



**WMO-ROSHYDROMET WORKSHOP
ON INTERNATIONAL POLAR DECADE INITIATIVE**

(St. Petersburg, Russian Federation, 14 and 15 April 2011)

Final Informal Report

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Introduction

In June 2010 the 62nd Session of the WMO Executive Council (EC) recommended to its EC Panel on Polar Observations, Research and Services (EC-PORS) to consult with other relevant organizations to assess interest and scope out an International Polar Decade (IPD) Initiative. To support this recommendation, Roshydromet hosted a Workshop at the Arctic and Antarctic Research Institute (AARI) of Roshydromet in St. Petersburg 14 and 15 April 2011, cosponsored by WMO.

The workshop was well attended and represented the first multi-stakeholder consultation on the IPD initiative. The workshop was chaired by Dr. David Hik (President of IASC) and Dr Jan-Gunnar Winther (Director of the Norwegian Polar Institute). The list of participants and the program of the Workshop are given in Annexes 1 and 2. These individuals participated in a personal capacity and their contributions were not expected to reflect the position of their respective organizations. Before the Workshop, WMO/WCRP Secretariats and AARI distributed an Information Note on IPD and John Calder (U.S. NOAA) forwarded some ideas on IPD to the Workshop participants. These documents are included in Annexes 3 and 4.

Workshop Overview

On the first day, workshop participants reviewed from their perspectives the lessons, structures, results and legacies of International Polar Year 2007-2008 (IPY), followed by many of the existing scientific, practical and societal challenges of the Polar Regions. In particular, they considered the WMO polar activities and initiatives; polar climate, its predictability and role in global climate; current capabilities of polar weather forecasting and climate prediction; existing and emerging observing initiatives and systems in the polar regions; Arctic air pollution; contaminants influence on biology and human health in the Arctic; perspectives from indigenous and local communities in relation to the "Opening of the Arctic"; the role of the Southern Ocean and Antarctica in global climate and climate change, and threats to Southern Ocean biodiversity, social processes in relation to peoples, societies and cultures in the polar regions; education, outreach, and new generation of polar researchers; and coordination and resource mobilization of national, regional and international scientific, funding, and operational agencies for a potential IPD. There was a recognition in these discussions that both Polar Regions contribute substantially to the Earth System and that a balanced approach to observing both the Arctic and Antarctic would also be required in an IPD.

Substantial research investments were made by many countries in IPY. This has resulted in new research infrastructure and scientific knowledge, including new technologies and models for observations, including human based observing and monitoring systems, analysis and prediction of all Earth System components, and similar advances in social observations and sciences focusing on peoples, societies, and cultures. Apart from the investments, also closer international cooperation and coordination of research efforts were a successful outcome of IPY. Substantial societal benefit can be gained by capitalizing on these IPY investments by improving services including better prediction capabilities, for example, in securing shipping routes, managing risks related to resource mapping, exploration and development (oil and gas, fisheries), protecting the fragile environment, and strengthening partnerships with polar communities and other stakeholders.. ***This formed an early, key conclusion of the workshop that any scientific efforts under the auspices of an IPD must be aligned to meeting broad***

societal needs such as those identified by WMO¹ and the ICSU Grand Challenges for Earth System Science for Global Sustainability², and be anchored on delivering better, more reliable scientific information for risk management and policy-making and other societal relevant activities in both Polar Regions.

Most of the participants had an opportunity to present their views on their potential commitment to participate in and support an IPD. There were points made on the differences between an IPY and an IPD. The former was a “snapshot” in time, reaffirming or establishing new scientific baselines and was therefore broad in focus. An IPD would have more focused goals and objectives. There were also concerns on timing (following on the heels of IPY) and the appropriateness of calling on funding institutions and governments for additional resources at this time. However, it was also evident that there were substantive investments currently being made in Polar Regions, and that some governments were continuing to make added commitments, particularly in the Arctic. All Arctic Council countries have produced or are preparing strategies for the Arctic and or the North, which include economic development, environmental stewardship and support to local and indigenous communities to adapt to changes in their environment as well as pointing to the importance of gathering relevant knowledge about the region. The Arctic Council has also commissioned a study on the legacy of the IPY that may provide an important guidance for the development of an IPD³. ***This supported the second key conclusion that there is consensus among the workshop participants to support an IPD that would begin beyond 2015 to permit existing programs and available resources to align to a set of dedicated decadal scale polar initiatives.***

The second day was reserved for scoping out an IPD which was facilitated through three breakout groups where participants discussed:

1. Existing science challenges in Polar Regions and possible objectives of IPD
(Chair: David Grimes, WMO EC PORS; Rapporteur: Cynan Ellis-Evans, NERC UK)
2. IPY achievements and legacies, how to sustain them and use as opportunities and platform for IPD development
(Chair: Vladimir Romanovsky, University of Alaska, Fairbanks, USA;
Rapporteur: Eduard Sarukhanian, WMO)
3. Potential stakeholders, governance, design and preparation process, resource mobilization, next steps
(Chair: Paul Egerton, European Science Foundation/European Polar Board;
Rapporteur: Vladimir Ryabinin, WMO/WCRP)

¹ Desired societal outcomes referred to in the WMO Strategic Plan (WMO-No. 1028, 2007):

- Improved protection of life, livelihoods and property,
- Improved health and well-being of citizens,
- Increased safety on land, at sea and in the air,
- Sustained economic growth in both developed and developing countries,
- Protection of other natural resources and improved environmental quality,
- Mitigation of natural disasters.

² ICSU (2010): Grand Challenges in Global Sustainability Research: A Systems Approach to Research Priorities for the Decade. ICSU, Paris.

³ Winther, J.-G., et al.: IPY Legacy for the Arctic Council (in preparation).

Assessing the Scientific Challenges for an IPD

The breakout group noted that there are significant risks and information/knowledge uncertainties that implicate decision-making as well as policy and regulatory formulation for social and economic development and environmental stewardship in Polar Regions. The management of Southern Ocean ecosystems and associated fisheries are under threat from environmental changes (warming, acidification) that could result in regime change and impacts on the entire food web. In many indigenous and other northern communities, traditional knowledge of seasonal variations in weather and climate is becoming less reliable, introducing risks to their future well-being. Airborne contaminants and environmental changes are resulting in increased health risks to local communities, to aquatic ecosystems, wildlife and to the food-chain in these regions, and globalization of regional and local economies introduce unprecedented changes for nature and societies. In many respects, IPY was a trailblazer for what could be possible for many of its areas of interest. The five Grand Challenges in Earth System Science for Global Sustainability identified by the ICSU Visioning Process Challenges, namely: the need to observe the environment, improve its predictions, avoid and manage negative impacts, respond to the issues with informed and efficient actions, and encourage innovation, are highly relevant for Polar Regions and thus can serve as a global scientific framework for a regional IPD initiative.

