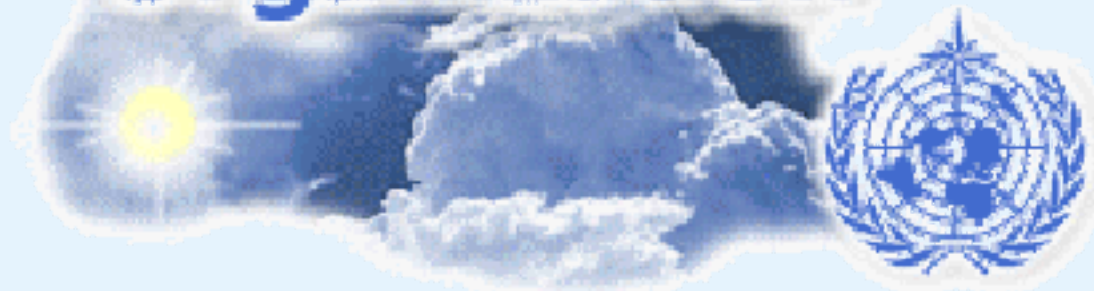


# WMO Processes and Standards

Gil Ross (Met Office)

ISO/TC211 Workshop 27May 2007

# World Meteorological Organization



**A United Nations Specialized Agency**

**Working together in Weather, Climate and Water**

- WMO – what is it
- WMO World Weather Watch Programme
- WWW Data and volumes
- WMO Data and Service standards
  - Where is WMO now and where is it going?
  - Maintenance Update and Development
- So where does ISO/OGC come in?

- WMO is the specialized agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences
- WMO is an intergovernmental organization with a membership of 187 Member States and Territories.
- Established in 1950, WMO was created from the International Meteorological Organization (IMO), which was founded in 1873.

## **Six regional associations**

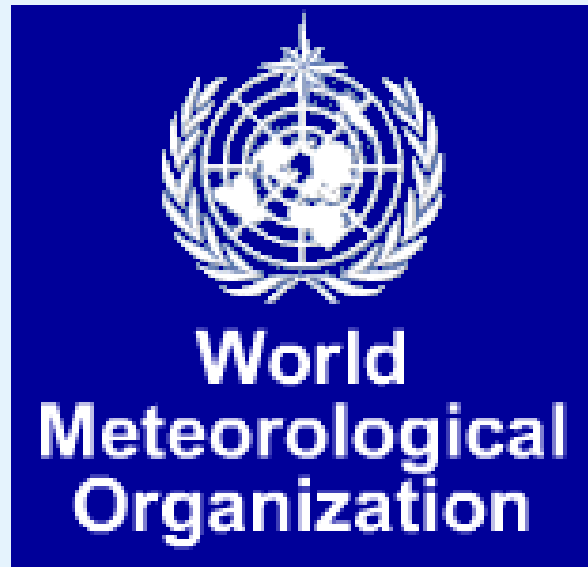
- Africa, Asia, South America, North America, Central America and the Caribbean, South-West Pacific and Europe

## **▪ The Secretariat in Geneva**

## **▪ Eight technical commissions**

Basic Systems	Instruments and Observation	Atmospheric Sciences
Hydrology	Climatology	Aeronautical
Agricultural	Marine (jointly with IOC of UNESCO)	

All commissions operate through management and task committees, R&D Programmes and Expert Teams



Operational Meteorology

WWW Programme

World Weather Watch

**WMO's SDI**

- December 1961 the United Nations resolution 1721
  - To advance the state of atmospheric science and technology
    - ...to develop existing weather forecasting capabilities
    - ...through regional meteorological centres.
  
- UN General Assembly in 1962
  - WMO and contributing agencies
    - International Atomic Energy Agency (IAEA)
    - International Telecommunications Union (ITU)
    - International Council of Scientific Unions (ICSU)
  - presented the report on the “**World Weather Watch**”.
    - **NOT** - World Wide Web (1990, Berners-Lee, Cailliau)

