Evolution in Service Production

(How technology has changed forecasting production)

Alexander Gusev

President CBS

WMO
OMM

How WWW technology evolution has changed forecasting production

Core elements

Observations and models

Assimilation and analysis

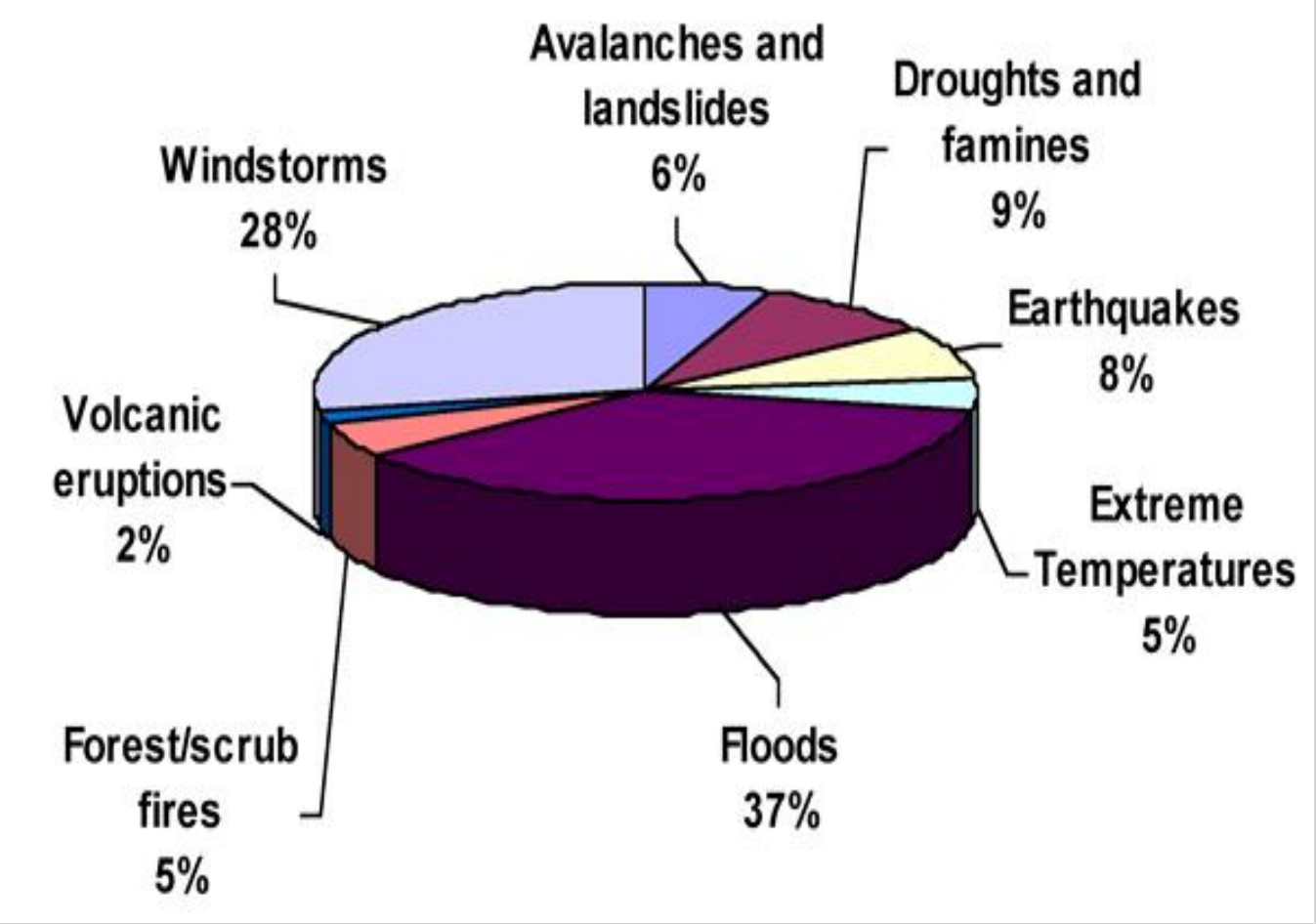
Research

Advanced computers

International coordination

Every year, disasters caused by weather-, climate- and water-related hazards impact communities around the world, leading to loss of human life, destruction of social and economic infrastructure and degradation of ecosystems.

Close to 90 % of all natural disasters in the last 10 years has been the result of hazards such as **floods, droughts, tropical cyclones, severe storms...**

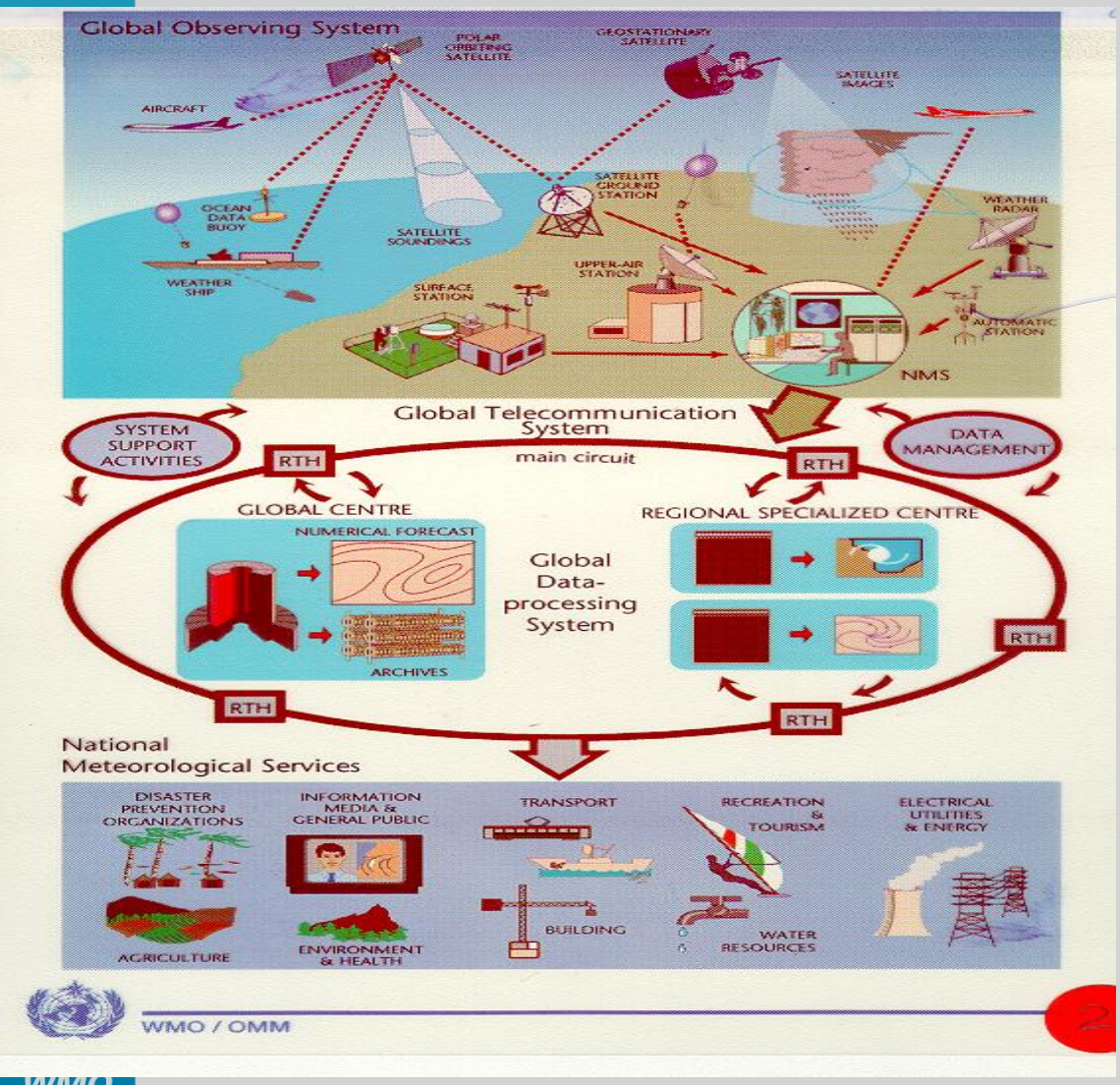


WWW - what does it mean?

The World Weather Watch consists of observing systems, telecommunication facilities, and data-processing and forecasting centres - owned and run by WMO Members countries - to generate and distribute meteorological and related geophysical observations, forecasts and early warnings

The World Weather Watch (WWW) system is a crossroad of meteorological sciences and operational technology, based on international cooperation, where Information and Communication Technology has a crucial role.

