Lessons from Global Networks for Observing and Data

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Outline

- WMO Structure
- WWW's Global Observing System (GOS)
- WMO Integrated Global Observing Systems (WIGOS)
- WMO Information System (WIS)
- WIGOS ,WIS and IPY
- WMO EC Panel of Experts on Polar Observations and Research

Purposes of WMO Weather ,Water and Climate

- World-wide cooperation in observing networks
- Standards for observations and interoperability
- Systems for data and information exchange
- Prediction and warning systems
- Applications for societal benefit
- Research, training and capacity building

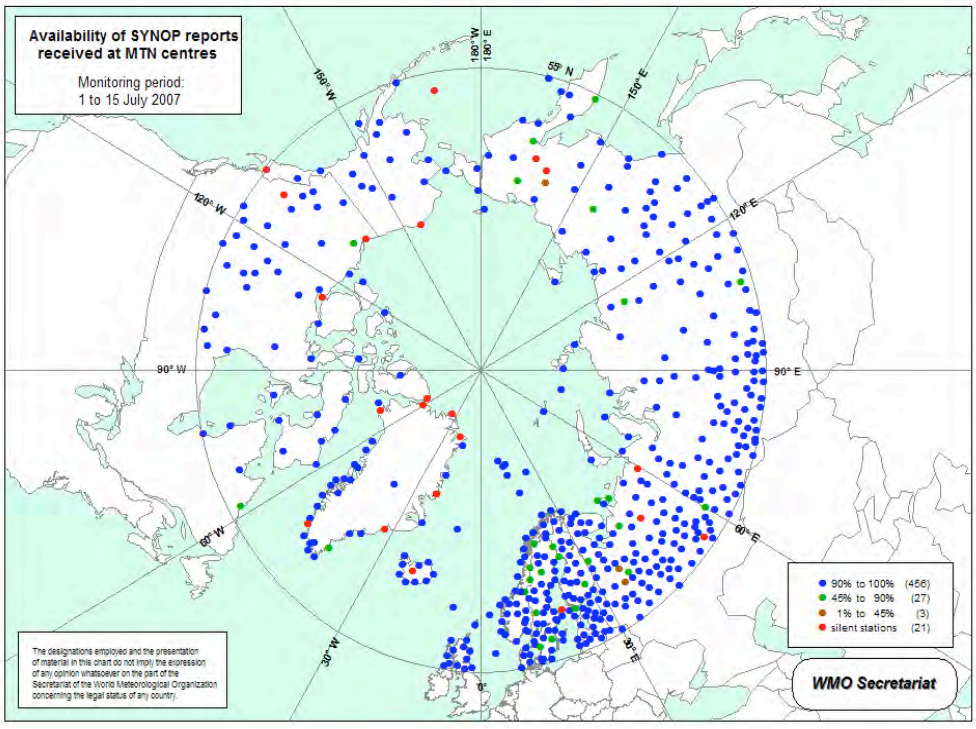
Organizational Structure