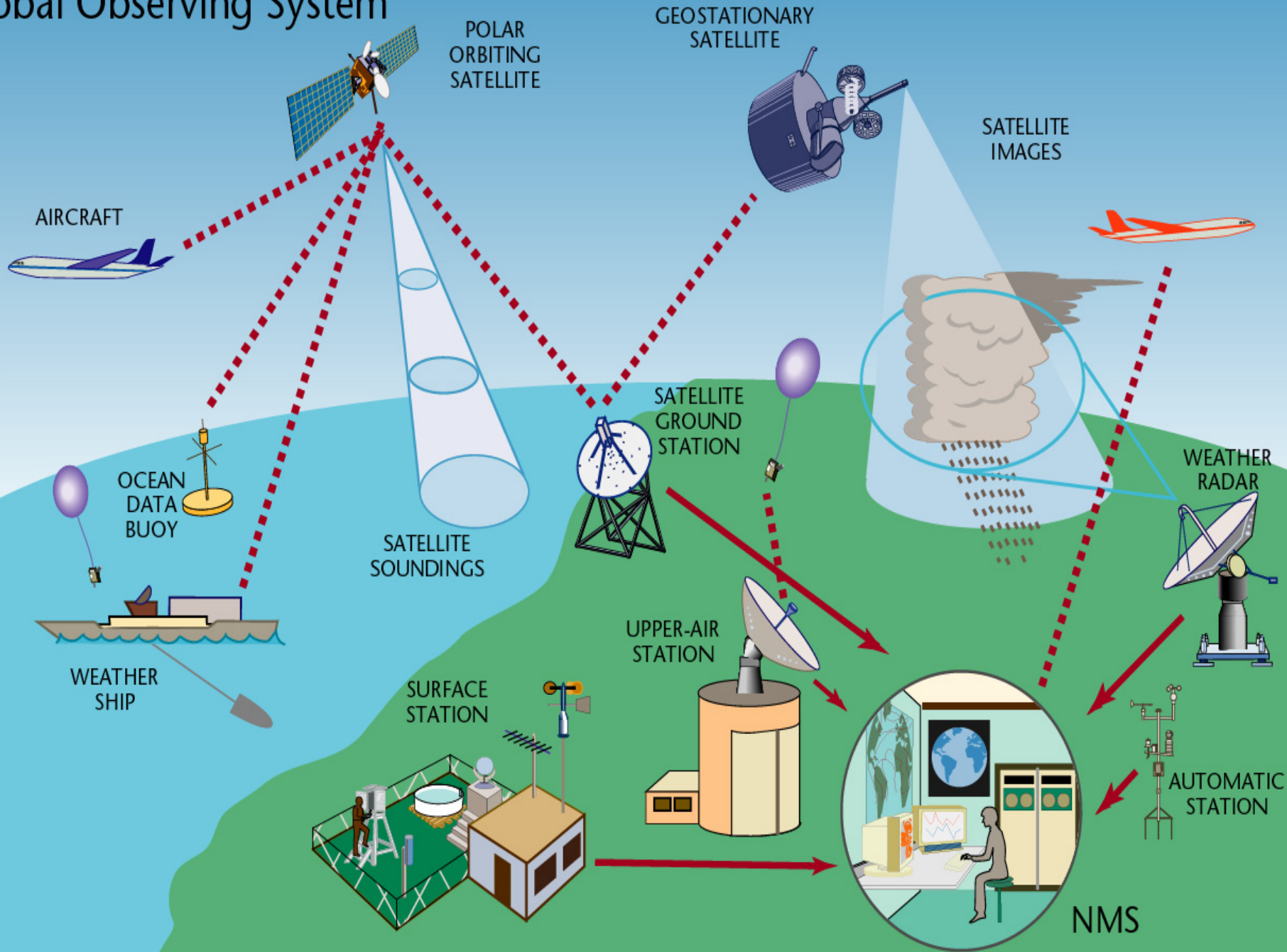
GOS - Global Observing System

GTS Global Telecommunications System  
Point-to-Point networks – *not* Internet

GDPFS Global Data Processing and Forecast  
System

Public Weather Service  
Warnings and forecasts

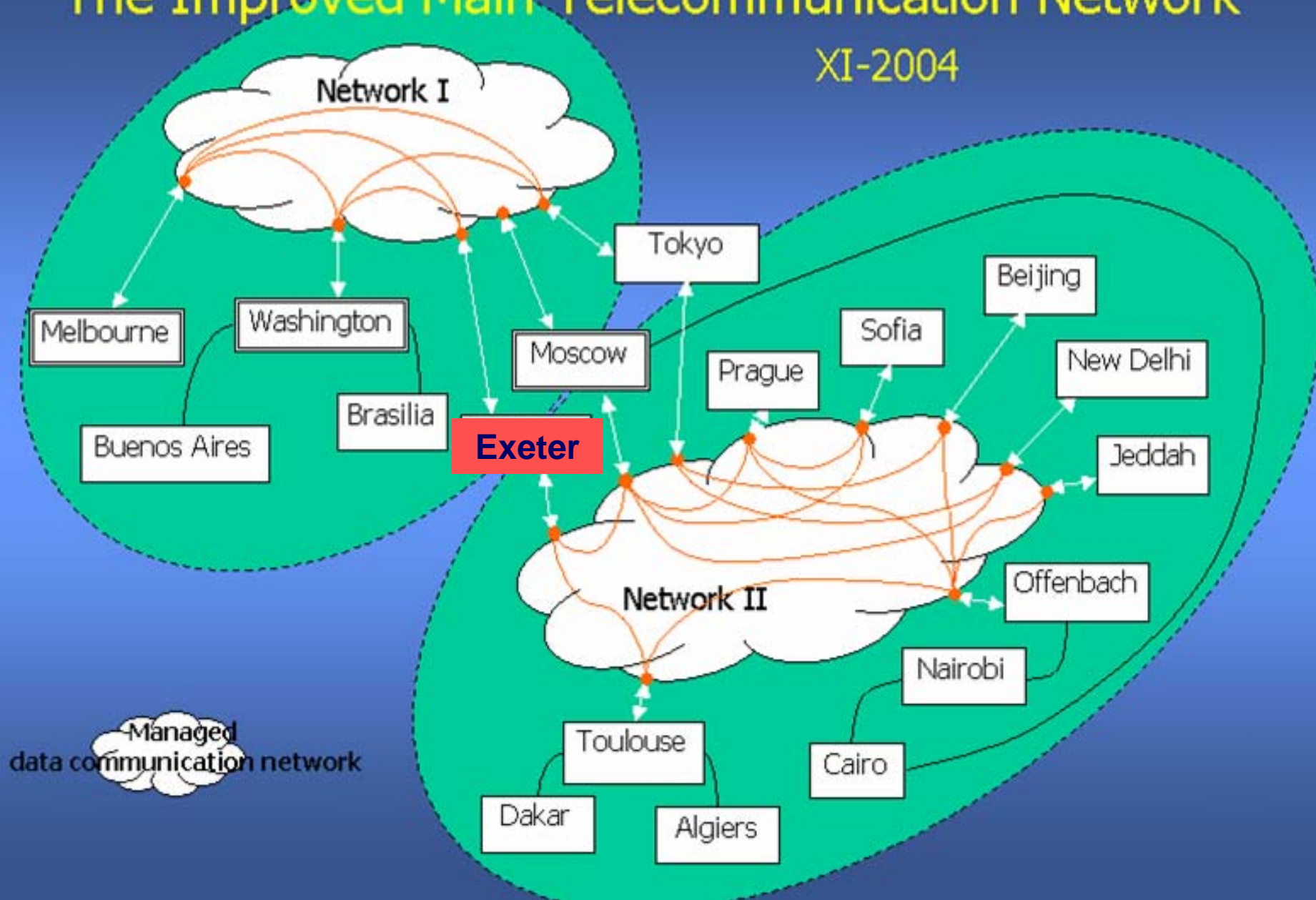
# Global Observing System

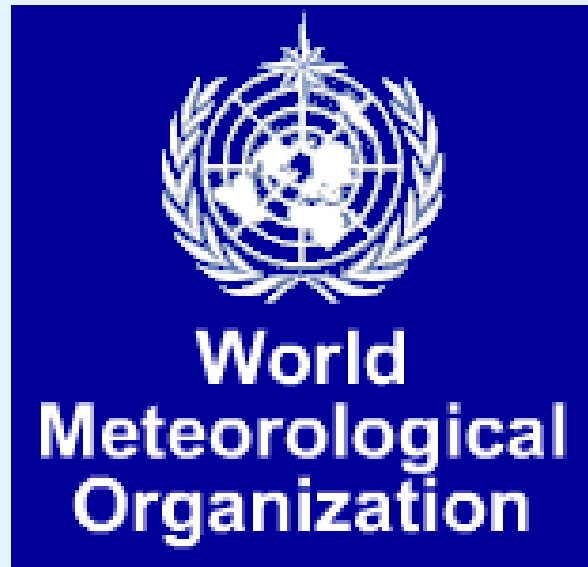




## The Improved Main Telecommunication Network

XI-2004





## Operational Meteorology

What sort of data?

How much data?

- **640+ direct lines (not Internet)**
- **Main Message Switch**
  - 400,000 bulletins received per day - 1.5 Gigabyte
  - 5.2 million bulletins sent/day - 15 Gigabyte.
  - minimum size ~ 20 bytes; average ~ 3000 bytes.
- **Main File Server**
  - 20,000 files received/day - 15 Gigabyte
  - 30,000 files sent/day 20 Gigabyte .
  - 0.7 Megabyte average size
- **Other routes** – e.g. Satellite data ~ 27GB/day

