

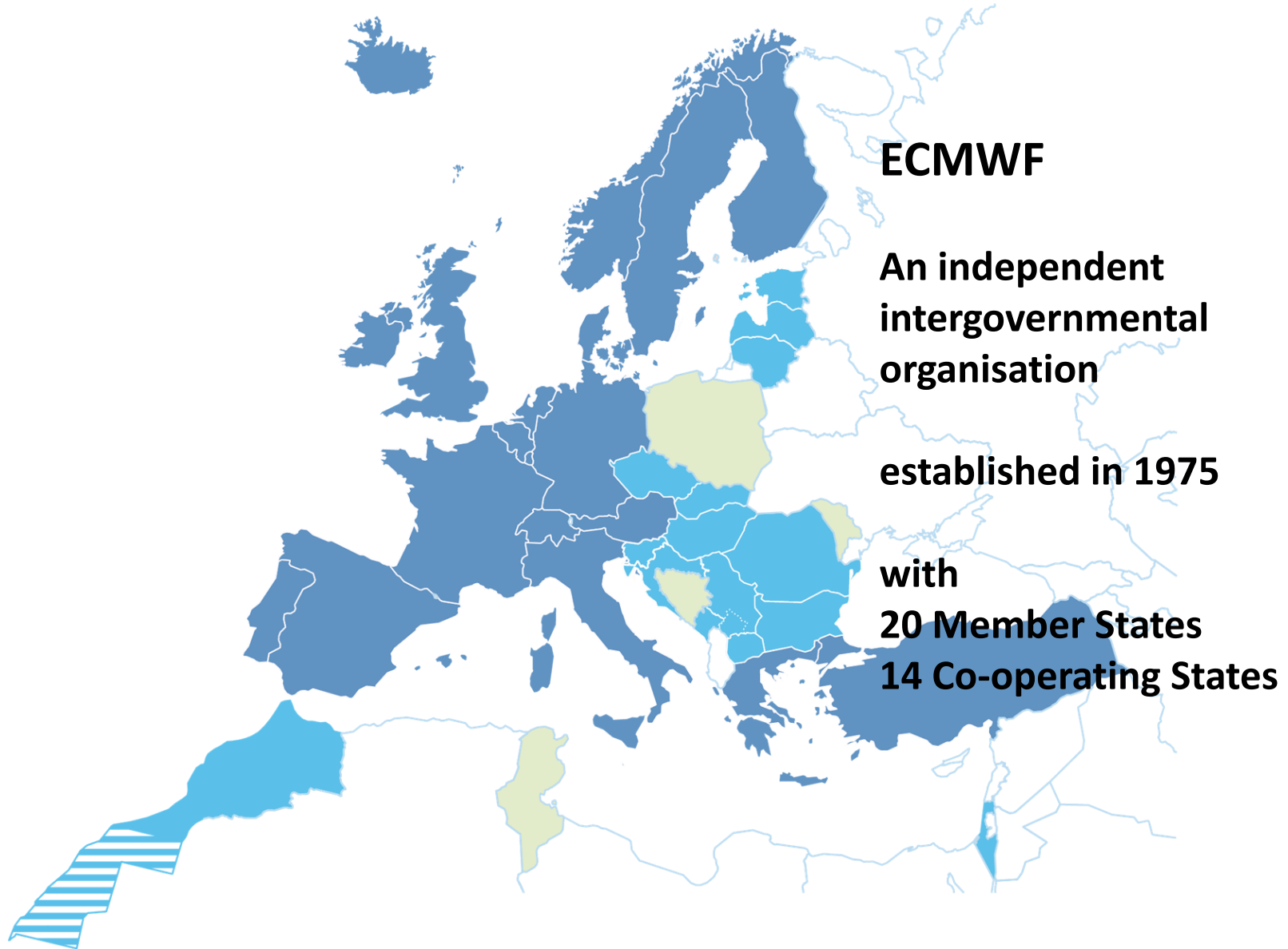


Introduction to ECMWF

Erik Andersson

Head of Meteorological Division

■ Member States ■ Co-operating States ■ Under negotiation



ECMWF

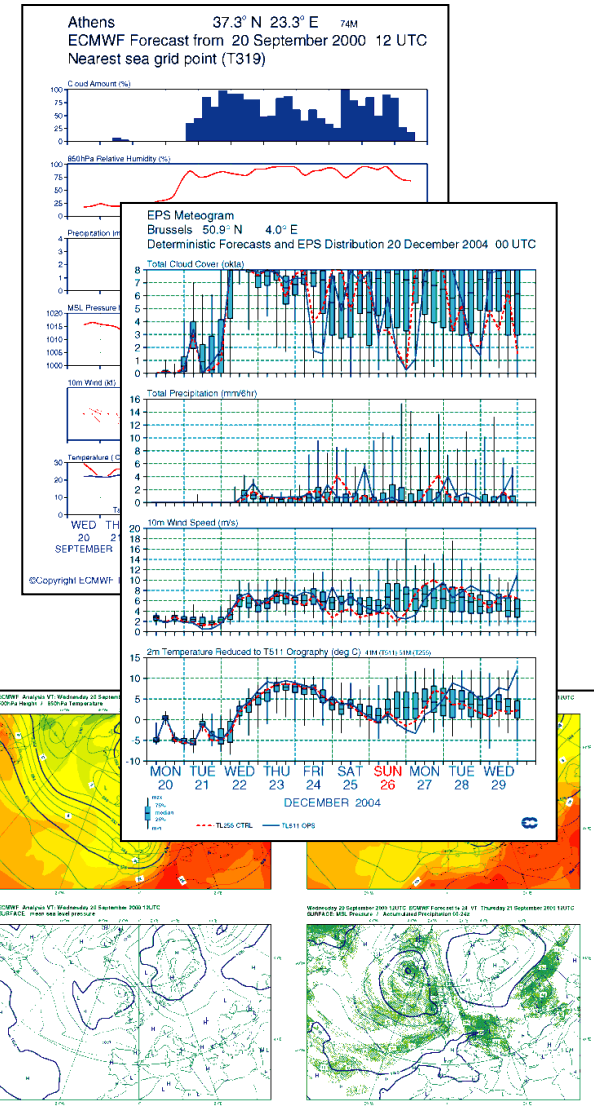
An independent
intergovernmental
organisation

established in 1975

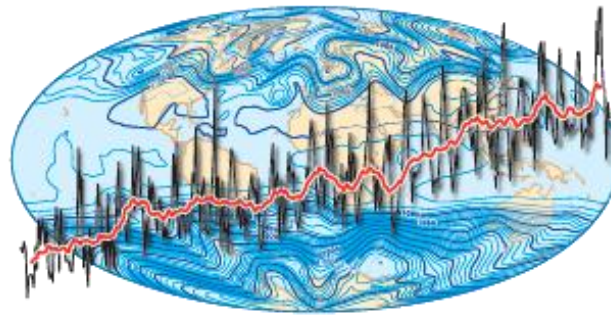
with
20 Member States
14 Co-operating States

Who are we and what do we do?

- European Centre** We are an **independent international** organisation funded by 34 States
- Medium-Range** **Up to fifteen days ahead.** Today our products also include **monthly** and **seasonal** forecasts and we collect and store meteorological data.
- Weather Forecasts** We produce **world-wide weather forecasts**
- What do we have to achieve this?**
- People** About 250 staff, specialists and contractors
- Equipment** State-of-the-art supercomputers and data handling systems
- Budget** £50 million per year
- Experience** 36 years



The ECMWF Strategy 2011–2020



Developing the core forecasting systems



Reliable forecasts of severe weather



High-quality near-surface weather products

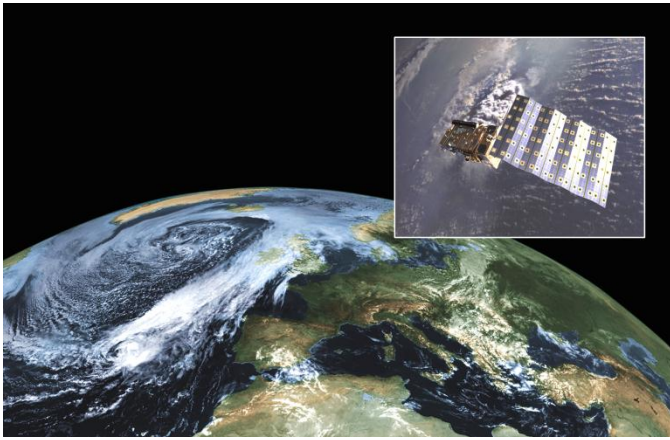


Atmospheric composition forecasting



Climate monitoring

Global observations



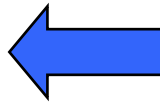
Global weather forecasts



Users



National weather services



Why “medium-range”?



