Theme 1

INTERNATIONAL POLAR YEAR

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International Polar Year - An Opportunity for Enhanced Capacity Building

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Abstract

IPY 2007-2008 becomes a more and more important programme due to the rapid and severe changes of climatic conditions, which are now evident in Polar Regions, in particular in the Arctic where they have a great impact on economic activities including marine navigation, oil and gas industry, and traditional activities of circumpolar human societies. Many IPY projects intend to develop new observing facilities in the oceans to extend our knowledge on the role of polar oceans in the climate system. On the basis of new knowledge, IPY will facilitate the development of sophisticated techniques for weather forecasting, operational oceanography, and climate prediction in support of socio-economic activities in polar regions. International, multi-disciplinary observing networks should be a particularly significant legacy of IPY 2007-2008 to provide scientists and decision-makers with real time information on the evolving state of the Polar Regions for decades to come.

In recognition that the IPY aims to exploit the intellectual resources and science assets of nations to make major advances in understanding the role of polar regions in the global climate system, other important legacies would be a new generation of polar scientists and engineers through the engagement of youth, as well as an exceptional level of interest and participation from polar residents, the general public, and decision-makers. IPY promotes constructive engagement with polar residents through acknowledgement and protection of traditional knowledge, and inclusion of them as valued partners in IPY conducting and building of IPY legacies. IPY will increase the public awareness and decision-makers' ability to make the best possible use of environmental knowledge. IPY activities on capacity building should also provide services tailored to the needs of women, who act as family protectors in time of disaster, play a significant role in fishery and water resources management, and perform a key function in receiving and using environmental information

Introduction

International Polar Year (IPY) 2007-2008, an intensive and internationally coordinated campaign of high quality research activities and observations in Polar Regions, is becoming an increasingly important programme due to the most rapid and severe changes in the environmental conditions which are now evident in the Polar Regions, particularly in the Arctic (Rapley, *et al.,* 2004; Allison, *et al.,*2007). In the Arctic region these changes have a strong impact on the economic activities including marine navigation and oil and gas industry, as well as on the traditional activities of circumpolar human societies. One of the findings of the Arctic Climate Impact Assessment (ACIA) has been that projected shrinking of sea-ice coverage would increase access to shipping roads and seabed resources. This would require new and revised national and international regulations focusing on marine safety and environmental protection. ACIA has also found that, due to the coastal erosion and thawing of permafrost, the existing industrial facilities (such as oil and gas extraction infrastructure, pipelines, and roads) are likely to be destabilized (ACIA,2004). In the Antarctic where no similar industrial activities have taken place so far, the weather and climate conditions may affect marine and air navigation as well as research activities on the continent and in the Southern Ocean.

The above assumptions and projections mandate the need of increasing our knowledge on the variability and change of the polar environmental processes in order to provide high-quality hydro-meteorological services to socioeconomic activities in the Polar Regions based on sophisticated techniques for weather forecasting and warning, including sea-ice coverage and ice-edge forecasts, and on climate change prediction. As the first priority this approach requires obtaining long-term series of observational data on the state of the atmosphere, the ocean, the cryosphere, and the other components of the polar climate system and using them for analysis and modeling.

IPY projects related to studies of the physical and chemical oceanic processes, sea-ice properties and changes, physical and chemical interaction between the atmosphere, sea-ice and ocean, marine geology and biology are intended to develop new observing facilities in the oceans to acquire more data on oceanic processes. According to the information received from the Arctic

Ocean Science Board (Dickson,2008), several international multidisciplinary marine expeditions within IPY projects such as DAMOCLES (EU), SEARCH (USA), ARCTICA-2007(Russia) and others were successfully carried out in July-September 2007 in the Arctic Ocean. One of the main achievements of these activities was the deployment (for the first time in the history of Arctic Ocean studies) of 156 current meter moorings and arrays as well as a large number of new underwater and under-ice mobile observing facilities across the Arctic Ocean.

