Sparrow,
Executive Director SCAR



SCAR's Vision

"SCAR's strategic vision is for a world where the science of Antarctica and associated systems is used for the benefit of all, excellence in science is valued, and scientific knowledge is effectively linked to policy making. SCAR has a key role to play in leading the international Antarctic science community, implementing new scientific initiatives, discerning emerging scientific themes, promoting international cooperation and partnerships, and engaging with policy-makers and other sectors of society to advance this vision. As an Interdisciplinary Scientific Body of ICSU, SCAR embraces and contributes to the Strategic vision and mission of ICSU."

Highlights in this issue

- SCAR focus on . . . Astronomy and Astrophysics from Antarctica (AAA) - page 2
- SCAR OSC 2012 - page 2
- ISAES XI - page 3
- Antarctic Fellowships - page 3
- News from SCAR - page 4
- Antarctic Science - pages 5 & 6
- Forthcoming Events - page 7

SCAR focus on . . . Astronomy and Astrophysics from Antarctica



Photo taken at Amundsen-Scott South Pole station by Daniel Luong-van

SCAR's newest Scientific Research Programme, Astronomy and Astrophysics from Antarctica (AAA), is now underway.

AAA's objectives are to coordinate astronomical activities in Antarctica in a way that ensures the best possible outcomes from international investment in Antarctic astronomy. AAA is particularly timely, given the current flurry of astronomical activity, not only in Antarctica, but in the Arctic as well.

A striking example of the growth in Ant-

arctic astronomy is the establishment of a new astronomical observatory at the Japanese station of Dome Fuji during the 2010 – 2011 season. During the summer, a 40 cm infrared telescope was used to make observations of the sky brightness and of the planet Venus, while a Differential Image-Motion Monitor (DIMM) made measurements of the integrated "seeing", or image quality, of the site. In addition, the team deployed experiments that are intended to work year-round for the next two years, supported by a *PLATO* autonomous laboratory. These experiments include an acoustic radar for boundary layer measurements, and a small two-camera astronomical telescope called *Twincam*.

Of particular importance, not only to astronomy but to other Antarctic researchers as well, are the two new automatic weather stations – one at Dome Fuji and the other at Kunlun (Dome A). At Dome Fuji, the 52nd Japanese Antarctic Research Expedition installed a fully-instrumented 16 metre tower, while at Kunlun station the traverse team of the 27th Chinese Antarctic Research Expedition deployed a new 15 metre weather tower (KL-AWS). Both these weather stations are supported by *PLATO* laboratories, allowing the data to be sent back in real time. Both data sets are available on-line for the benefit of the community.

At the French/Italian Concordia Station (Dome C), installation of new telescopes continues, with the 80 cm *IRAIT* infrared telescope achieving "first light", and observations with the 40 cm *ASTEP* optical telescope and the 2.6 metre mm-wave *COCHISE* telescope continuing.

Amundsen-Scott Station continues to host the largest and most ambitious astronomical facilities. *South Pole Telescope* and *IceCube* are being joined by *BICEP 2* and the *Keck Array*, while additional pathfinder experiments installed this season include a small terahertz telescope and an ultraviolet spectrometer/imager.

AAA will hold its kickoff meeting (*AAA2011*) at the end of June this year at Sydney's Taronga Zoo conference centre. Although some astronomical and meteorological data sets from Domes A, C and F are already on-line, achieving best practice in archiving and accessibility for all data will be a key agenda topic. Another important item for discussion will be how astronomy can best maximize the opportunities for productive interaction with other disciplines, for example by sharing of atmospheric, ionospheric and boundary-layer data.

Article by John Storey
email: j.storey@unsw.edu.au



Japanese astronomers setting up a new observatory at Dome Fuji.
Photo by Hirofumi Okita.



SCAR 2012 Biennial Meetings and Open Science Conference Portland, Oregon, July 13 to 25, 2012



The Local Organizing Committee and Portland State University look forward to welcoming the Antarctic community to Portland, Oregon in July of 2012.