It would be important to develop a logic model for an IPD, which links the filling of key gaps in environmental monitoring and surveillance to processes that improve understanding and knowledge generation leading to better prediction and scenarios of environmental change, ultimately leading to the production of better services and feeding into decision making. This also applies to gaps in understanding of linkages between global societal changes with nature, life, and development in Polar Regions. IPD should result in a permanently enhanced ability to provide policy advice, governance, and risk management in Polar Regions.

The bottom-up led IPY process produced a considerable breadth of activity but resulted in an incomplete observational system. Designing optimal and efficient observational systems for Polar Regions, which would make the global systems complete and still have a polar specificity, is urgently needed. The design will depend on the main questions posed and should be able to efficiently capture a full spectrum of variability and its dominating mechanisms and continue reliable and accurate detection and attribution of the long-term trends. Data should be openly and freely available for analysis, assimilation and use according to established data management plans. Polar Regions have to be observed by both standard well-proven technologies and novel approaches including new instrumentation and autonomous unmanned observing systems. The establishment of a number of well-supported superstations as part of a well designed observational system in both Regions would greatly enhance these efforts. The observing system should employ an efficient and optimized combination of remote sensing and a broad network of diverse *in situ* observations that would allow both up-scaling and down-scaling of observations and data records.

The need for improved data, observations, and long-term monitoring also applies to human and societal systems. Benefits of access to the Polar Regions and use of their natural resources (mainly for the Arctic) need to be monitored. Studies under IPY demonstrated that the economics of the North and the world, the global drivers, political and cultural systems in the North, are all unquestionably linked to the development of the natural systems. However, the current understanding of the actual linkages is poor. There are specific challenges in the Arctic

that require novel monitoring methods to provide background for the development of scenarios that can lead to policy options.

Achieving increased predictive (and projection) capabilities for weather, climate and the environment in the Polar Regions are key challenges and will require an Earth System approach and span time scales from operational forecasting to climate change scales. There is a need to discover mechanisms leading to predictable elements of the polar Earth System, including the global effects of these changes. Scenario modelling should add value to information used in knowledge-based management including risk management with respect of extreme events.

There are currently large uncertainties in our knowledge and understanding of changes in the carbon cycle and freshwater balance in the Polar Regions. Projecting and predicting the state of the cryosphere, including sea ice in both Polar Regions, as well as the state of the cold regions hydrological system is also a key requirement. The key to answering one of the most significant climate science questions – what is the upper limit for the mean sea-level rise during this century – is now rapidly shifting towards the polar ice sheets and requires a new level of their understanding, observations and modelling. Acidification of the polar oceans, dramatic loss of biodiversity, augmenting pollution and health issues are all also very important.

A comprehensive quantification of the state of the both Polar Regions, such as provided for the atmosphere by the meteorological reanalyzes, needs to be extended to oceanic, cryospheric, terrestrial and biological domains. Further extension to the human and societal systems is also necessary, and would enable a coordinated assessment of the state of Polar Regions.

The third key conclusion of the workshop is that the scientific focus of an IPD could be on topics such as: better understanding of the changes in the carbon cycle; optimization and development of observational methods, systems and networks for the Polar Regions; improved understanding of the polar climate predictability and reducing the uncertainties in the short-term to decadal “earth system” polar predictions and projections; and establishing a “peoples, societies and cultures” initiative that would integrate new understanding into their practices and culture resulting in improving livelihoods, community well-being and health of polar societies and the ecosystems upon which they, as well as the globe as a whole, depend.

IPY Legacy as the Foundation for Addressing the Identified Challenges

A comprehensive summary of all IPY activities and its legacies was given by the IPY Joint Committee in “Understanding Earth’s Polar Challenges: International Polar Year 2007-2008” (<http://www.icsu.org/publications/reports-and-reviews/ipy-summary/ipy-summary>).

IPY elevated enthusiasm of polar exploration to a much higher level and strengthened international collaboration in Polar Regions. It is this IPY collaborative spirit that drives the idea of an IPD and makes it possible to effectively address the identified science and societal challenges.

Many elements of the IPY networks and initiatives can provide the seeds for a comprehensive polar observing system. They include Polar Satellites Constellation, Sustaining Arctic Observing Networks, integrated Arctic Ocean Observing System, Southern Ocean Observing System, Global Cryosphere Watch, Circumpolar Biodiversity Monitoring Program, significant extension and strengthening of the permafrost observations, and community-based monitoring initiatives.

At present these initiatives are acting separately, and their integration, ensuring data delivery and optimization should turn them into the first functioning polar observing system, which is able to provide data for scientific research and practical applications. Cooperation of the IPY-born observing systems mostly driven so far by scientific and academic institutions with agencies having operational responsibilities should be encouraged to sustain the achieved and required IPY legacy in terms of polar observations.

IPY created building blocks for a multidisciplinary data management system. The IPY Data and Information Service (IPYDIS, <http://ipydis.org>) assembled a valuable metadata description of numerous data sets obtained from IPY projects and other data relevant for Polar Regions. These descriptions are available through the Global Change Master Directory (<http://gcmd.gsfc.nasa.gov/KeywordSearch/Home.do?Portal=ipy>) and follow the Directory Interchange Format international standard. Development of an information system with its infrastructure that integrates multidisciplinary data and provides effective access tools both for broad community and professionals in different thematic fields (biology, geology, social sciences etc.) is still an important task of data management. Early establishment of data management arrangements and an open and free data access policy should be one of the first steps of IPD preparation if the IPD initiative is to be launched. Continued support for existing data centers and related IPY legacy initiatives such as the Polar Information Commons (PIC) will be essential and necessary elements of the IPD initiative.

The novel and very significant human component of IPY, with its sensitive regard to indigenous peoples, polar residents and their cultures, and its supportive and non-intrusive manner of activities should be preserved and strengthened in the future. Involvement of International Arctic Social Sciences Association (IASSA) in this work from the earliest stages should be encouraged. The same applies to the University of the Arctic and International Antarctic Institute. Noting particularly the longer time scale of the IPD initiative, the networks of early career polar researchers and observers (Association of Polar Early Career Scientists (APECS) and Permafrost Young Research Network (PYRN), etc.) should be engaged in all aspects of IPD planning.

IPD Stakeholders, Timeline, Process, Resource Mobilization

IPD stakeholders will be those who act and deliver, who support those acting and delivering, and also those who benefit from the actions and delivery. An early identification of these stakeholders is needed. A service-oriented IPD means that decision makers at various levels including local and national governments, funders, as well as local Arctic residents are key stakeholders. Special consideration should be given to securing funding for the participation of mandated representatives of indigenous peoples' organizations, such as IPS, and polar residents in IPD design and activities, so that their rights-based contributions to the IPD can best be promoted, facilitated and supported. The early engagement of all stakeholders, including indigenous and local Arctic residents, is essential to ensuring that they all take part in formulating the questions to be addressed by the IPD and by that also have the ownership in, and benefits from, the IPD outcomes. The need of an early, comprehensive and efficient stakeholders' and funders' engagement is a lesson learned of similar work undertaken in IPY.

