

International Council for Science

ICSU International IPY – Planning Group

Based on project proposals received from the research communities in Greenland and Denmark the Danish National IPY Committee proposes the following main themes for IPY activities in Greenland:

- ❖ **Greenland's Ice Sheet**
- ❖ **The Arctic Climate**
- ❖ **Man, Nature and Arctic Societies**

Greenland's Ice Sheet

Rationale

The single most unique feature in the physical nature of the Northern Hemisphere is the vast ice sheet covering 82% of the total land area of Greenland. This Ice Sheet is matched only by the Antarctic Ice Sheet and therefore offers outstanding possibilities for bi-polar comparison in a research context.

The main question to address is that of the mass balance of Greenland's Ice Sheet. There are indications that the southern part of the ice sheet has a negative balance whereas the northern part has a positive balance. However, studies have also shown that the melting zone now reaches higher altitudes than before, probably due to the present climate warming. These issues may be addressed by modelling and satellite measurements in addition to studies of ice sheet dynamics and outlet of glaciers.

Greenland's Ice Sheet is not only a research target in itself, – it is also used as a platform by researchers for upwards studies of troposphere,

stratosphere, mesosphere, thermosphere and space – as well as downwards into the lithosphere. This is particularly true at the highest elevation (3250 m above sea level) where physical and chemical conditions are exceptionally good for upward directed research endeavours.

The relative accessibility of the Ice Sheet, its proximity to populated areas and its key role in the climate of the North Atlantic region are core factors in promoting coordinated and concerted activities during the IPY, – and also key issues in linking this theme with the “Arctic Climate” and “Arctic Societies” themes.

Major logistic needs

Research on the Ice Sheet often requires demanding, costly and exceptional logistical solutions, airborne as well as surface-based. This is particularly true for activities in the interior, high-altitude region. It therefore makes good sense to establish logistics clusters on the Ice Sheet to optimize infrastructure investment and usage. The present research facilities at the Ice Sheet summit should be updated and restructured to accommodate an increased influx of persons and hardware during the IPY. However, an ice traverse option should be considered to supplement the current aircraft dependent traffic. An ice traverse between the airport (Kangerlussuaq, W. Greenland) and the ice summit may also be valuable for specific studies along the slope of the Ice Sheet.

International collaboration

The Ice Sheet as a main IPY theme in Greenland naturally invites international collaboration in developing integrated, multi-disciplinary approaches to handle the complex science questions and challenging logistics. The long tradition for multi-national consortia to operate on the Ice Sheet should be maintained and will hopefully be consolidated during IPY.

Disciplinary keywords [unprioritized list]

Ice sheet mass balance and dynamics; global sea level; snow and ice physics; ice coring; palaeo-climate; modelling; ice-ocean-atmosphere interaction; environmental studies along climate gradients; life in extreme environment; aerosols; airborne pollutants; prehistoric DNA profiles; astronomy; space physics; geophysics; seismology; tectonics; bi-polar comparison; habitation in extreme environments; human psychology; ice sheet as a testing ground in Martian polar context.

Community Outreach opportunities

Greenland's Ice Sheet and the high diversity of associated research activities create outstanding possibilities for developing and implementing community outreach activities covering the entire educational spectrum. The international airport at Kangerlussuaq (W. Greenland), close to the Ice Sheet, is the only major gateway to the Ice Sheet and may be used to further the interplay between science, disseminators, media and the public.

Proposals addressing this theme

DK-Proposal 2; DK-Proposal 27; DK-Proposal 28; DK-Proposal 33; DK-Proposal 34; DK-Proposal 37; DK-Proposal 38; DK-Proposal 39.

The above proposals refer to the list submitted March 15 2004 by the Danish National Committee for IPY

The Arctic Climate

Rationale

Greenland and its surrounding waters play a key role in shaping the Arctic climate. Greenland's Ice Sheet, the permafrozen land areas, the Arctic Ocean and its outlets of Fram Strait and Nares Strait, the Transpolar Current, the thermohaline circulation 'pump' in the Arctic Ocean, the Greenland Sea and the Labrador Sea, and the Arctic/North Atlantic Oscillation are all known to be essential factors in shaping the Arctic climate system.

Although the Arctic climate exerts a significant two-way interaction with the climate at lower latitudes, there are still major breaches in the knowledge of how the Arctic climate really works, how sensitive and adjustable it will be to future changes in natural and / or anthropogenic forcing elements. Major uncertainties lie in our ability to predict the recovery of the ozone layer in a future climate, characterized by decreasing stratospheric temperatures and increasing water vapour. Improved atmosphere – ice – ocean models for the Arctic will, therefore, be essential tools in evaluating and predicting consequences of future climate scenarios. To accommodate this need, a large-scale multi-national data collection campaign, in combination with modelling, must be orchestrated during the International Polar Year.

The importance of the major Arctic climate factors lies in their ability to alter the thermohaline circulation 'pump' significantly, thereby potentially reducing the North Atlantic deep water formation, – resulting in global climate perturbations.

