

**WCRP AND THE INTERNATIONAL POLAR YEAR (IPY) 2007-2008****(Submitted by CliC SSG Chair, the CliC Intl. Project Office, and JPS for WCRP)****Background**

The WMO and ICSU lead the IPY, which is envisioned as an intensive burst of internationally coordinated, interdisciplinary, scientific research and observations focused on the Earth's polar regions. Intensive field investigations from March 1<sup>st</sup>, 2007 to March 1<sup>st</sup>, 2009 will enable nations to make major advances in knowledge and understanding of the high latitudes. This report discusses only WCRP's role, activities and interests in IPY. Regularly updated description of the various aspects of IPY is available at the IPY web site <http://www.ipy.org>.

**Scientific goals, relevance of and for WCRP**

The main goal of WCRP in IPY is to close or significantly reduce the existing gaps in polar processes knowledge and ability to predict the poles and their influence on the rest of the globe at a variety of important time scales.

Specific objectives:

- expand the polar research community contributing to the WCRP goals and cooperating with WCRP,
- produce, for the first time in history, a comprehensive snapshot of both polar regions,
- focus the science on addressing the climate feedbacks in which the poles are significant,
- leave the legacy of IPY in terms of a coordinated climate change – relevant polar observing system.

Major scientific and operational issues with regard to the polar regions are:

- strong impact on weather and seasonal anomalies and insufficient understanding of predictability associated with polar processes,
- extremely poor observational coverage of the polar regions,
- need to quantify and strongly reduce uncertainty in description of how the poles affect the rest of the globe by changing freshwater balance (impact on ocean baroclinic circulation), dynamics of atmosphere (from the surface to mesosphere), atmospheric chemistry (aerosols, ozone, carbon balance), poor representation of all cryospheric elements in climate studies as "frozen" part of the global hydrological cycle,
- knowledge of global teleconnections with participation of poles and polar modes of climate variability.

The following major specific WCRP scientific achievements can be expected during the IPY:

- establishment of a basis for an innovative Arctic Ocean Observing System,
- first in the history coordinated observation period of major satellites, especially for the Synthetic Aperture Radar,
- breakthrough in the establishment of an Arctic hydrological cycle observing system and advances in polar hydrology,
- strong step forward in permafrost monitoring,
- record-long ice-core based climate history (Chinese contribution),
- future-oriented interoperable data legacy,
- unprecedented survey of the Southern Ocean,

- massive snapshot of the polar cryosphere and polar atmosphere, stratosphere and mesosphere as a benchmark for future studies.

These results will require future processing and use in modeling, analysis and reanalysis in order to gain benefits for predictability studies and progress in understanding of human effect on climate.

### **Policy relevance of WCRP**

The expected results and the process through which they will be produced will contribute to several high-level plans. They directly contribute to several strategies of the WMO Sixth Long-Term Plan. Establishment of the Arctic Ocean Observing System will fulfill a key task in the GCOS Implementation Plan, which was assigned to the WCRP. The results will lead to a better ability to predict climate in the polar regions, especially in the Arctic, i.e. where it is expected to change the fastest, and this will be another contribution of WCRP to UNFCCC and IPCC.

Following preliminary analysis of the IGOS-Cryosphere Theme, the Group on Earth Observations (GEO) assigned WCRP/CliC to lead the implementation of its IPY legacy task, CL-0605. The assignment reads: "Coordinate with the IPY to enhance the utilization of Earth Observations in all appropriate realms (including, but not limited to, sea and land ice, permafrost, coastal erosion, physical and chemical polar ocean changes, marine and terrestrial ecosystems changes, biodiversity monitoring and impacts of increased resource exploitation and marine transport)."

There is an increasing use of traditional knowledge for arctic research in Canada, the Nordic countries and the US (Alaska). This is reflected in the research planning through International Conference of Arctic Research Planning (ICARP), the structure of IPY and the funding in several of these countries.

### **Organization and governance of WCRP IPY activities**

At its 25<sup>th</sup> session in Moscow, March 2004, the JSC gave an assignment to CliC to stimulate and coordinate the preparations for IPY on behalf of the WCRP.