IPY provided a pulse in new spending on polar research. A similar approach to an IPD would likely be unsustainable particularly in view of the difficult current financial situation of the world economies. Thus, IPD is envisioned to be fundamentally different from IPY in the sense that IPD should represent a continuous process of aligning existing committed resources to achieve

efficiency and impact in addressing the identified challenges, with a possibility for future resource injection depending on the needs of society and corresponding requirements of the science community. The emphasis is on increased coordination and harmonization of polar activities, and efficient use of the existing and future infrastructure for observations and research. Use of existing venues and supporting and coordination structures to plan IPD should be encouraged.

Unlike the IPY, which was mostly a bottom-up campaign where funding was decided on the basis of scientific excellence, the foundation of an ***IPD would be a negotiated program that still includes an element of merit-based competition. This program would be prepared in advance, and it would include a science outline and specific implementation considerations, with recommendations for actions and commitments by interested parties.*** The resultant more efficient and better informed decisions in various domains of activity will be achieved through more economical, targeted, and shared expenditures.

Preparation of an IPD would require, therefore, cooperation and coordination of funding agencies (international and national) of polar research, relevant international organizations and polar agencies, national agencies managing monitoring and survey programs, ministries who direct the economic and operational frameworks of these, and other operators. These agencies should be engaged in discussions at the earliest possibility. It would be essential to focus on a mutual and clearly defined set of achievable priorities including ones linked to existing funded initiatives.

The IPD timeline should be determined so that there is a balance between the need to keep the momentum of most important and promising activities developed during IPY and avoiding discontinuation of current useful activities, and the need to comprehensively design and plan integrated IPD activities. Three phases of IPD could be anticipated: a planning phase, sufficient not only to design the activities but also to engage funding commitments and ensure completion of necessary preparatory processes; an implementation phase, staggered over several years; while dissemination and evaluation need to be integral throughout the implementation phase. These phases may overlap. The actual length of IPD should be determined by planning and does not need to be equal to ten years.

Next Steps

Noting that the Polar Regions are significant drivers of changes in global weather and climate, extreme events, global carbon cycle, and sea level rise, to mention only a few, and as well critical resource pools that the rest of the world is becoming critically dependent on, the Workshop participants unanimously agreed that a polar decadal initiative would be highly desirable to address the growing risks and concerns associated with rapid environmental changes in Polar Regions, not only for the benefits of Arctic residents but also for society at large.

To move the idea forward, a consultative process is needed and an appropriate group, in which key stakeholders would be represented, should be established in due course. Initially, the work would be constructed around participants in the IPD Workshop, who would take this Workshop Report forward for consultations with their Governments and/or organizations. The Workshop Co-Chairs were willing to lead this initial consultation process over the coming months.

The 16th World Meteorological Congress (16 May – 3 June 2011) provides an early opportunity to gauge the interests of governments. WMO EC-PORS will present the findings of this workshop to the Congress. The recommendations of the Panel are closely aligned with the outcomes of this workshop. For WMO, the Third Pole (high mountain regions of the planet) is also an important consideration to be integrated into the next steps for an IPD. The Arctic Council Ministerial meeting in Nuuk, Greenland, on 12 May 2011 also provides an early opportunity to discuss the IPD initiative. Other organizations, including ATCM, Arctic Parliamentarians, IASSA, the SCAR-IASC Bipolar Action Group, University of the Arctic, the Intergovernmental Oceanographic Commission of UNESCO, ICSU, etc, will be meeting in the coming months and asked to provide their suggestions and comments on the initial ideas outlined in this report.

A draft IPD Concept Document will be developed in the course of consultations and collection of views from these relevant meetings. A small steering group, initially led by the workshop co-chairs, will lead the consultation and drafting process. The steering group will be supported by a small secretariat, initially based at the WMO/WCRP Secretariat, which will serve as a focal point for synthesizing information and preparing drafts of the Concept Document. Norway also kindly offered to seek some human resources for these purposes, and IASC will similarly provide some assistance.

A critical milestone would be the Montreal 2012 IPY Conference “From Knowledge to Action”, at which a draft IPD Concept Document would be reviewed, corresponding community decisions recommended, and possible commitments expressed. A major preparatory meeting is required to finalize the IPD Concept Document for discussion in Montreal. WMO offers to organize such a meeting in October 2011 in Finland in conjunction with the Third Session of EC-PORS.

In summary, workshop participants agreed that the next 6-12 months should be used to ensure an open dialogue with all potential stakeholders in an International Polar Decade initiative in order to better define the framework, objectives, resource requirements, timing, and organizational structure of an IPD.

To facilitate the work of the steering group and to provide input for the first draft of the IPD Concept Document, please submit comments, questions and suggestions by 30 September 2011 to: ipd.concept@gmail.com.

List of participants

No	Name	Represented organization/ Affiliation	Address
1.	AHVENHARJU Sanna	Gaia Consulting Oy, NordForsk	Lemminkäisenkatu 14-18 C, FI - 20520 Turku Finland Mobile: +358 50 322 8341 E-mail: sanna.ahvenharju@gaia.fi
2.	BOCK Nikolaj	Executive Directors Office, European Environment Agency (EEA)	Kongens Nytorv 6, 1050 Copenhagen K Denmark Tel: +45.29.65.25.48 Fax: +45.33.36.72.72 E-mail: Nikolaj.Bock@eea.europa.eu
3.	CALDER John	Sustaining Arctic Observing Networks (SAON), National Oceanic and Atmospheric Administration (NOAA) Arctic Research Climate Program Office (R/CPO)	1100 Wayne Ave., Room 1202 Silver Spring, Maryland 20910-5603 USA Tel: +1-301-427-2470 Fax: +1-301-427-0033 E-mail: John.Calder@noaa.gov
4.	DANILOV Alexander	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 02 Fax: 7 812 337 32 27 E-mail: aid@aari.ru
5.	DMITRIEV Victor	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 06 Fax: 7 812 352 32 41 E-mail: v_dmitriev@aari.ru
6.	DROZDOV Dmitry	Earth Cryosphere Institute, Siberian Branch of Russian Academy of Sciences (ECI SB RAS)	Vavilov Street. 30/6, Moscow 119991 Russian Federation Tel.: 7 499 135 65 82 Fax: 7 499 135 98 77 e-mail: ds_drozdo@mail.ru
7.	EGERTON Paul	European Science Foundation (ESF) /European Polar Board (EPB)	1 Quai Lezay Marnesia, BP- 90015 F-67080 Strasbourg Cedex France Tel: + 33 (0) 388 76 71 74 E-mail: pegerton@esf.org
8.	ELLIS-EVANS Cynan	Natural Environment Research Council (NERC), British Antarctic Survey (BAS)	Madingley Road, Cambridge, CB3 0ET, United Kingdom Tel: +44-(0)1223-221555 fax: +44-(0)1223-221330 E-mail: jcel@bas.ac.uk