**Short-range
weather forecast
(to 2 days ahead)**

Very high
resolution –
regional models

1-2 hour
production
schedule

**Medium-range
weather forecast
(2 weeks ahead)**

High resolution
– global models

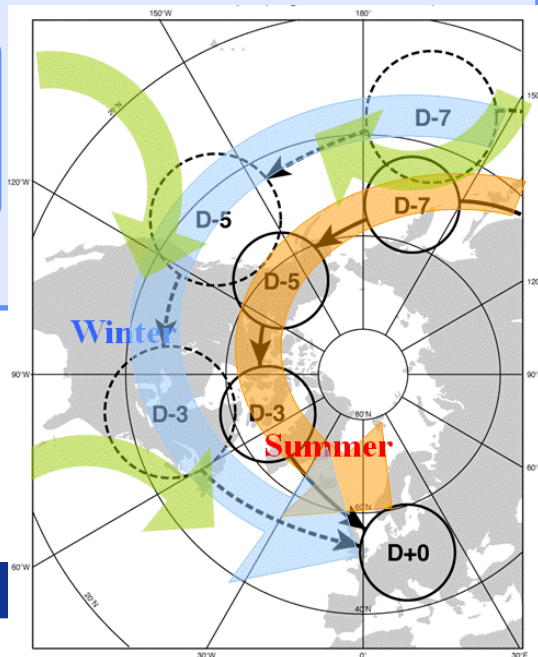
6-10 hour
production
schedule

**Long-range
weather forecast
(to seasons
ahead)**

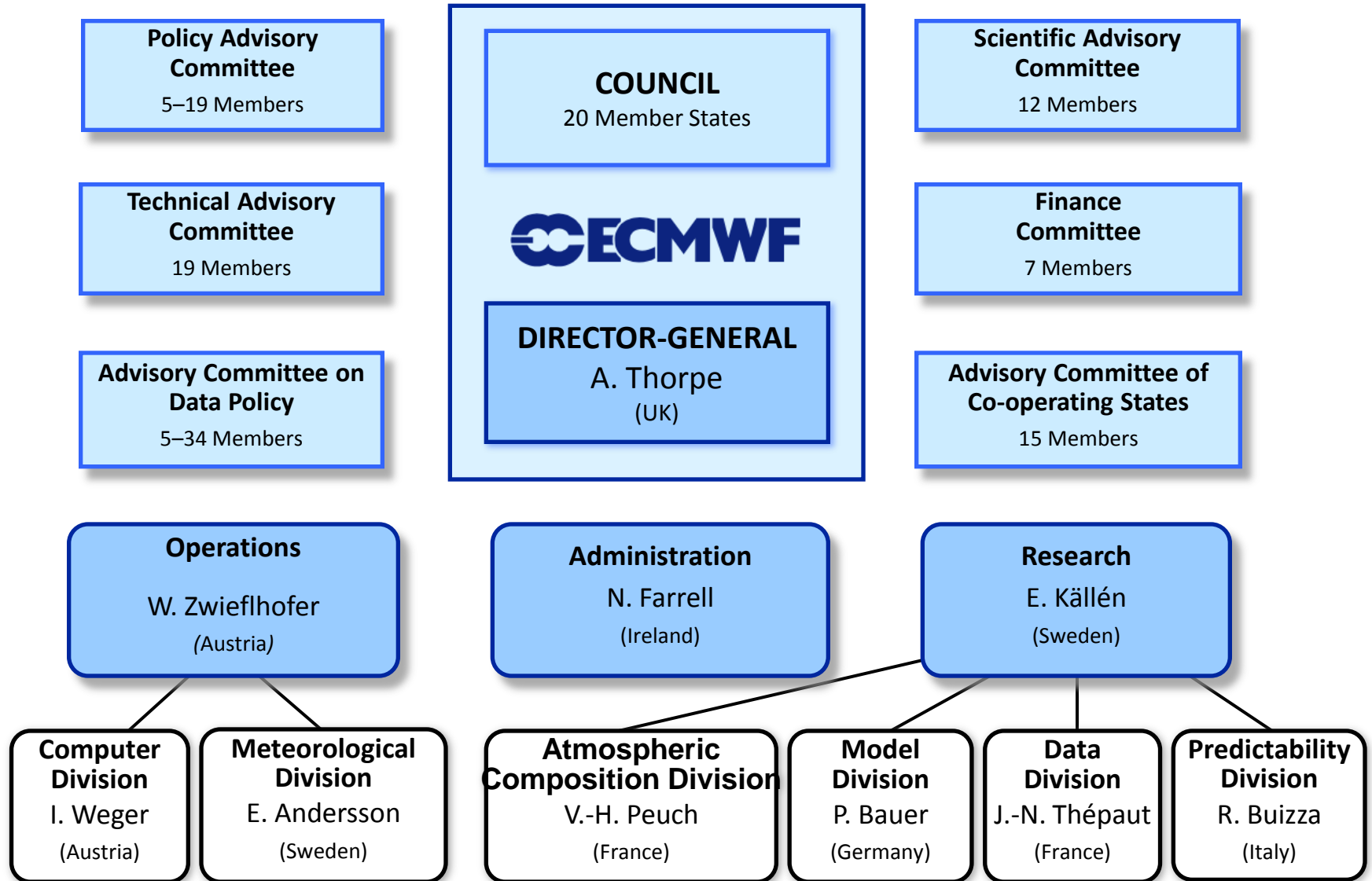
Predict statistics
of weather for
coming month
or season