World Weather Watch Basic Systems

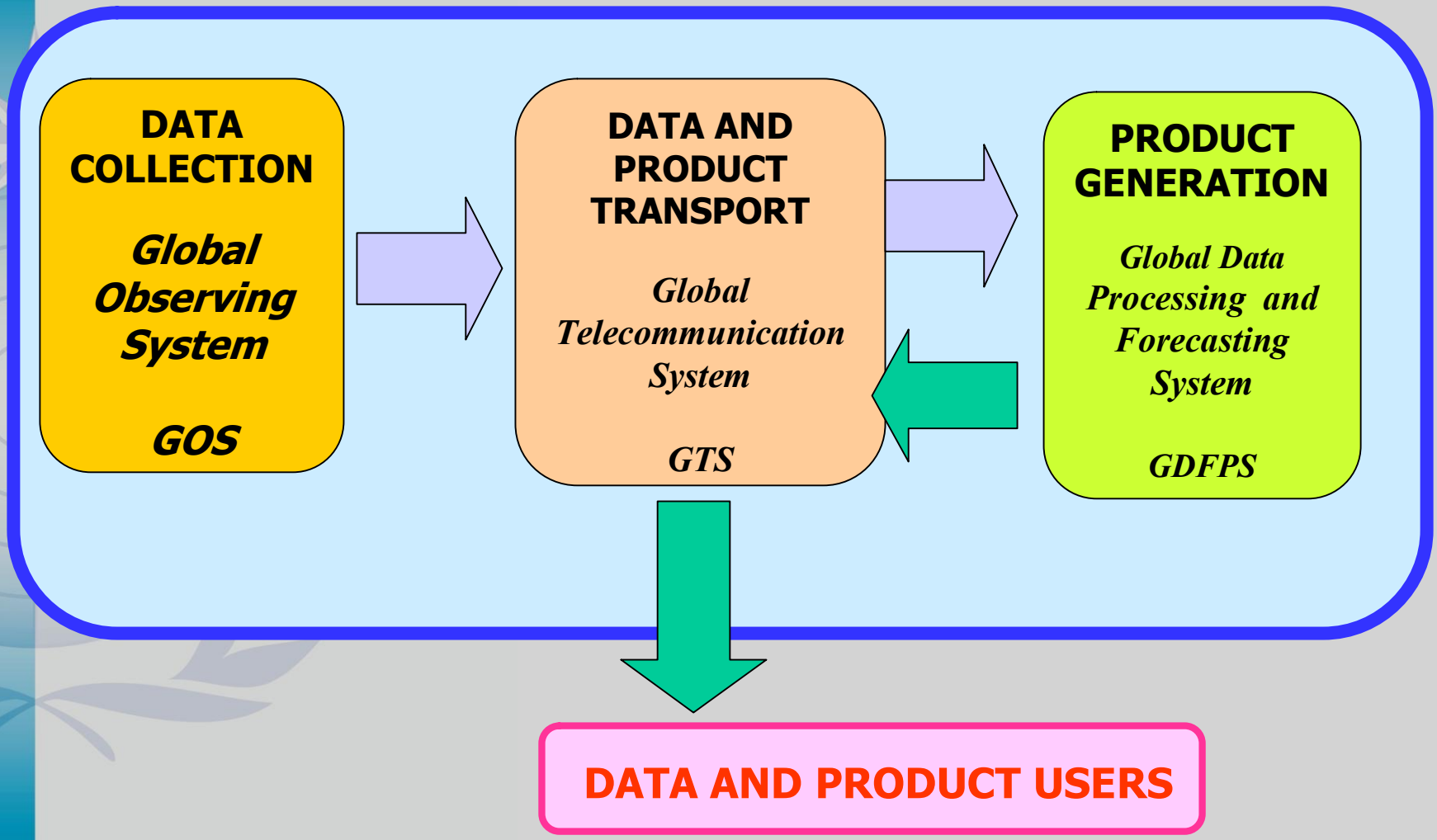


GOS - Global Observing system

GTS - Global telecommunication system

GDPFS – Data-Processing and Forecasting system

FLOW OF INFORMATION



Global Observing System

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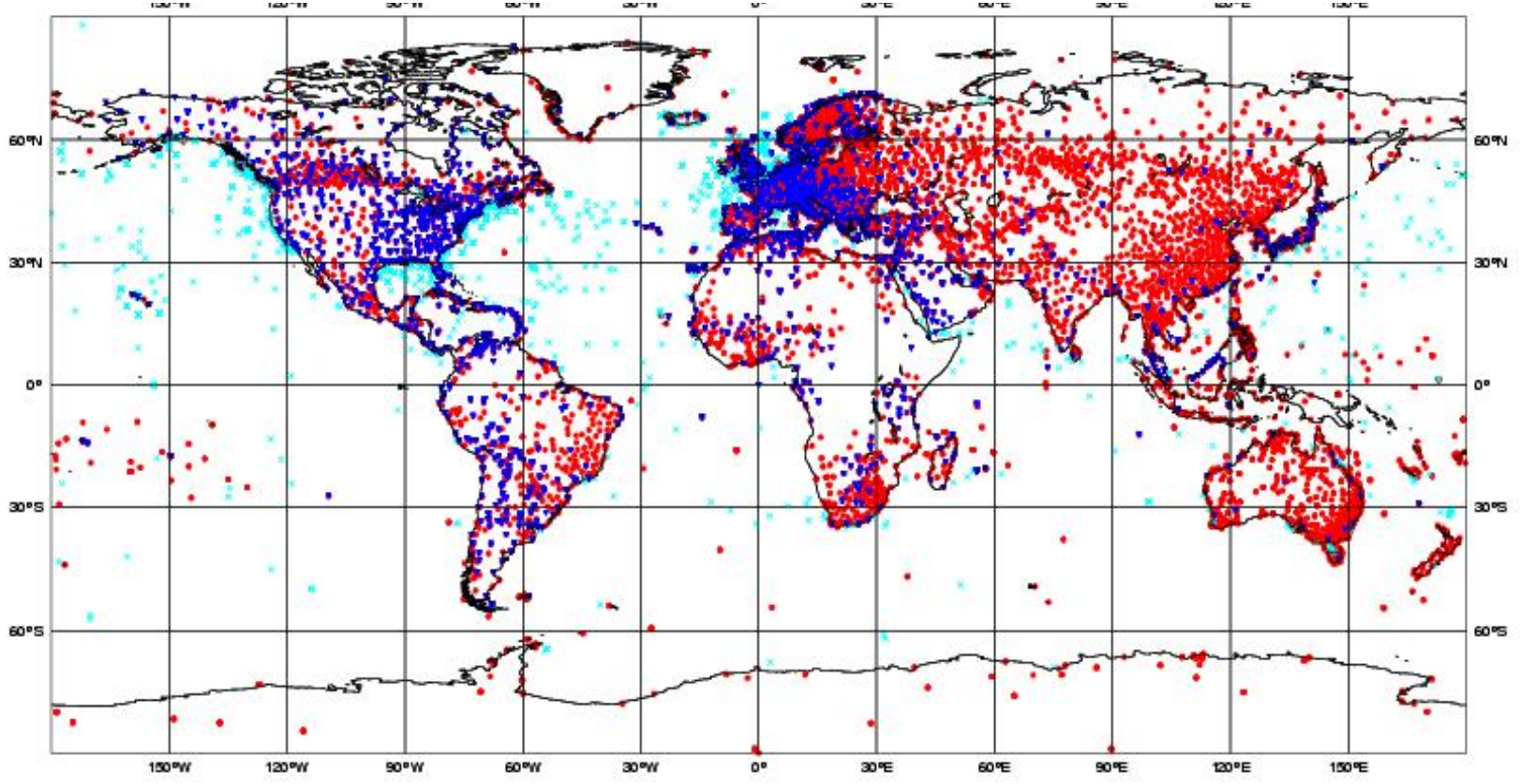
SURFACE OBSERVING SYSTEM

Observations from land stations and ships on 5 January 2005 at 12 UTC

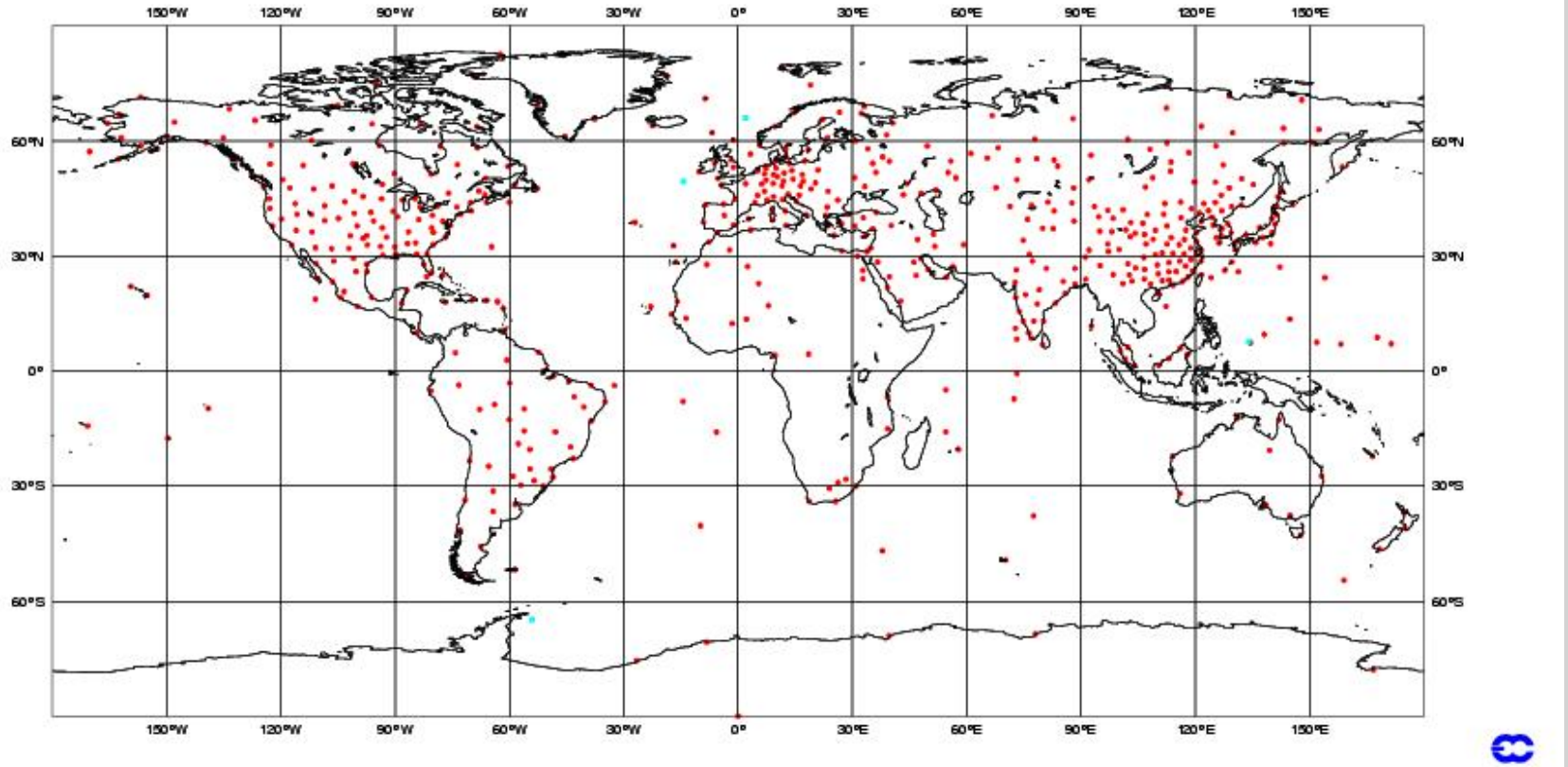
Total number of obs = **28693**



UPPER-AIR OBSERVING SYSTEM

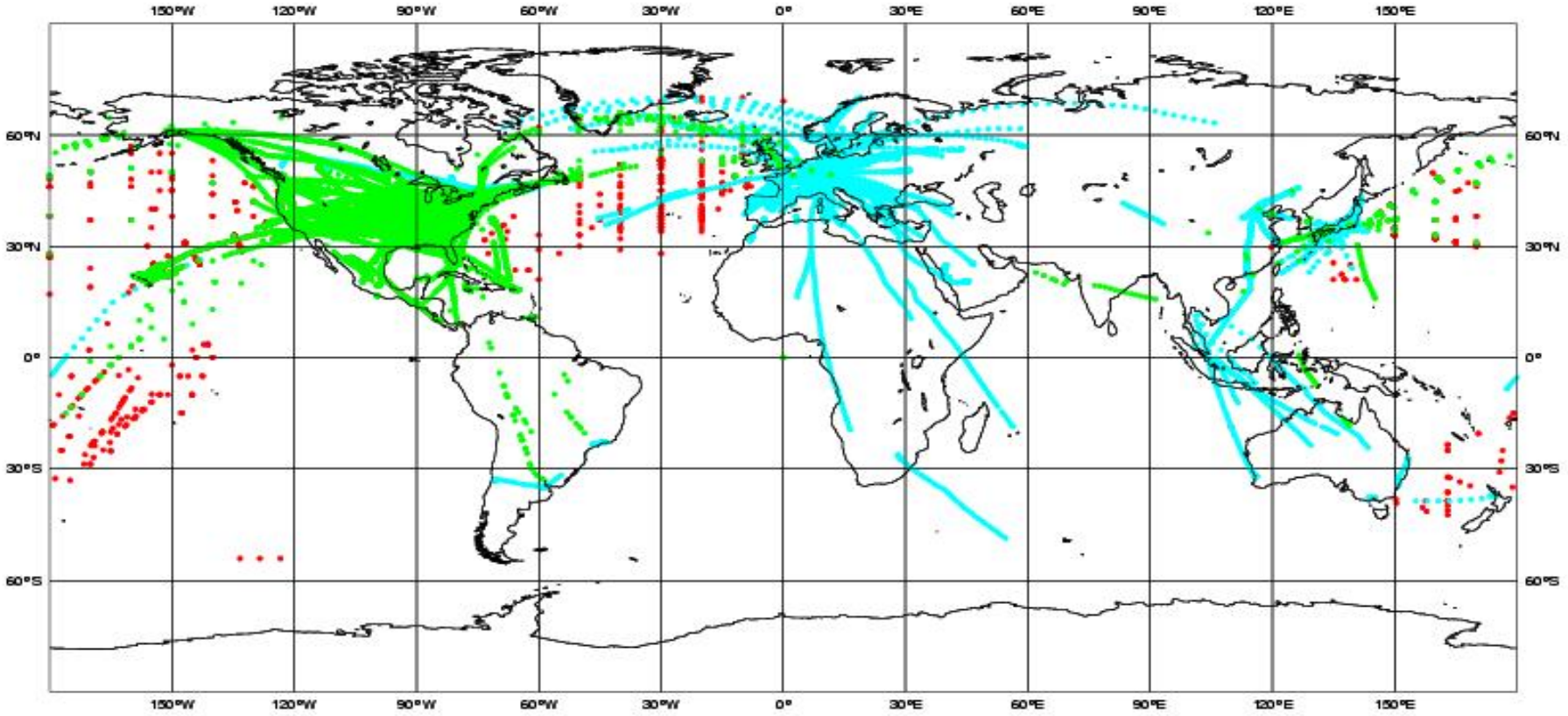
Observations from upper-air stations on 5 January 2005 at 12 UTC