WCRP representatives were instrumental in building links between the WMO and ICSU in their approaches to the IPY, participated in the discussions of IPY ideas and plans, and solicited substantial input to the IPY planning from the WCRP community. Members of the CliC SSG and WCRP JPS were a lead in developing the IPY Scientific Framework and the initial data policy and data management process.

In November 2004, a Joint Committee (JC) for IPY was established by WMO and ICSU. This is the lead coordinating body of IPY. To facilitate IPY implementation, the JC has established three Sub-Committees: Observations (SCOBS) with its Space Task Group (STG), Data Policy and Management (SCDPM), and Education, Outreach and Communications (SCEOC). In 2004 the WMO also established an Intercommission Task Group (ITG) on IPY, which reviewed IPY plans and WMO contribution to them. WCRP nominees are on JC, SCOBS and its STG, SCDPM and ITG. This means that almost all aspects of IPY planning involve coordination with the WCRP.

ICSU and WMO have issued call for Expressions of Intent in November 2004. 1200 responses were obtained and clustered. In March 2005, the JC issued a call for preparation of full proposals with final deadline January 31, 2006. The JC evaluated 452 received proposals and endorsed 172 scientific proposals, 1 project for data and information management and 56 proposals on education and outreach.

Internal calls to all WCRP projects were made in 2004 to propose ideas for IPY and in 2005 to propose clustered projects. The WCRP community has been very responsive to these calls. WCRP and its projects are a leading international agency of 22 major projects. Overwhelming majority of the WCRP- and project-related proposals were endorsed by the IPY JC. The WCRP projects are concerned with the Land, Ocean, Ice, Atmosphere, Space and Data sections of the

IPY-chart (see the last page of this document). There are no WCRP projects in Education, Outreach, Earth or People categories, although some projects will cross-cut these topics.

Main WCRP projects in IPY are shown in the following Table.

No.	Domain or Name	Affiliation	IPY No.
1	Synoptic Antarctic Shelf-Slope Interactions Study (SASSI)	CliC	8
2	Sea level and tidal science in the polar oceans	CLIVAR	13
3	Integrated Arctic Ocean Observing System (iAOOS)	WCRP, CliC, AOSB	14
4	Bipolar Atlantic Thermohaline Circulation (BIAC)	WCRP	23
5	POLar study using Aircraft, Remote sensing, surface measurements and modelling of Climate, chemistry, Aerosols and Transport (POLARCAT)	SPARC	32
6	Ocean-Atmosphere-Sea Ice-Snowpack Interactions affecting Atmospheric Biogeochemistry and Ecosystems in the Arctic (OASIS-IPY)	SOLAS	38
7	Data and Information Service (IPYDIS)	WCRP, CliC, NSIDC	49
8	Permafrost Observatory Project: Thermal State of Permafrost (TSP)	WCRP, CliC, IPA	50
9	Monitoring of the upper ocean circulation, transport and water masses between Africa and Antarctica (UCAA)	CLIVAR	70
10	Arctic Circum-Polar Coastal Observatory Network (ACCO-Net)	through MoU with IPA	90
11	Global Inter-agency IPY Polar Snapshot Year (GIIPSY)	WCRP, CliC, IGOS-Cryo	91
12	The Arctic Hydrological Cycle Monitoring, Modelling and Assessment Program (Arctic-HYDRA)	WCRP, CliC	104
13	The State and Fate of the Cryosphere	WCRP, CliC	105
14	Sea Ice from Space for the IPY (iAOOS – SISI)	WCRP, CliC	108
15	Climate of Antarctica and the Southern Ocean – Ocean Circulation Cluster (CASO)	WCRP, CliC	132
16	Cold Land Processes in the Northern Hemisphere (CLPNH)	WCRP, CliC, GEWEX	138
17	Hydrological Impact of Arctic Aerosols (HIAA)	GEWEX	140
18	Antarctic Sea Ice in IPY	WCRP, CliC	141
19	Antarctic Climate and Atmospheric Circulation	WCRP, CliC	180
20	Impacts of Surface Fluxes on Arctic Climate: Severe Storms, Effects on Coastal Processes and Relationships to Changing Climate	SOLAS	205
21	The Structure and Evolution of the Polar Stratosphere and Mesosphere and Links to the Troposphere during IPY (SPARC-IPY)	WCRP, SPARC	217
22	Comprehensive Meteorological dataset of active IPY Antarctic measurement phase (COMPASS)	WCRP	267
23	Program of Antarctic Nova Disciplines Aspects (PANDA)	CliC	313

There are many other projects, which focus on the climate change science but are not formally affiliated to the WCRP and its projects. It is possible to say that climate research dominates the IPY agenda.

