Full Proposals for International Polar Year 2007-2008 Activities

Proposed IPY Activity Details

1.0 PROPOSER INFORMATION

(Activity ID No: 32)

1.1 Title of Activity
POLar study using Aircraft, Remote sensing, surface measurements and modelling of Climate, chemistry, Aerosols and Transport (POLARCAT)

1.2 Short Form Title of Proposed Activity
POLARCAT

1.3 Activity Leader Details
Andreas Stohl
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Norway

1.4 Lead International Organisation(s) (if applicable)
IGAC (International Global Atmospheric Chemistry)
SPARC (signalled that endorsement is likely)
NULL
NULL

1.5 Other Countries involved in the activity
Canada
France
Germany
Poland
UK
USA
Japan
Russia
Switzerland
Spain
Italy
Finland
Sweden
China
Belgium
Columbia, Estonia, Portugal

1.6 Expression of Intent ID #'s brought together in this proposed activity
244, 28, 48, 484, 318, 725, 637, 720, 309, 212

1.7 Location of Field Activities
Arctic

1.8 Which IPY themes are addressed
1. Current state of the environment
2. Change in the polar regions
3. Polar-global linkages/tele-connections
4. Exploring new frontiers
5. The polar regions as vantage points

1.9 What is the main IPY target addressed by this activity
1. Natural or social science

2.0 SUMMARY OF THE ACTIVITY

The overall objective of POLARCAT, which proposes a coordinated programme of measurements and modelling, is to quantify the impact of trace gases, aerosols and mercury transported to the Arctic and their contribution to pollutant deposition and climate change in the region. POLARCAT has 5 major scientific objectives detailed in a White Paper (see http://zardoz.nilu.no/~andreas/POLARCAT/):
·Quantification of the major transport pathways controlling distributions of oxidants, aerosols, heavy metals together with their precursors/degradation products in the Arctic troposphere during winter-spring when Arctic Haze is prevalent and during summertime. Processes controlling the carbon budget at Northern high latitude forest/tundra/ocean regions will also be investigated.
·Quantification of the optical properties and direct radiative effects of aerosols and their interactions with clouds and possible impacts on surface albedo and ice/snow cover.
·Investigation into the influence of summertime boreal forest fires on the composition of the Arctic free troposphere compared to other source regions (e.g. Asia) including the impact of soot deposition on snow/ice albedo. The impact of pyro-convection on the composition/aerosol loading of the lower stratosphere and possible influences on stratospheric ozone depletion will also be investigated.
·Determination of chemical processes controlling atmospheric composition, particularly during the winter and the spring-summer transition in the Arctic. This will include assessment of the nature and extent of ozone depletion events (link to halogen/mercury cycling) in the boundary layer; quantification of the role of VOCs and oxygenated species, relative roles of dry deposition and wet deposition of soluble species in rain- and snowfall, quantification of sources and sinks of major oxidants such as ozone and PAN including assessment of the odd-nitrogen budget. Also the chemistry and effect of polar air masses on mid- and high latitude particle formation is investigated.
·Study of processes controlling inter-annual variations in atmospheric composition over the Arctic such as transport patterns (e.g. NAO) and changing emissions in different source regions. The impact of climate change on atmospheric composition and conversely the impact of atmospheric composition change on climate will also be investigated.
These scientific objectives will be addressed by the collection and analysis of data on trace constituents, aerosols and their radiative properties, heavy metals (mercury), CO2, O2, and precipitation composition at multiple surface sites. At certain sites, remote sensing instrumentation will also provide information on vertical distributions or columns of atmospheric constituents. Major international airborne intensive campaigns are also planned, focusing on winter/spring in 2007 and 2008 (Artic Haze) and summer 2008 (Forest Fires) involving multiple aircraft from several countries, a ship and real-time use of satellite data and forecast tools for planning. Novel Lagrangian balloons will be used to follow polluted air masses enabling multiple samplings by different aircraft. Satellite data validation and analysis (e.g. CALIPSO, SCIAMACHY, ACE, GOME2, IASI) will also be a major component together with chemistry-aerosol-climate modelling, particularly in the assessment of inter-annual variations and impacts on climate.
POLARCAT brings together the original EoI (ITCT-Arctic) on long-range transport of pollutants with several other EoIs within sub-cluster 4.1 on clouds, aerosols and chemical composition as well as one other related EoI resulting in a wide-ranging and comprehensive research programme.

