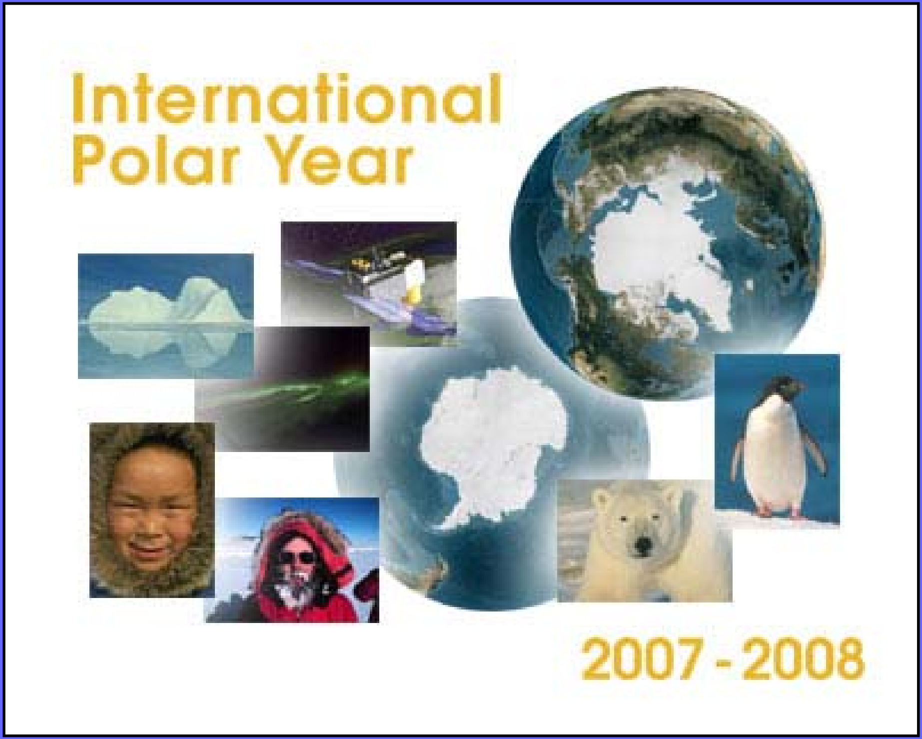


Chris Rapley - Chair ICSU Planning Group
Arctic Science Summit Week
Reykjavik April 2004

International Polar Year 2007 - 2008

IPY Concept

- An international programme of coordinated, interdisciplinary, scientific research and observations in the Earth's Polar regions :
  - to explore new scientific frontiers
  - to deepen our understanding of polar processes and their global linkages
  - to increase our ability to detect changes
  - to attract and develop the next generation of polar scientists, engineers and logistics experts
  - to capture the interest of the public and decision-makers

IPY Main Characteristics

- Timeframe
  - 1st March 2007 to 1st March 2009
- Geographic Focus
  - Latitudes ~60 to 90, North and South
- Content
  - 5 major Themes comprising a manageable number of Core Activities plus associated activities

International Polar Year 2007 - 2008

ICSU IPY PG

Members

- Chris Rapley (UK, Chair)
- Robin Bell (USA, Vice-Chair)
- Ian Allison (Australia)
- Robert Bindschadler (USA)
- Gino Casassa (Chile)
- Steve Chown (South Africa)
- Gerard Duhaime (Canada)
- Vladimir Kotlyakov (Russia)
- Olav Orheim (Norway)
- Prem Chand Pandey (India)
- Hanne Petersen (Denmark)
- Zhanhai Zhang (China)

Ex Officio

- Michael Kuhn (IUGG)
- Werner Janoschek (IUGS)
- Ed Sarukhanian (WMO)
- Thomas Rosswall (ICSU)

Support

- Chris Elfring (US PRB)
- Cynan Ellis-Evans (BAS)
- Tim Moffatt (BAS)
- Leah Goldfarb (ICSU)