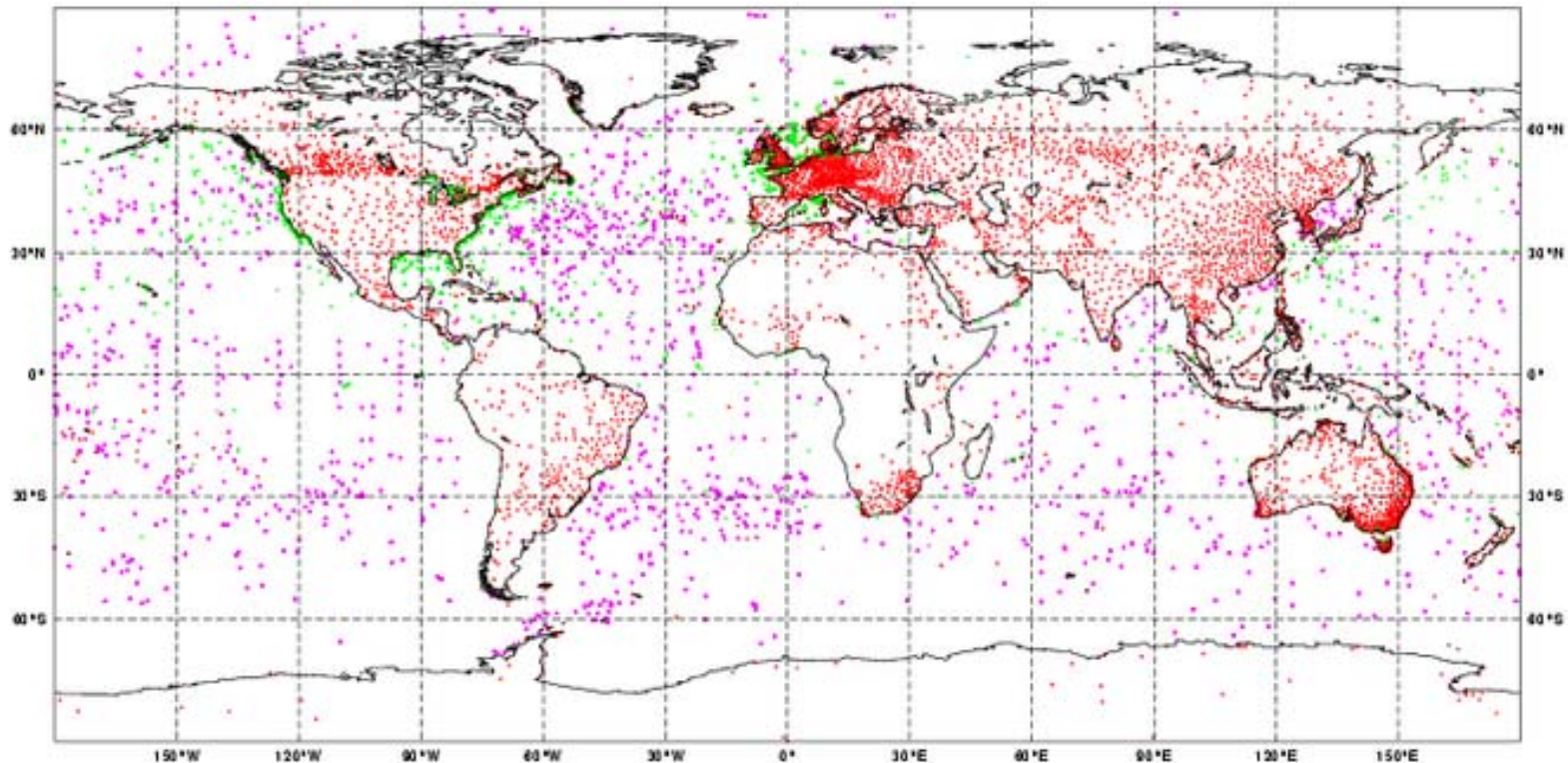
# Surface Observations 0000Z 24th May



**Data Coverage: Surface (24/5/2007, 0 UTC, qu00)**  
**Total number of observations assimilated: 12994**



LNDSYN (5790) SHPSYN (2108) BUOY (5096)



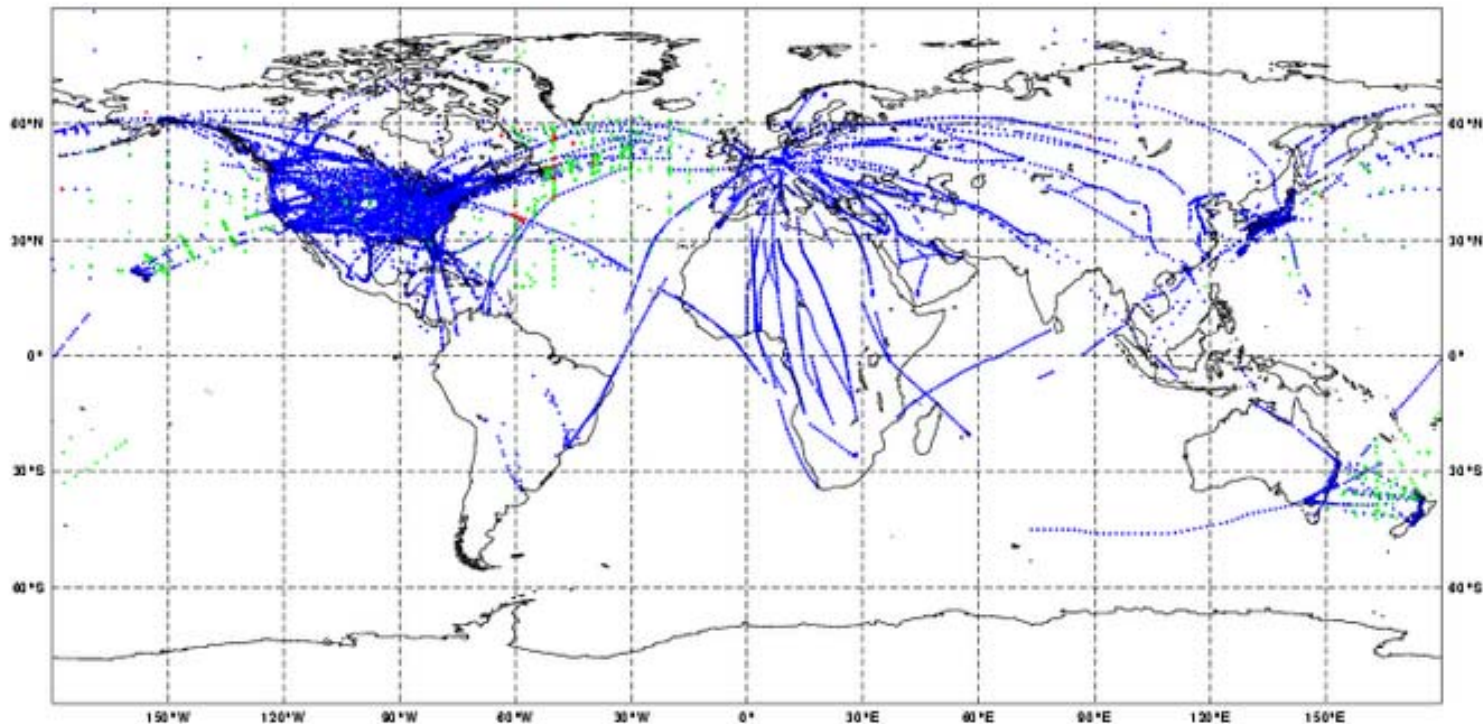
# Aircraft winds 000Z 24th May



**Data Coverage: Aircraft (24/5/2007, 0 UTC, qu00)**  
**Total number of observations assimilated: 16269**



AMDARS (15409) AIREPS (789) TCBOGUS (0) BOGUS (71)