POLARCAT now includes components covering surface precipitation chemistry (POLAP, 318), mercury transport and cycling (HgCanEur, 725), carbon budget (GRAAM, 484), surface trace gas, aerosol and greenhouse gases (GHG) measurement network (STEP, 637) and NDSC remote sensing network for trace gases (TOPAS, 28), satellite measurements (ACE, 720), airborne measurements of aerosol-radiation-clouds (ICE-CLOUD, 48), and isotopic measurements focusing on the nitrogen budget (SANTAS, 309). It also includes components and links to other EoIs being coordinated by other lead EoIs (e.g. summer cloud-ocean study (ASCOS), 212; Circumpolar Aerosols, 557, Int. Arctic System for Observing the Atmosphere (IASOA), 138 and Aerosol Measurements at Summit (AEROMAS), 530).

2.1 What is the evidence of inter-disciplinarity in this activity?
This initiative will bring together climate modellers, chemists, meteorologists, biogeochemists, physicists and engineers. Activities include collection (including instrument development) and analysis of data collected at long-term surface sites (inc. lidar) and during several dedicated field missions, and use of a range of modelling tools. This effort combined with analysis and validation of satellite data will be used to study key processes, feedbacks and climate change in the Arctic region. The activity will promote collaboration between scientists working towards common goals, and also with other IPY activities, e.g. OASIS.

2.2 What will be the significant advances/developments from this activity? What will be the major deliverables? What are the outputs for your peers?
·Climate change - POLARCAT will provide better understanding of processes influencing atmospheric composition, aerosol-climate feedbacks and the carbon cycle (including a refinement of the carbon budget estimates in the northern hemisphere) leading to improved predictions of climate change in the Arctic (e.g. soot deposition on snow, forest fire aerosols, Arctic haze).
·Pollutant transport pathways and deposition – collection and analysis of a comprehensive dataset on chemical and physical processes influencing chemical composition, aerosol properties, distributions of heavy metals (mercury) in the Arctic troposphere and lower stratosphere and deposition of species in precipitation and by dry deposition to snow/ice; Also including analysis of sources and sinks for oxidants, aerosols, GHGs and heavy metals.
·Global context - the proposed series of field activities, which will be closely linked to satellite data analysis, will enable long-term measurements collected at surface sites on air/snow/ice composition and pollutant deposition to be put into not only a regional Arctic but also a global context.Results will be published in peer-reviewed journals as part of linked special sections with other EoIs in this cluster and also presented at international scientific meetings; a cluster workshop is planned. Key findings will be presented via press releases to the media and summarised in newspaper/magazine articles. The POLARCAT website (in development) will provide an up to date account of results including material which is understandable for the general public and school children.

2.3 Outline the geographical location(s) for the proposed field work (approximate coordinates will be helpful if possible)

Locations	Coordindates
Aircraft, based in e.g. Longyearbyen (Svalbard), Thule (Greenland), Kiruna (Sweden), transects between Tomsk and Yakutsk (Russia)	
Ny Ålesund, Kinnvika, Hornsund, Longyearbyen, Barentsburg, Zeppelin mountain (Svalbard)	
Summit, Kangerlussuaq, Cape Farewell (Greenland)	
Andoya, Bjornoya, Jan Mayen, Hopen, Tromso (Norway)	
Abisko (Sweden), Värriö, Pallas GAW, Kaamanen, Rovaniemi (Finland)	
Barrow, Alaska (USA); various ships	
Kuujjuarapik, Quebec; Ellesmere Is., Alert (Canada)	
Kola Peninsula, Kotelny Island, Tiksi, Wrangel Is., Lena River (Russia)	

2.4 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	Antarctic Fieldwork time frame(s)
04/07- 04/07	
11/07- 04/08	
05/08 - 08/08	

2.5 What major logistic support/facilities will be required for this project?
Fixed wing geophysical aircraft
Observatories
Existing field stations
Multi-instrumented platforms
Icebreaker

Further details – airport requirements are suitable runway, de-icing facilities, hangars for one or more aircraft, contacts with air traffic control/customs, facilities for chemical preparation, fast internet connections for flight planning/coordination. Surface sites require logistical support for materials, shipping equipment/samples etc.