9.	FORBES Bruce	Arctic Centre, University of Lapland	Pohjoisranta 4, Box 122 FIN-96101 Rovaniemi, Finland Mobile: +358-40-8479202 Fax: +358-16-362-934 E-mail: bforbes@ulapland.fi
10.	FROLOV Ivan	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 01 Fax: 7 812 337 31 14 E-mail: frolov@aari.ru
11.	GANT Erik	Arctic Council Indigenous Peoples Secretariat (IPS)	Strandgade 91, 1401 Copenhagen K Denmark Tel: +45 3283 3794 Fax +45 3283 3791 E-mail: erik.gant@arcticpeoples.org
12.	GLAZOVSKIY Andrey	Institute of Geography Russian Academy of Sciences (IG RAS)	Staromonetny, 29, Moscow 119017 Russian Federation Tel.: 7 499 125 90 11 Fax: 7 495 959 00 33 E-mail: glazovsky@gmail.com
13.	GORIACHKIN Sergey	Institute of Geography Russian Academy of Sciences (IG RAS)	Staromonetny, 29, Moscow 119017 Russian Federation Tel.: 7 495 959 00 22 Fax: 7 495 959 00 33 E-mail: sergey.gor@mail.ru
14.	GRIMES David	Meteorological Service of Canada	141 Laurier Avenue West, 2 nd Floor Ottawa Ontario K1A 0H3 Canada Tel.: +1 613 943 5585 Fax: +1 613 943 5737 E-mail: david.grimes@ec.gc.ca
15.	HIK David	International Arctic Science Committee (IASC), Department of Biological Sciences, University of Alberta	Z-1007 Biological Sciences Building, Edmonton, Alberta, T5N 0R5 Canada Tel: 780 492 9878 Fax: 780 492 9234 E-mail: dhik@ualberta.ca
16.	HOLMEN Kim	Norwegian Polar Institute (NPI)	Framsenteret, N-9296 Tromsø Norway Tel.: +47 77 75 05 30 Fax: +47 77 75 05 01 E-mail: kim.holmen@npolar.no
17.	HOV Oystein	Norwegian Meteorological Institute (Met.no)	P.O.Box 43 Blindern, NO-0313 Oslo, Norway Tel.: 47 22963360 Fax: +47 22 96 30 50 E-mail: oystein.hov@met.no

18.	IVANOV Vladimir	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 76 Fax: 7 812 337 32 41 E-mail: Vladimir.Ivanov@aari.nw.ru
19.	JOHANNESSON Christina	General Consulate of Sweden in St Petersburg	General Consulate of Sweden in St. Petersburg, Ministry for Foreign Affairs Sweden E-mail: christina.johannesson@foreign.ministry.se
20.	JUNG Thomas	Alfred Wegener Institute for Polar and Marine Research (AWI)	Bussestrasse 24 D-27515 Bremerhaven Germany Tel.: +49 (0)471 - 4831 - 1761/1760 Fax: +49 (0)471 - 4831 - 1797 E-mail: Thomas.Jung@awi.de
21.	KANKAANPÄÄ Paula	Arctic Centre, University of Lapland	Pohjoisranta 4, Box 122 FIN-96101 Rovaniemi, Finland Tel. +358 16 341 341, Mobile +358 40 7777 825 E-mail: paula.kankaanpaa@ulapland.fi
22.	KATTSOV Vladimir	Voeikov Main Geophysical Observatory of Roshydromet (MGO)	7, Karbyshev street, St.-Petersburg 194021 Russian Federation Tel: 7 812 247-43-90 Fax: 7 812 247-86-61 E-mail: kattsov@mail.ru
23.	KLEPIKOV Alexander	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 19 Fax: 7 812 337 32 41 E-mail: klep@aari.ru
24.	KOPYLOV Vasily	All-Russian Institute of Hydrometeorological Information-World Data Center (ARIHI-WDC)	6, Koroleva St., Obninsk, Kaluga Region, Russian Federation Tel.: (+7) 499-795-2194 Fax : (+7) 499-795-2225 E-mail: kvn@meteo.ru
25.	KRASNOPIEROV Michael	Consulat honoraire de la Fédération de Russie	Avenue de Rumine 13-CH-1005 Lausanne, Switzerland Tel. + 41 (0) 21 623 85 82, Fax. + 41 (0) 21 623 85 89 krasnooperov@bluewin.ch
26.	KULLERUD Lars	University of the Arctic (UArctic)	Postboks 183, N-4802 Arendal, Norway Tel. +47 9087 0099 Fax. +47 3703 5050 E-mail: Lars.Kullerud@uarctic.org

27.	KUZNETSOV Alexander	All-Russian Institute of Hydrometeorological Information-World Data Center (ARIHI-WDC)	6, Koroleva St., Obninsk, Kaluga Region, Russian Federation Tel.: (+7) 48439-74674 Fax : (+7) 499-795-2225 E-mail: kuznet@meteo.ru
28.	LARSEN Joan Nymand	International Arctic Social Sciences Association (IASSA), Stefansson Arctic Institute	Borgir, Nordurslod, IS-600 Akureyri, Iceland Tel: +354 460-8984; Mobile: +354 893-0488 Fax: +354 460-8989; E-mail: jnl@unak.is
29.	LAURILA Tuomas	Finnish Meteorological Institute (FMI)	Erik Palménin aukio, FI-00560, Helsinki Finland Tel. +358 9 1929 2311 Fax +358 9 1929 2303 E-mail: Tuomas.Laurila@fmi.fi
30.	LUKIN Valery	Arctic & Antarctic Research Institute of Roshydromet (AARI), representing the Council of Managers of National Antarctic Programs (COMNAP)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 04 Fax: 7 812 337 31 86 E-mail: lukin@aari.ru
31.	MOSKALEVSKY Maxim	Institute of Geography Russian Academy of Sciences (IG RAS)	Staromonetny, 29, Moscow 119017 Russian Federation Tel.: 7 495 959 00 22 Fax: 7 495 959 00 33 E-mail: moskalevsky@mail.ru
32.	NEMITZ Paul	Directorate-General Maritime Affairs and Fisheries, European Commission (EC)	B-1049 Brussels, Belgium Tel: +32 (0)2 29 87218 Paul.Nemitz@ec.europa.eu
33.	OLIOUNINE Iouri	Intergovernmental Oceanographic Commission (IOC) UNESCO	1, rue Miollis, 75732 Paris Cedex 15, Paris France Tel.: +33 1 45 68 39 84 Fax: 33 1 45 68 58 10 i.oliounine@unesco.org
34.	PAASCHE Øyvind	Department of Research Management, University of Bergen	Professor Keyzers gt. 8 NO-5020, Bergen Norway Tel.: +47 55588959 E-mail: oyvind.paasche@uib.no
35.	PIECHURA Jan	Institute of Oceanology, Polish Academy of Sciences (IOPAS)	55 Powstańców Warszawy Str. 81-712 Sopot, Poland Tel.: 48 58 7311913 Fax: 48 58 5512130 piechura@iopan.gda.pl