Climate prediction

CO2 doubling and
other scenarios



Organisation of ECMWF



Supporting States and Co-operation

Austria
Belgium
Denmark
Finland
France
Germany
Greece

Iceland
Ireland
Italy
Luxembourg
The Netherlands
Norway
Portugal

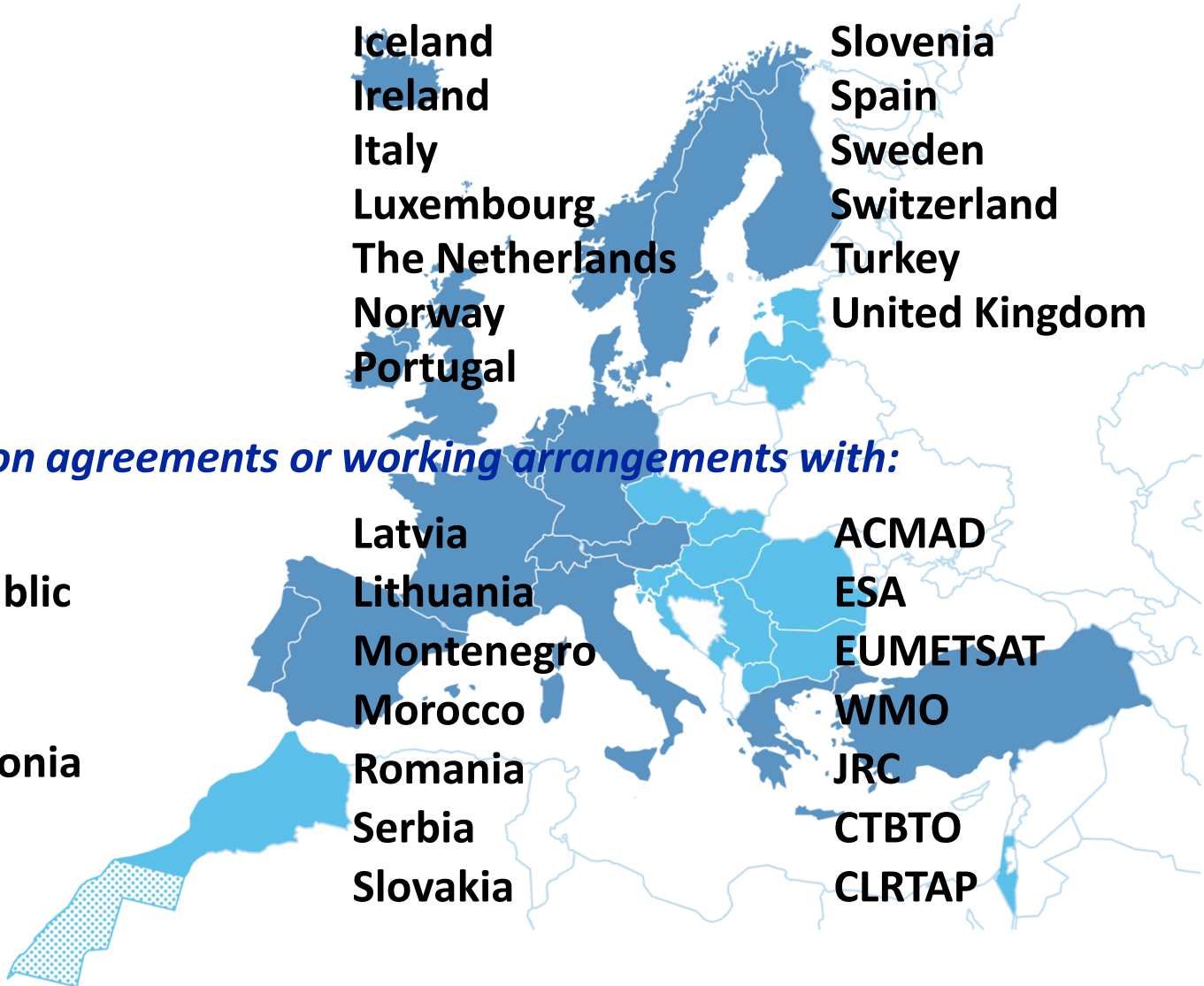
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom

Co-operation agreements or working arrangements with:

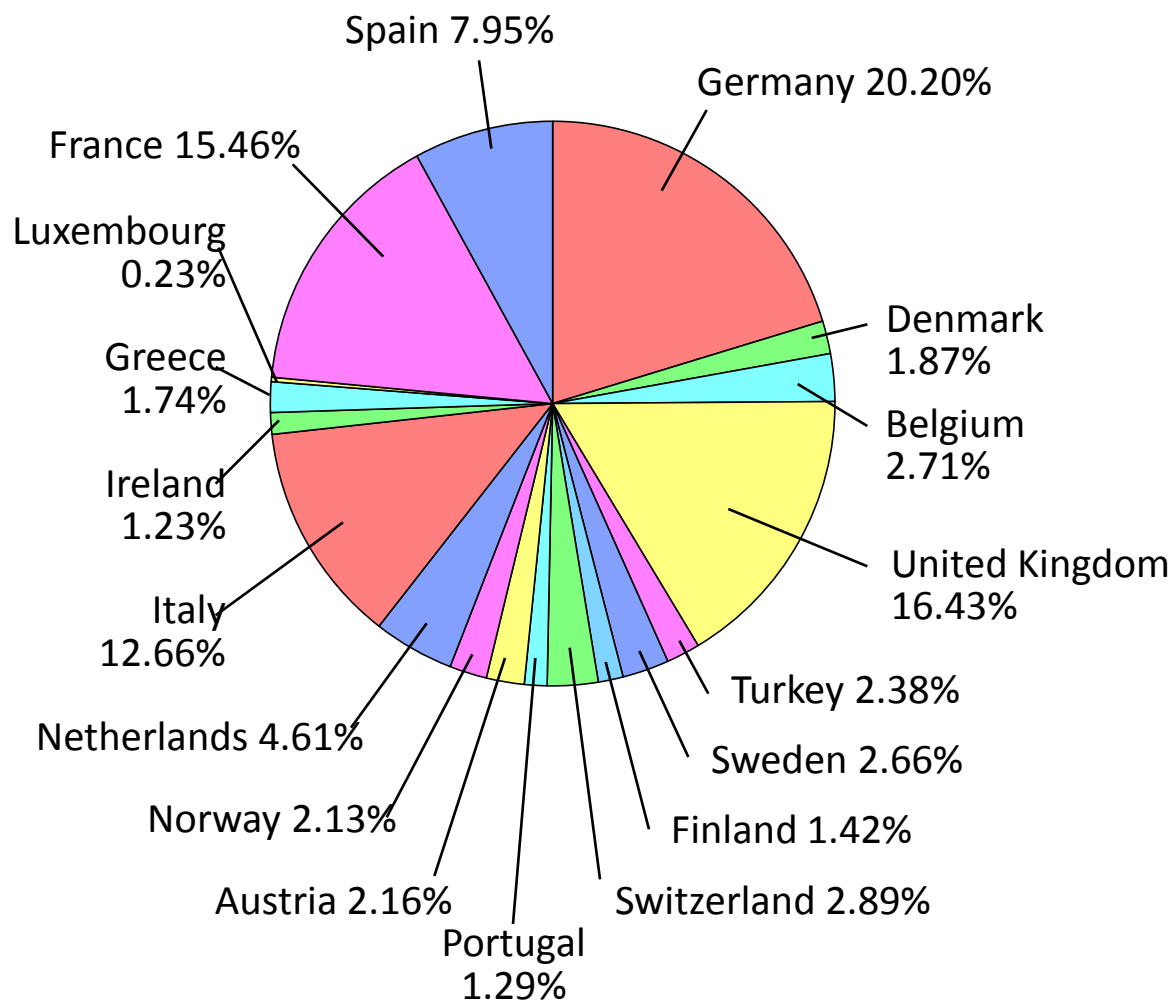
Bulgaria
Czech Republic
Croatia
Estonia
FYR Macedonia
Hungary
Israel