2.6 How will the required logistics be supplied? Have operators been approached?

Source of logistic support	Likely potential sources	Support agreed
Consortium of national polar operators		
Own national polar operator	Y	Y
Another national polar operator		
National agency	Y	
Military support		
Commercial operator	Y	
Own support		
Other		Y

2.7 If working in the Arctic regions, has there been contact with local indigenous groups or relevant authorities regarding access?

3.0 STRUCTURE OF THE ACTIVITY

3.1 Origin of the activity
This is a new activity developed for the IPY period

3.2 How will the activity be organised and managed? Describe the proposed management structure and means for coordinating across the cluster
The POLARCAT White Paper (http://zardoz.nilu.no/~andreas/POLARCAT/) describes in detail how POLARCAT will be managed and how it is linked to other IPY activities. POLARCAT forms part of the sub-cluster 4.1 on Clouds, aerosol and chemical composition. It has been agreed that within this sub-cluster there will be meetings of the activity leads in order to foster collaboration between the different activities. It is also proposed to have joint workshops and after the main field phase joint publication in journal special sections involving several activities. The sub-cluster led by the OASIS project (344) will also form part of this grouping as their activities are closely linked to our cluster activities and in particular POLARCAT and AICI. There are also links with EoI 158 on hydrological impacts of aerosol.Within this overarching IPY umbrella, POLARCAT has defined its own management structure. A Steering Group has been formed led by the activity lead (chair) and co-chair. It is made up of representatives from the original ITCT-Arctic proposal and other EoIs joining this activity within POLARCAT (e.g. POLAP, STEP, HgCanEurasia). The Steering Group will report directly to the Steering

Committees of IGAC, where POLARCAT has been endorsed as a new task, and SPARC which is in the process of endorsing this activity. This will ensure that the project is overseen by independent experts within an international framework. Note also that the POLARCAT SG includes current members of the IGAC SC (Law, Parrish) who are also IGAC representatives on the SPARC SC. POLARCAT has also defined several Working Groups on data management, aircraft/satellite data, surface sites, campaign planning, analysis and modelling. A further activity on education and outreach will be developed in coordination with, for example, the EU ACCENT network. The WGs will be coordinated by task teams (SG members) responsible for coordinating activities within and between WGs. An implementation plan will be written in early 2006 detailing the specific field activities that will take place as part of POLARCAT and links with other sub-cluster 4.1 and related (e.g. OASIS) activities. SG meetings and meetings/discussions with other sub-cluster leads will facilitate this process. Meetings will be held in 2005/6 to plan and coordinate the field intensives.

3.3 Will the activity leave a legacy of infrastructure and if so in what form?
POLARCAT will leave a legacy in terms of a very comprehensive dataset on atmospheric composition in the troposphere and lower stratosphere that will be used to characterise aerosol, oxidant and pollutant loadings in the Arctic and their impact on climate. Several surface sites are new (e.g. Cape Farewell, Greenland) and it is planned to continue their operation after IPY. Development and installation of new instrumentation (e.g. mercury sensors) at surface sites and on aircraft are also planned and will be available for future missions after IPY.

3.4 Will the activity involve nations other than traditional polar nations? How will this be addressed?
This activity will involve scientists from more than a dozen nations, many of which are not considered as traditional polar nations (e.g. Columbia, China, Switzerland). It will also arrange workshops and conferences, which will inform the global scientific community on new findings.