The successful start of the IPY resulted in a significant increase of the number of reports from the traditional observational networks of atmosphere and oceans in Polar Regions. According to the results of the WMO World Weather Watch monitoring from 1 to 15 July 2007 (compared to the same two-week period of 2006) the number of reports from drifting buoys deployed in Arctic Ocean increased by 1,096, and from those deployed in the Southern Ocean - by 18,150 reports (five times more). Thanks to the deployment of the Argo floats in this period, the number of reports on the temperature and salinity profiles in the Southern Ocean deep waters increased by 39. It is evident that the IPY provides an excellent opportunity to substantially improve the observational data coverage in polar oceans that, in turn, will facilitate the development of operational oceanography, including new techniques of oceanographic forecasts and warnings and long-term prediction of the state of ocean as a component of the climate system.

International, multidisciplinary observing networks, including polar ocean observing systems, should be a particularly significant legacy of the IPY 2007-2008. These observing networks will provide scientists and decision-makers with real time information on the evolving state of the Polar Regions for decades to come (Kotlyakov, Sarukhanian, 2007). However, the observing networks established or modernized during the IPY 2007-2008 must be sustained and maintained in the post-IPY era by well-educated, top class specialists (scientists, engineers, technicians) who will take succession from the IPY project teams. The IPY leverages intellectual resources and scientific assets of nations to deliver major advances in the polar knowledge and understanding of the role of Polar Regions in the global climate system. Thus, its other important legacies will be the new generation of polar scientists and engineers as well as an exceptional level of interest and engagement from polar residents, decision-makers, and the general public.

Regarding the new generation of polar researchers, the IPY promotes recruitment of new and future research scientists and collaborators and aims to increase awareness of polar issues at educational and research institutions worldwide. Research and field experiences are powerful mechanisms for engaging university students. One of the IPY projects focused on this activity in Canada is titled “Students on Ice” (www.studentsonice.com). This award-winning organization is offering unique learning expeditions to the Arctic and the Antarctic. Their mandate is to provide students from around the world with inspiring educational opportunities at the ends of our planet, and in doing so, help them foster a new level of understanding and respect for our planet. Another excellent example is the young students’ expedition to Svalbard. Twelve students from Germany, Canada and the UK made a voyage north of the 78th parallel to the fragile extremes of Svalbard in the High Arctic to investigate and raise awareness of the impacts of climate change. Sailing from Longyearbyen to Ny-Alesund, the students lived and worked together for 10 days on the sailing schooner Noorderlicht (Fig. 1).

Fig.1: Students onboard of schooner Noorderlicht (www.ipy.org/youthexpedition).

The IPY project titled “The Sixth Continent Initiative - Capacity Building in Antarctic Scientific Research” was initiated by the International Polar Foundation (IPF), Belgium. Its goal is to open up access for researchers from the developing countries to research and development activities in the Antarctic, introducing a whole new group of people who have had limited exposure to this field previously, to the culture of international scientific cooperation in Antarctica, and its relevance in the wider scheme of things**.** The new Antarctic station Princess Elisabeth (70 S 23 E) was established by the IPF and can be used for this purpose (Fig. 2).

Fig. 2: View of Princess Elisabeth station in Antarctica (www.polarfoundation.org)

Within the IPY framework, the Regional Math & Science Center at the Grand Valley State University (GVSU, USA), in collaboration with GVSU College of Liberal Arts and Sciences, is proposing a year-long series of events to engage the public, teachers and students in programmes to increase their awareness and understanding of polar issues. Such programmes help generate interest combined with the excitement of discovery of the Polar Regions allowing participants to learn about the science, mathematics, and technology related to exploring, living, and working in the Polar Regions.

It is the first time in the history of IPYs when it is planned to investigate the cultural, historical, and social processes that shape the sustainability of circumpolar human societies. IPY promotes constructive and respectful engagement with polar residents through acknowledgement and protection of traditional knowledge, and through their inclusion as valued partners in conducting IPY observations and building IPY legacies. Several IPY projects rely upon active collaboration and initiative of polar residents, including women and youth, as local monitors, project assistants, website designers, knowledge experts, and disseminators of the results of IPY research. Capacity building activities should provide services tailored to the needs of women, who act as family protectors in case of disaster, play a significant role in agriculture and water resources, and perform a key function in receiving and using environmental information. Some IPY projects target polar residents and local communities, and specifically the polar youth, in addressing such issues as education, community building, preservation of traditional knowledge, and health and food security.