Total number of obs = 569

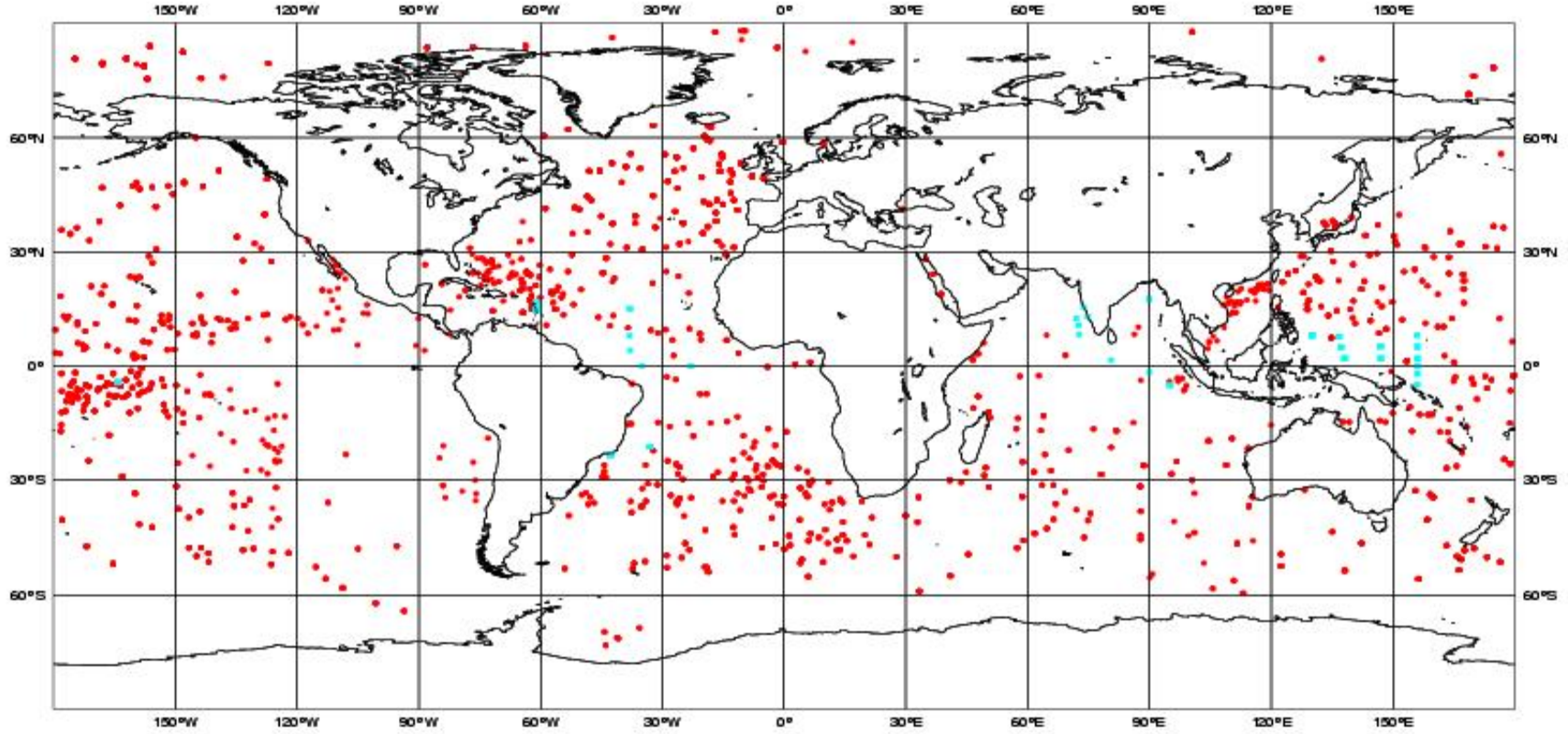


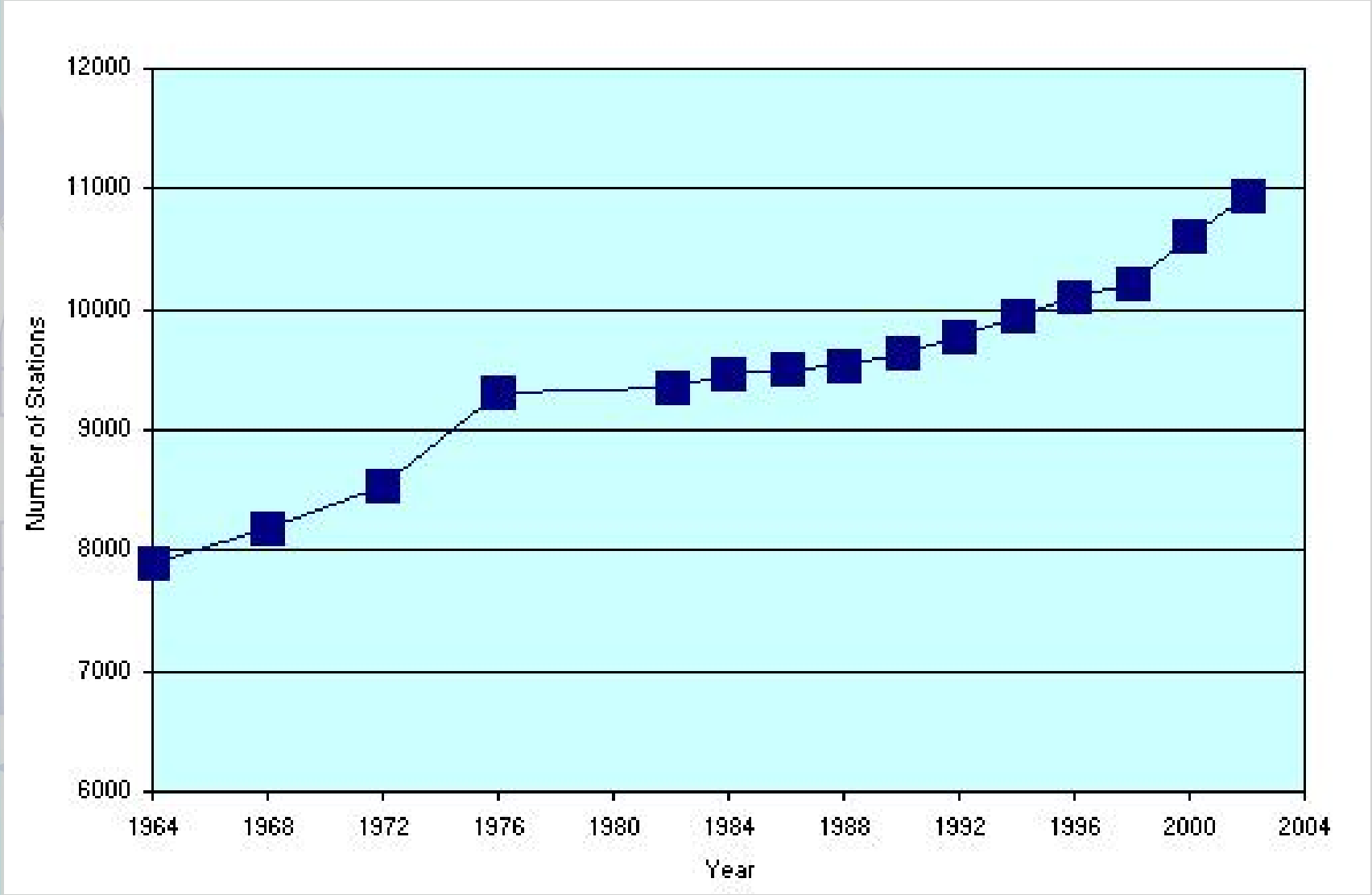
UPPER-AIR OBSERVING SYSTEM

Observations from aircraft on 5 January 2005 at 12 UTC
Total number of obs = 44582



SURFACE OBSERVING SYSTEM
Observations from buoys
Total number of obs.=2880
05 Jan 2005, 12 UTC





Surface synoptic station implementation during the period 1964 to 2002

Other observation platforms

Doppler radars

solar radiation observations

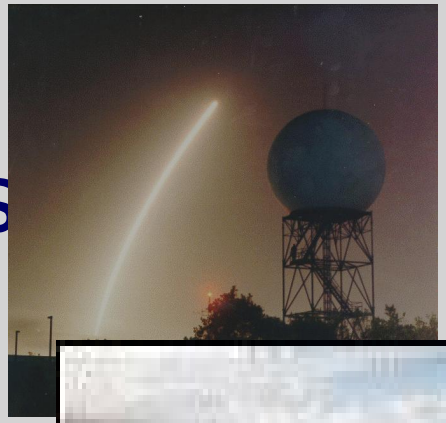
lightning detection measurements

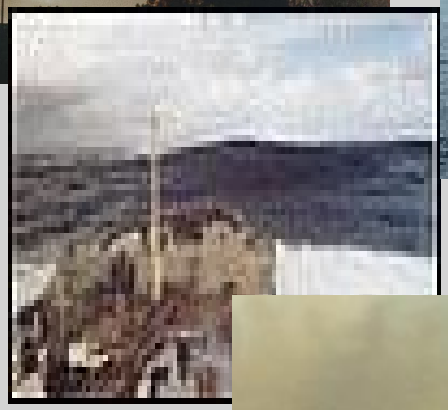
tide-gauge measurements

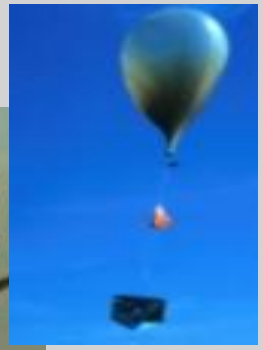
Candidate Observing Systems

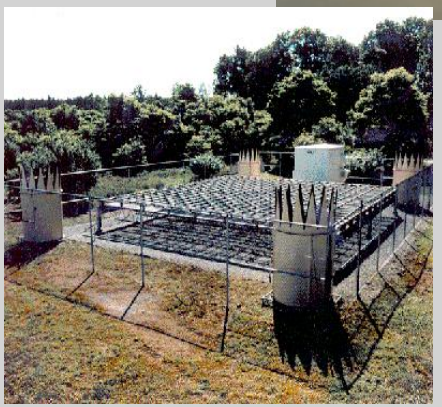
The future GOS should build upon existing components, both surface and space based, and capitalize on existing and new observing technologies not presently incorporated or fully exploited

Each incremental addition to the GOS would be reflected in better data, products and services from the NMHSs



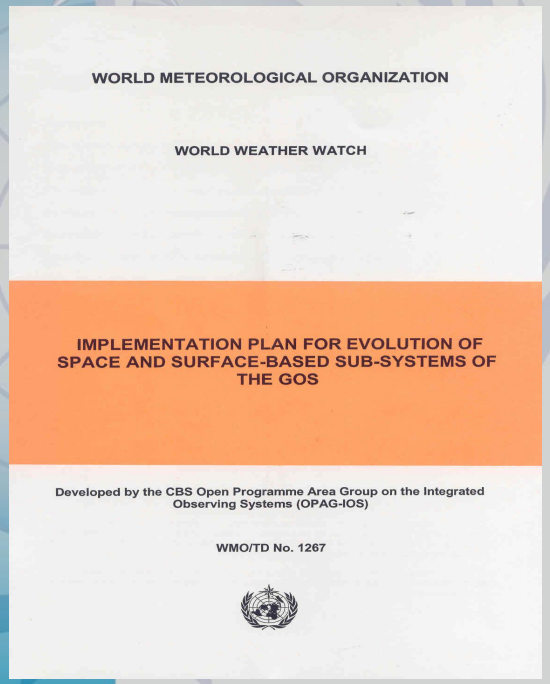






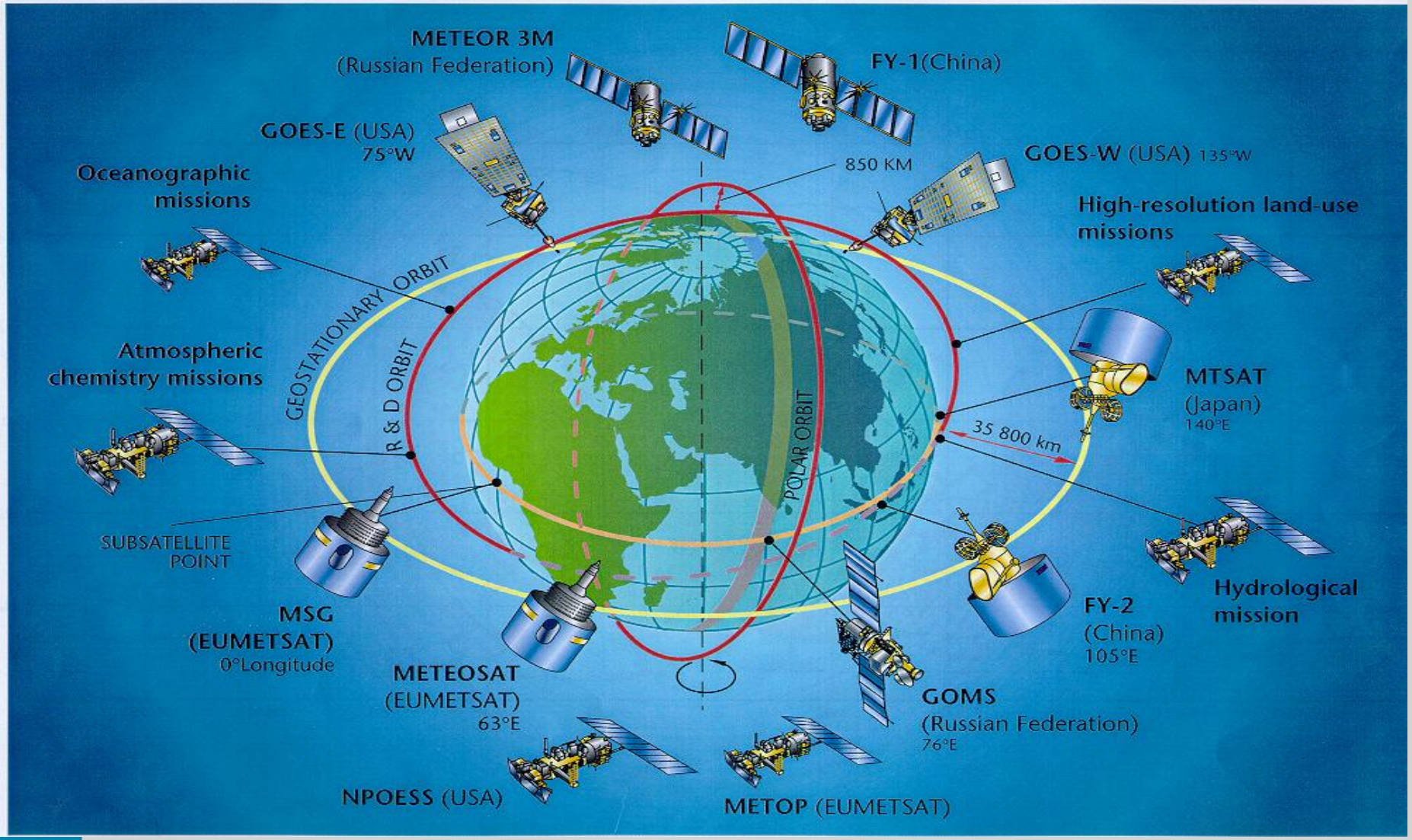
Global Observing System (GOS)