IPY PG – ToR

1. To gather, summarise and make widely available information on existing ideas for an IPY serving as a clearinghouse for ideas
2. To stimulate, encourage and organise debate amongst a wide range of interested parties on the objectives and possible content of an IPY
3. To formulate a set of objectives for an IPY
4. To develop an initial high level Science Plan for an IPY which engages younger scientists throughout the planning process
5. To develop a specific set of objectives targeted at formal and informal education as well as the general public in the next IPY
6. To develop a proposed mechanism for the design, development, guidance, and oversight of an IPY
7. To present a draft plan to the ICSU EB at their February 2004 meeting
8. To report to the ICSU 28th General Assembly in 2005 a plan for an IPY in 2007/8 for final endorsement

IPY PG – ToR

- Committed to IPY 2007-2008
- Joint sponsorship with WMO
- PG to complete by Oct 2004

7. To present a draft plan to the ICSU EB at their February 2004 meeting

IPY PG - Approach

- Present & debate IPY at major science meetings and symposia
- Hold specific meetings, discussions
- Engage interest of high profile journals
- Establish Website www.ipy.org
- Define rationale, concept and objectives of IPY
- Invite ICSU National Members, Unions and ICSU / non-ICSU science coordination bodies to:
  - Establish IPY National Committee / National Point of Contact
  - Comment on three suggested Themes
  - Submit ideas (NOT proposals) to map out scope / domain of IPY
- Discussion Forum
- Analyse inputs and synthesise initial Outline Science Plan
- Discuss and debate iOSP
- Discuss and debate implementation, outreach, data
- OSP and Final Report to ICSU

Community Response

- Scientists from 25 countries
- ~25 ICSU and non-ICSU bodies
- 12 National Committees
- 7 National Points of Contact / NCs under formation
- >340 "Ideas"

IPY Objectives

- Intensive internationally-coordinated burst of polar research that would not otherwise be undertaken
- Foundation for major scientific advances
- Legacy of observing sites, facilities, systems and geographic access
- Strengthen and enhance international collaboration
- Address both polar regions and their global interactions
- Interdisciplinary
- Reference dataset for comparison with the future and the past
- Ensure data available in an open and timely manner
- Intensify the recovery of relevant historical data
- Attract, engage and develop a new generation of polar researchers, engineers and logistics experts
- Optimise exploitation of polar assets / infrastructure
- Build on existing and potential new funding sources
- Engage the public and decision-makers worldwide

International Polar Year 2007-2008

Mandatory Characteristics of IPY Core Activities

- High scientific quality, addressing an important question or issue
- Capable of resulting in major progress
- Address one or both polar regions
- Contribute to international collaboration / coordination
- Logistically and technically feasible and achievable within IPY timeframe
- Avoid duplication or disruption of established initiatives and plans
- Provide open and timely access to data
- Maximise effective utilisation of available logistical assets
- Explicitly address roles and tasks for young scientists, technical and logistics experts
- Explicitly address outreach activities

Desirable Characteristics of IPY Programme Elements

- Build on existing activities – adding value
- Interdisciplinary or with potential for interdisciplinary linkage and synthesis within the IPY programme overall
- Provide international access to field sites to support additional science and monitoring activities
- Address training / capacity building including opportunities for individuals to convert to polar science and monitoring
- Provide opportunities for regional scholarship within broader international activities
- Readily communicable to public

International Polar Year 2007 - 2008

IPY Themes

1. To determine the present environmental status of the polar regions by quantifying their spatial and temporal variability
2. To quantify and understand past and present environmental and human change in the polar regions in order to improve predictions
3. To advance our understanding of polar-global teleconnections on all scales, and of the processes controlling these interactions
4. To investigate the unknowns at the frontiers of science in the polar regions
5. To use the unique vantage point of the polar regions to develop and enhance observatories studying the Earth's inner core, the Earth's magnetic field, geospace, the Sun and beyond

Specific Issues (1)

- What is status of the high latitude ocean circulation and composition?
- How do polar ecosystem structure and function vary through space and time and how much of this variation can be attributed to anthropogenic change?
- What are the contemporary factors of social cohesion and values for polar societies?
- How are climate, environment, and ecosystems in the polar regions (including high latitude oceans) changing?
- How has polar diversity responded to long-term changes in climate?
- What are the inter-hemispheric connections in these changes?
- How has the planet responded to multiple glacial cycles?