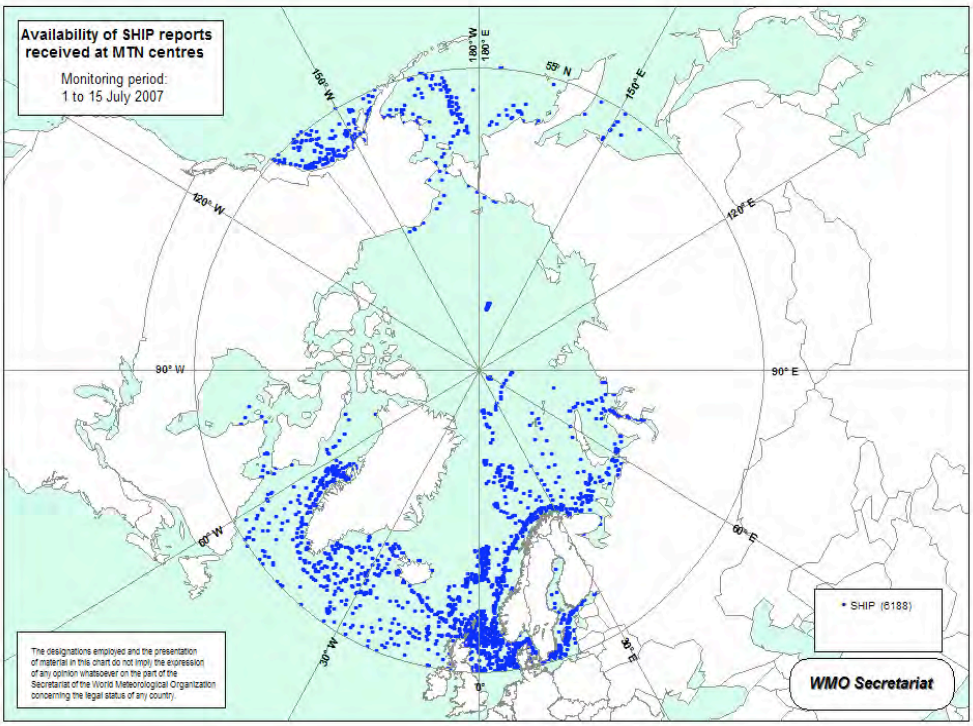
- *Congress*, supreme body, determines the future policy (meets every 4 years)
- *Executive Council*, 37 Directors of Meteorological or Hydro-meteorological Services. They act in their individual capacities (meets annually). Includes a Panel of Experts on Antarctic Meteorology Activities
- *Regional Associations* (6) - Address regional concerns
- *Technical Commissions* (8) - Technical experts make recommendations on scientific or technical issues within the purposes of WMO
- *Secretariat* with Regional (3) and subregional (4) Offices

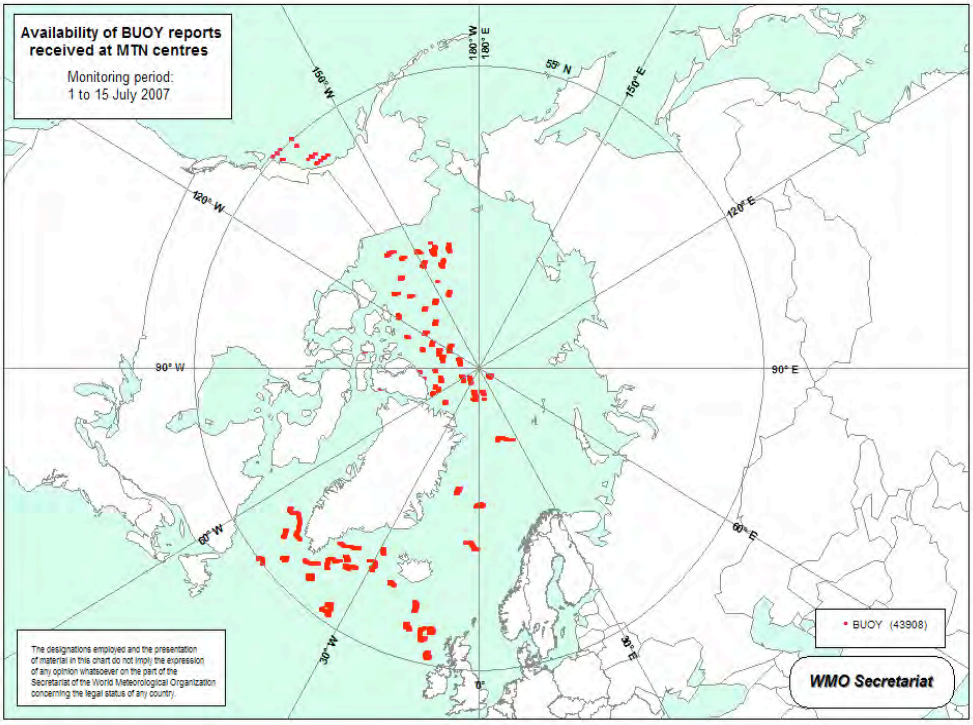
World Weather Watch
Global Observing Systems (WWW/GOS)