Specific input to the planning and implementation of the evolving integrated GOS comprised:



- Revision of the content of the WMO publication *Guide on the Global Observing System* (WMO-No. 488);
- Publishing as WWW Technical Report The *Implementation Plan for Evolution of Surface- and Space-based Subsystems of the GOS;*
- Preparation of updates for the WMO publication *Manual on the Global Observing System* (WMO-No. 544);
- Revision of the content and development the database for the WMO publication *Weather Reporting, Observing Stations* (WMO-No.9,Vol. A);

Space segment of GOS



Assessment of the merits of a third sounding mission in the ECMWF NWP system

Background of the study

The launch of NOAA-17 has provided the NWP user community with an operational opportunity of benefiting from a uniform advanced (AMSU) sounding observing system

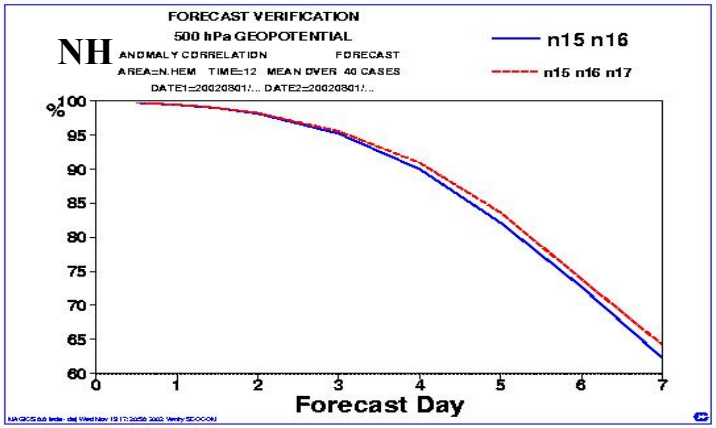
The NOAA trio represents an overall homogeneous high quality data source

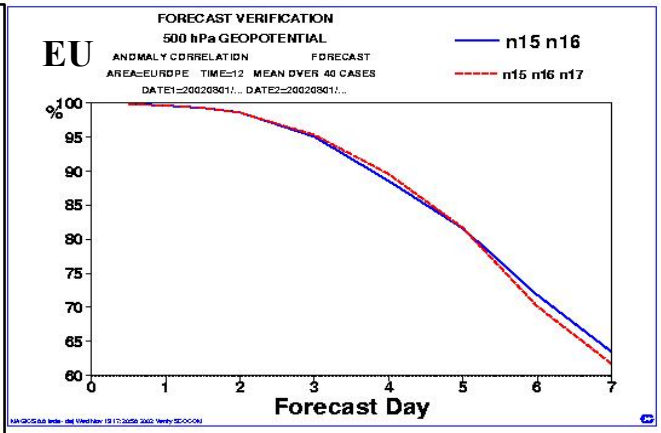
An assessment of the impact of NOAA-17 has been performed at ECMWF, towards an operational implementation

- To increase the global sounding coverage
- To anticipate possible problems with the NOAA-15 platform

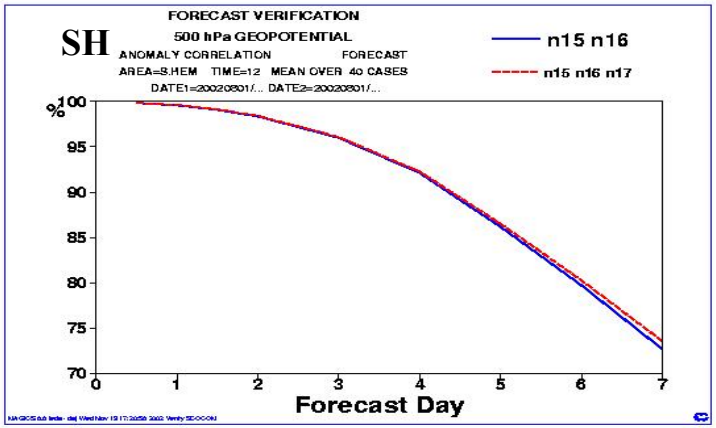
Outcome of the assimilation studies (3SAT versus 2SAT)

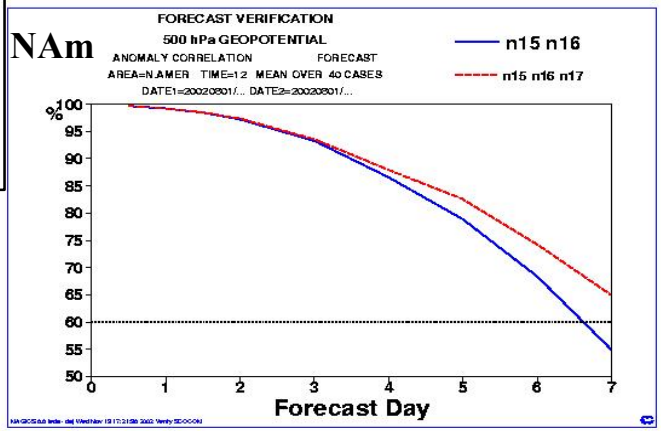
Z500 scores averaged over 40 cases





- 3SAT is better than 2SAT for hemispheric scores
- 3SAT is better than 2SAT up to d-4 over Europe, then worse at d-6
- 3SAT is impressively better than 2SAT over North-America!





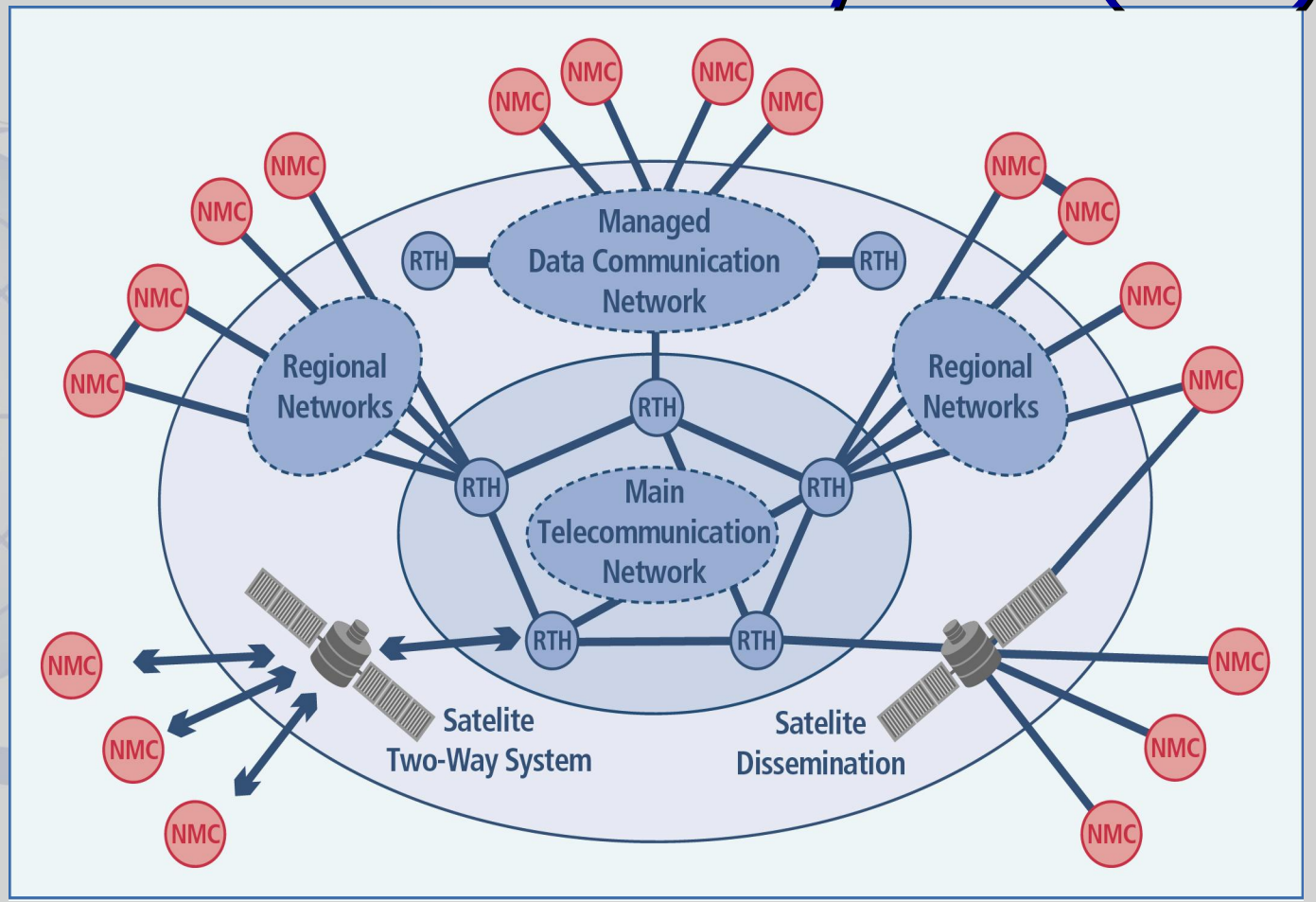
Despite the limited period under investigation, the positive impact of a third sounding mission (NOAA-17) on the quality of the ECMWF forecasts has been demonstrated