Strong collaboration exists between WCRP affiliated projects within the IPY. For example, the CASO project (# 132) is being coordinated by the CLIVAR/CliC/SCAR Southern Ocean Region Implementation Panel. The CLPNH project (# 138), developed within the Northern Eurasia Earth Science Partnership Initiative (NEESPI), has strong interactions with the CliC community for its terrestrial cryosphere components, as well as with the GEWEX community, for the development of a synergistic observing system.

### **Interaction with other bodies**

WCRP has used the opportunity of IPY to engage several partners in joint proposals for ideas and projects. In some cases WCRP and its projects were recognized as logical and legitimate umbrellas for cooperative proposals without a prompt. Some cooperation links were actively pursued, and some formed naturally. Strong cooperation of WCRP-led or affiliated projects can be noted with WMO, SCAR, IPA, and AOSB.

Operational links with IASC, AMAP, IOC, IHDP and GEO are weaker and require attention. Cooperation with IASC is developing because WCRP/CliC was accepted as the coordinator of research on terrestrial cryosphere. Joint work with AMAP is unrolling in the process of developing a Sustained Arctic Observatory Network (SAON) project. CliC's initiatives on the establishment of the Arctic Ocean Observing System contributed to the inauguration of an Arctic GOOS Regional Alliance. It is essential to ensure that WCRP polar oceanographic activities form a part of a coherent IOC ocean climate science program. Links with GEO will strengthen because CliC is assigned by this organization to coordinate the development of IPY legacy in terms of data and observing systems.

The IPY has strongly influenced activities and coordination between research groups and the WCRP projects. GEWEX scientists interact with several international bodies (e.g. IPA) and national bodies (e.g. the Russian Academy of Science). CliC community has been further developed in Australia, Canada, China, Japan, and the USA. An 'Asia-CliC' Regional Group was established in 2006. This regional group has attracted support from the funding agencies and fostered unprecedented cooperation between countries and agencies in the cryosphere / climate science.

WCRP core projects lead several of the IPY endorsed proposals and these international proposals have provided the context for national research proposals. Just as an example: the project *Variability and Change in the Canadian Cryosphere* is designed to contribute to CliC's *State and Fate of the Cryosphere* (IPY # 105). Some regional projects, such as *Antarctic and sub-Antarctic Permafrost, Periglacial and Soil Environments* project (# 33) contribute to larger scale CliC-affiliated projects such as the *Permafrost Observatory Project: Thermal State of Permafrost* (# 50).

IPY projects by are definition expected to promote international interactions, e.g. for HIAA (# 140), through the GEWEX GCSS Working Group on Polar Clouds, NEESPI, and the Coordinated Energy and water cycle Observing Project (CEOP). The IPY is going to intensify the WCRP networking in terms of co-sponsoring of meetings, like it is already the case for CliC with SCAR (e.g. co-sponsorship of the International Workshop on Antarctic Sea-Ice Thickness, Hobart, Tasmania, July 2006) and with the IPA (e.g. co-sponsorship of a Young Permafrost Researcher Presentation Award at the Asian Conference on Permafrost, Lanzhou, China, August 2006).

### **Visibility and communication by WCRP**

Several large-scale initiatives were launched by WCRP and partners. One recent example is the ESA announcement of opportunity to work with IPY satellite data, which explicitly indicates that it is made to meet CliC objectives. Several forthcoming meetings organized by WCRP projects will enhance the visibility of projects by their link to IPY (e.g. a large SPARC-IPY workshop is currently being planned to be held in conjunction with the next SPARC Data Assimilation Workshop in September 2007). If the GEWEX IPY project HIAA is funded, it will provide additional visibility to WCRP through an extensive effort in outreach and education (website, a special segment on the Weather Channel, press releases, involvement of U.S. high school teachers, town meetings in Arctic communities, etc.). In addition, training of young scientists from all participating countries but especially Russia could be an important contribution of GEWEX IPY activities to capacity building.