Latvia
Lithuania
Montenegro
Morocco
Romania
Serbia
Slovakia

ACMAD
ESA
EUMETSAT
WMO
JRC
CTBTO
CLRTAP



ECMWF Budget 2011

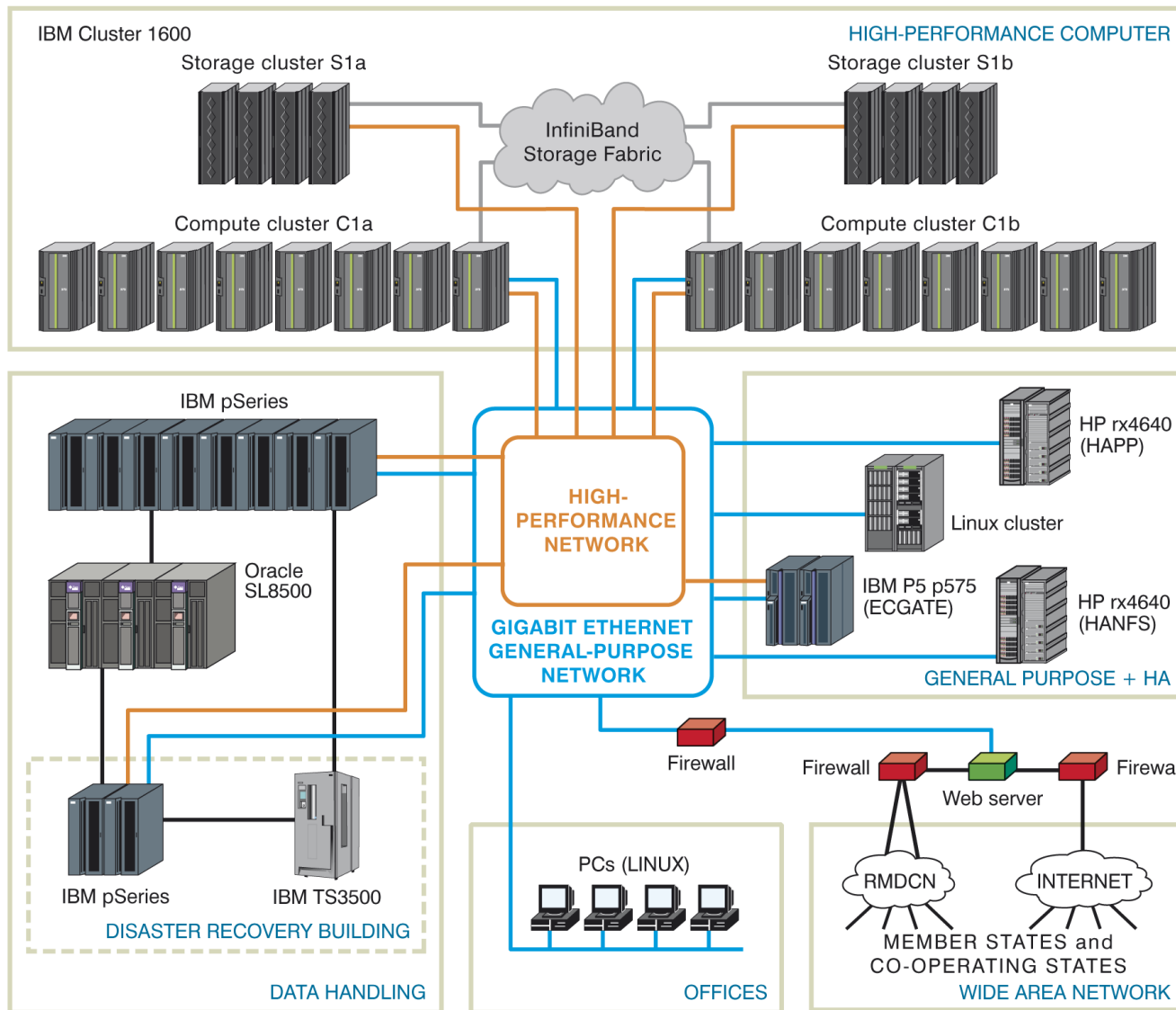


GNI Scale 2009–2011

Main Revenue 2011	
Member States' contributions	£38,538,400
Co-operating States' contributions	£1,256,400
Other Revenue	£3,161,900
Total	£42,956,700

Main Expenditure 2011	
Staff	£16,230,900
Leaving Allowances & Pensions	£5,174,300
Computer Expenditure	£16,994,200
Buildings	£3,647,700
Supplies	£909,600
Total	£42,956,700