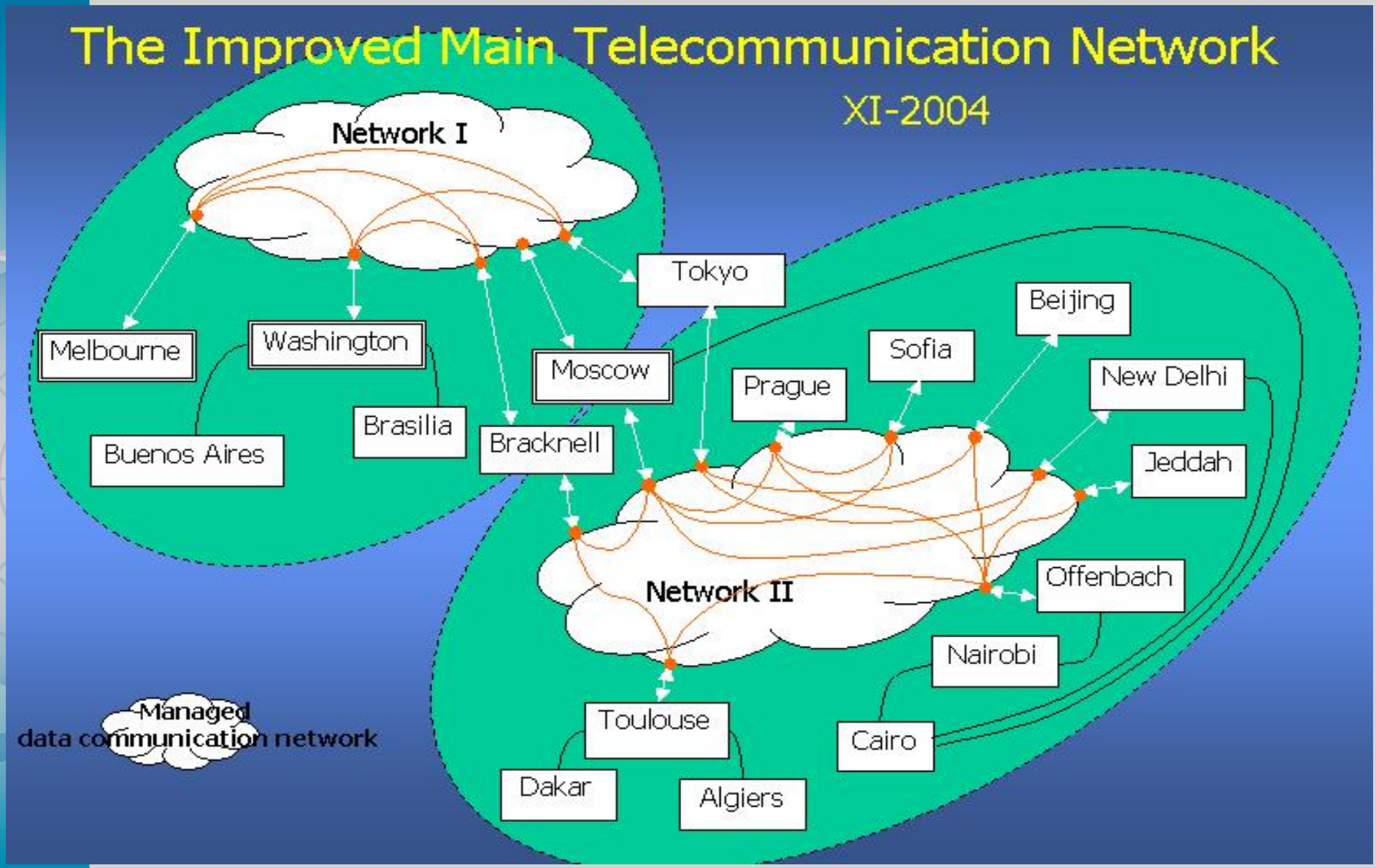
NOAA-17 has therefore been implemented operationally at ECMWF on 28 October 2002

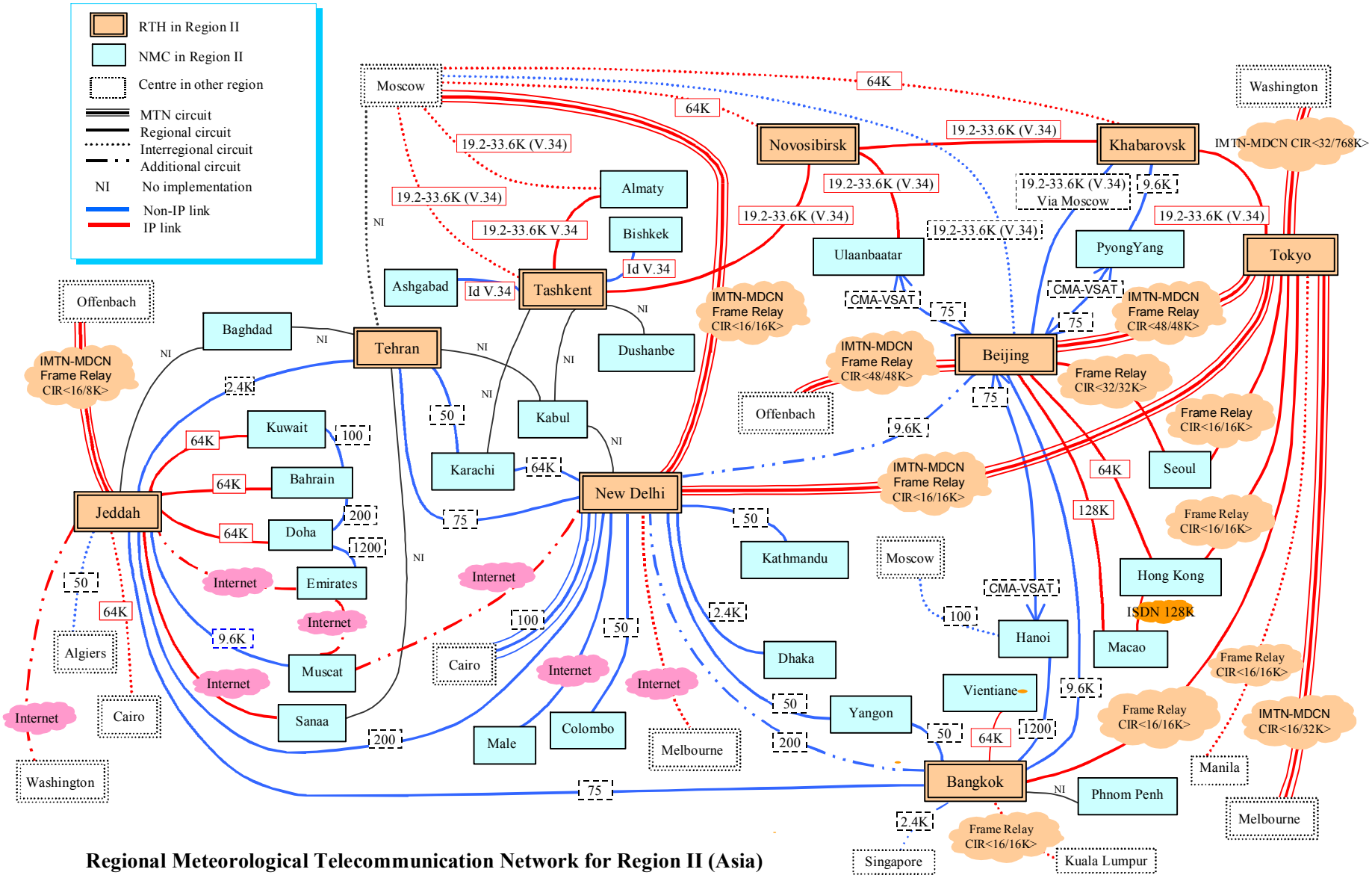
To some extent, similar results have been obtained by UK Met Office (S. English, pers. comm.) with a different NWP system

Global Telecommunication System

The general structure of the Global telecommunication System (GTS)




The Improved Main Telecommunication Network
XI-2004
Network I
Tokyo
Melbourne
Washington
Moscow
Beijing
Sofia
New Delhi
Prague
Brasilia
Bracknell
Buenos Aires
Jeddah
Network II
Offenbach
Nairobi
Managed
data communication network
Toulouse
Cairo
Dakar
Algiers



Regional Meteorological Telecommunication Network for Region II (Asia)

Current status as of December 2004

WWW Data Management

provides specifications for data and metadata formats, including codes and exchange formats;

provides guidelines for the design of data bases for storage of observational data and products;

monitors WWW operations and quality control of basic data and output products;

develops standards in data representation, and operational procedures;

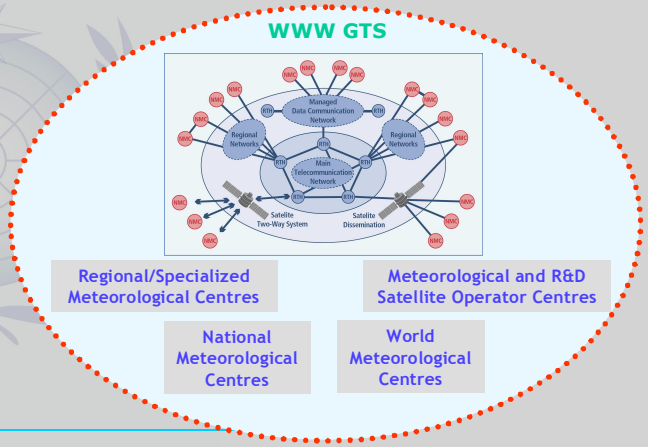
provides information to Members on the operation of the WWW system and develops methods to correct deficiencies promptly.

WIS

EC-LVIII 2006

GTS current users

National, Regional, Specialized, and World Meteorological Centres
Meteorological Satellite Operator Centres



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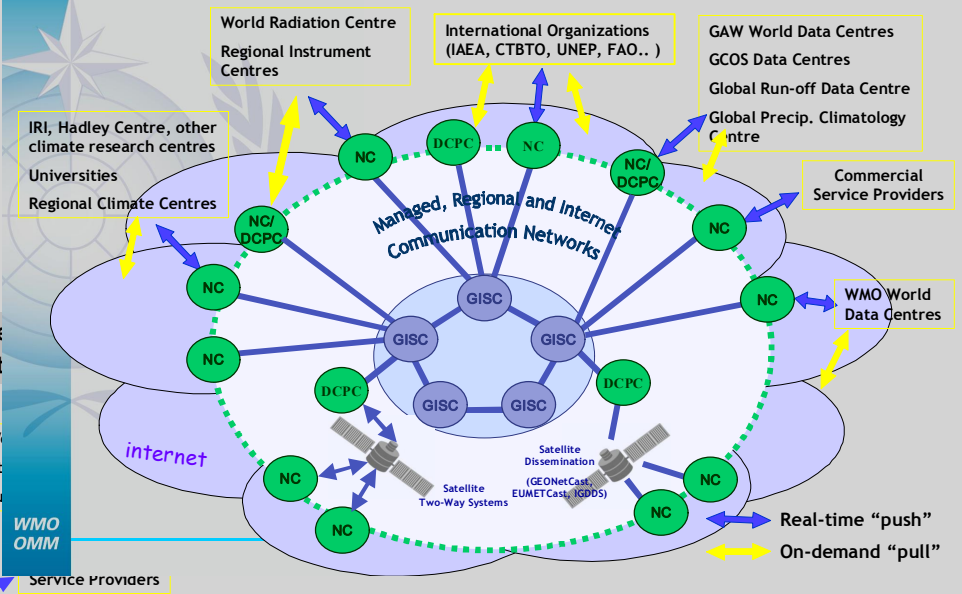
WIS

Information exchange – common procedures; real-time and non-real time services
Information management – few standard data formats; coordinated metadata & catalogues

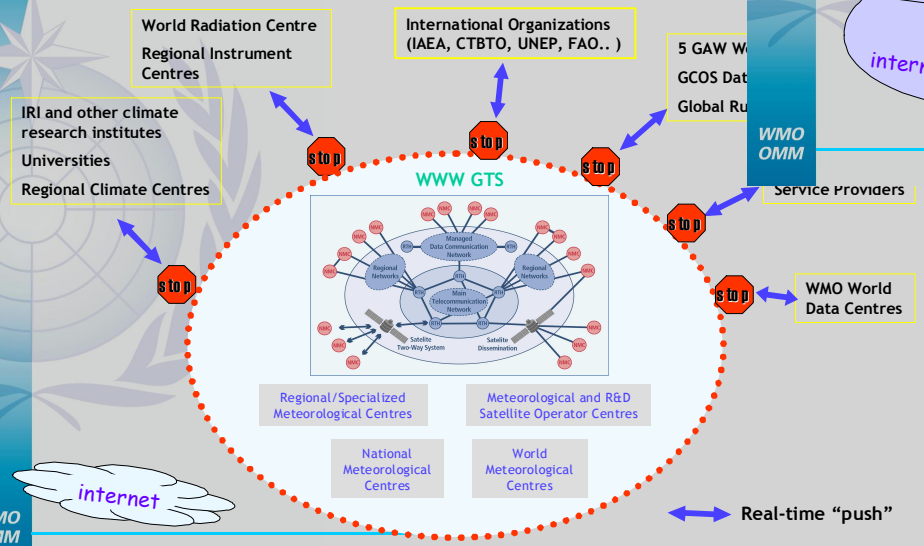


WMO OMM

EC-LVIII 2006

Current situation

Information exchange – multiplicity of procedures; real-time and non-real time
Information management – many data formats; uncoordinated metadata & cat



WMO OMM

Global Data Processing and Forecasting System

WMO
OMM

World Meteorological Centres (WMCs)

Melbourne

Moscow

Washington

Regional Specialized Meteorological Centres (RSMCs)

Centres with geographical specialization: Algiers, Beijing, Brasilia, Buenos Aires, Cairo, Dakar, Darwin, Exeter, Jeddah, Khabarovsk, Melbourne, Miami, Montreal, Moscow, Nairobi, New Delhi, Novosibirsk, Offenbach, Pretoria, Rome, Tashkent, Tokyo, Tunis/Casablanca, Washington, Wellington

Centres with activity specialization for the provision of transport model products for environmental emergency response: Beijing, Exeter, Melbourne, Montreal, Obninsk, Tokyo, Toulouse