Observing facilities on land, sea, air and outer space

- 10,000 land stations
- 1,300 upper-air stations
- 4,000 ships
- 1,200 drifting buoys
- 200 moored buoys
- 3,000 Argos profiling floats
- 3,000 commercial aircraft
- Six operational polar-orbiting satellites
- Ten operational geostationary satellites, and several environmental R&D satellites




Availability of SHIP reports received at MTN centres
Monitoring period:
1 to 15 July 2007
180° W
180° E
55° N
150° W
150° E
120° W
120° E
90° W
90° E
60° W
60° E
30° W
30° E
0°
SHIP (6188)
The designations employed and the presentation of material in this chart do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country.
WMO Secretariat


Availability of BUOY reports received at MTN centres
Monitoring period:
1 to 15 July 2007
180° W
180° E
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90° W
90° E
60° W
60° E
30° W
30° E
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BUOY (43908)
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Six Regional Basic Synoptic Networks (RBSN) and Antarctic Basic Synoptic Network (ABSN)

- Agreed selection of surface and upper-air meteorological observing stations – worldwide
- 4282 surface stations (reporting every six hours) and
- 860 upper-air stations on land (generating a vertical sounding twice per day)

Six Regional Basic Climatological Networks (RBCN) and Antarctic Basic Climatological Network (ABCN)

- Agreed selection of surface and upper-air meteorological observing stations - worldwide
- 2887 surface stations and
- 534 upper-air stations

- Generate monthly averages of meteorological parameters measured at the surface and in vertical layers of the atmosphere up to 30km

World Weather Watch
Global Telecommunication System

- Integrated network dedicated point-to-point, data-communication network services and multi-point circuits (e.g., satellite-based distribution systems) - interconnects all NMHSs
- GTS provides for near real-time collection and global exchange of synoptic observations made by RBSN stations
- GTS provides for collection and global exchange of climate observations from RBCN stations
- All regional and global telecommunication hubs in GTS have established quantitative data monitoring procedures
- Regular monitoring exercises.

Satellites were the genesis

SATELLITES AND THE WWW

UN Resolution No. 1721 for "international co-operation in the peaceful uses of outer space" approved 20 December 1961

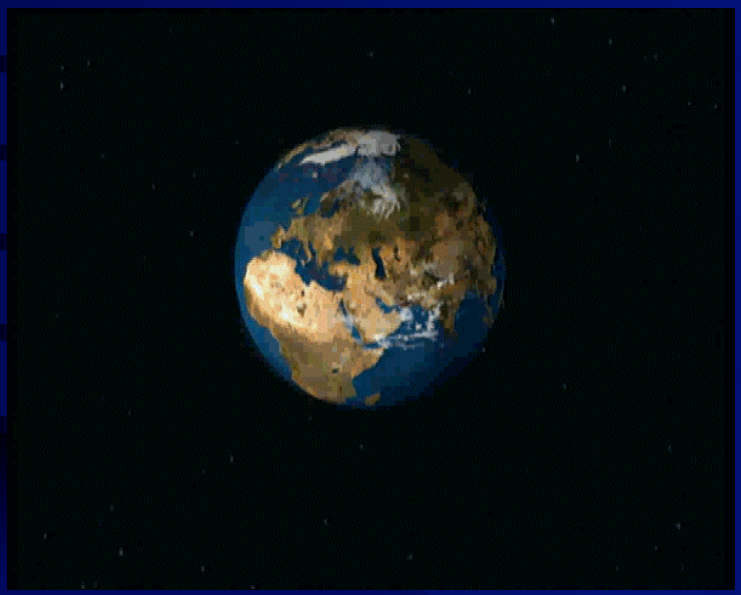
- **Advent of satellites offered substantial opportunities for improvements in meteorological services**
- **Called on WMO to lead a study and report on recommendations of the UN Resolution**