Fig. 3: Fishing in the Arctic seas (by Christian Morel, www.ourpolarheritage.com)

The IPY project “Bering Sea Sub-Network of Community-Based Environmental Monitoring of Observation and Information Stations” proposed by Russia and USA, intends to create an infrastructure for monitoring and observation by the indigenous and other Arctic residents’ organizations based in the coastal communities of the Bering Sea including the Bering Strait and the adjacent Chukchi Sea. It will increase the capacity and the effectiveness of circum-Arctic monitoring through responding to the need of the long-term collection of data in remote Arctic locations. Major objective of the project “Survey of Living Conditions in the Arctic” (Greenland), implementing in partnership with indigenous peoples organizations, is to develop a new design for measurement of living conditions and individual wellbeing among the Inuit and Saami peoples in the Arctic and the indigenous peoples of Chukotka. The project carries out a survey of living conditions, reflecting the welfare priorities of the indigenous people.

Local arctic peoples and young students (trainees) in each region took part in the fieldwork, educational outreach, and/or data analysis of the IPY project “Pan-Arctic Tracking of Belugas” (Greenland, Denmark). In the process of implementation of this project, 100 belugas per year over three years will be equipped by satellite transmitters and, in some locations, oceanographic data loggers, to obtain a synoptic snapshot of the pattern and timing of beluga movements in relation to sea ice, surface temperature, primary productivity, bathymetry, as well as temperature and salinity at depth through beluga dive profiles. Belugas will be tagged across their range in Svalbard, Russia, Alaska, Canada, and Greenland. This will help delineate their stock structure, particularly where ranges overlap but beluga migration patterns are distinct. Samples, measurements, and other data will be collected from each tagged beluga. Finally, establishment of a real-time web-based display of beluga movements will be a window for the public through which to view this fascinating research.

All that has been stated above leads to the following conclusions and recommendations. ICSU, WMO, and the Joint Committee for IPY should closely collaborate with the participating nations and the respective governmental and intergovernmental organizations to seek additional funding to secure the legacy of major IPY 2007–2008 achievements, including the establishment of new observational networks, data sets, and enhanced capacity building across Polar Regions and local communities. The IPY 2007–2008 **“**capacity building” legacy in the Polar Regions and in local communities should be strengthened via various means, including the new educational and outreach programmes developed during the IPY years; new educational and research facilities and technologies; and the new generation of local residents interested in research, scientific education, and community development. Governmental agencies of the IPY nations should provide assistance in maintaining such facilities and offer support to the new cohort of educated northern youth that will constitute a major professional and leadership resource for decades to come. Governments, intergovernmental and nongovernmental organizations should develop strategies to assure adequate professional development of the next generation of scientists, educators, and leaders (including women), who will benefit from advanced training**,** increased dissemination of the scientific knowledge and new international connections established during the IPY years.

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The Scotia Sea region: links between the marine ecosystem and ocean physics

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Abstract

Within the Southern Ocean surrounding Antarctica, the Scotia Sea region is of particular interest both physically and ecologically. The Scotia Sea is situated in the South Atlantic, between Drake Passage and the South Sandwich Islands. The physical settings are highly influenced by the strong, eastward flowing Antarctic Circumpolar Current and the northern branch of the Weddell Gyre, leading to strong variable flow and mixing in the region. This has impacts on the ecosystem of the region. Antarctic krill, *Euphausia superba*, are a keystone species of the Southern Ocean ecosystem and the focus of much research. While many marine predators such as whales, seals and penguins feed on Antarctic krill, it is also the target of a multinational fishery. The Scotia Sea hosts the largest abundance of Antarctic krill in the Southern Ocean. South Georgia, an island in the northeast Scotia Sea, supports large colonies of breeding higher marine predators that depend on krill as a vital food source. It is still unclear how the krill stocks at South Georgia are sustained, but there is evidence that ocean currents play a major role. Krill are large zooplankton and their early life stages can be considered planktonic in that they can be carried in the ocean circulation. It is suggested that krill larvae are transported by currents from spawning grounds at both sides of the tip of the Antarctic Peninsula across the Scotia Sea to South Georgia. However, the ocean current and frontal systems in this region are not yet fully understood.