36.	POPE Allen	Association of Polar Early Career Scientists (APECS), Scott Polar Research Institute, University of Cambridge (SPRI)	Lensfield Road, Cambridge CB2 1ER United Kingdom Tel.: +44(0)1223336558 Fax: +44(0) 1223 336549 E-mail: apope00@gmail.com
37.	PROSHUTINSKY Andrey	Woods Hole Oceanographic Institution (WHOI)	Woods Hole Oceanographic Institution 266 Woods Hole Rd. MS# 29 Woods Hole, MA 02543-1050 USA Tel.: +1 508 289 2796 aproshutinsky@whoi.edu
38.	PRYAMIKOV Sergey	Arctic & Antarctic Research Institute of Roshydromet (AARI)	38 Bering str., St.-Petersburg, 199397 Russian Federation Tel.: 7 812 337 31 15 Fax: 7 812 337 31 99 E-mail: priamiks@aari.ru
39.	REFSNES Karin	Division for Strategic Priorities, Research Council of Norway (RCN)	PO Box 2700, St.Hanshaugen, NO 0131 Oslo, Norway Tel. +47 22037000 kre@forskningsradet.no
40.	REIERSEN Lars-Otto	Arctic Monitoring and Assessment Programme (AMAP) Secretariat	P.O. Box 8100 Dep. N-0032 Oslo Norway Tel.: +47 23 24 16 32 Fax: +47 22 67 67 06 E-mail: lars-otto.reiersen@amap.no
41.	ROMANOVSKY Vladimir	Geophysical Institute University of Alaska, Fairbanks (UAF)	P.O. Box 10 04 65, 903 Koyukuk Drive Fairbanks, AK 99775-7320 USA tel.: (907) 474-7459 veromanovsky@alaska.edu
42.	RYABININ Vladimir	Joint Planning Staff for World Climate Research Programme (WCRP), WMO Secretariat	7bis, Avenue de la Paix, CP2300, Geneva 2, CH-1211 Switzerland Tel.: 41 (0) 22 730 8486 Fax: 41 (0) 22 730 8036 E-mail: VRyabinin@wmo.int
43.	SARUKHANIAN Eduard	WMO Secretariat	7 bis, Avenue de la Paix, CP2300, Geneva, CH-1211 Switzerland Tel: 41 22 730 8420 E-mail: ESarukhanian@wmo.int
44.	TSATUROV Yury	Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet)	12, Novovagan'kovsky per. 123995 Moscow Russian Federation Tel/Fax 7 499 252 24 29 E-mail: tsaturov@mecom.ru

45.	WINTHER Jan-Gunnar	Norwegian Polar Institute (NPI)	Framsenteret N-9296 Tromsø Norway Tel.: +47 77 75 06 21 Fax: +47 77 75 05 01 E-mail: winther@npolar.no
46.	YOON Young Jun	Division of Polar Climate Research, Korea Polar Research Institute (KORPI)	Get-pearl Tower, SongDo Techno Park, 12 Gaetbeal-ro, Yeonsu-Gu, Incheon, 406-840 Republic of Korea Tel.: 82-(0)32-260-6233 Fax : +82-(0)32-260-6109 E-mail: yjyoon@kopri.re.kr
47.	VOROBIOV Vladimir	Russian State Hydrometeorological University (RSHU)	98, Maloohhtinskiy pr., 195196 St.Petersburg Russian Federation Tel/Fax: 7 812 444 02 62 E-mail: vuv@rshu.ru
48.	VUGLINSKY Valery	State Hydrological Institute of Roshydromet (SHI)	23, 2 nd line, Vasilievsky Island, St.Petersburg, 199053 Russian Federation Tel: 7 812 323 34 58 Fax: 7 812 323 10 28 E-mail: vvuglins@VV4218.spb.edu
49.	YEMELIN Valentin	Capacity Building and Assessments, UNEP GRID-Arendal	Teaterplassen 3, N-4836 Arendal Postboks 183 N-4802 Arendal Norway Mobile: +47 99512229 Fax: +47 37 03 50 50 E-mail: Valentin.Yemelin@grida.no

Program

Day 1 (14 April 2011)

0900

Opening and welcome addresses:

Ivan FROLOV, the AARI Director

Yury TSATUROV, Adviser to the Head of Roshydromet

Christina JOHANNESSON, Consul, General Consulate of Sweden in St Petersburg

Vladimir RYABININ, WMO Secretary-General Representative

0925

Election of Workshop and Breakout Groups Chairpersons

Goals, format, and expected output of the meeting, accepting agenda – Chairs

Practical information –AARI

0950

Eduard SARUKHANIAN IPY organization, results and legacy, setting the stage for IPD

1010

Coffee Break

1030

Polar prediction: key initiatives and issues

David GRIMES WMO Executive Council Panel of Experts on Polar Observations, Research and Services: Decadal Perspectives

Vladimir RYABININ Polar climate and its predictability

Thomas JUNG Polar weather and its prediction skill

Vladimir KATTSOV Polar regions and global climate modelling

John CALDER Sustaining Arctic Observing Network

1210

Group photo & Lunch

1300

Polar ocean processes and related activities

Sergey PRYAMIKOV Legacy of the Arctic Ocean IPY studies and IPD

Jean-Claude GASCARD From DAMOCLES to ACCESS: an IPY legacy (presented by Vladimir Ivanov)

Alexander KLEPIKOV Southern Ocean Observing System

1350

Towards healthy polar environment

Øysten HOV Arctic air pollution and climate

Lars-Otto REIERSEN Contaminants influence on biology and human health in the Arctic

1430

Polar societies and social processes

Erik GANT Indigenous communities and the opening of the Arctic

Joan Nymand LARSEN Social processes in the polar regions

1510

Coffee Break

1530

Signing of the Memorandum of Understanding between IASC, University of the Arctic and IASSA

1545

Views of international and national organizations (ICSU, IOC, UNEP, EC, EEA, COMNAP, NRC, NERC, NordForsk...)

1645

General discussion of the 1st day topics

1745

Address by Dr Arthur CHILINGAROV, Special Representative of the President of the Russian Federation on International Cooperation in the Arctic and Antarctic (by cable)

1800

Reception at the AARI

Day 2 (15 April 2011)

0900

Education, outreach, and new generation of polar researchers

Lars KULLERUD

Education, outreach, and new generation of polar researchers

Allen POPE

APECS and the Next Generation of Polar Research

0940

Polar Research Communities

David HIK

Overview of IASC perspectives on IPD and IPY legacies

Paul EGERTON

Perspectives for coordination and resource mobilization from European national funding and operational agencies for participation in the IPD

1040

General discussion on the 2nd day topics

1100

Forming breakout groups and assigning their tasks

1110

Coffee Break

1130

Work by breakout groups

Group 1: Existing science challenges in Polar Regions and possible objectives of IPD

Group 2: IPY achievements and legacies, how to sustain them and use as opportunities and platform for IPD development

Group 3: Potential stakeholders, governance, design and preparation process, resource mobilization

1300

Lunch

1400

Plenary session: presentations by leads of the groups, discussion, further proposals

1600

Coffee Break

1630

Plenary session: continuation of discussion, next steps for IPD initiative development and promotion

1800

Workshop closure

WMO-ROSHYDROMET WORKSHOP
ON INTERNATIONAL POLAR DECADE INITIATIVE

(Arctic and Antarctic Research Institute /AARI/,

St. Petersburg, Russian Federation, 14 and 15 April 2011)

(Information note submitted by WMO/WCRP Secretariat and AARI)

The 62nd session of the WMO Executive Council (EC, June 2010) recommended to WMO to hold a workshop on International Polar Decade (IPD) Initiative. Early in 2011, Roshydromet proposed to WMO to host the Workshop at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg in April 2011 and asked WMO to cosponsor it. This proposal was accepted by the WMO Secretary-General. The Workshop attendees (representatives of relevant international organizations, leading experts in polar sciences, representatives of research funding agencies, etc.) are meeting in St. Petersburg to exchange views on the IPD initiative and its potential development. The results of the Workshop will be presented to the Sixteenth World Meteorological Congress, to be held in Geneva from 16 May to 3 June 2011.