Report delivered in June 1962

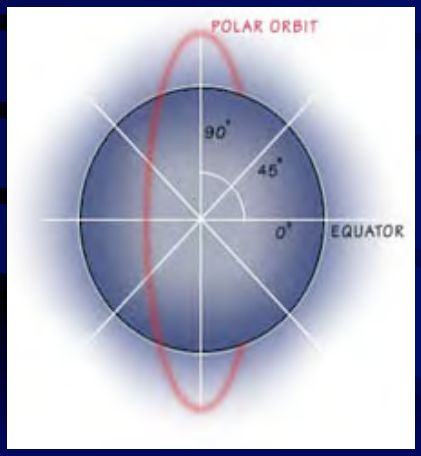
- ***"First report on the advancement of atmospheric sciences and their application in the light of developments in outer space"***
- **Birth of World Weather Watch**

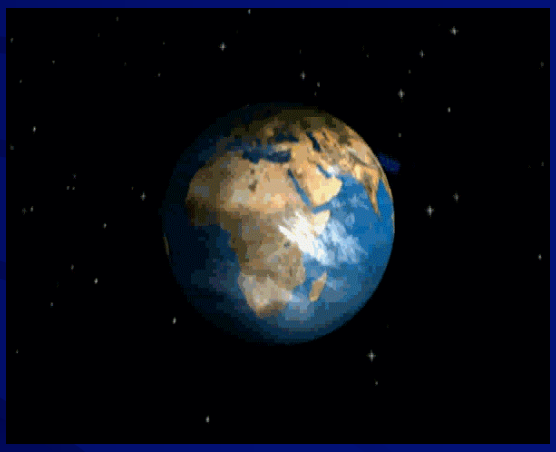
On April 1, 1960 the first U.S. weather satellite was launched from Cape Canaveral, FL