The author describes her participation in a current research project, the Antarctic Drifter Experiment: Links to Isobaths and Ecosystems (ADELIE). ADELIE is an example of a project that examines the links between ocean physics and the marine ecosystem. Possible pathways of surface waters in the northwestern Weddell Sea and the implications for krill populations at South Georgia are being investigated. During fieldwork in the Southern Ocean in February 2007, 40 satellite-tracked near-surface drifters were deployed, which get advected with the currents. These have already revealed valuable information about the upper ocean physics. Through additional experiments using numerical ocean models, further knowledge of the variability of the currents and fronts in this important region can be extracted.

Association of Polar Early Career Scientists (APECS): Shaping the Future of Polar Research

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Abstract

The Association of Polar Early Career Scientists (APECS) is a new initiative emerging form the current International Polar Year (IPY) that aims to bring together early career scientists and engineers from around the world who share an interest in the Polar Regions and the Cryosphere as a whole. The mission is to raise the profile of polar science and provide a continuum of leadership that is focused both internationally and interdisciplinary. APECS is a major component of the IPY Youth Steering Committee (YSC), and as such an endorsed and recognized International Polar Year project. This organization and all of its members are a direct legacy from IPY 4.

The YSC will form a worldwide network of young people who care deeply about the Polar Regions and the issues facing these areas. It will ensure that after IPY has ended, the focus on polar research will not. It will provide the opportunities for the next generation of polar researchers to get the training and mentorship necessary for them to succeed in future polar research and will hopefully spawn new creative interdisciplinary directions for these polar research activities. It will ensure that the voice of youth is heard by policymakers and will not be overlooked in the future. It will ensure that this generation does not forget the wisdom of past generations. It will bring awareness to the youth of the world about the Polar Regions and will hopefully, through that awareness, bring about positive change.

APECS is one important component to achieve these goals. Founded by three early career scientists in 2006 as a directive from the International Polar Year international office, this network provides a forum for polar scientists to begin international and interdisciplinary collaborations early in their careers, fostering international science. The network represents people with a wide range of expertise and interests including natural and social sciences and engineering in Polar Regions as well as the broader cryosphere. It also strongly encourages the participation of people involved with polar education and outreach and has a strong body of members actively participating in these activities. APECS has many partnered organizations such as the Permafrost Young Researchers Network, UK Polar Network, the Alaska Young Researchers Network, etc., and some 800 members worldwide. It conducts field work both in the Arctic and Antarctica, but also in other glaciated areas of our planet. APECS aims at providing an online platform for discussion and networking and redistributing information to early career scientists and engineers through online and offline means. APECS is represented at many international research symposia and conferences and maintains strong links with International Youth Steering Committees in many countries.

Introduction

APECS-what's this?

The International Polar Year 2007-2008 (IPY) is well underway and polar researchers are producing an unprecedented and diverse collection of physical, natural, and social science data. These data are vital for advancing our fundamental understanding of the Polar Regions and the cryosphere as a whole. Important objectives of IPY are to advance this understanding by fostering interdisciplinary science and international exchange, engaging the public in polar discovery and attracting the next generation of polar researchers.

Ensuring the legacy of these scientific advances, however, requires educating and mentoring a "next generation" of polar researchers. It is the current and future generations of researchers who will build on the advances of this IPY to further our understanding of the Arctic and Antarctica. This knowledge includes examining how changes in these regions will affect the global system, as well as contributing to decision making about vital issues facing our planet. More than ever, it is essential for the experienced and seasoned science community to serve as teachers and mentors to early career scientists as well as assist in recruiting the next generation of researchers (ICSU 2004, NRC 2004).

The Association of Polar Early Career Scientists (APECS) is a new initiative emerging from the current International Polar Year (IPY) that aims to bring together undergraduate and graduate students, postdoctoral researchers, early faculty members and educators from around the world who share an interest in the Polar Regions and the Cryosphere as a whole. Many polar early career scientists find themselves involved with innovative, topical, adventurous, and intellectually stimulating science. It is this connection to link science and the polar environment that sparks many talented young scientists to pursue polar science careers. However, these young researchers, and the future researchers, face a number of challenges: 1) the need for increased international/multinational cooperation; 2) the need for integrated and interdisciplinary research; 3) keeping up with technological advancements such as high-throughput genomic sequencing, supercomputing centers, coupled-system models, and cyber infrastructure needs, and gaining access to these advances; 4) scientific results that must be translated for effective use by policymakers and the public; and 5) unique and challenging research sites.