Current computer configuration



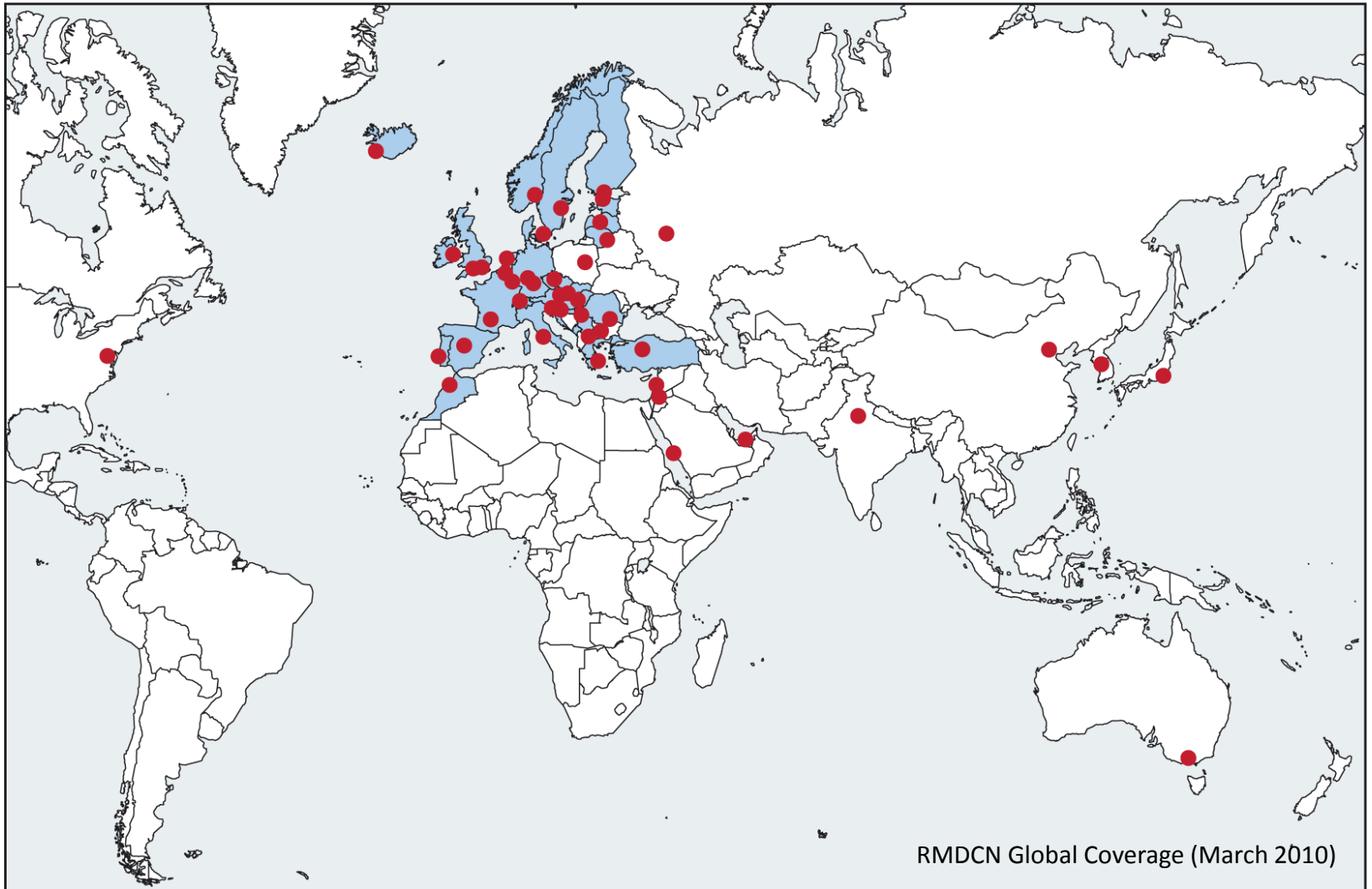
September 2011

Supercomputers at ECMWF

- ECMWF has a long history of using High Performance Computing in NWP
 - ➔ 1978 – 1996: Cray (Cray-1A, XMP, YMP, C90, T3D)
 - ➔ 1996 – 2002: Fujitsu (VPP700, VPP700E, VPP5000)
 - ➔ 2002 – today: IBM (Power4, Power5, Power6, Power7)
- ECMWF has currently the 10th and 11th in Europe (in terms of compute capacity)