Specific Issues (2)

- What critical factors triggered the cooling of the polar regions?
- What role do the polar regions play in the global carbon cycle?
- What is the stability of the Earth's major ice masses and what will be their impact on global mean sea level?
- What are the linkages between the physical chemical and biological systems in the polar regions?
- What are the interactions between the polar regions and lower latitudes including linkages through climatic, social, ecologic, and hydrologic processes?
- How do actors, institutions, relations explain changes at a variety of levels both globally and within the polar regions?
- What are the character of the sub-ice and deep ocean polar ecosystems?

Specific Issues (3)

- What is the pattern and structure of polar marine and terrestrial biodiversity, at all trophic levels?
- What effect does the solid earth have on ice sheet dynamics?
- What are the nature, composition and morphology of the sea floor and earths crust beneath the polar ice cover?
- How does phylogenetic and functional diversity vary across extreme environments, and what are the evolutionary responses underpinning this variation?
- How does the neutral atmosphere interact with geospace at the polar regions and what are the consequences?
- What is the influence of solar processes at the polar regions on earth's climate?
- What is the state of the Earth's magnetic dipole?
- Is the inner core rotating differentially?

International Polar Year 2007 - 2008

Emerging Vision

- A synoptic set of multidisciplinary observations to establish the status of the Polar environment in 2007-2008
- The acquisition of key data sets necessary to understand factors controlling change in the Polar environment
- The establishment of a legacy of multidisciplinary observational networks
- The launch of internationally coordinated multidisciplinary expeditions into new scientific frontiers
- The implementation of Polar Observatories to study important facets of Planet Earth And Beyond

WMO IPY Contributions

1. Improve World Weather Watch Global Observing System
2. Ozone layer monitoring
3. Greenhouse gas / aerosol transports particularly to the Arctic
4. Assess global-to-regional influences on polar high impact weather events
5. Intensify polar climate studies / global interactions & feedbacks
6. Establish comprehensive database of polar climate data
7. Investigate physical processes in polar oceans and establish Arctic Ocean and Southern Ocean Observing Systems
8. Further develop capabilities to observe and model polar hydrological cycle including establishment Arctic Hydrological Cycle Observing System

Electronic Geophysical Year (eGY)

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION VOLUME 85 NUMBER 11 16 MARCH 2004

Moving Beyond the IGY: The Electronic Geophysical Year (eGY) Concept

The International Geophysical Year (1957–1958) was inspired by the realization that much better and more complete information was needed about the Earth and geospace to understand and manage the complete terrestrial environment on which we depend. So it was that the IGY member countries worked together to deploy a large number of geophysical observatories around the world. These nations were pursuing the major IGY objectives to collect geophysical data as widely as possible, and to provide free access to these data for all scientists around the globe. About 50 permanent stations were set up in the Arctic and Antarctic, and the World Data Center System was established to ensure that the data collected were properly archived and made available without restrictions for scientific research and practical applications.

IGY was an outstanding success. It elevated geophysical monitoring to a new level, and set new standards for international collaboration and data-sharing. Many successes of the geophysical sciences in recent times have origins that can be traced back to the IGY. A notable example is the modern era of space exploration. As we approach the 50-year anniversary of the IGY, it is appropriate to seek to build on the achievements through renewed global resolves as well as to review the outcomes of the IGY and celebrate its successes. This is the "IGY+50" concept.

At the 1999 International Union of Geodesy and Geophysics (IUGG) Assembly in Birmingham, in the United Kingdom, a resolution on "IGY+50" was introduced through the International Association of Geomagnetism and Aeronomy (IAGA). This resolution, which may be viewed at http://www.ngdc.noaa.gov/stp/SCOSTEP/scostep.html, does not stand alone, but is complemented by several earlier resolutions passed by the IUGG and its constituent associations urging international cooperation in the collection and sharing of geophysical data.