There is a strong causal relationship between the dynamics of the Arctic climate and the living conditions for indigenous Arctic peoples. The 'Arctic Climate' theme is therefore in a close contextual connection with the other proposed themes.

Major logistic needs

The logistics will have to be multi-faceted to accommodate the highly diverse research needs. The remoteness and the extreme environment of the Arctic Ocean and off-shore NE Greenland will require unusual and/or large-scale logistical solutions and involve costly logistics such as floating ice camps, buoys, robot submarines, icebreaking vessels as well as a fine-meshed automated climate station network on ice and land.

International collaboration

The Arctic climate is by nature an international topic. To fully address the climate issue, the research and logistical tasks will be demanding and require efforts at a level not presently available in any nation by itself. Therefore, coordinated international collaboration is a necessity. A well-coordinated circumpolar activity is suggested for IPY.

Disciplinary keywords [unprioritized list]

Ocean currents; deep water convection; thermohaline ocean circulation; sea ice dynamics; ozone-climate couplings; atmospheric pressure anomalies; atmosphere-ice-ocean models; Arctic river run-off; albedo changes; arctic cloud changes; sea ice thinning; southbound pack ice flux; data assimilation; oceanography; meteorology; remote sensing; sedimentology; palaeo-climate coring.

Community Outreach opportunities

The Arctic Climate as a theme lends itself rather well to community outreach and the diversity of associated research activities create outstanding prospects for developing and implementing outreach activities covering the entire educational spectrum.

The Arctic Climate theme holds many aspects that are of direct importance to peoples at lower latitudes; therefore, disseminating information

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about the Arctic climate will be received with immediate interest by the public in North America and Europe.

However, it will require a highly coordinated plan to obtain pertinent and suitable material from researchers directly involved, as the Arctic climate scientists will be deployed over a vast area during IPY.

Proposals addressing this theme

DK-Proposal 1; DK-Proposal 5; DK-Proposal 6; DK-Proposal 8; DK-Proposal 10; DK-Proposal 11; DK-Proposal 12; DK-Proposal 16; DK-Proposal 17; DK-Proposal 18; DK-Proposal 19; DK-Proposal 21; DK-Proposal 24; DK-Proposal 25; DK-Proposal 29; DK-Proposal 37; DK-Proposal 40.

The above proposals refer to the list submitted March 15 2004 by the Danish National Committee for IPY

Man, Nature and Arctic Societies

Dynamic Greenland – Facing Challenges in a Changing Environment

Rationale

During the last two decades research institutions focusing on arctic societies have moved to or have been established in Greenland where they unfold their research in national and international partnerships and with partners inside and outside the circumpolar region.

Arctic societies have experienced several cultural encounters and are now facing new challenges due to increasing globalization, internal developments and different levels of economical and political independencies. The rapid development in many arctic cultures has however led to radical changes that affect all aspects of human life: in family structures, in social and political organization, in knowledge regimes, in health and other living conditions etc.

On top of these changes within the Arctic Societies themselves, they are also affected by and has to cope with international and global mechanisms driven by change in climate and ecosystems, changes in environmental conditions and in economical and political structures, intellectual and cultural inputs and dominance via Internet and other media as well as physical and mental impacts as a consequence of changes in life ways, access to western foods, beverage, drugs etc.

Arctic societies still hold unique and valuable information on the mechanisms of interaction between man, society and the arctic nature from the distant past to the present. This and more information is embedded in language, social organization, norms and value systems, the cultural landscape, archaeology, history, spiritual life, local and regional settlement

patterns, strategies for mobility and (semi-)sedentarism, oral tradition, traditional and local ecological knowledge etc..

In order to empower the arctic societies to face and deal with the multitude of challenges which affects the living conditions, the natural environment and the ways of life in a speed of an unprecedented nature the information present in arctic societies about their own past and present must be further investigated in partnerships with the residents of the Arctic and put at the disposal of the societies involved as well as the international community.

Within the general research-area Man, Nature and Arctic Societies GreenPYC suggests a programme which focus on Greenland: Dynamic Greenland – Facing Challenges in a Changing Environment. Within this broad title GreenPYC especially welcomes research proposals focusing on Survival Strategies – past and present.

International collaboration

The programme and the theme can be adapted in other parts of the arctic and should enforce coordinated research and promote national and regional research efforts and international partnerships with a core of Arctic based research institutions and organizations.

Proposals addressing this theme

DK-Proposal 3; DK-Proposal 5; DK-Proposal 19; DK-Proposal 26; DK-Proposal 34; DK-Proposal 35; DK-Proposal 41; DK-Proposal 42; Proposal GL-IPY 001; Proposal GL-IPY 002; Proposal GL-IPY 003; Proposal GL-IPY 004; Proposal GL-IPY 005; Proposal GL-IPY 006; Proposal GL-IPY 007; Proposal GL-IPY 008; Proposal GL-IPY 009; Proposal GL-IPY 010; Proposal GL-IPY 011; Proposal GL-IPY 012; Proposal GL-IPY 013; Proposal GL-IPY 014; Proposal GL-IPY 015; Proposal GL-IPY 016; Proposal GL-IPY 017.

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