To retain the current cohort of early career polar scientists and recruit the next generation of researchers, professional development and networking activities must be expanded to address difficulties in international and interdisciplinary collaborations, rapidly developing technologies, logistical requirements of fieldwork, and the increasing need to disseminate science results to the public and policymakers. Early career scientists have noted this need through their own experiences and have worked together to create a global network to address and aid them in overcoming these challenges.

APECS was founded in response to the need for enhanced and sustained career development opportunities and as a legacy of IPY Endorsed Project #168, the International Youth Steering Committee (YSC). By providing networking and career development opportunities, APECS' activities aim to raise the profile of polar research, develop effective leaders in education and outreach, and stimulate interdisciplinary and international research collaborations. APECS builds on extensive national and disciplinary networks to develop integrated research directions, meet career development needs, and communicate the urgencies of polar science to a worldwide audience.

APECS' primary objective is to assist young researchers in addressing the challenges of polar research as they progress through the early stages of their careers. Education and outreach is also a high priority of APECS members for a number of reasons, including the stimulation and engagement of the next generation of polar scientists that will be needed to meet growing scientific challenges. In addition to being a networking organization, APECS facilitates mentoring by liaising with senior researchers. APECS is in the early stages of organizational development and a modest investment of resources would greatly enhance its performance, reach, and sustainability for years to come. APECS' membership includes more than 1200 early career researchers from every continent (we invariably do have a presence in Antarctica!) ranging from undergraduate and graduate students, postdoctoral fellows, and new faculty members.

APECS' goals include creating opportunities for the development of innovative, international, and interdisciplinary collaborations among current early career polar researchers as well as recruiting, retaining and promoting the next generation of polar enthusiasts. Specifically we aim to:

1) Create a network of polar researchers across disciplines and national boundaries to meet, share ideas and experiences, and develop new research directions and collaborations;

2) Provide career development for traditional and alternative polar and cryosphere professions;

3) Promote education and outreach as an integral component of polar research and stimulate future generations of polar researchers, and

4) Recognize outstanding achievements and contributions to polar science by early career researchers.

APECS as IPY legacy

APECS is a worldwide network of young people who care deeply about the Polar Regions and the issues facing these areas. This group will ensure ongoing emphasis and attention on polar research beyond IPY 2007-2008. It will provide access to the opportunities for the next generation of polar researchers to get the training and mentorship necessary for them to succeed in future polar science careers and will spawn new creative interdisciplinary directions for these polar research activities. It will ensure that the voice of youth is heard by policymakers and will not be overlooked in the future. It will ensure that this generation does not forget the wisdom of past generations. APECS will continue to bring awareness to the youth of the world about the Polar Regions and will stimulate positive change.

IPY 2007-2008 comes at a time when interest in the poles has been focused by concerns over environmental, social, geopolitical and climate change in the polar regions and understanding their underlying causes and consequences. The IPY aims to create large international and interdisciplinary research addressing the delicate Polar Regions on Earth that play such an important role for the function of this planet and to increase the general public's awareness, understanding and appreciation of these regions. The APECS organization taps into the momentum surrounding the IPY to unite early career researchers in a network that ensures the development of international and interdisciplinary collaborations early in our careers that will last well beyond the IPY.

APECS activities

APECS provides an online platform for discussion and networking and distributing information to early career scientists and engineers through online and offline means. Communication among members is fostered through an interactive website, newsletter and a mailing list. The website features discussion boards for various topics of interest, a searchable job listing, a searchable calendar of events, a searchable member list and a news section listing recent APECS-related and polar news. The executive committee of APECS is engaged in raising funds and organizes annual meetings for planning and development of future activities. In addition, workshops focused on career development are being organized to raise awareness of opportunities for early career scientists in areas such as science planning. APECS has been and will be represented at many international research symposia and conferences, including the American Geophysical Union (AGU) fall meeting, 2007, European Geophysical Union (EGU) meeting, 2008, and the first IPY science conference - the International Arctic Science Committee/Scientific Committee on Antarctic Research Science Conference in St. Petersburg, Russia (2008). Open meetings and informal receptions are organized to enable face-to-face interactions and personalized networking of members. Career advice and resources with a focus on polar research are collected and distributed via the website. The IPY has placed strong emphasis on education and outreach and many early career polar researchers are using this momentum to get involved in broader communication of their work and the importance of the Polar Regions.