National Meteorological Centres (NMCs)

The NMCs prepare:

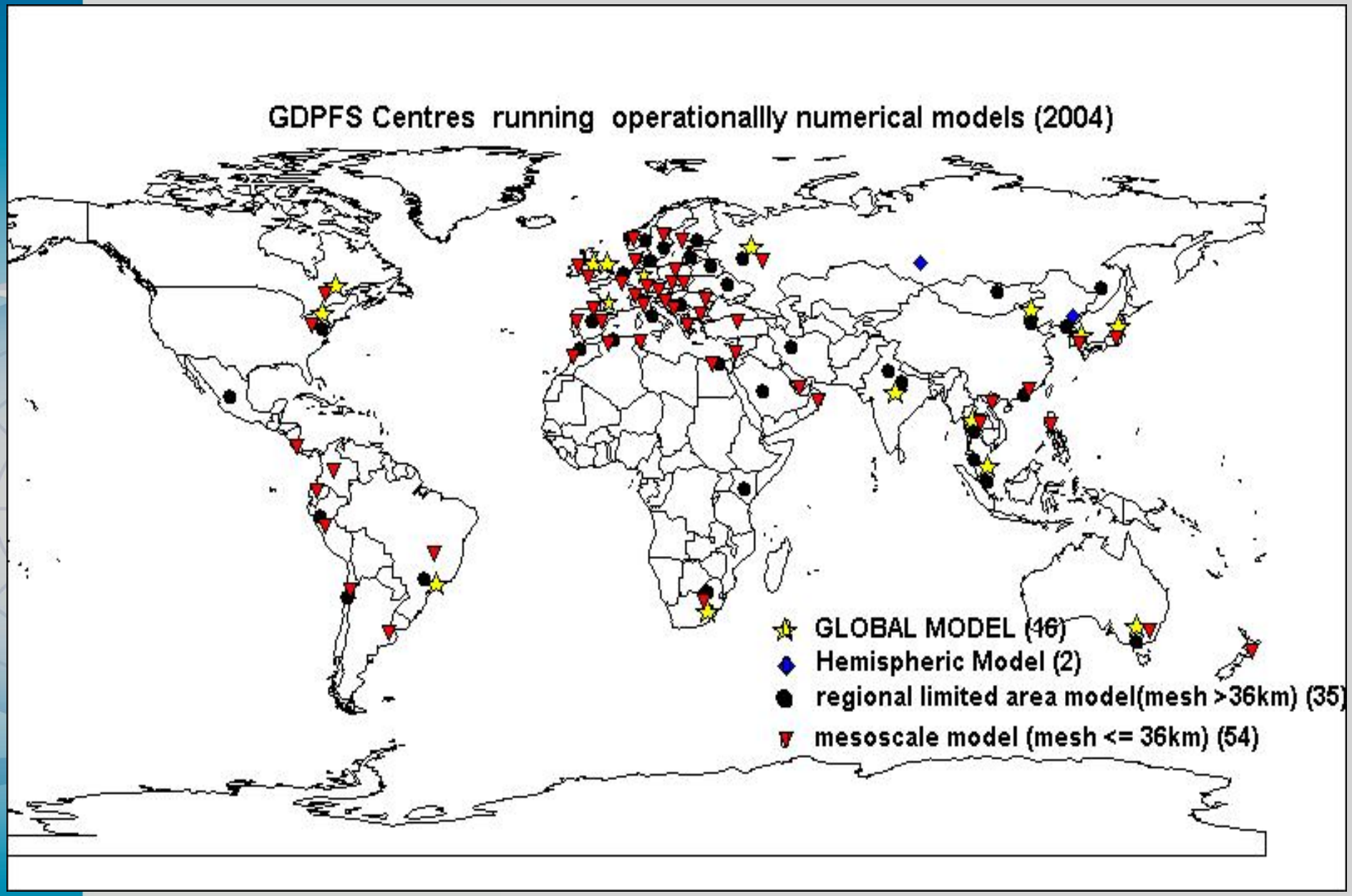
Nowcasts and very short-range forecasts;

Short-, medium-, extended- and long-range forecasts based on products received from WMCs and RSMCentres, or by integrating regional models using boundary conditions based on these products;

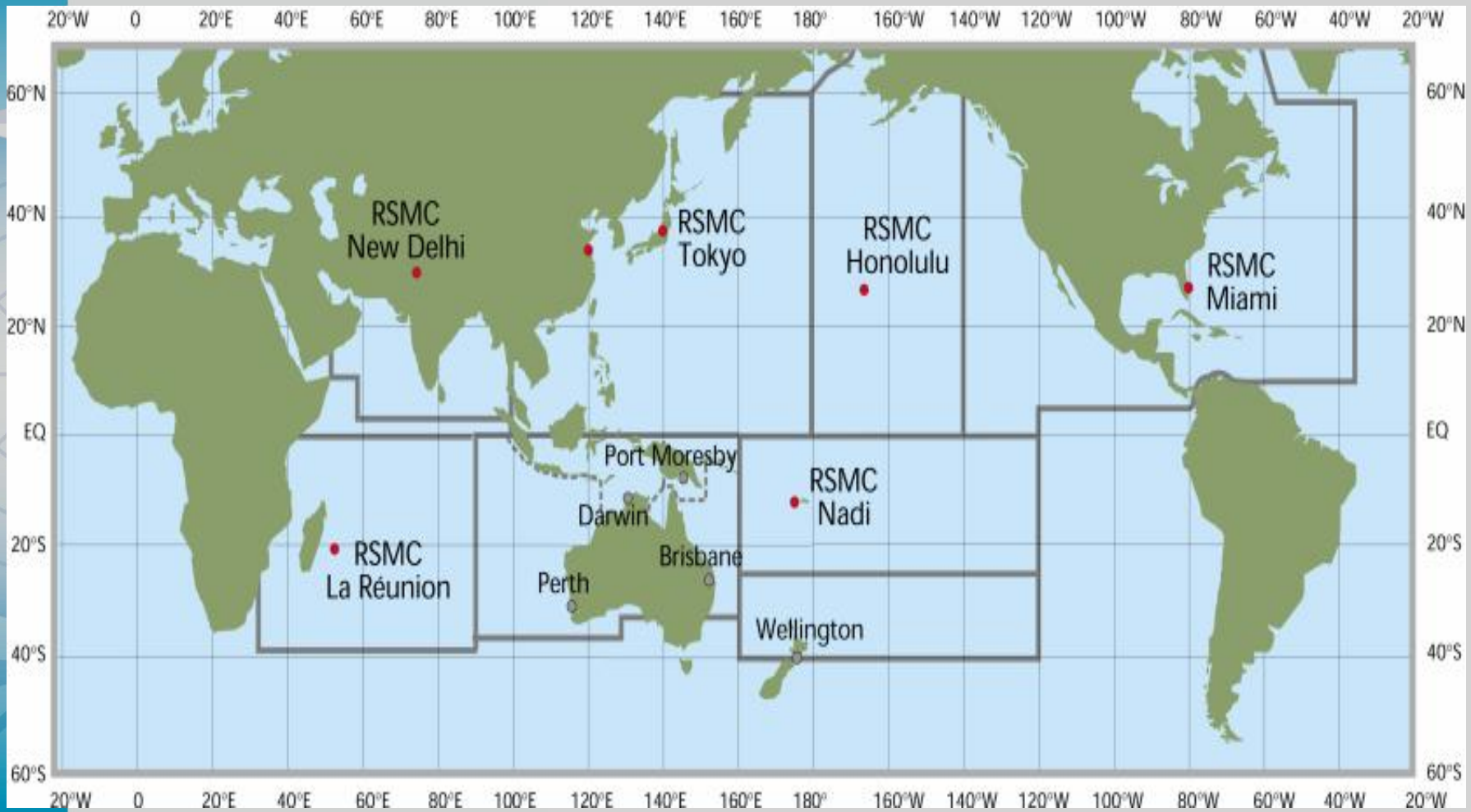
Special application-user products, including warnings of severe weather, climate and environmental quality monitoring and prediction products;

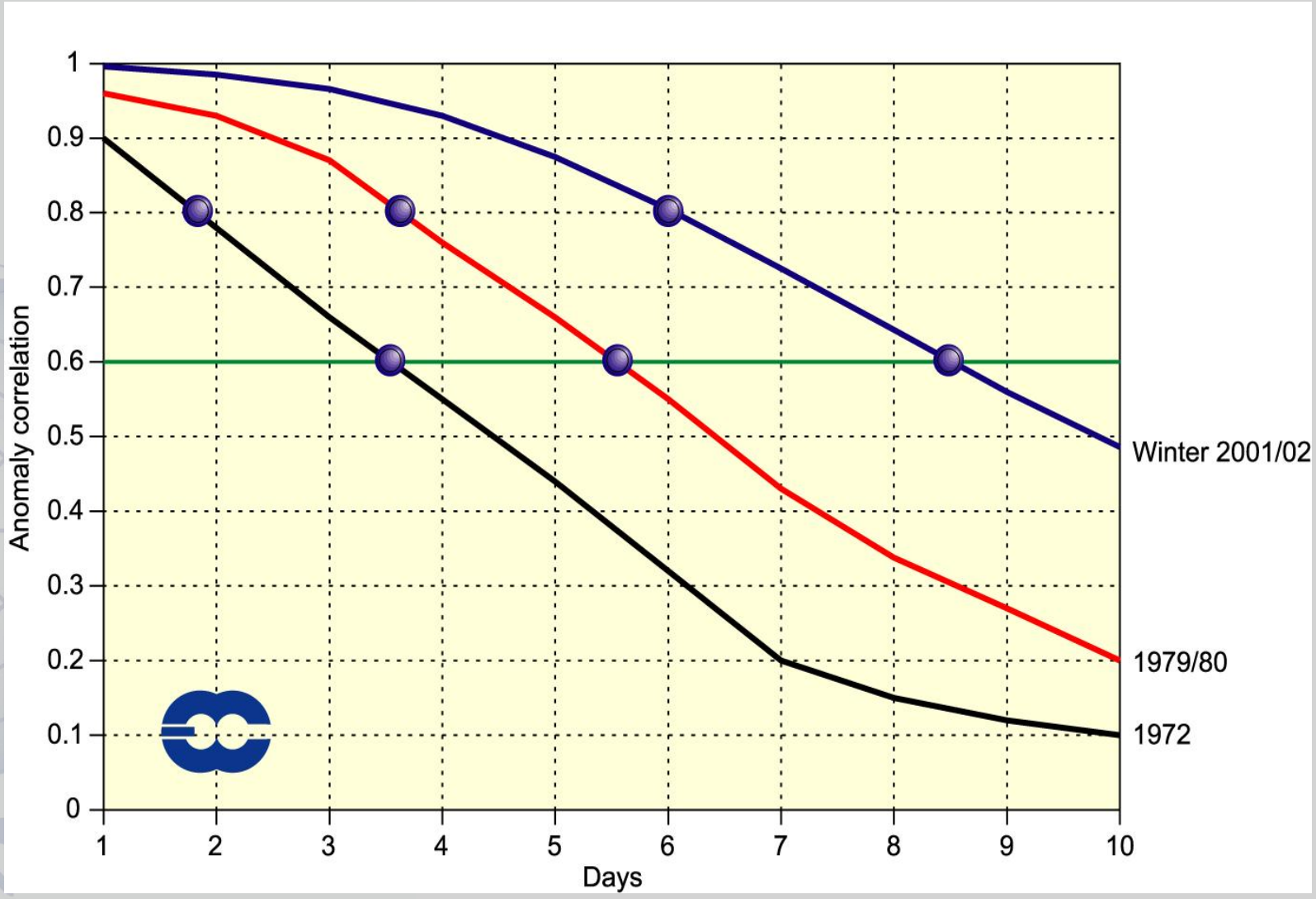
Specific products and their delivery in support of United Nations humanitarian missions;