Regions such as deep space and ocean bottoms are still challenging the worldwide scientific communities with their relative remoteness or inaccessibility. However, at the beginning of the 21st century, only a few places are left on the Earth's continents where geophysical instruments are not yet installed or that satellite-based remote systems cannot observe. The new frontiers that are the logical extension to the IGY now lie in the intelligent, efficient, and cooperative use of observational data that make full use of modern information management opportunities. With the tremendous growth of computing and networking technologies in the last decade of the 20th century, there are no longer serious barriers to establishing large, centralized or distributed geophysical data bases, or to ingesting worldwide geophysical data into high-performance global simulation models to advance our knowledge of planet Earth and its surrounding geospace. Furthermore, much scientific progress is occurring at the interface between traditional disciplines; thus, data have to be made even more widely available.

We are witnessing rapid progress in Earth and space science in the development of an integrated data environment. That integrated environment will offer easy, simultaneous

eGY Concept cont. on page 109

By D. N. Baker, C. Barton, A.S. Rodger, B. Fraser, B. Thompson, and V. Papitashvili

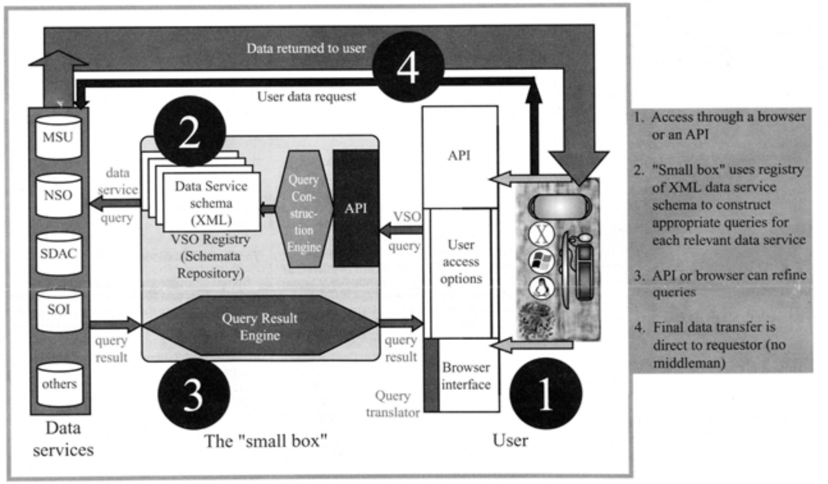
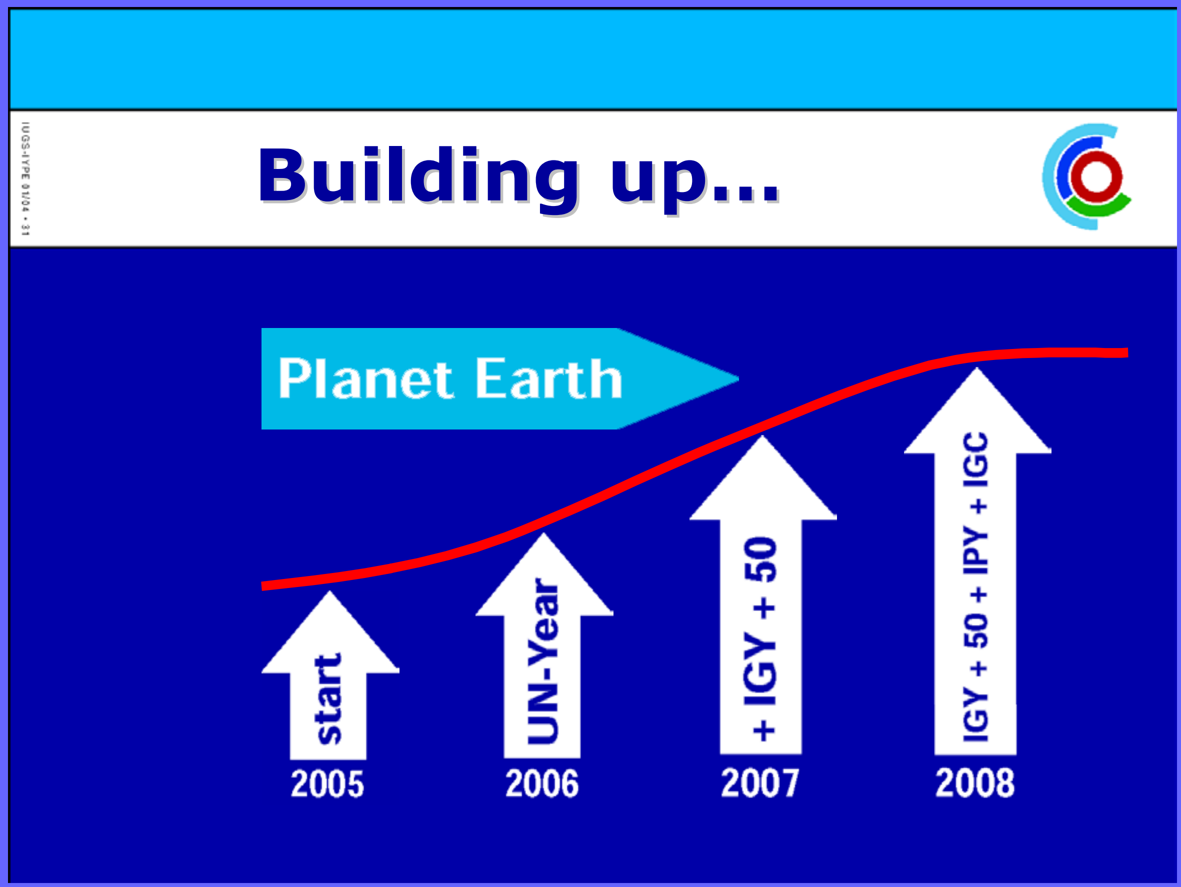