3.5 Will this activity be linked with other IPY core activities? If yes please specify
Yes. At a planning meeting in May 2005, the leads of OASIS (344), AICI (213), and ATMOPOL (89) were present. E-mail contacts were also made with PO3L (542), POLAR AOD (299) and there was a coordination meeting at the EGU conference in Vienna (April 2005). Close scientific cooperation was agreed including joint activities such as workshops and the publication of a small series of review papers in 2006 summarising the state of knowledge prior to IPY.

3.6 How will the activity manage its data? Is there a viable plan and which data management organisations/structures will be involved?
There will be a POLARCAT Working Group specifically tasked with data management. A data management plan and a protocol for data quality control and quality assurance will be developed It is most probable that the data will be held at different data centres (i.e. NILU, NASA, BADC, DLR, NOAA, NDSC, GAW) with links via the POLARCAT website. Sub-projects which have their own websites (e.g. POLAP, TOPAS) would also link to the POLARCAT website. Meta data links will also be made to other core IPY activities.In the particular case of the field campaigns, data will be submitted to the distributed data centres in a common format which has already been used in previous multi-aircraft campaigns (e.g. ICARTT in 2004). It is envisaged that surface site data would also be made available in common formats where possible. Quick look data from sites/aircraft/satellites taking part in field intensives will be available to colleagues in near-real time for flight planning with raw data available within a few weeks after the campaign. Final data will be available after a short time (about 6-9 months) after the campaigns. After a defined period (about 18 months) the data will be made public. For POLARCAT, merged files of final data from the different measurement platforms will be produced. These plans will be discussed and developed at the next POLARCAT planning meeting.

3.7 Data Policy Agreement
Will this activity sign up to the IPY draft Data Policy (see website)
Yes

3.8 How will the activity contribute to developing the next generation of polar scientists,

logisticians, etc.?
POLARCAT will provide PhD positions to train young researchers. Some of the participants will also offer courses for students at their universities. Outreach activities will also offer material for school teachers in order to attract young people into polar and atmospheric research. Courses will also be held at field stations (e.g. in STEP: Nordic graduate school CBACCI - Biosphere-Carbon-Aerosol-Cloud-Climate Interactions).

3.9 How will this activity address education, outreach and communication issues outlined in the Framework document?
Participants have a good record in communicating results to the public (e.g. NASA, DLR) and making new results quickly available to the media. The project will make use of facilities being developed related to e-learning, particularly for undergraduates, in the framework of the EU ACCENT network. Outreach activities targeted towards school children will include “Teacher at Sea” (which already in the past has taken teachers onto the research vessel R.H. Brown during research cruises) or “Teachers and researchers exploring and collaborating” (TREC). A POLARCAT web site will be created that will serve the communication among researchers, the communication between researchers and journalists, and will also communicate information on the program to the public. Press conferences will be held during the field campaigns. Communication of polar atmospheric research to other atmospheric researchers will be carried out via reviewed publications, established newsletters (e.g., IGAC and SPARC) and presentations at international conferences.

3.10 What are the proposed sources of funding for this activity?
The field campaign in April 2007 is already funded together with some surface/satellite activities (e.g. Finnish Acad. Sciences, CARBO-Ocean, Polish Nat. Comm., Canadian Space Agency, BMBF). For the major part, funding is being sought from national agencies (e.g. NASA, NOAA, NSF, NERC, CNRS, Norges forskningsråd, Deutsche Forschungsgemeinschaft, SNF, Spanish Program for Polar Research, State Committee for Scientific Research of Poland, INTAS, IPEV, etc.). Agencies and participating institutions will also bring in their own funds (AWI, DLR, CNES, NASA, NOAA). It is also planned to submit a proposal to EU FP VII under the Global Change priority.

3.11 Additional Comments

4.0 CONSORTIUM INFORMATION

4.1 Contact Details

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4.2 Other significant consortium members and their affiliation

Name	Organisation	Country
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Brian Stocks	Canadian Forest Service	Canada
Peter Bernath	University of Waterloo	Canada
Jan Bottenheim	Environment Canada	Canada
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