Non-real-time climate-related analyses and diagnosis

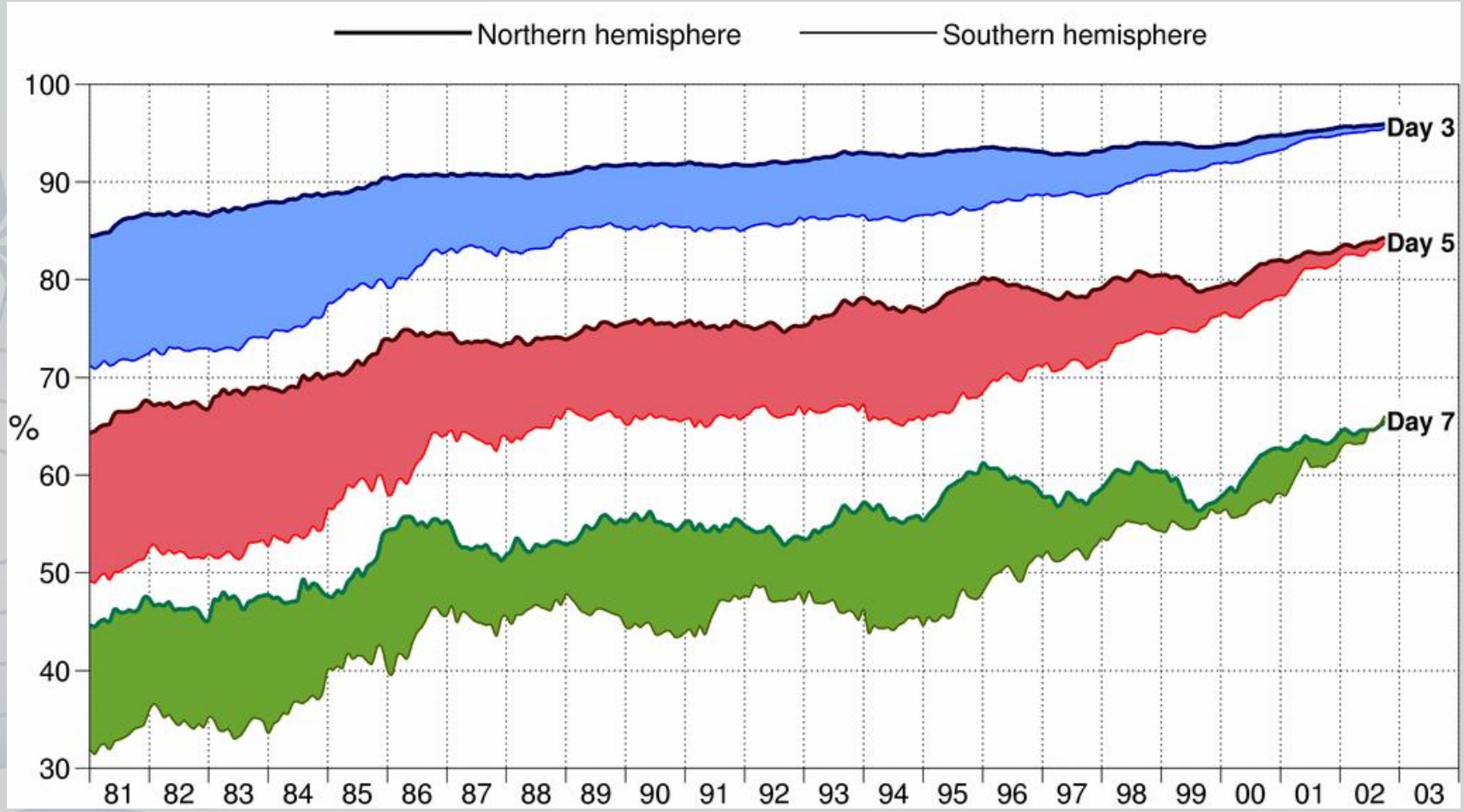

GDPFS Centres running operationallly numerical models (2004)
GLOBAL MODEL (46)
Hemispheric Model (2)
regional limited area model(mesh >36km) (35)
mesoscale model (mesh <= 36km) (54)

RSMCs for tropical cyclone forecasting



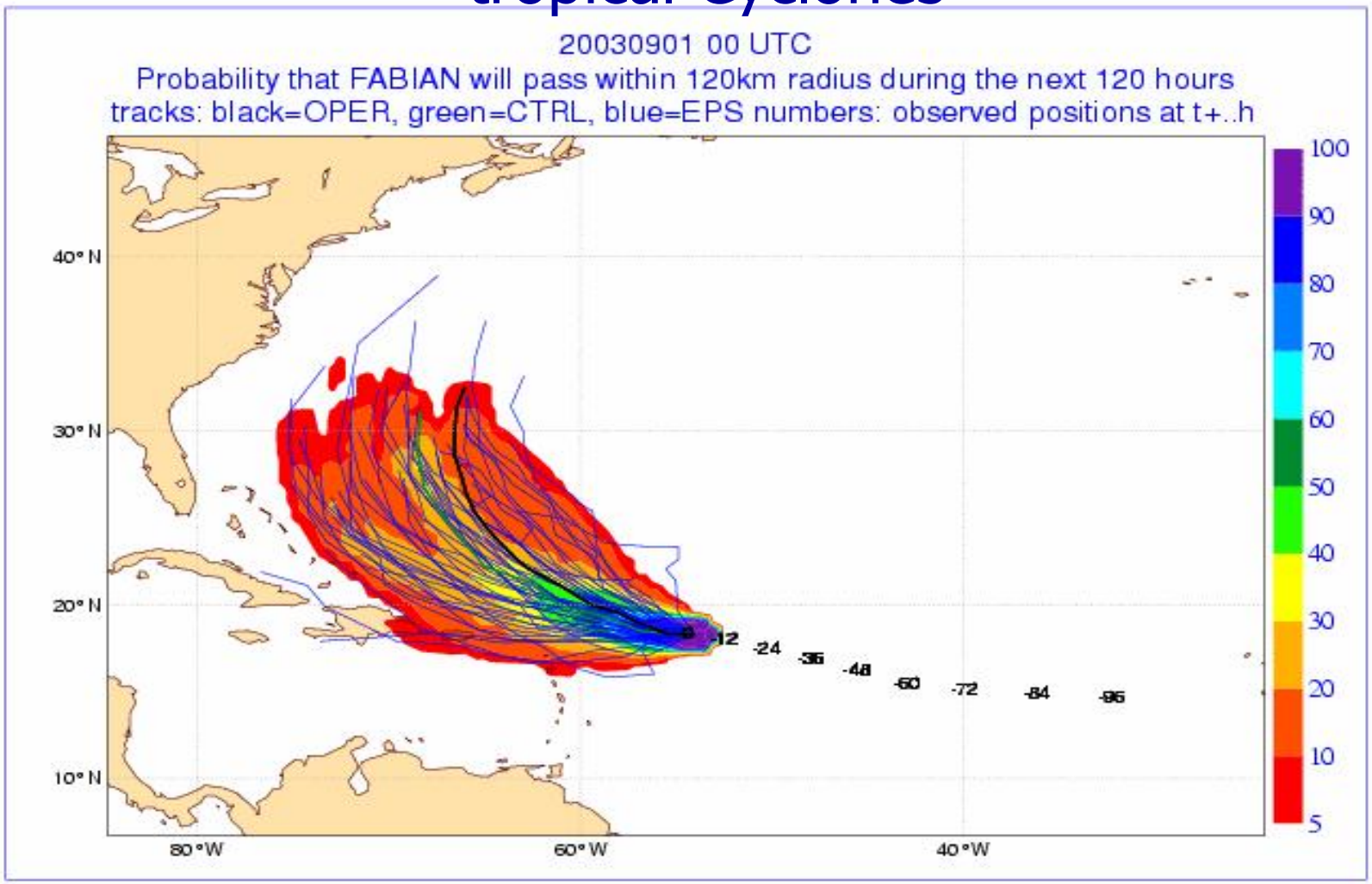


Anomaly correlation scores for 500 hPa geopotential forecasts from Miyakoda et al (1972), labelled 1972, from the daily ECMWF operational forecasts for Dec 1979 -Feb 1980 (labelled 1979/80), and from the daily ECMWF operational forecasts for Dec 2001-Feb 2002 (labelled winter 2001/02).

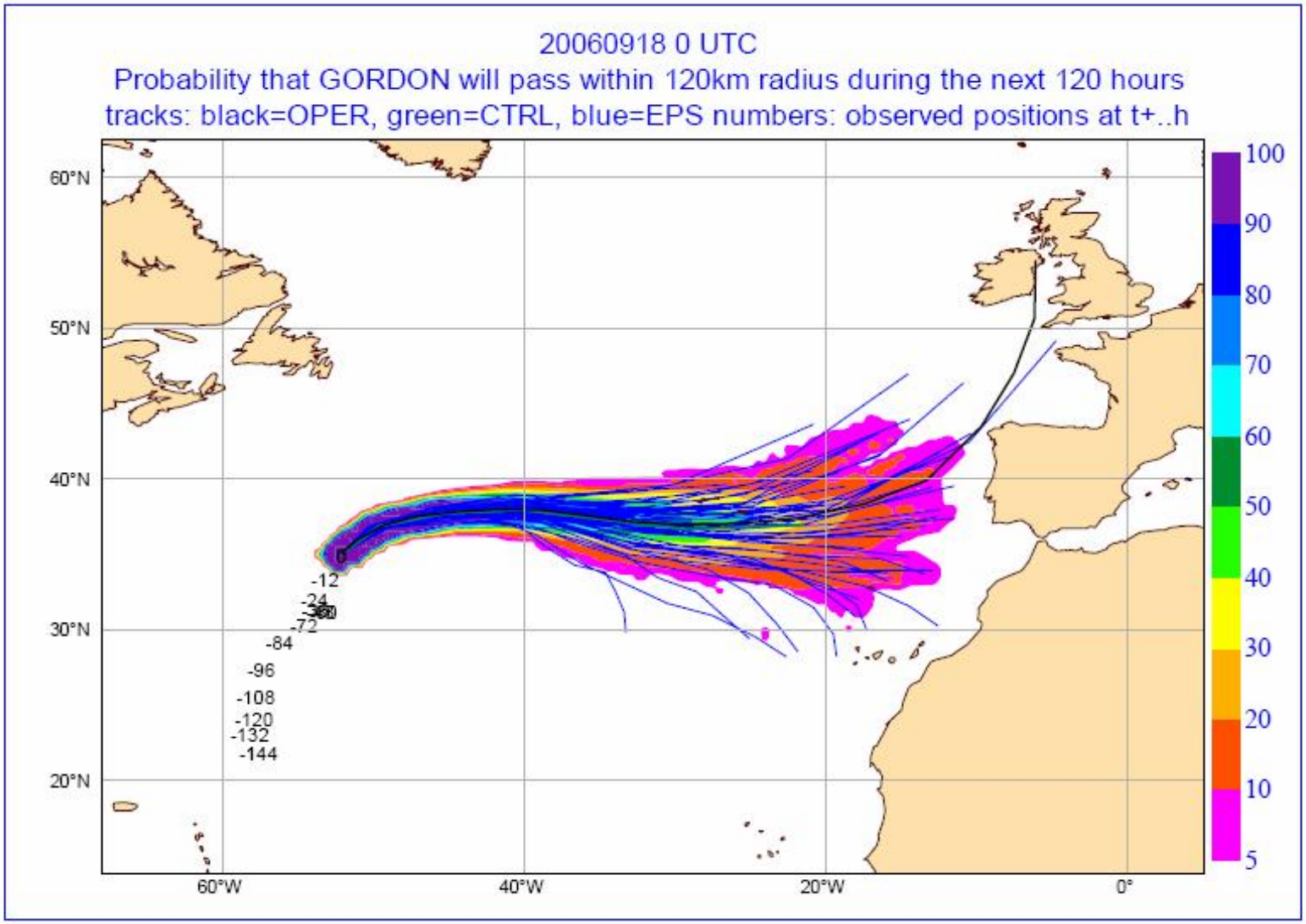


Anomaly correlation coefficients of 3-, 5- and 7-day ECMWF 500hPa height forecasts for the extratropical northern and southern hemispheres, plotted in the form of annual running means of archived monthly-mean scores for the period from January 1980 to September 2002. Values plotted for a particular month are averages over that month and the 11 preceding months. The shading shows the differences in scores between the two hemispheres at the forecast ranges indicated. After Simmons & Hollingsworth (2002)