July is prime time in Oregon, from the eastern desert to the western shores, our skies are blue and the living is easy. We hope you will be able to arrive early or stay late and get to know us. Both Portland State University and the conference hotel, the Hilton Portland, are located in the heart of the city, with convenient public transportation connections to Portland International Airport and city attractions.

Travel to and around Portland is easy. Portland International Airport (PDX) has direct connections to major airport hubs throughout the United States, as well to Europe, and Asia. Portland's public transportation system is, extensive, easy to use, and rail is free downtown. When you arrive at PDX, buy your ticket at the airport station, board the Max (lightrail) Red Line, and about 45 minutes later, disembark at Pioneer Courthouse Square, only a few blocks away from the meeting venue.

News from SCAR

Antarctic Fellowships

SCAR has joined forces with the Council of Managers of National Antarctic Programs (COMNAP) to offer up to five fellowships of up to \$15,000 each for 2011/2012. Such fellowships have enabled Antarctic and Southern Ocean scientists to participate in a range of significant research including using ice cores to determine proxies for the Southern Annular Mode, a molecular study of Antarctic ostracods, and investigating particulate carbon and biogenic silica in sea ice in both the Arctic and Antarctic regions.

Since 2005, twenty-five SCAR Fellowships have been awarded. This year, the Council of Managers of National Antarctic Programs (COMNAP) has joined in to offer additional fellowship opportunities for early career researchers. The two schemes are being jointly promoted by both organisations. This supports the scientific goals of SCAR and the international cooperation goal of COMNAP to develop and promote best practice in managing the support to Antarctic science.

The fellowships enable early career researchers to join a project team from another country, opening up new opportunities and often creating research partnerships that last many years and over many Antarctic research seasons. If successful, it is envisioned that COMNAP will continue to be able to provide Fellowships in future years along with the SCAR Fellowships. The deadline for applications is 15 May 2011.

For further details see:

<http://www.scar.org/awards/fellowships/>

New IASC/SCAR Bipolar Action Group (BipAG II)

There are many common interests between SCAR and IASC in scientific research in the polar regions. The joint Bipolar Action Group on Science Cooperation has the term of reference to advise the SCAR and IASC Executive Committees on the development of instruments such as workshops, programmes and networks to address bipolar issues. The group will hold a meeting on the 17th of May in Cambridge and is chaired by Cynan Ellis Evans. Further details are available from <http://www.scar.org/about/partnerships/iasc/bipag2.html>

Conference Announcement 11th International Symposium on Antarctic Earth Sciences July 10-16th 2011



ISAES XI EDINBURGH 2011



© BGS/NERC 2010

www.isaes2011.org.uk

the birthplace of earth science

Our ambition is to bring together scientists studying the different components of Polar Earth Science to exchange information and perspectives.

As we come to terms with climate change, understanding the landscape and environmental response of the Polar regions, in particular the great Antarctic Ice Sheets, becomes ever more important. Study of geological archives, ice cores, and modern systems offers an unrivalled opportunity to reconstruct and understand the Earth's climatic variability - something which impacts on all countries and peoples of the world.

The symposium will take place at the John McIntyre Conference Centre in Edinburgh, adjacent to Holyrood Park and the University of Edinburgh's Halls of Residence. It will cover the following science themes:

1. Antarctic ice sheet and the Southern Ocean
2. Major reorganisations of the ice-ocean-atmosphere system in the Cenozoic and Quaternary
3. Tectonic evolution of Antarctic seaways and margins during the Mesozoic and Cenozoic, and its influence on biota and climate
4. Antarctica and supercontinent evolution
5. Landscape and biological evolution of ice-free areas
6. Evolution of life, environments and climates in Antarctica from deep time to the present
7. Uncovering the continent
8. New frontiers and interdisciplinary advances in Antarctic Science
9. Hydrology, dynamics and biogeochemistry of the Antarctic Ice Sheet
10. Observation and modelling of POLENET data
11. Antarctic data, collections and maps

There will be an optional pre-conference excursion (1 week) to the Inner Hebrides and Lochaber, and an optional post-conference excursion (1 week) to the North West Highlands and Moine Thrust.