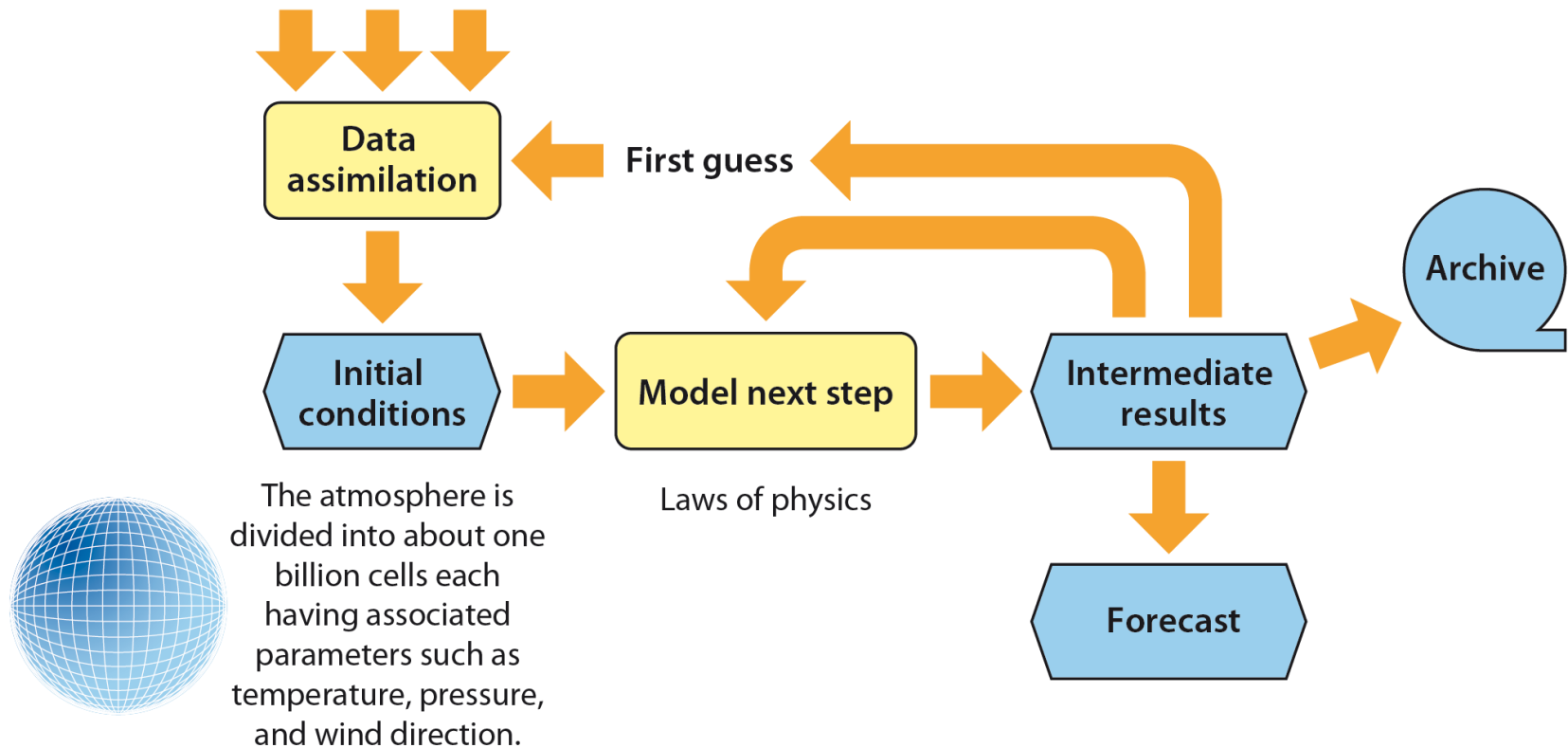
RMDCN Connections



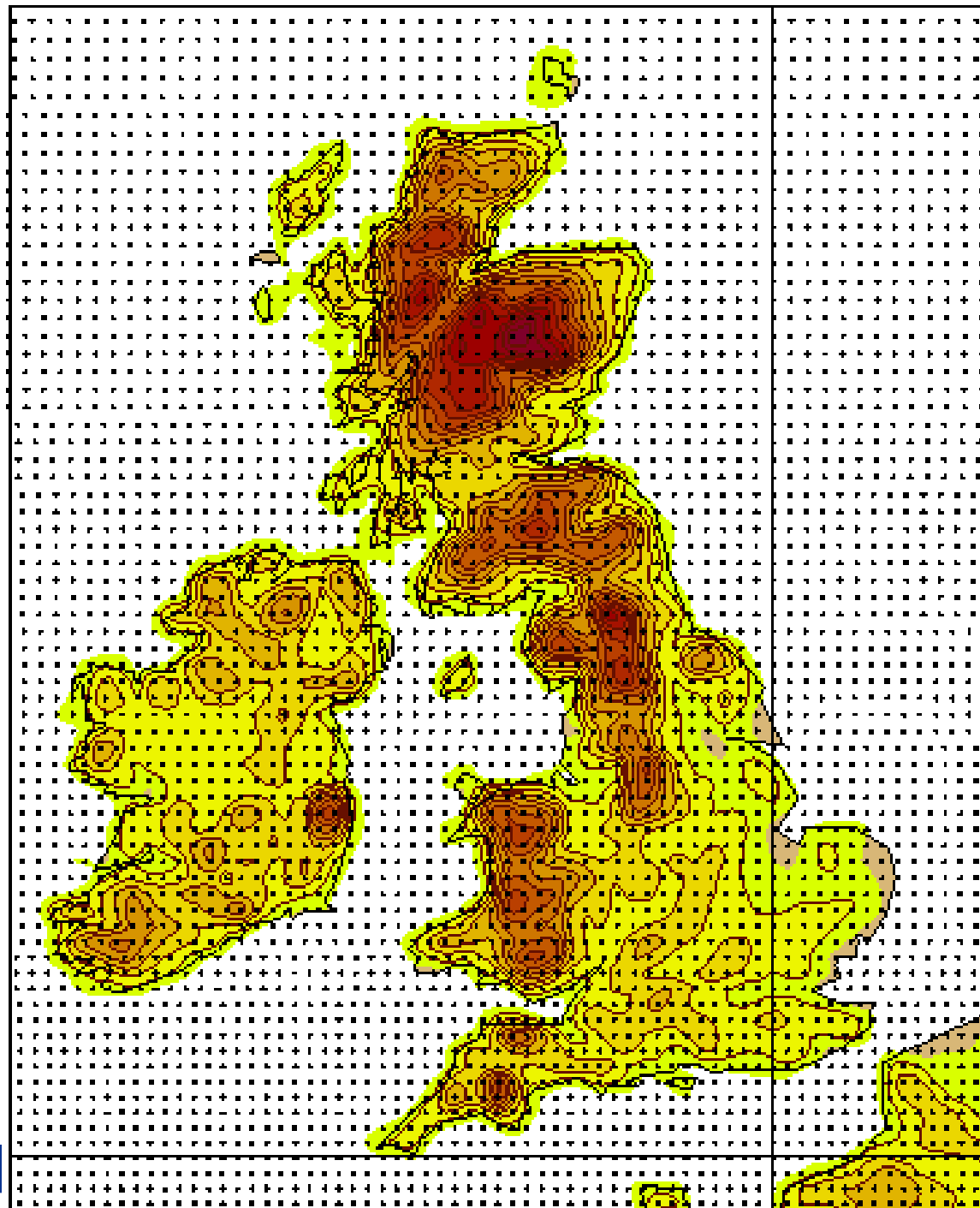