Global System of Geostationary Satellites

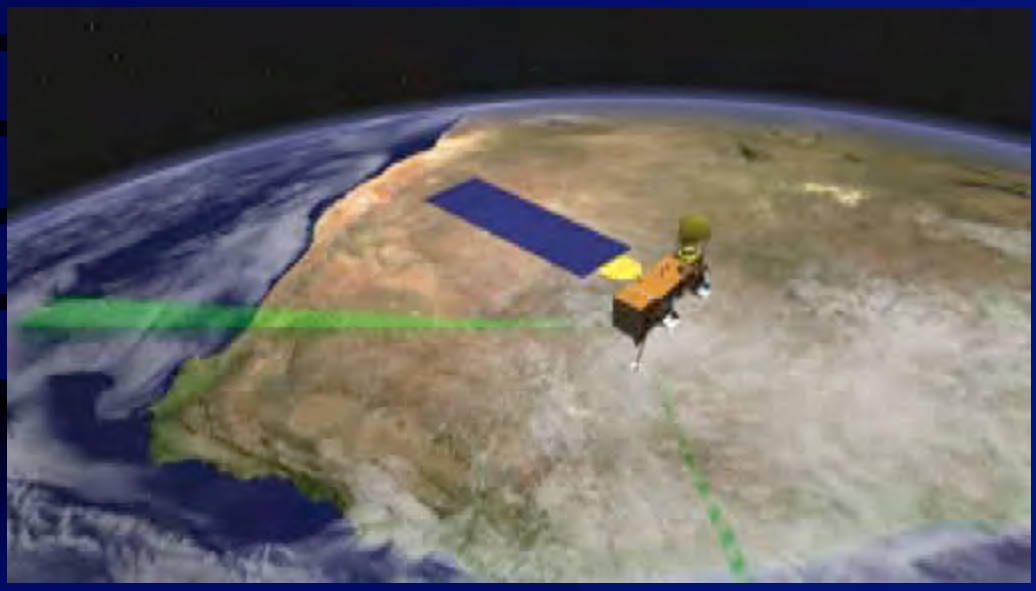


Global System of Polar Orbiting Satellites

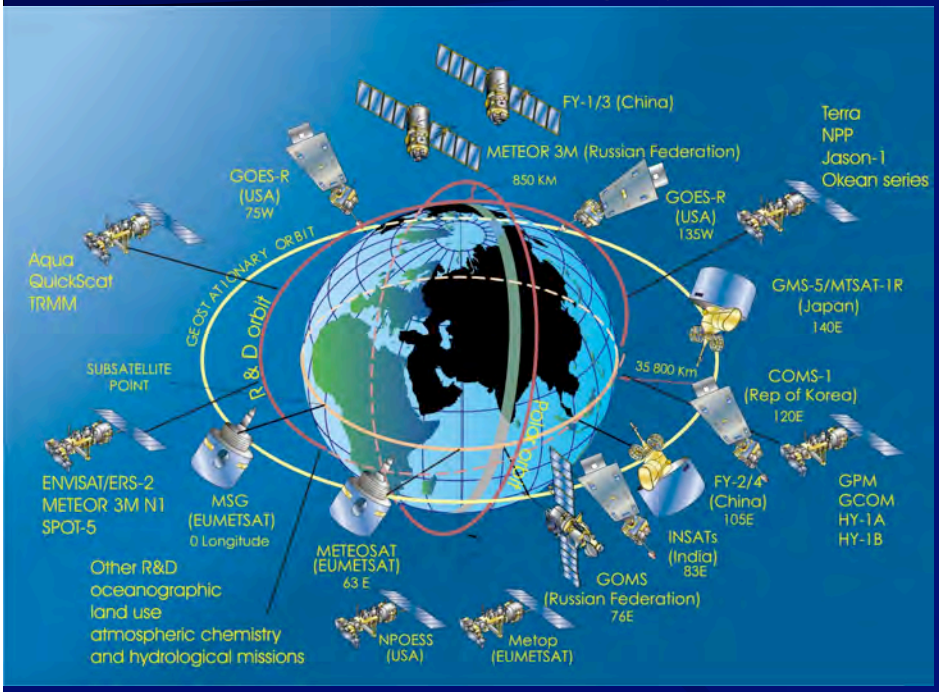




Research and Development Satellites NASA's AQUA



WWW's space-based component of the Global Observing System (2008)



Unparalleled international cooperation has been achieved in satellite activities

IGeoLab

- Concept of an International Geostationary Laboratory (IGeoLab) supported by CGMS in May 2004
- Goal is international partnering on instrument, S/C, launch, and test / evaluation for possible future Geo orbit capabilities
- Three test proposals to demonstrate the benefits and viability of the concept:
  - (1) demonstration of the GIFTS instrument at several geographical locations
  - (2) development and exploitation of a sub-mm sounding instrument in geo orbit
  - (3) Highly-Elliptical Orbit
- IGeoLab Focus Group Teams (work in progress)

EC WG WIGOS-WIS-1, Dec 2007

WIGOS is a comprehensive, coordinated and sustainable system of observing systems, ensuring interoperability between its component systems

Aiming to:

- Address in most cost/effective way all WMO Programme requirements
- Ensure availability of required information
- Facilitates access in real and quasi-real time to all required information through WIS
- Ensure data quality standards
- Facilitate archiving and technological innovations

Four broad WIGOS objectives:

- Atmospheric, oceanic and terrestrial including hydrological and cryosphere domains
- Ensure broader governance frameworks (e.g. inter-agency co-sponsorship of systems) and relationships to improve management and governance of component systems
- Increase interoperability between various systems with particular attention given to complementarity between the space-based and *in-situ* components
- Other international initiatives are respected, sustained and strengthened

Benefits derived through integration for WIGOS

- Improved services
- Increased quality and access to observations
- More efficient use of resources
- Better preparedness to incorporate new observing systems and to interface with non-WMO systems

WIGOS Components

- Weather observing networks (e.g. WWW/GOS, AMDAR, ASAP etc);
- Atmospheric composition observing networks (e.g. GAW);
- Radiation observing networks (e.g. BSRN);
- Marine meteorological networks and arrays (e.g. VOS, drifting and moored buoy arrays etc.);
- Hydrological observing networks (e.g. observing components of WHYCOS etc.); and
- Climate components of various atmospheric, oceanographic and terrestrial observing systems contributing to GCOS
- Global Cryosphere Watch

WIGOS observations and products will:

- be moved via WIS using WIS data and metadata formats
- use WIGOS compatible hardware and software
- adhere to WIGOS instrument and methods of observation standards and standard observing network practices and procedures
- be archived in WIGOS approved formats and resolutions at WMO authorized centers

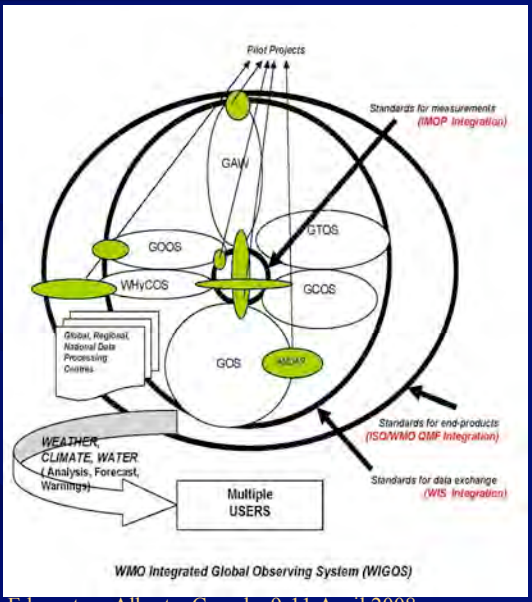
WIGOS integration levels

As a system of observing systems, integration accomplished at three levels:

1.Observation standardization

2.Common information infrastructure, i.e. WIS

3.End-product quality assurance



WMO Integrated Global Observing System (WIGOS)

WMO Information System -WIS

- Routine collection and dissemination service for time-critical and operation-critical data and products, Real-time "push" mechanism including multicast and broadcast; dedicated telecommunication providing guaranteed quality of service;
- Data Discovery, Access and Retrieval service: Request/reply "pull" mechanism with relevant data management functions, essentially through the Internet;
- Timely delivery service for data and products: Delayed mode "push" mechanism; implemented through combination of dedicated telecommunication means and of public data-communication networks, especially the Internet.

Structure of WIS

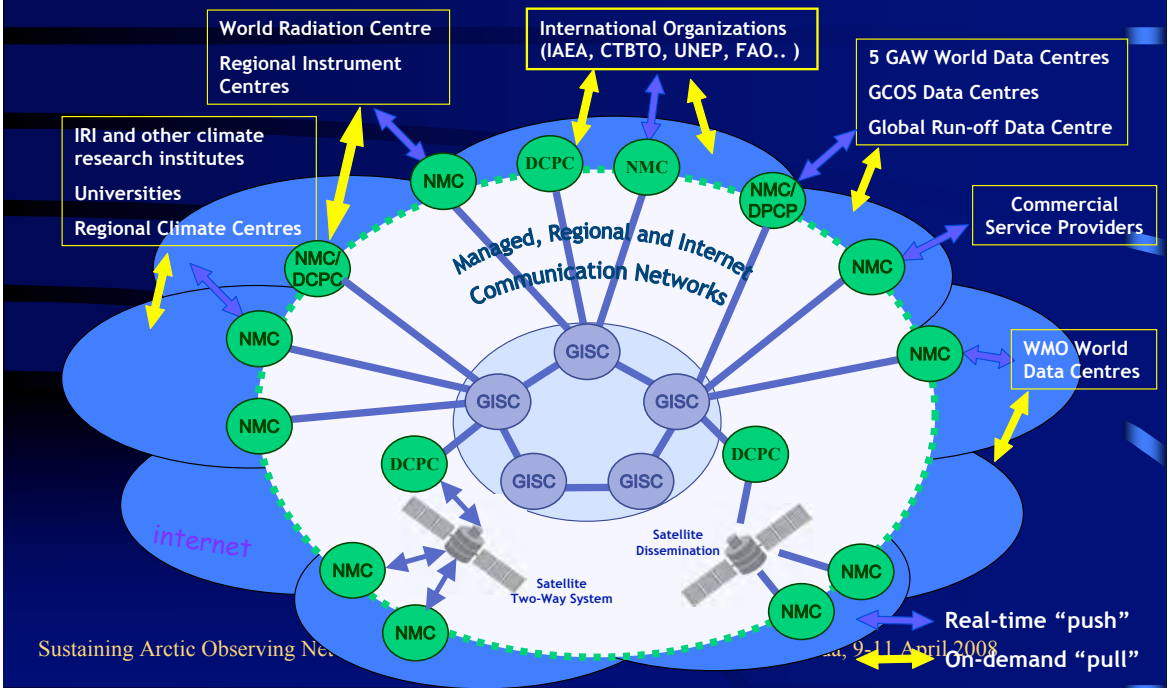
- **National Centres (NC)**
  - Links national data providers and users to regional and global data exchange nodes, and administrates access to WIS
- **Data Collection or Production Centres (DCPC)**
  - Provides for regional and international exchange of WMO programmes' data and products
  - Supports data and information push and pull
- **Global Information System Centres (GISC)**
  - Provides for global exchange of data and products
  - Collects and provides metadata for all data and products
  - Supports data and information discovery and pull
- **Data communication networks (including the internet)**