This information note explains the Workshop background and is intended to facilitate discussions.

1. Previous discussions of IPD and preliminary recommendations/decisions

1.1. The International Polar Decade (IPD) initiative is based on scientific advances and lessons of the International Polar Year 2007-2008 (IPY). In June 2008 the 60th session of the WMO Executive Council (EC) recognized the success of the first year of the IPY implementation, the significant investments made by the governments in IPY, and acknowledged that ongoing rapid and significant changes of the polar environment motivate the nations to continue observations and research in the polar regions for a more extended period of time than the observing period of IPY (March 2007- March 2009). Consequently, the Council proposed that WMO, in consultation with ICSU and other international organizations consider the launch of an International Polar Decade as a long-term process of research and observations in Polar Regions.

1.2. The IPD initiative was considered at the sixth Ministerial Meeting of Arctic Council (Tromsø, April 2009). As an outcome of the meeting, Ministers representing the eight Arctic States “welcomed commitments to deliver a lasting legacy from the IPY and decided to consider the proposal to arrange an International Polar Decade” (Tromsø Declaration).

1.3. The 25th Assembly of the Intergovernmental Oceanographic Commission of UNESCO (June 2009) supported multilateral ocean-observing systems in the Arctic and Southern Oceans as regional contributions to GOOS, implemented under the guidance of JCOMM, and of IODE for data exchange and long-term stewardship of the data; and supported the Arctic Council's call for an International Polar Decade.

1.4. Noting the interest in the IPD initiative by the international polar research community and some international organizations, the 61st session of the WMO EC requested its Panel of Experts on Polar Observations, Research and Services (EC-PORS) to consider modalities and plans for the IPD, focusing on decadal needs and issues of long-term character, and make recommendations to the Council.

1.5. The 62nd session of WMO EC (June, 2010) recognized the need to engage a broad partnership to secure the IPY legacy and requested EC-PORS to continue to seek Members' ideas for an IPD, such as those submitted by that time by the Russian Federation, discuss IPD at its second meeting, and organize a workshop (*this workshop*) to further scope IPD with other relevant scientific bodies and international organizations by early 2011.

1.6 A workshop on the IPY legacy was organized by Arctic Council and Antarctic Treaty Consultative Meeting in Oslo in June 2010 in conjunction with the Oslo IPY Science Conference. One of the six themes of the Workshop was dedicated to the IPD initiative. The Workshop recommended the following:

- Continued focus on polar sciences in the coming decades should be supported, and the initiative of the WMO Executive Council of an International Polar Decade should be further explored and supported as appropriate.
- WMO should consult with other international bodies, such as ICSU, IASC, SCAR, UNEP and UNESCO with its IOC, to jointly explore scientific decadal needs.
- Considerations should be given to find mechanisms for work together with the Arctic Council and the Antarctic Treaty Consultative Meeting in the process of developing a strategy to sustain polar research, including the concept of an International Polar Decade. National funding agencies should be encouraged to commit to such efforts.

1.7. Considering IPD initiative at its the second session (Hobart, Australia, October 2010), EC-PORS agreed that over the next several years, the Panel will take action to launch, with partners, a major decadal initiative entitled the Global Integrated Polar Prediction System (GIPPS). "Such an activity was seen as the most effective way to capture the IPY legacy and maintain the spirit of an International Polar Decade". It also stated that "Panel will take action to support and contribute to an IPD should one be initiated, recognizing the need for a coordinating mechanism of various activities... The focus needs to be on actions that lead to better services outcomes rather than the concept of a decade" (WMO, 2010). The Panel also agreed to take action to integrate all Antarctic networks into an Antarctic Observing Network (AntON) that will comprise all operational stations all to produce climate messages; to define the scope of Arctic and Antarctic Regional Climate Centres, noting their contribution toward increasing the number and improving the quality of climate products that support the Global Framework for Climate Services; and to develop the Implementation Strategy for the Global Cryosphere Watch.

1.8. Since 2009, the ICSU Visioning Process has been engaging the scientific community, relevant stakeholders and decision-makers in the development of a holistic strategy for Earth system research. After a broad large consultation, which resulted in the identification of five Grand Challenges in Earth System Science for Global Sustainability (ICSU, 2010) the ICSU, the International Social Sciences Council (ISSC) and leading funding agencies of the global change research, comprising the Belmont Forum, are now designing a new ten-year research initiative to address the identified Grand Challenges in an integrated way. All five identified Challenges, namely the need to observe the environment, improve its predictions, avoid and manage negative impacts, respond to the issues with informed and efficient actions, and encourage

innovation, are highly relevant for Polar Regions and thus can serve as a global scientific framework for a regional IPD initiative.

2. IPY findings and some of its legacies

2.1. The IPY produced new baselines of polar environmental conditions with respect of biodiversity and ecosystem processes and status of the polar oceans. The IPY findings significantly strengthen the evidence of the widespread effects of global warming (IPY JC, 2011), which had been based on earlier long-term observations and studies in the Polar Regions. Our knowledge of all these phenomena has significantly improved during a relatively short period of the IPY implementation (2-3 years) due to a massive coordinated snapshot of the polar environment, both from space and in situ, during a time period when the global environment was changing faster than ever in human history.

2.2. IPY efforts have documented some of the key connections between the poles and the global processes. To name only a few, it was shown that changes in the Arctic Ocean conditions are transmitted to subarctic seas on both sides of Greenland, modulating ocean circulation in the North Atlantic. New connections were identified between the ozone concentrations above Antarctica and wind and storm conditions over the Southern Ocean. Better understanding was achieved of the microbiological processes and carbon dioxide and methane release to the atmosphere from soils suffering permafrost degradation. Fundamental insights into the polar habitats, their evolution and the role of climate change were associated with discoveries of numerous new polar microorganisms demonstrating surprising diversity, essential ecological functions, and environmental role as global warming sentinels.

2.3. For the first time significant emphasis was given to the human dimension and to the concerns of local and indigenous peoples related to the requirements of sustainable development, impacts of globalization of the world economy on local economies, human wellbeing, culture and health. IPY projects contributed to our increased understanding of how indigenous knowledge could be matched with instrumental data in monitoring the changes in polar ice, snow and vegetation cover, marine and terrestrial animal migrations, behavioral patterns of polar animals, birds, and fishes.