Visit www.isaes2011.org.uk for more details and updates.

News from SCAR

Deep Sea Research Part II - a CAML Special Issue

The Census of Antarctic Marine Life (CAML) represented the largest survey undertaken of Antarctic marine life, and contributed one of the larger programmatic efforts to the International Polar Year (IPY) 2007/2008. It coordinated 19 research voyages distributed broadly throughout the Southern Ocean and Antarctic shelves, and supported by a network of over 300 biologists from 30 countries. The major achievements of this unprecedented assessment have now been published in a special issue of the ScienceDirect journal *'Deep Sea Research Part II: Topical Studies in Oceanography'*. The issue contains

25 papers from the 42 presentations given at the CAML Final Symposium, entitled *'Diversity and Change in Southern Ocean Ecosystems'*, hosted and organized by the Italian National Antarctic Museum in Genoa during May 2009.

CAML has secured three months of online free access to the special issue so you are encouraged to make use of it and spread the word amongst your colleagues.

To view the DSR II CAML Special Issue, visit the Science Direct website at <http://www.sciencedirect.com/science/issue/6035-2011-999419998-2905745>



Book on 'History of the International Polar Years'

A new book on the 'History of the International Polar Years' by Susan Barr and Cornelia Lüdecke (eds.) is now available to order.

Although international scientific cooperation - particularly in meteorology - was established previous to the first International Polar Year, the IPY-1 (1882-83) is considered to be the first revolutionary step

towards an extensive international cooperation in the polar areas for the benefit of science rather than national prestige and territorial gain. This was followed by IPY-2 (1932-33) and IPY-3 - actually the International Geophysical Year (1957-58) - before the crowning effort of IPY-4 (2007-08). The history of these years is recounted here and explains the political, economic, technical and scientific conditions and expectations that laid the basis for each IPY and which gradually expanded both the scope and extent of our understanding of the complexities in polar regions.

For more information, please visit the publisher's website: <http://www.springer.com/>



The Martha T. Muse Prize for Science and Policy in Antarctica 2011

(Nominations close 1 May 2011)

The Martha T. Muse Prize is an annual \$100,000 unrestricted prize awarded to an individual who has demonstrated excellence in Antarctic science and/or policy and who shows clear potential for sustained major and significant contributions that will enhance the understanding of Antarctica. The Prize is inspired by Martha T. Muse's passion for Antarctica and is intended to be a legacy of the International Polar Year 2007-2008. The Prize is awarded by the Tinker Foundation and administered by the Scientific Committee on Antarctic Research (SCAR).

The prize-winner can be from any country and work in any field of Antarctic/Southern Ocean Science and/or policy. The goal is to provide recognition of the important work being done by the individual and to call attention to the significance of understanding Antarctica in a time of change.

Further details, including the process of online Nomination are available at www.museprize.org.

**Nominations
now open**



New SCAR Organisation Chart available

Following the changes to group structure agreed at the SCAR Delegates Meeting last August, the SCAR Organisation chart has been updated. It is available to view on the Organisation page of the SCAR website, where there is also a fully printable version in pdf format. See <http://www.scar.org/about/introduction/organization/>

New SCAR Presentation

A presentation entitled *'Antarctic Science and Policy Advice in a Changing World'* is now available. The presentation is in the zooming presentation editor "Prezi" and is aimed at the general public. See: http://prezi.com/m0_uu6zwwvzz/presentation-about-the-scientific-committee-on-antarctic-research/

Antarctic Science

Polar ice loss quickens, raising seas

Ice loss from Antarctica and Greenland has accelerated over the last 20 years, research shows, and will soon become the biggest driver of sea level rise. From satellite data and climate models, scientists calculate that the two polar ice sheets are losing enough ice to raise sea levels by 1.3mm each year. Overall, sea levels are rising by about 3mm (0.12 inches) per year.