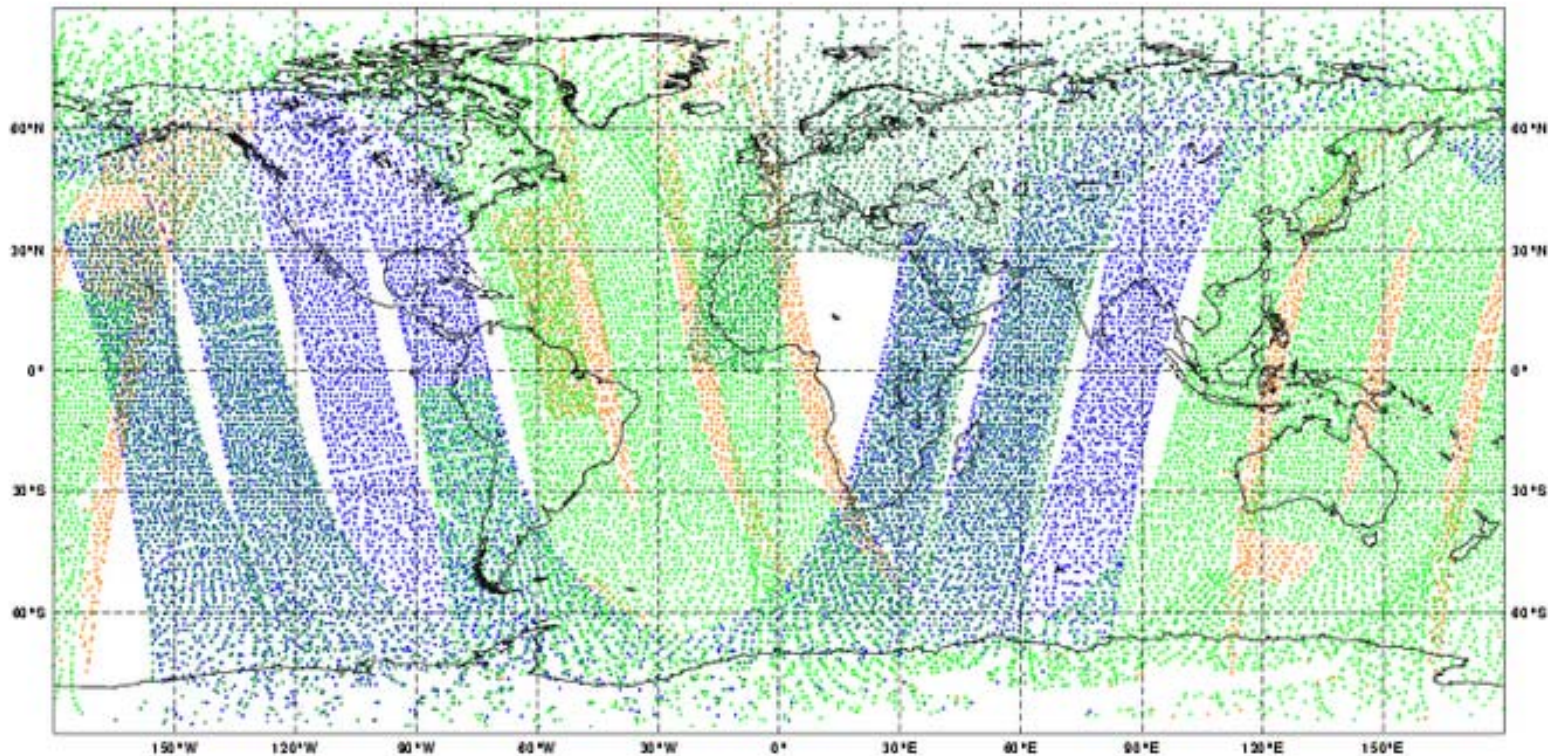
# ATOVs Sat. Radiances 000Z 24<sup>th</sup> May



Data Coverage: SatRad ATOVS (24/5/2007, 0 UTC, qu00)  
Total number of observations assimilated: 31066