Another recent opportunity needs to be seized. There is an arrangement with Google to have an IPY layer as one of the default layers in Google Earth. Any time one of the 100 million users of this application opens the application, an IPY layer will appear in the lower left option box. It is an easy and effective outreach pipeline and needs to be used as widely as possible.

Despite many of the IPY leaders and participants are members of WCRP projects and groups, the role of WCRP in IPY planning is not always acknowledged. Our experts need to be encouraged to more strongly promote WCRP in principle and its role in IPY in particular.

### **Capacity Building in / by WCRP**

Model shortcomings in the polar regions are a well-known impediment to better understanding and prediction of polar climate. Important progress has been made through various WCRP IPY initiatives in the last year, but the modeling and the insufficient or lacking representation of satellite data and products in IPY endorsed projects remain severe concerns for future knowledge and network building within the discipline. The IPY integrated modeling strategy by the Southern Ocean Basin Implementation Panel of CLIVAR constitutes an important effort for high latitudes.

An IPY Data and Information Service (IPYDIS) will build on ICSU and WMO strategies for future data systems. Planning and implementation of IPYDIS will be carried out in partnership with the concurrent Electronic Geophysical Year. The technical solutions necessary to implement IPYDIS will comply with advanced international standards for interoperability and for metadata. IPYDIS and the long-term IPY data legacy will involve many innovative solutions. CliC wishes to collaborate with the IPYDIS in the long-term legacy of data, taking a coordinating role for cryospheric data and information. The Data and Information Service for CliC (DISC) is the prototype of a central metadata portal with web-based search engines providing a comprehensive overview of cryospheric data based on discovery-level metadata, and with efficient linkages between all data and metadata centers worldwide. However, due to funding limitations, CliC has not been able to extend the DISC tool past the prototype. New directions have been explored in order to help the development of DISC, in particular with data management services at the Norwegian Polar Institute. A solution has not yet been found.

The total amount of funding available to IPY research and observations is estimated to be very significant, of order of one billion US\$ (equivalent). Approximately one quarter of this funding will come as new (additional) investment, which would not be possible without IPY. More than 50,000 individuals from 63 countries (current estimate) are expected to participate in IPY.

IPY activities may be very helpful in building the capacity of WCRP polar research. There are indications that many of the projects proposed by WCRP or relevant projects will receive some funding. Contributions to WCRP interests may also come unsolicited. For example, a major relevant project that has funding in the U.S.A. is International Arctic Systems for Observing the Atmosphere. It is funded by NOAA and is deploying cloud radars and other instruments to augment observations at observing sites in the Arctic. Even in the case there is no additional fresh funding, some existing resources available to individual investigators can be redirected towards IPY activities. For example, in the case of GEWEX project HIAA resources of several PIs may be redirected for polar modeling and satellite remote sensing.

### **Challenges and questions to JSC**

1. The IPY science program is a result of top-down solicitation by the initiators and bottom-up response from scientific community. The endorsed IPY projects were selected because of their relevance for the themes and international character. Some of the endorsed projects failed to obtain funding. This all means that with certain exception the IPY agenda is a collection of useful projects but it does not envision achievement of specific overarching goals. The role of the WCRP could be to try to help the IPY JC to obtain a program, which helps to study predictability of the polar regions. This requires contribution of all WCRP projects and certain resources. WCRP should define observing strategies and provide the coordination of analysis activities for the IPY.
2. The IPY will produce an unprecedented data set of polar observations. IPYDIS with participation of CliC works on preserving it and making available to science. WCRP should plan in advance how this data can advance modeling, reanalysis and prediction on a range of essential time scales. GEWEX stresses that the long-term global data sets produced from satellite data are inadequate over polar regions and that it has been very difficult to maintain homogeneous data sets (as reported in the latest IPCC report). Efforts are needed at the WCRP level to ensure that appropriate data are collected for product development and evaluation and that reprocessing occurs

3. Should CliC, given shortage of its resources, embark on an effort-intensive coordination of the legacy of IPY in terms of data and observing systems as a contribution to the GEO Work Plan for 2007-2009?