Writing in *Geophysical Research Letters*, the team says ice loss here is speeding up faster than models predict. They add their voices to several other studies that have concluded sea levels will rise faster than projected by the Intergovernmental Panel

on Climate Change (IPCC) in its landmark 2007 assessment.

By 2006, the Greenland and Antarctic sheets were losing a combined mass of 475Gt (gigatonnes - billion tonnes) of ice per year. On average, loss from the Greenland sheet is increasing by nearly 22Gt per year, while the much larger and colder Antarctic sheet is shedding an additional 14.5Gt each year. If these increases persist, water from the two polar ice sheets could have added 15cm (5.9 inches) to the average global sea level by 2050. A rise of similar size is projected to come from a combination of melt water from mountain glaciers and thermal ex-

pansion of seawater.

“That ice sheets will dominate future sea level rise is not surprising - they hold a lot more ice mass than mountain glaciers,” said lead author Eric Rignot from Nasa’s Jet Propulsion Laboratory (JPL) in Pasadena, California. “What is surprising is this increased contribution by the ice sheets is already happening.”

For more information, visit the the *BBC News* website at <http://www.bbc.co.uk/news/science-environment-12687272>

Read the full article in *Geophys. Res. Lett.* **38**, L05503 (2011); <http://www.agu.org/pubs/crossref/2011/2011GL046583.shtml>

“Crazy Green” Algae Pools Seen in Antarctic Sea

“Crazy green” pools teeming with life have been found among remote Antarctic sea ice, scientists say — and they may be a global warming boon.

Observed in the little-studied Amundsen



Photo of emerald green waters of a polynya in Antarctic sea ice by David Munroe, USAP

Sea, the brilliant blooms owe their colours to chlorophyll, a pigment in various types of phytoplankton, or tiny algae. Algae-eating zooplankton, small crustaceans called krill, and fish and shrimp larvae also thrive in the area. A recent scientific expedition studied the blooms while plying the Amundsen Sea’s polynya, a region of seasonally open water surrounded by sea ice.

Often hundreds of miles wide, polynyas are nutrient-rich “oases” that offer refuges for animals big and small, according to Patricia Yager, chief scientist for the Amundsen Sea Polynya International Research Expedition (ASPIRE), which is funded by the U.S. National Science Foundation and the Swedish Polar Research Secretariat. The open pockets occur for two reasons: because wind blows chunks of ice away from the coast, and because warm air or an upwelling of warmer water melts sections of ice away.

When summer sea ice melts, it can release micronutrients into the ocean that supercharge algae blooms. Micronutrients are trace amounts of elements, such as iron, that are essential for plant growth. As glaciers and sea ice in western Antarctica begin to melt due to global warming, a greater influx of micronutrients may flow into the oceans and fuel bigger algae blooms, Yager said in an interview.

Such an algae explosion may actually be a climate boon, since the plants gobble up more of the greenhouse gas carbon dioxide — but only to a point, Yager warned.

For more information, read the full *National Geographic News* article:

<http://news.nationalgeographic.com/news/2011/02/110228-antarctica-green-algae-bloom-global-warming-science-environment/>

Scott’s Antarctic samples give climate clues

Samples of a marine creature collected during Captain Scott’s Antarctic trips are yielding data that may prove valuable in projecting climate change.

The expeditions in the early 1900s brought

back many finds including samples of life from the sea floor. Comparing these samples with modern ones, scientists have now shown that the growth of a bryozoan, a tiny animal, has increased in recent years. They say this means more carbon

dioxide is being locked away on the ocean bed.

For more information, read Richard Black’s full article on *BBC News* website at <http://www.bbc.co.uk/news/science-environment-12524042>

No breakthrough to Antarctica’s Lake Vostok this season

A Russian drilling team hoping to reach the surface of Lake Vostok, a vast freshwater lake 3,750 metres under Antarctica’s ice-sheet, appears to have run out of time as the region’s summer drilling season draws to a close. On the 7 February

2011, Valery Lukin, director of the Russian Antarctic programme, confirmed that drilling at Lake Vostok stopped on 5 February at a depth of 3720.47 metres - 29.53 metres short. The drilling team left by aircraft on 6 February. Drilling will resume in

December 2011.