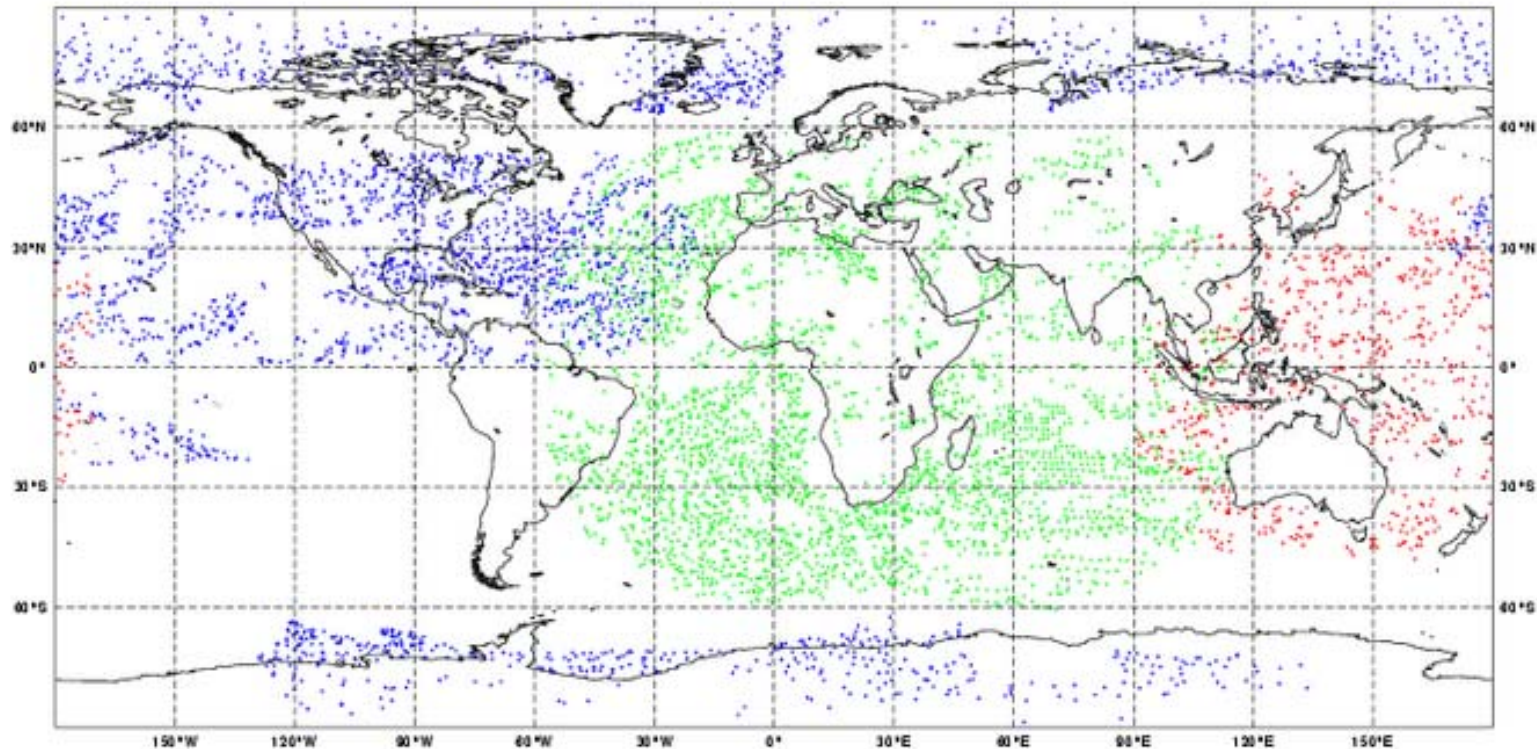
11982 METOP-A  
7379 NOAA-18  
8962 NOAA-16  
2743 NOAA-17

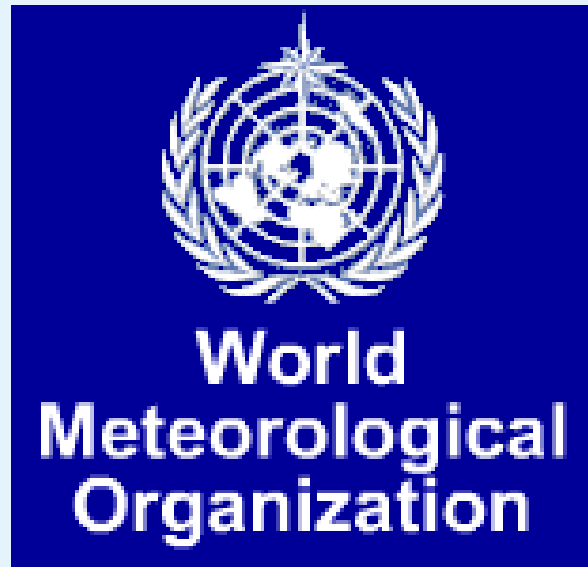


**Data Coverage: Satwind (24/5/2007, 0 UTC, qu00)**  
**Total number of observations assimilated: 6208**



JMA (698) EUMETSAT (1772) + (468) + (591)  
+ (0) NESDIS (2679)





Data and service standards

Where is WMO now?

Where is WMO going?

- WMO Codes and Representation Forms
  - Data Formats, Codes and Standards
- Distributed Databases
- ISO 19115 Metadata WMO Core Profile
- WMO Information System
  - Portal for Operational Meteorology
  - Replacement for GTS
  - ISO/OGC standards – where appropriate

## ■ Alphanumeric codes

SYNOP	SHIP	SYNOP MOBIL	METAR	SPECI
BUOY	RADOB	RADREP	PILOT	PILOT SHIP
PILOT MOBIL	TEMP	TEMP SHIP	TEMP DROP	TEMP MOBIL
ROCOB	ROCOB SHIP	CODAR	AMDAR	ICEAN
IAC	IAC FLEET	GRID	GRAF	WITEM
TAF	ARFOR	ROFOR	RADOF	MAFOR
TRACKOB	BATHY	TESAC	WAVEOB	HYDRA
HYFOR	CLIMAT	CLIMAT SHIP	SPCLI	CLIMAT TEMP
CLIMAT TEMP SHIP	SFAZI	SFLOC	SFAZU	SAREP
SATEM	SARAD	SATOB	CLISA	INCLI

## ■ Binary Codes - Table Driven Codes

**GRIB BUFR/CREX**

- GRIB – GRIdded Binary
  - Mathematically defined grids
  - GRIB1 – 2D
  - GRIB2 – 3D, 4D+
  
- BUFR Binary Universal Form
  - Table driven
  - Atmospheric – oceanographic – chemistry
  