For more information on WIS see
http://www.wmo.int/pages/themes/wis/index_en.html

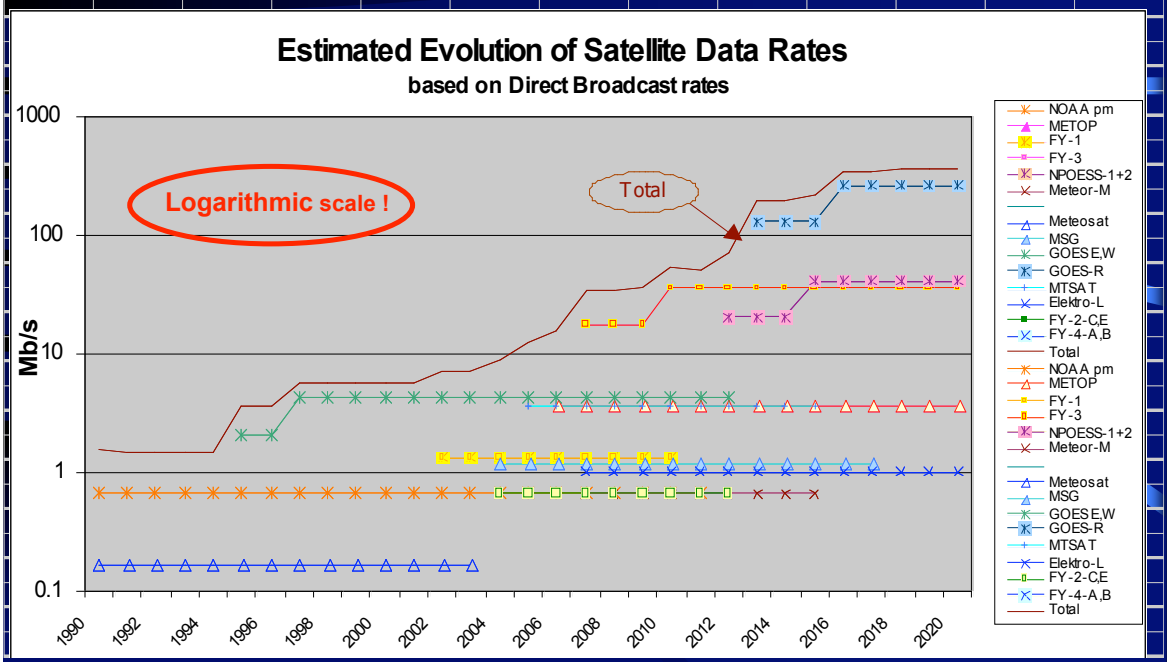
WIS

Information exchange – common procedures; real-time and non-real time

Information management – a few standard data formats; coordinated metadata and catalogues