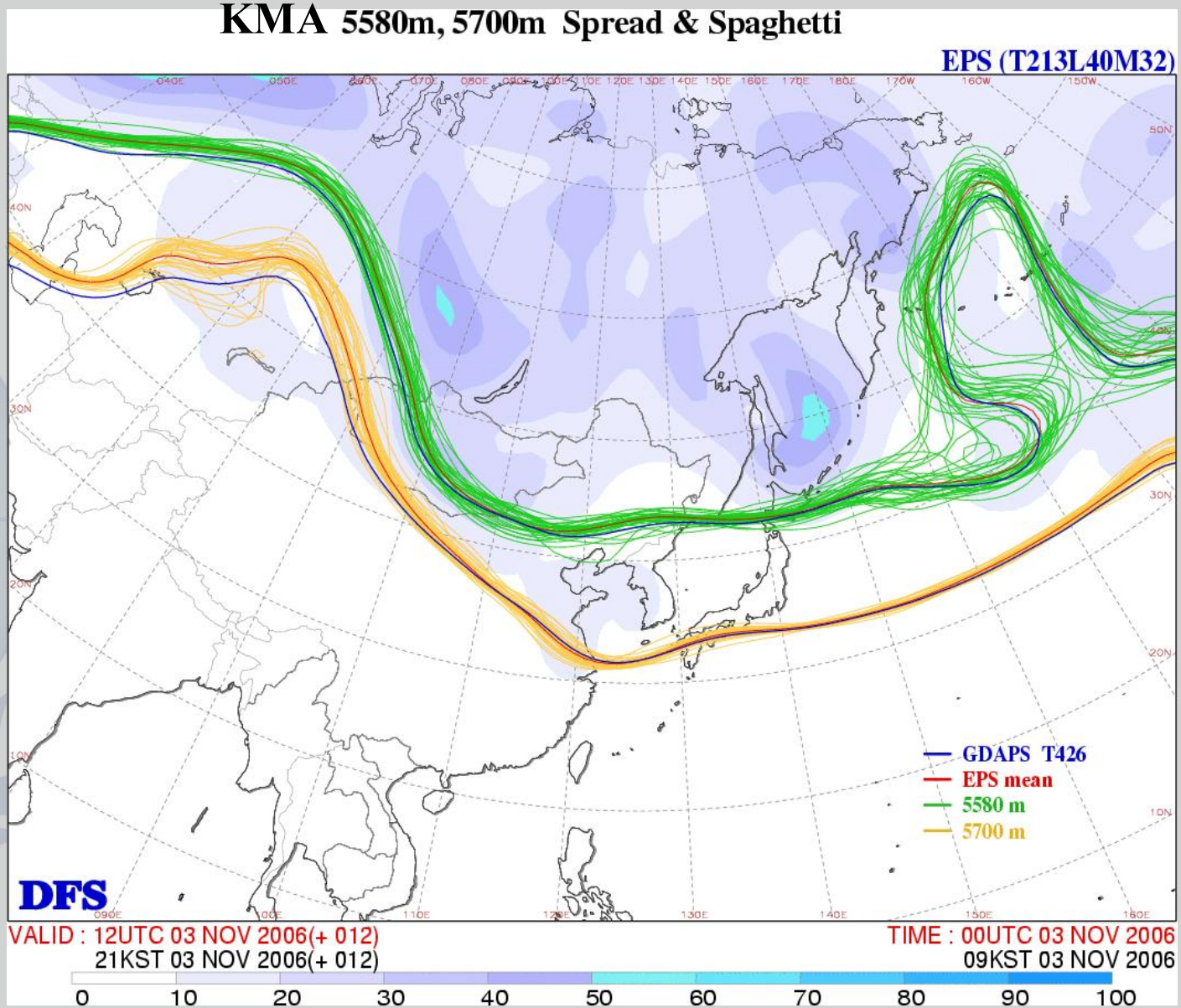
The application of EPS-forecast technique to the calculation of probabilities for the trajectory of tropical Cyclones



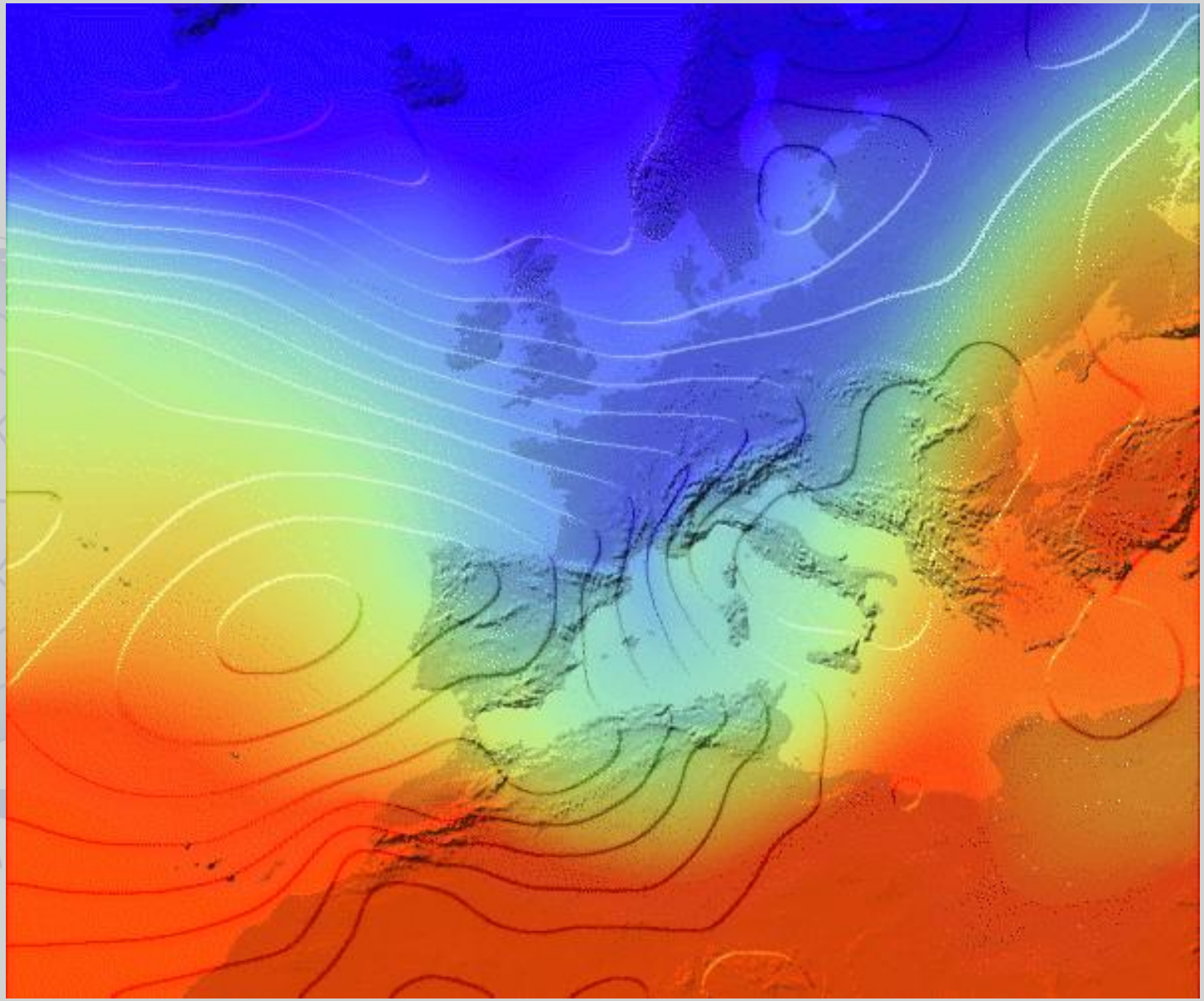
Hurricane Gordon – strike probability



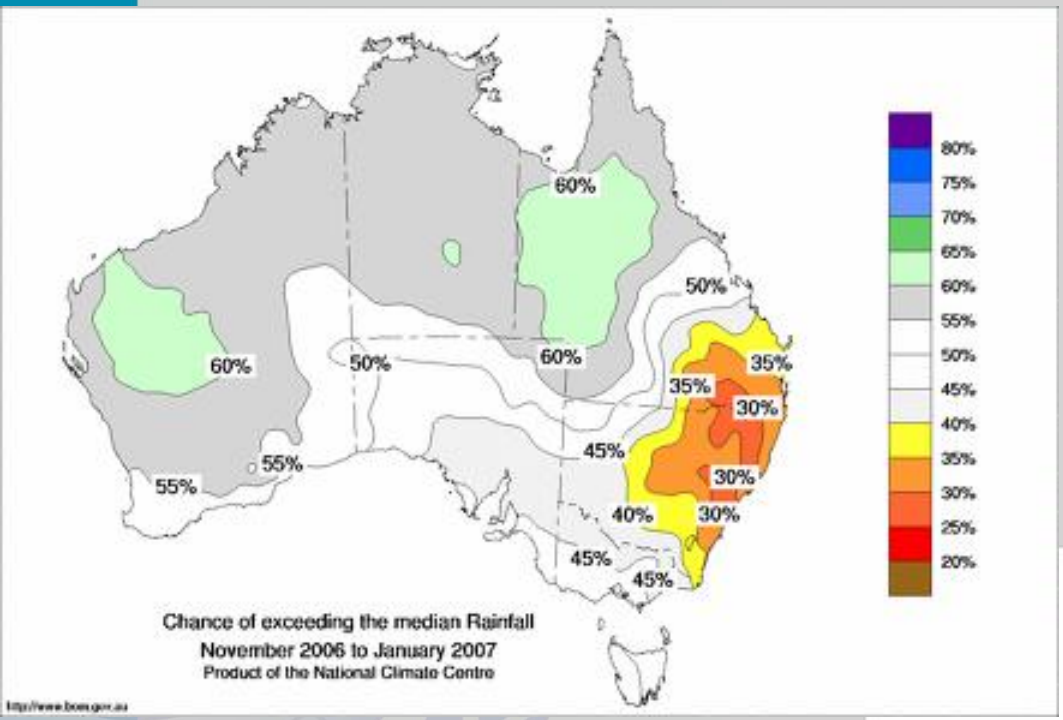
ECMWF

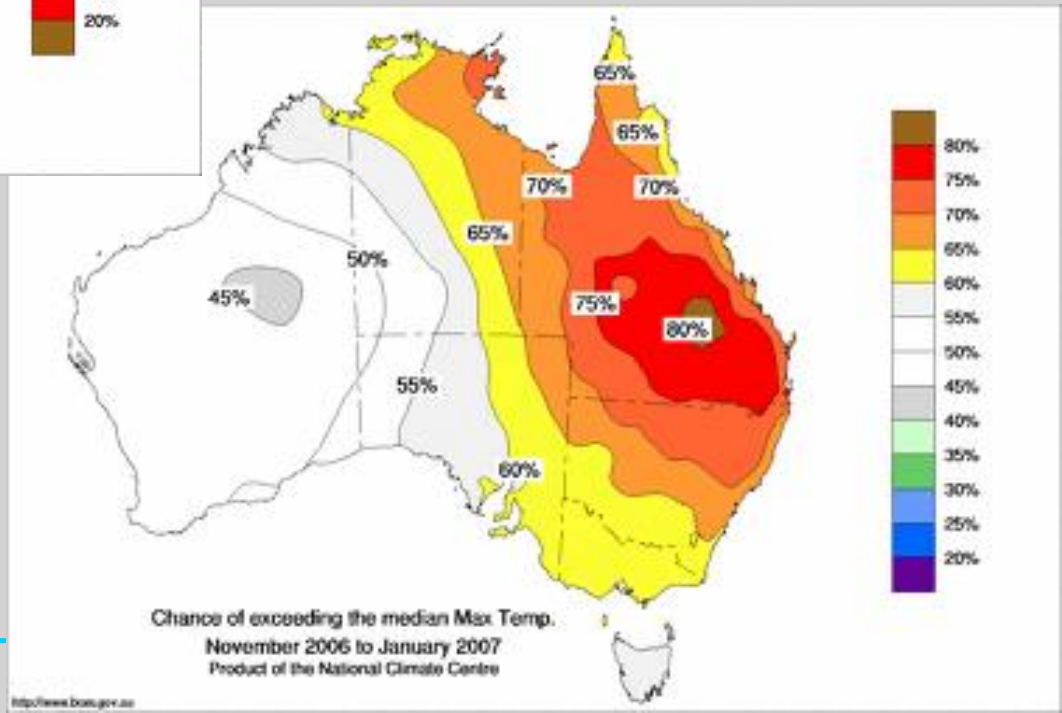

KMA 5580m, 5700m Spread & Spaghetti
EPS (T213L40M32)
GDAPS T426
EPS mean
5580 m
5700 m
DFS
VALID : 12UTC 03 NOV 2006(+ 012)
21KST 03 NOV 2006(+ 012)
TIME : 00UTC 03 NOV 2006
09KST 03 NOV 2006
0 10 20 30 40 50 60 70 80 90 100

ECMWF Ensemble Mean, MSL + T



Long Range Forecasting





Global weather prediction has advanced to the point that NWC`s routinely provide useful forecast with a 5-day accuracy comparable to the 2-day forecast of 25 year ago, including EPS that provide probability estimates of their expected level of skill for a week or more.

Core elements for the future progress

High-resolution observations and models

High-resolution assimilation and analysis

Underpinning research

Advanced high-performance computers

International coordination

Information - the production of information for policy makers and stakeholders

Thank You !