2.4. IPY created a strong legacy in our understanding of polar processes and of their global linkages. Novel and enhanced observing systems were launched that will eventually produce long-term benefits to many stakeholders, including polar residents and indigenous people. Last, but not least, IPY trained a new generation of scientists and leaders who are determined to carry this legacy into the future.

2.5. Several observing systems were proposed during IPY and comprise its legacy. They include Polar Satellites Constellation, Sustaining Arctic Observing Networks, Integrated Arctic Ocean Observing System, Southern Ocean Observing System, Global Cryosphere Watch, Circumpolar Biodiversity Monitoring Program, Community-human-based monitoring systems and others. These initiatives and the IPY projects of a long-term nature (e.g. DAMOCLES, SEARCH) could be considered as possible observing platforms for the IPD. Description of current status of some of them is given below.

Polar Satellite Constellation (PSC)

2.6. During IPY, the enhanced international coordination and cooperation among space agencies have produced an extraordinary quantity and quality of satellite observations of Polar Regions. Expanding the acquisition and product suite beyond the Polar Regions to cover all sectors of the cryosphere will be possible in an IPD. Further integration of the atmospheric chemistry and polar meteorological science communities into the future activity suite, as well as potential incorporation of gravity and magnetic geopotential missions into this activity are desirable (Drinkwater et al., 2011). It is also possible to envision discussion and collaboration on emerging technologies and capabilities such as the Russian “Arktika” Project and Canadian Polar Communications and Weather (PCW) Project and advanced subsurface imaging radars.

2.7. The Polar Space Task Group (PSTG) was recently established under the auspices of the EC-PORS. The group’s mandate is to provide coordination across space Agencies to facilitate acquisition and distribution of fundamental satellite datasets and to contribute to or support development of specific derived products to advance cryospheric scientific research and applications (Drinkwater, draft PTSG TOR). The main PSTG objective is continued coordination of international efforts in securing collections of space-borne “snapshots” of the Polar Regions through the further development of a virtual Polar Satellite Constellation.

Sustaining Arctic Observing Networks (SAON)

2.8. A coalition of Arctic organizations known as the Sustaining Arctic Observing Networks Initiating Group (SAON-IG) began its work in early 2007 (Calder et al., 2011). In April 2009 the Arctic Council (AC) accepted the main SAON-IG recommendations developed in a series of workshops. AC stated that it will support continued international coordination to maximize the legacy of IPY within the areas of observations, data access and management, access to study areas and infrastructure, education, recruitment and funding, outreach, communication and assessment for societal benefits, and benefits to local and indigenous people (Tromsø Declaration). AC will consult with national funding and operational agencies to create a basis for internationally coordinated funding and shared infrastructure and enhance the recruitment of early career polar scientists.

2.9. AC, IASC and WMO formed the SAON Steering Group (SG) to continue to develop the SAON process. The SG agreed that SAON itself will not undertake observations, conduct research, perform scientific analysis or assessment, nor be a source of funding for these activities. SAON will identify issues, gaps and opportunities related to Arctic observing and data sharing and take a multi-national approach to demonstrate improvements to the current situation, and consequently, SAON will work with a broadly defined Arctic observing community and with national and multi-national organizations and non-governmental partners.

Global Cryosphere Watch (GCW)

2.10. WMO Congress XV (May, 2007) welcomed the proposal of Canada for WMO to create a GCW as an IPY legacy. The following initial key tasks of GCW were identified for implementation (Goodison, 2011): implement recommendations of The Integrated Global Observing Strategy Theme on Cryosphere (CryOS); initiate pilot and demonstration projects; establish cryospheric reference sites; develop an inventory of satellite products for GCW; develop a web portal and interoperability arrangements for data users and providers; initiate capacity building, communication and outreach activities.

2.11. GCW partnerships are being identified and implemented, including government agencies and institutions that measure/observe/monitor/archive cryosphere data and information from *in-situ*, space-based and model sources and from research and operational networks. Over 30 countries from all WMO Regions identified contacts for the development of GCW. The World Glacier Monitoring Service, the International Permafrost Association, the National Snow and Ice Data Center, and the Global Precipitation Climatology Centre expressed their intention to support the GCW mission.

2.12. The Implementation phase (2012 – 2019), coordinated by WMO and its partners will focus on tasks and activities that will form the GCW Implementation Plan. Once the framework is established, GCW enters its Operational Phase (2020 onward). It will continue to evolve to improve service delivery and support decision-making in response to the needs of users and technological opportunities. Cryospheric data, information, products and knowledge will be provided not only from NMHSs, but also from national and international partner organizations, agencies and the scientific community.

Community/human-based observational systems

2.13. The field of indigenous and community-based monitoring has emerged as one of the most inspirational outcomes of IPY. This field had not even existed until the late 1990s and it has been advanced to the polar research arena only by the time when IPY was being planned—via Arctic Climate Impact Assessment process (2005), the second International Conference for Arctic Research Planning (ICARP II, 2005), the *Inuit Qaujimajatuqangit* (Inuit traditional knowledge/values/way of thinking) movement in Nunavut and across Arctic Canada and a few pilot publications.

2.14. Several IPY projects in indigenous and community based monitoring (CAVIAR, BSSN, EALÁT, CARMA, MODIL-NAO, SIKU and others) produced impressive sets of local data related to areas critical to the IPY science themes, such as climate change and weather, sea ice and snow dynamics, status of marine and terrestrial biological resources, environmental preservation, status of the Arctic land and waters, documentation of indigenous knowledge, impacts of modern industrial development in the polar regions, and the like (Hovelsrud et al., 2011). Several IPY projects documented indigenous knowledge in environmental observations, invested substantial effort in developing standard observational protocols, and used the standardized methodologies across large study areas to allow new comparative analyses across a broad spectrum of communities and regions.

2.15. To achieve its full potential, the field of indigenous and community based monitoring needs new successful efforts, more resources, and continuation of its momentum into the post-IPY era. AC and SAON –SG have identified local and community based monitoring as a priority for future Arctic research and polar observational systems. Many polar Indigenous Organizations, including the AC Permanent Participants, are seeking to turn community based monitoring into long-term sustained activities. Such programs are being increasingly viewed as precursors to future monitoring services for both indigenous and scientific communities and, potentially, one of the lasting achievements of the post-IPY era.

Association of the Polar Early Career Scientists (APECS) is one of the major IPY legacy

2.16. The APECS is an international and interdisciplinary organization for undergraduate and graduate students, postdoctoral researchers, early faculty members, educators and others with

interests in Polar Regions and the wider cryosphere. It was launched in early 2007. The phenomenal level of energy and volunteer efforts of talented young researchers and the support of senior mentors around the globe led to the success of APECS on many fronts (Baeseman J. and H. Lantuit, 2011). Support to the new generation of polar researchers should be one of the driving principles of polar science over the years to come. The success of IPY needs to be sustained, and mechanisms need to be created to retain the young researchers that began polar research during IPY and keep them involved. High-quality educational, outreach and communication initiatives and networks created during the IPY will need to be supported to help researchers in producing publications, exhibitions, films, web pages and lectures around science. Only then will polar research reach out to society and play an important role in involving communities in the continuing analysis and assessment of IPY outcomes and impacts.