- CREX – ASCII form of BUFR

## Numerical Weather Prediction Models

Global and Regional

Short term forecast – Climate models

Linked models – oceanographic / soil / ice

## Mathematically defined grids

In horizontal

Special grids in vertical

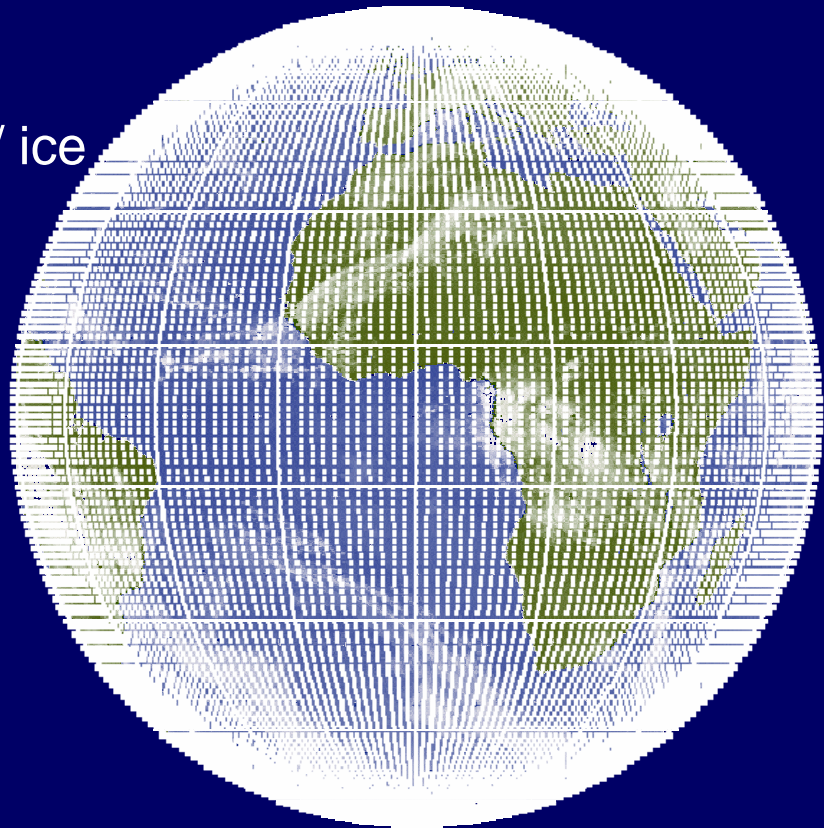
terrain following at surface,  
pressure coordinates at top

## Temporal coordinates

T+00 – T+144

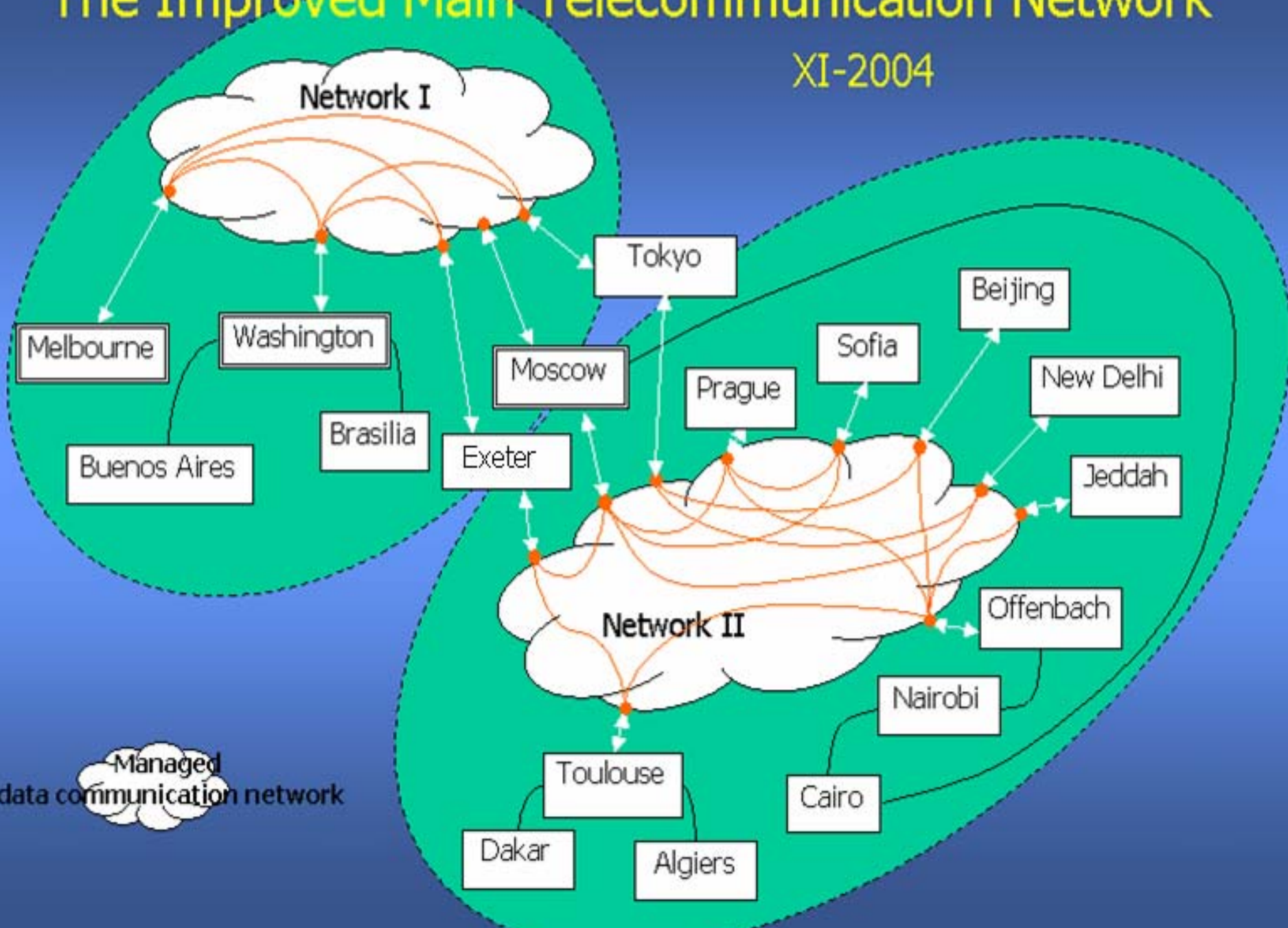
(0 to 6 days ahead)