Fig. 1. The NASA Office of Space Science concept for a "Virtual Solar Observatory" is shown. (Courtesy of J. Gurman and C. Holmes, NASA).

International Year of Planet Earth: *Earth sciences for society*

- **IUGS** initiative, **UNESCO** co-initiator
- Aiming for **UN proclamation in 2006**
- **PR China** lead country
- **Eight science topics** selected
- **Flyer and brochure** available
- **Activities** throughout 2005-2007
- **Web site** www.esfs.org

The “Years”


Building up...
Planet Earth
start
2005
UN-Year
2006
+ IGY + 50
2007
IGY + 50 + IPY + IGC
2008

Next Steps

- Build consensus on OSP – Core Activities
- Address crosscutting activities – data, outreach, capacity building
- Establish JOC Programme Office / secretariat
- Agree implementation structure and processes esp. relationships with other key bodies
- Submit report to ICSU
- Establish ICSU-WMO IPY joint body
- Organise & Establish Consortia and SSGs to implement Core Activities

International Polar Year 2007 - 2008

Issues

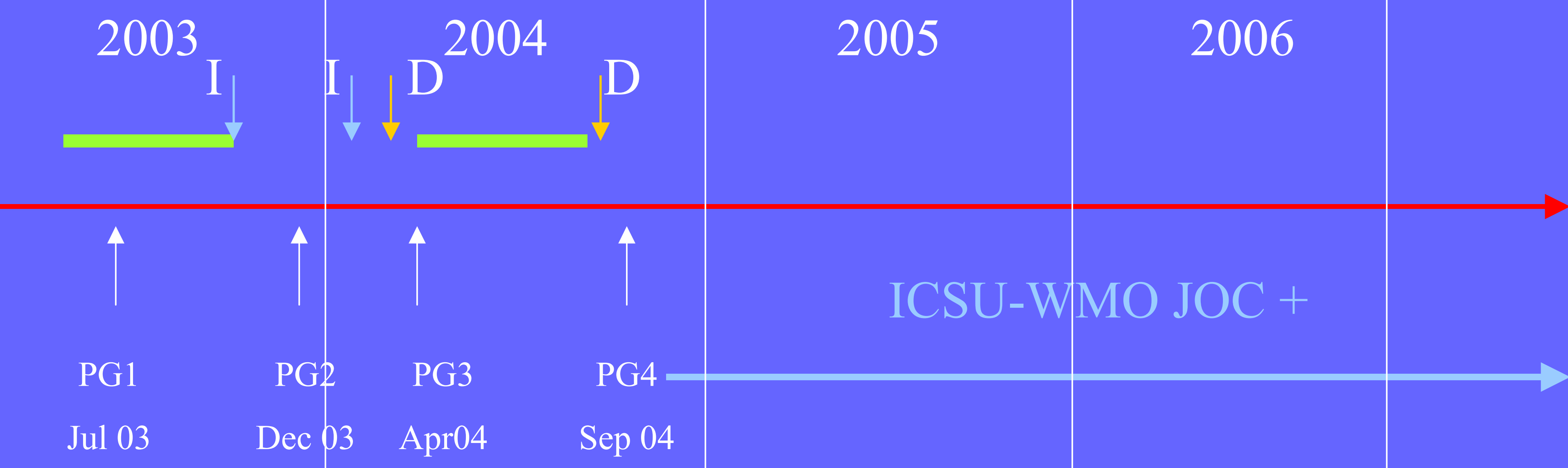
- Response to iOSP – strengths / weaknesses / gaps?
- Relationship with ICARPII
- Role of SCAR, IASC, COMNAP, FARO, AOSB, etc


International
Polar Year
2007 - 2008

Additional Material

International Polar Year 2007 - 2008

PG Timeline



International Polar Year 2007 - 2008

National Submissions

- o Australia
- o Belgium
- o Canada
- o China
- o Denmark / Greenland
- o France
- o Germany
- o India
- o Italy
- o Japan
- o New Zealand
- o Norway
- o Russia
- o Spain
- o Sweden
- o United Kingdom
- o United States of America

- ✓ Argentina
- ✓ Brazil
- ✓ Czech Republic
- ✓ Chile
- ✓ Finland
- ✓ Netherlands
- ✓ South Africa
- ✓ Ukraine

o NC or NPO input
✓ Individual input

Submissions from Science Coordinating Bodies