3. Some existing science challenges in Polar Regions

3.1. The Polar Regions are going through rapid, complex, and diverse changes. They accumulate influences from all other parts of the globe, amplify and/or transform them and significantly modulate global changes. Would it be possible to achieve significant progress in completing the development of a truly global earth observation system, understanding global tendencies, predicting global changes and addressing them without a decadal focus on polar research? This Workshop is asked to take a holistic look at the polar dimension of global environmental and social sciences and try to answer this important and challenging question.

3.2. The Workshop participants will not be alone in addressing the challenge. The five Grand Challenges identified in the result of the ICSU Visioning Process can help by providing a global guiding framework. The International Conference on Arctic Research Planning in Copenhagen, 2005 (ICARP II) and subsequent consultations resulted in a dozen of science plans on various Arctic science challenges. A recent Polar Climate Predictability Workshop of the World Climate Research Programme (Bergen, October 2010) critically reviewed the known and unknown about polar climate and its predictability on scales from seasons to decades. This short list of seminal planning activities can be extended.

3.3. The IPY snapshot identified massive ongoing changes in the Polar Regions. Their further evolution needs to be closely monitored. Only a combination of novel methods employing unmanned vehicles (such as subsea gliders, lidars, with help of fauna – seals, and high altitude balloons – CONCORDIASI, to name just a few), and maintenance and extension of more traditional methods like hydrometeorological stations, remote sensing and community based observations will allow us to extend and sustain the observing system able to detect the changes and be instrumental in their prediction. At the same time, processing of the observed data, assimilation and integration of various types of observations into fundamental environmental data records remain largely not addressed in the current planning efforts. Polar observations and their development are predominantly supported through research funding. This situation is not going to change in the near future. Thus, there is a need for continuation of support to the development of novel polar observing systems by major funding agencies of environmental research.

3.4. One of the main conclusions of the WCRP Polar Climate Predictability Workshop was that the achieved level of understanding of the Arctic climate system already allows experimental predictions of climate on several times scales, while in the Southern Ocean and Antarctica the main focus of activities should be on deepening of the understanding of the individual components of the Earth system and learning more precisely how they interact. For example,

without taking into account the changes in the Antarctic stratosphere ozone, it is hardly possible to explain the past changes in surface climate variables, which affect ocean circulation and water mass formation, evolution of the regional large marine ecosystem and the future of the global ocean carbon sink. Polar ice sheets and ice shelves and their contribution to the sea-level rise are also dependant on the complex evolution of the entire Polar Regions.

3.5. Thus, two examples of potential grand scientific and technological challenges that require a decadal effort in the Polar Regions are:

- the development and maintenance of the polar components of the global Earth observing system and
- development of the Global Integrated Polar Prediction System encompassing a wide range of prediction types and scales, from the weather times scales to scales corresponding to the complex evolution of Polar Regions under the influence of the greenhouse gas buildup in the atmosphere and ocean, taking into account the evolving ozone layer and other factors such as effects of pollution and black carbon.

Another issue of highest practical importance and extreme scientific and technological challenge is protection of the polar environment and life support systems of indigenous peoples under conditions of changing and varying climate and intensive industrial development of the Arctic, intensified shipping, and offshore activities.

More scientific and, probably, other types of challenges from other areas of polar sciences will undoubtedly be identified at the Workshop.

4. Cooperation

Addressing complex environmental and social issues of the Polar Regions requires a system multi-disciplinary approach. Identifying potential stakeholders, partners, and their interests, as well as finding synergistic activities that make a potential decadal initiative bigger than the sum of its parts is one of the main objectives of the Workshop.

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Thoughts on the International Polar Decade (IPD)

(John Calder, April 8, 2011, submitted for discussion at the IPD Initiative Workshop, St. Petersburg, Russia, April 14-15, 2011)

Philosophy:

The IPD needs to be an activity that focuses international efforts on mutual priorities, but that can be undertaken within the anticipated resource base of the participants. It should not assume a “pulse” of new funding as was done with the IPY, and should emphasize coordination rather than level of funding. It should be conducted over three phases: planning (including a review of knowledge gained from the IPY), implementation, and evaluation. The planning phase should be of sufficient length to include a period of time for funding and implementing agencies to complete their internal processes for resource allocation and for international collaborations to be established. The overall timeline doesn’t need to be constrained exactly to a decade.

Focus: Unlike the IPY, the IPD should have a predetermined, and limited, set of themes or priorities so that available resources can be focused on them. Having these priorities predetermined will allow better coordination and resource sharing and alert the broader scientific community to topics for which novel approaches and new technologies will be needed. The priorities could be based on “science” drivers, “operational” drivers, or both. The priorities suggested below have an ultimate “operational” goal with a strong need for “science” to enable the goal.

Possible Priorities:

1. Establish, maintain, or enhance critical polar observing networks (SAON and Arctic Observing Networks, SOOS, etc)
 1. Strengthen networking mechanisms, especially internationally
 2. Refine observing system strategies and fill observing gaps
 3. Develop new observing technologies
 4. Improve data integration and data product development
2. International Polar Prediction Project
 1. Sea ice forecasting – operational daily to seasonal forecasts of sea ice extent, thickness, and movement; tailored support for shipping, subsistence activities, offshore resource activities
 2. Weather – improved 1 to 10 day forecasts, with emphasis on storms, precipitation, superstructure icing
 3. Climate – improved seasonal-to-decadal forecasts in the Arctic and for regions influenced by the Arctic, research and modelling to improve predictability for polar atmosphere and tele-connections to lower latitudes, improved decision-support tools for water management, wildfire management, agriculture
 4. Ocean - improved coastal wind/wave/erosion forecasts; marine productivity forecasts; decision-support tools for living resource management

3. Understanding and Projecting the State of Polar Ecosystems

1. Developing and applying ecosystem-based approaches to ecosystem modelling and management
2. Developing and applying new approaches for biodiversity observations and trend detection

4. Polar Applications of Remote Sensing

1. Develop and test algorithms and processing schemes for converting raw sensor data to meaningful products for polar regions
2. Develop new blended remote sensing products to enhance information in polar regions (sea ice, snow cover, permafrost state, etc)

5. Climate Processes in Polar Regions

1. Observation and research on polar feedbacks
2. Enhancing global and regional climate models with new polar process information

What Next:

1. A mechanism is needed to continue working after the IPD workshop. A bipolar international planning group should be proposed and initial membership established. A scoping paper is needed to drive discussion in the many international and national settings required. A “summit” might be needed to work through the recommendations received and start development of the final IPD plan.
2. The IPD plan should include a set of “principles” that should suffuse the entire IPD effort. The principles should include statements on: physical access to polar study sites; access to and sharing of original data; recognition for, and rights of, data providers; involvement and rights of indigenous people and other Arctic residents; etc.