Data volume increase



Benefits of WIS

- Ensure continued improvements in the GTS
- Provide central metadata catalogues listing all available WMO data and products and how to get them.
- Allow non WMO centres to become DCPCs within WIS.
- Open WIS catalogues to the web.
- Manage metadata and data policies (i.e. security)
- Provide
  - better access to information to assist in weather, water & climate affected activities
  - the ability to collect & share critical information necessary to monitor and predict the state of the environment
- Enhance profile and level of services of NMHS
- Interface with GEOSS

Requirements of WIS

- Metadata is based on WMO profile ISO19115
- WIS atomic items are a file pair
  - Information file
  - Metadata file
- Unique file names
  - WIS utilizes the file names to identify relevant metadata file. Used in DAR as well as message handling.
- Preferable to utilize WMO data representation and codes
- Designation procedures exist for incorporating a new DCPC in WIS
  - Annex III of Final Report - CBS Ext06
    http://www.wmo.ch/pages/prog/www/CBS/Reports/CBS-Ext06/WMO-1017_English.pdf
  - Only Interfaces of what needs to be the same are specified
  - Key is to make metadata catalogues and information available

WIGOS ,WIS and IPY

- Observing networks established or improved during IPY should be kept in operational mode for as many years as possible to provide data for the detection and projection of climate change (WMO EC–LVI Recommendation, June 2004)
- IPY projects provide great opportunity for the integrated observations of the polar environment. IPY should contribute to a suitable WIGOS Pilot Project for the integration of WMO observing systems and linked to one of the main Expected Results of the WMO Strategic Plan (WMO Cg-XV Recommendation, May,2007)

Increased reports in IPY period

The successful start of IPY resulted in an increase in the number of reports from traditional observational networks of atmosphere in Polar Regions (according to results from WWW monitoring from 1 to 15 July 2007 compared with the same period in 2006)

In the Arctic

- the number of synoptic stations transmitting 90-100% of expected reports increased by 8 stations located on the coast and islands of the Euro-Asian sector,
- the number of BUOY reports has increased by 1096

In the Antarctic

- the number of synoptic stations increase by 2 stations,
- the number of BUOY reports increased by 18,150 (five times more)

IPY data management activities

- At present a major impediment to effective IPY implementation is the lack of any formal support or system that would ensure quick, easy and reliable discovery of and access to IPY data, as well as the lack of a formal pathway for IPY scientists to archive their data and make available metadata to ensure their future access and archival
- WMO Inter-commission Task Group (ITG) on IPY supported the proposal by the IPY JC to consider the Canadian ArcticNet portal and its associated searchable metadata as an IPY portal, which would meet most of the needs of a great majority of the IPY scientists to provide access to data through searchable metadata related to their projects
- Noting that these activities would be highly useful as a Pilot Project to demonstrate an operational national contribution to WIS, the ITG recommended that WIS should work closely with ArcticNet to ensure it became fully compliant with the WIS portal and metadata standards

Legacy of IPY observing systems

IPY legacy should be built upon the surge observational programmes and converted into sustainable long-term research and monitoring capabilities. ITG requested relevant technical commissions to be actively involved in this process within their areas of responsibility through the expert teams and panels related to the evolution of the GOS, WIS development, AMDAR, WHYCOS and GAW implementation. In strongly supporting the JC roadmap development towards creation of a legacy embracing IPY observing systems, the ITG urged WMO Members to participate in this activity

WMO EC Panel of Experts on Polar Observations and Research

- Successful implementation of IPY 2007-2008 will result in a legacy of enhanced polar observing systems and research of polar environment
- WMO EC at its upcoming session (June 2008) will consider a new Panel of Experts on Polar Observations and Research to:
  - ensure coordination of acquisition, exchange, and archiving of observational data from polar regions in compliance with WIGOS and WIS requirements
  - provide a WMO high-level Partnership in activities aimed to secure IPY observing system Legacy in close communications with operational agencies in Member-countries and international organizations such as the Arctic Council, International Arctic Science Council, the Antarctic Treaty Consultative Meeting, the Scientific Committee on Antarctic Research and others

Sustaining Arctic Observing Networks – Second Workshop, Edmonton, Alberta, Canada, 9-11 April 2008