Highlights of APECS' activities have included:

- Successfully acquiring initial financial and in-kind support from several agencies, including: the International Arctic Science Committee (IASC); the Scientific Committee on Antarctic Research (SCAR); the Arctic Ocean Sciences Board (AOSB); Serla, a Nordic Eco-labelled paper company; IPY International Programme Office; European Polar Board; the Arctic Research Consortium of the U.S. (ARCUS); the Arctic Portal; the British Antarctic Survey (BAS); and the University of the Arctic (UArctic).
- Formed partnerships with the above organizations and related projects and activities, including the US National Science Foundation-supported "New Generation of Polar Researchers Symposium".
- Disciplinary associations of young researchers such as the Permafrost Young Researchers Network (PYRN) and the Climate and the Cryosphere young researchers group also have joined under the APECS umbrella.

- Established an international strategic plan, a working organizational format, constitutional and organizational documents, and an international advisory committee that will guide the formalization of the operating procedures for the organization.
- Launched a website, supported by in-kind contribution from the Arctic Portal, http://arcticportal.org/apecs. The website contains a list of events, job openings, funding and research opportunities, and a discussion forum to share ideas, develop collaborations, and learn about challenges at various field sites.
- Held informal meetings and workshops at national and international conferences, including a roundtable discussion, informal social gathering, and networking opportunities at the Arctic Science Summit Week (ASSW) 2007 in Hanover, NH; a training workshop on modern investigation techniques in the field of permafrost science held in November 2007 in Russia through a partnership with the Otto Schmidt Laboratory for Polar and Marine Research (OSL); and invited participation as members of the Science Organizing Committee for the SCAR/IASC 2008 Open Science Conference. The IPY Joint Committee has recently offered APECS a seat on this international polar science planning body to represent the needs and views of early career polar researchers in this IPY and ensure the leadership for the next IPY.
- Planning for upcoming events include several career development workshops presented in conjunction with the senior polar science community focusing on developing international and interdisciplinary collaborations, improving writing skills, and conducting effective outreach. Some of the conferences where workshops will be held include the Northern Research Forum Bi-Annual Conference, the Society of the Advancement of Chicanos and Native Americans in Science, International Conference on Arctic Social Sciences, and the Arctic Forum. For a complete list of upcoming events, visit our website http://arcticportal.org/apecs.

Since its inception, APECS has relied on volunteers to carry out its mission. The needs for and impacts of effective career development activities and international networking have become increasingly apparent and will continue to grow as the next generation of researchers develops. The response to these identified needs from the international polar science community has created a larger demand for APECS involvement in conferences, meetings, and other science planning activities beyond the level that can be sustained by a volunteer effort. APECS is seeking support for its activities and for an International Secretariat to coordinate the large number of activities occurring globally. For more information, become a member, or to develop a partnership with APECS, visit the website, hosted by the Arctic Portal, at http://arcticportal.org/apecs or email APECSinfo@gmail.com.

Acknowledgements

APECS is an endorsed activity and legacy of the 4th International Polar Year, IPY 2007-2008. We would like to thank all the members of the IPY IPO, and their sponsoring organizations, ICSU and WMO for support. CH-L gratefully acknowledges the IPY-IPO for travel support to attend the XXXII *Pacem in Maribus* Conference in Malta in November 2007. Our activities and network are made possible by dedicated time, financial and in-kind contributions from many organizations, including the IPY International Program Office, Arctic Research Consortium of the US, International Arctic Research Center at the University of Alaska, Arctic Portal, International Arctic Science Committee, Scientific Committee on Antarctic Research, European Polar Board, Arctic Ocean Science Board, New Generation of Polar Research Symposium, Serla, University of Akureryi, and others. This institutional support had been implemented through the committed, voluntary efforts of many APECS members and the senior research community.