- Air-Ice Chemical Interfaces Programme (AICI)
- Arctic Ocean Sciences Board (AOSB)
- Arctic SubArctic Ocean Flux Study (ASOF)
- Census of Marine Life (CoML)
- Climate of the Arctic and its role in Europe (CARE)
- Climate and Weather of the Sun-Earth System (CAWSES)
- European Polar Board (EPB)
- Global Ocean Observing System (GOOS)
- International arctic Science Council (IASC)
- International Heliophysical Year (IHY)
- Intergovernmental Oceanographic Commission (IOC)
- International Permafrost Association (IPA)
- International Science Initiative in the Russian Arctic (ISIRA)
- International Society of Photogrammetry and Remote Sensing (ISPRS)
- International Union of Geological Sciences (IUGS)
- International Union of Geodesy and Geophysics (IUGG)
- International union of Radio Science (URSI)
- Scientific Committee on Antarctic Research (SCAR)
- Scientific Committee on Solar-Terrestrial Physics (SCOSTEP-STPP)
- World Meteorological Organisation (WMO)
- World Climate Research Programme (WCRP)
- WCRP Climate and Cryosphere (CLiC)
- WCRP International Programme for Antarctic Buoys
- WCRP Southern Ocean CLIVAR

Endorsements

- Antarctic Treaty Consultative Meeting (ATCM)
- Arctic Climate Impact Assessment (ACIA)
- Arctic Council
- Arctic Ocean Science Board (AOSB)
- Arctic-SubArctic Ocean Flux study (ASOF)
- Committee of Managers of National Antarctic Programmes (COMNAP)
- European Polar Board (EPB)
- European Space Agency (ESA)
- Forum of Arctic Research Operators (FARO)
- International Arctic Science Committee (IASC)
- International Oceanographic Commission (IOC)
- National Aeronautics and Space Administration (NASA)
- Scientific Committee on Antarctic Research (SCAR)
- United States Polar Research Board (US-PRB)
- World Meteorological Organisation (WMO)

Why International?