Read the full article on the Nature blog at: http://blogs.nature.com/news/thegreatbeyond/2011/02/no_breakthrough_to_antarcticas.html?WT.ec_id=NEWS-20110208

Antarctic Science

Antarctic Ice Sheets Grow From Bottom Up, Scientists Discover

When it comes to ice, scientists are giving a whole new meaning to the phrase “bottoms up.” Those massive ice sheets in Antarctica don’t just grow on top when snow falls, they also grow from the bottom up, according to new research published on 3rd March.

The warmth of the planet causes ice melts at the bottom of ice sheets, and the water helps the sheets slide across the ground below. But the water can refreeze to the bottom of the sheets and push them up, the researchers report in the online edition of the journal *Science*.

The base of a massive ice plateau on the East Antarctic ice sheet called Dome A is about 24 percent refrozen water, according to the team headed by Robin Bell, a geophysicist at Columbia University’s Lamont-Doherty Earth Observatory. According to the observations, massive ice blocks seem to form when liquid water — propelled by the pressure of the ice — moves up the steep walls of the Gamburtsev mountains. As the water rises, it encounters lower temperatures and less



The ice surface of Antarctica, looking toward the Gamburtsev Mountains and Dome A. Deep below the surface here, new ice is forming around the mountains and pushing upward.

Photo: Robin E. Bell/Lamont-Doherty Earth Observatory

pressure from overlying ice, so it refreezes.

Find out more on the *BBC News* website at <http://www.bbc.co.uk/news/science-environment-12619342>

Read the full article on the *Science* website at <http://www.sciencemag.org/content/early/2011/03/02/science.1200109>

Secrets of Antarctica’s fossilised forests

It may be hard to believe, but Antarctica was once covered in towering forests.

One hundred million years ago, the Earth was in the grip of an extreme Greenhouse Effect. The polar ice caps had all but melted and rainforests inhabited by dinosaurs existed in their place.

These Antarctic ecosystems were adapted to the long months of winter darkness that occur at the poles, and were truly bizarre. But if global warming continues unabated, could these ancient forests be a taste of things to come?

One of the first people to uncover evidence for a once greener Antarctic was none other than the explorer, Robert Falcon Scott. Toiling back from the South Pole in 1912, he stumbled over fossil plants on the Beardmore Glacier at 82 degrees south. The extra weight of these specimens may have been a factor in his untimely demise. Yet his fossil discoveries also opened up a whole new window on Antarctica’s subtropical past.

Read the full *BBC News* article at: <http://www.bbc.co.uk/news/science-environment-12378934>



Annual rings in fossil wood reveal Antarctica’s subtropical past. Photo by Jane Francis

IceCube Neutrino Observatory Completed

The deep Antarctic cold has created an ideal natural medium for detecting high-energy neutrinos. At a depth of 1.5 kilometres below the surface, the sheer weight of the overlying layers at the South Pole keeps the Antarctic ice sheet free of air bubbles and thus perfectly clear. Within its dark, transparent depths, even a faint flash of light can be spotted at some distance — including the kind of flash signalling that a fast-moving neutrino has hit an oxygen atom sitting in the ice and produced a muon.

The final Neutrino detector, a basketball-sized optical sensor, was the 5160th to be placed since construction began on IceCube in 2005. Since then, every Antarctic summer, researchers have used a jet of near-boiling water to drill holes in the ice. At every hole, a kilometre-long string of detectors was lowered down and the hole allowed to refreeze.

Now complete, at a cost of about US\$271 million, IceCube monitors a cubic kilometre of ice — the size required for the experiment to have a realistic chance of

spotting its rare and elusive quarry. But as the instrument has grown, so has its scope. Over the years, the team has realised that IceCube might also shed light on a broader range of questions, including an understanding of physics beyond the standard model.