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Fig. 1: The APECS council at its founding meeting in September 2007 at the Conference Centre Sånga Säby near Stockholm (Sweden)

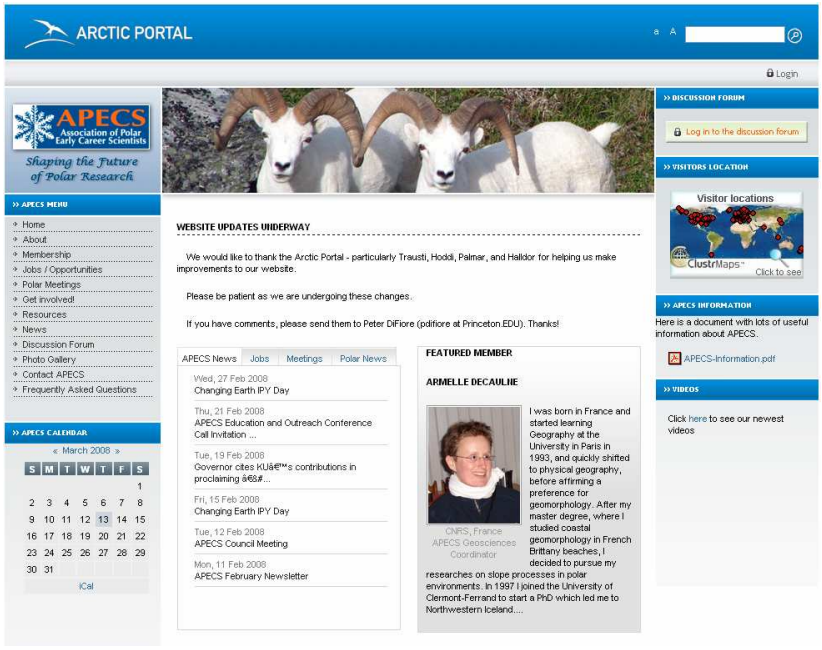

Fig. 2: The APECS website hosted by the Arctic Portal (http://www.arcticportal.org/apecs/)

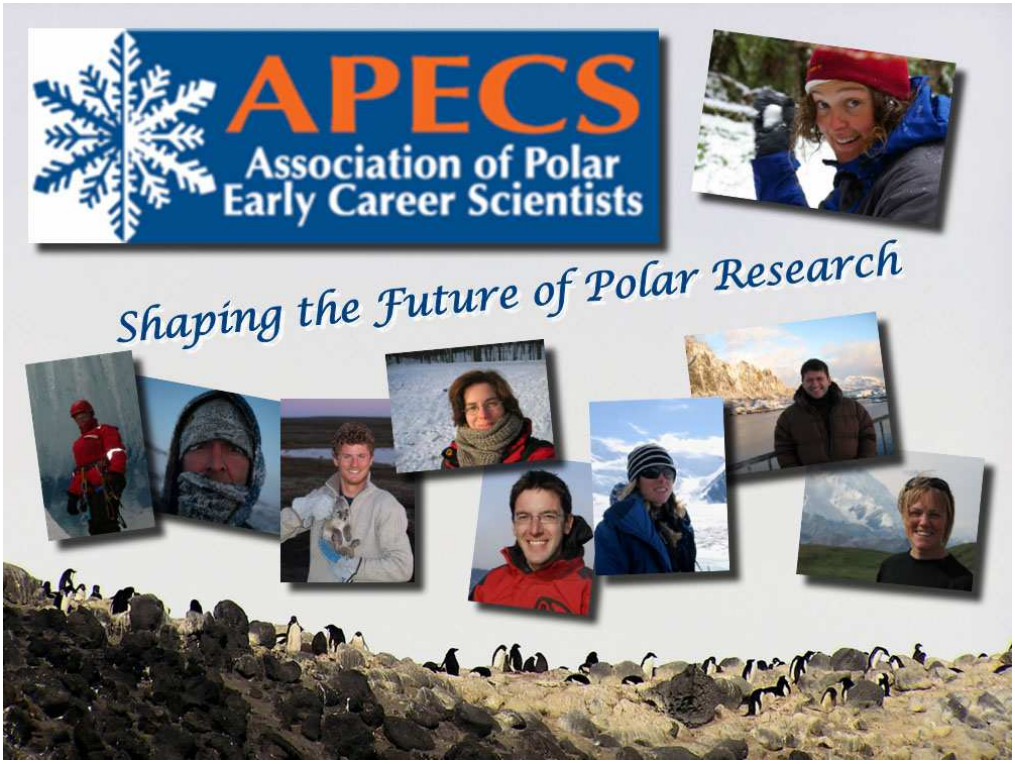

Fig. 3: APECS – Shaping the Future of Polar Research