- Polar processes extend across national boundaries
- Science challenge exceeds the capability of any one nation
- Coordinated approach maximizes outcomes and cost-effectiveness
- International collaboration shares benefits and builds relationships

International Polar Year 2007 - 2008

Why Polar?

- Polar regions are active, highly connected components of the planet
- Significant changes are occurring in the polar regions
- Polar regions hold unique information on past behaviour of Earth system
- Polar regions have growing economic and geopolitical importance – especially the Arctic
- The harsh conditions and remoteness of the Polar regions have hampered scientific progress
- There is a need to re-establish / enhance polar operational observing systems
- The polar regions offer a unique observational vantage point for a variety of terrestrial and cosmic phenomena

Why a Year?

- Intensive burst of effort will accelerate progress
- "Polar Snapshot" will provide crucial benchmark for change detection relative to future and past data sets
- Provides opportunity for observations of both polar regions over all seasons
- Resulting legacy of enhanced observing systems will provide improved foundation for ongoing operational monitoring

Why 2007-2008?

- Anniversary of past IPY/IGY provides firm deadline
- Pressing need to capture current polar changes
- 3-4y planning horizon challenging but feasible
- New advances in technology and logistics provide possibility of addressing new issues and accessing new areas

Priorities

- During the IPY the regular scientific facilities of the world must be supplemented by additional observations suitably distributed in space and time as needed for the solution of the selected problems.
  - Highest priority should be given to problems requiring concurrent synoptic observations at many points involving co-operative observations by many nations
  - The extraordinary efforts that could be generated during the IPY in these relatively inaccessible regions of the Earth mean that the observations there should preferably cover all major geophysical phenomena, in order to augment our basic knowledge of the Earth and solar and other influences acting upon it
  - IPY should also include epochal observations of slowly varying terrestrial phenomena to establish basic information for subsequent comparison at later epochs

International Polar Year 2007 - 2008

First Polar Year 1882-1883

- Karl Weyprecht / Hans Wilczek / Georg von Neumayer
- International Meteorological Organisation
- 11 Nations
- 12 Arctic stations, 2 southern
- Exploration and Science
- Meteorology, magnetic, aurora, glaciology oceanography, ethnography
- Solar Max, Transit of Venus (SG), Krakatoa

Second Polar Year 1932-1933

- J. Georgi / Dan La Cour
- International Meteorological Organisation
- 44 Nations, ~ 60 Arctic stations + ships & expeditions – few in S. hemisphere
- Meteorology, magnetic, aurora, ionosphere
- New technology – telephone, radio, aircraft
- Constrained by world economic depression but acquired unprecedented quantity of systematic data

International Geophysical Year 1957-1958

- Lloyd Berkner, Sydney Chapman, James Wordie
- ICSU + UNESCO + WMO
- 67 nations, 8000 stations (Antarctic - 12 nations / 40 stations)
- ~80,000 scientists and volunteers
- V. broad range of science - launched Polar Science to a new level
- In the Shadow of the Cold War but fostered High Level International Co-operation
- New technology – Space Age

IGY Outcomes

- Major advances in knowledge & understanding (e.g. discovery of Van Allen Belts)
- Establishment of Arctic and Antarctic permanent bases and *in-situ* programmes
- Establishment of World Data Centres
- International Research Institutions (SCAR, SCOR, subsequently WCRP, etc)
- Antarctic Treaty System
- Major public impact

Why an *International Year of Planet Earth?*

- To demonstrate the **huge potential** of the Earth sciences to build a **safer, healthier and wealthier Society**

- To encourage Society to **apply this potential more effectively**

Eight Scientific Programmes

- **Groundwater** – *towards sustainable use*
- **Hazards** - *minimising risk, maximising awareness*
- **Earth and Health** – *building a safer environment*
- **Climate** – *the "stone tape"*
- **Resources** – *prosperity and sustainability*
- **Megacities** – *going deeper, building safer*
- **Deep Earth** – *from crust to core*
- **Ocean** – *abyss of time*