Climate models use 360 day year!

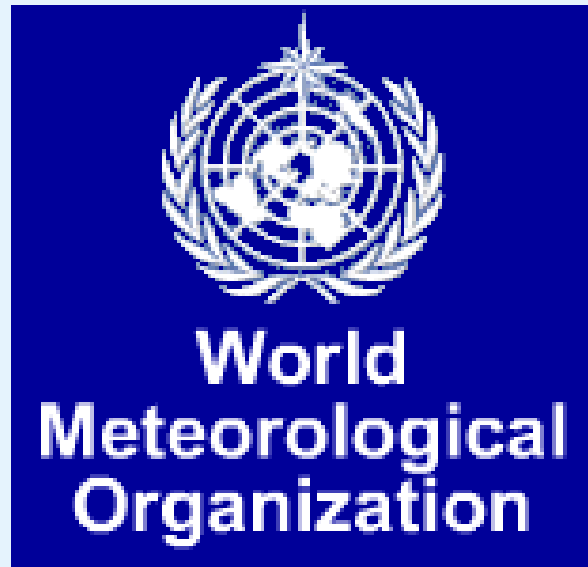


# The Improved Main Telecommunication Network

XI-2004



- WMO/ICAO
  - METAR Meteorological Aerodrome report
  
  - Rome Ciampino
    - LIRA 241245Z 28014KT 240V290 9999  
FEW020TCU 31/10 Q1011
  - Rome Fuimicino
    - LIRF 241250Z 28012KT 250V310 9999 FEW020  
26/17 Q1012 NOSIG
  
- ~ 2-3 Million pilots understand this – whatever language they speak

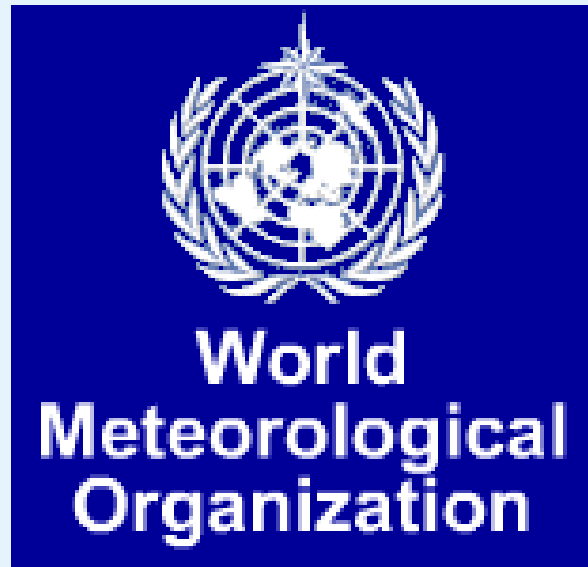


**Data and service standards**

**Maintenance, Update and Development**

- WMO Member states do the data exchange.
- WMO Secretariat organises
  - facilitates the work of Expert Teams who are nominated and paid by Member States
  - Expert Teams develop, maintain and monitor programs and standards
- WWW is the WMO Program for data exchange
  - It is WMO's SDI Spatial Data Infrastructure
  - WWW costs 13M CHF per year

- Expert Team on Data Representation and Codes
  - Last meeting in April
    - ~200 changes
      - Most minor – table changes,
        - quick confirmation process (Jan 2008?)
      - About 30 major
        - 10 or so require formal agreement
        - Next CBS – anything up to 4 year cycle.
    - In recent years – more and more new data types



So where does ISO/OGC come in?

- WIS process
  - WMO Information System
    - Replacement of GTS
    - Portal for WMO data
      - not just real-time operational data
    - Data by request and dissemination through subscription
    - Data refactoring, extraction and aggregation
    - Registries
    - Metadata – but evaluation and use

- WMO Core Profile of ISO19115
  - WMO ET with help from D Danko, C Portele
  - 3<sup>rd</sup> version – proper extensions, 19139 coding
  - Problems we encountered
    - Topic category, keywords – need
    - Temporal extent
    - DQ problems
    - Features and Coverages
    - Grid models not adequate/superfluous

- Main problem
  - Lack of experience
  - Extensive existing system and expertise
    - Natural caution and doubts
- Features and Coverages
  - Observation and Measurement
- Temporal can be **more** important than spatial
- GIS paradigm
  - Highly inadequate for Meteorology
  - Attributes at a spatial point - very high dimensionality
    - Minimum 6, max- chemistry 1000-10000 df at each 4D point
- RDBMS too slow

# Questions & Answers