For further details, read the full *Nature* article at:

http://www.nature.com/news/2010/101229/full/469013a.html?WT.ec_id=NEWS-20110104

Forthcoming Events

VIII Symposium on Polar Studies

Palma de Mallorca (Spain), 7 - 9 September 2011

The VIII Symposium on Polar Studies is promoted by the Spanish SCAR Committee and organized in collaboration with the Spanish Polar Research Program.

Major objectives of the Symposium are to promote the exchange of information between research groups working on different aspects of polar research, either in the Arctic or in Antarctica, and to encourage collaborative links at both national and international level. This will be the first Polar meeting to be held in Spain after the

International Polar Year (IPY, 2007-2008), and therefore it is expected to disseminate and evaluate the participation of Spanish groups in the framework of the IPY.

The Symposium will host parallel meetings of the Standing Committee on Antarctic Data Management (SCADM), the Standing Committee on Antarctic Geographic Information (SCAGI) and the ICSU Task Group on the Governance of Polar Data (CODATA). The members of these committees will participate in some of the sessions of the Symposium.



For more information, please visit the Symposium website at <http://www.uibcongres.org/congresos/ficha.en.html?cc=207>

Conference on Portuguese Polar Sciences

Coimbra (Portugal), 12 April 2011



The III Conference on Portuguese Polar Sciences will take place at the Institute of Marine Research of the University of Coimbra on the 12 April 2011 (see <http://cienciapolar.weebly.com>).

The main goals of the conference are to get together all teams of Portuguese polar scientists and key collaborators, show the best and most recent science results in Polar regions, identify future opportunities in polar science, and obtain information about the advantages of joining the international community in major organizations (such as the Scientific Committee for Antarctic Research (SCAR), International Arctic Science Committee (IASC), European Polar Board (EPB) and Association of Polar Early Career Scientists (APECS)). The SCAR Executive Director, Dr. Mike Sparrow will attend. This information will be essential to consolidate a strong national programme, after Portugal signed the Antarctic Treaty in January 2010.

For further information, please contact José Xavier, email: jccx@cantab.net

APECS Upcoming Events!



The enthusiasm and excitement of early career polar scientists is a unique resource - seemingly only matched by the desire to learn the skills necessary to do better science and communicate their work and the importance of polar science! Taking advantage of these paired characteristics, APECS has a series of great events coming through the pipeline for the coming months:

APECS at ISAES 2011 – In addition to funding support provided by SCAR for early career researchers wishing to attend ISAES (Edinburgh, Scotland; July 2011), APECS and its UK branch the UK Polar Network will be putting on an open-floor mentoring panel session entitled “Succeeding in Polar Science.” Scientists from all career levels are invited to learn and share as appropriate. Drinks will be provided at the mentoring sessions and the evening will continue with informal networking in the conference centre bar! More information will be available on the conference website: <http://www.isaes2011.org.uk/>

APECS at IUGG 2011 – In association with the General Assembly of the International Union of Geodesy and Geophysics in Melbourne, Australia, APECS is holding a career development workshop on 27 June. Consisting of plenary lectures, hands-on breakout sessions, and panel discussions, the application deadline is April 11th. More information available at <http://www.apecs.is/workshops/iugg-2011>

APECS Webinars – In collaboration with the NSF and the University of Canterbury, APECS is continuing its hugely successful career development webinar series. Upcoming sessions this spring will address subjects such as “Giving a clear and memorable presentation” and “Translating scientific insights into policy.” For more information on how to participate, visit <http://apecs.is/webinars> or check out videos of past sessions on <http://vimeo.com/apecs>

These workshops are just a sample of the events, panels, and online events put together by APECS. You can stay filled in on future APECS events at www.apecs.is/events and more great APECS initiatives at www.apecs.is.

Contributed by Allen Pope, APECS President, email: ap556@cam.ac.uk

For details of further events,
please visit: <http://www.scar.org/events/>



Scientific Committee on Antarctic Research

Scott Polar Research Institute, Lensfield Road, Cambridge, CB2 1ER, UK

Tel: +44 1223 336550

Fax: +44 1223 336549

Email: info@scar.org

Web: www.scar.org



Format and design by Rosemary Nash