A basic description of our models



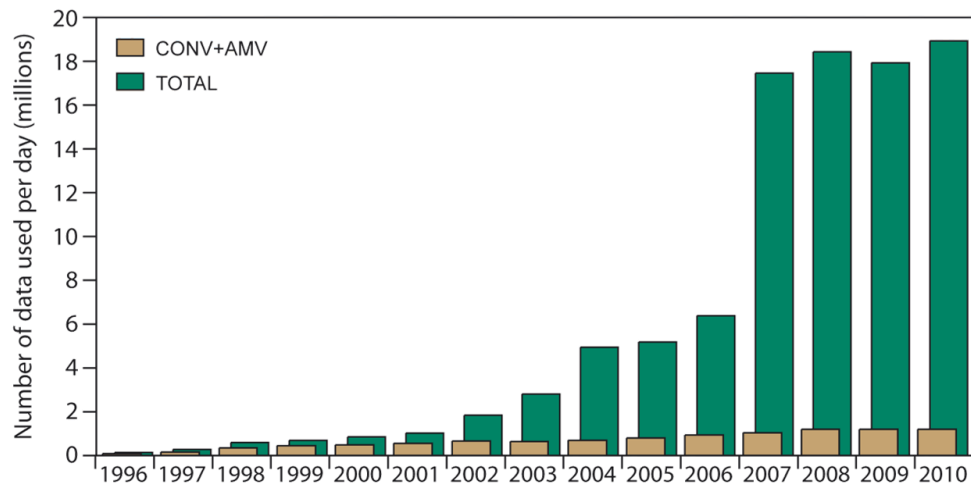
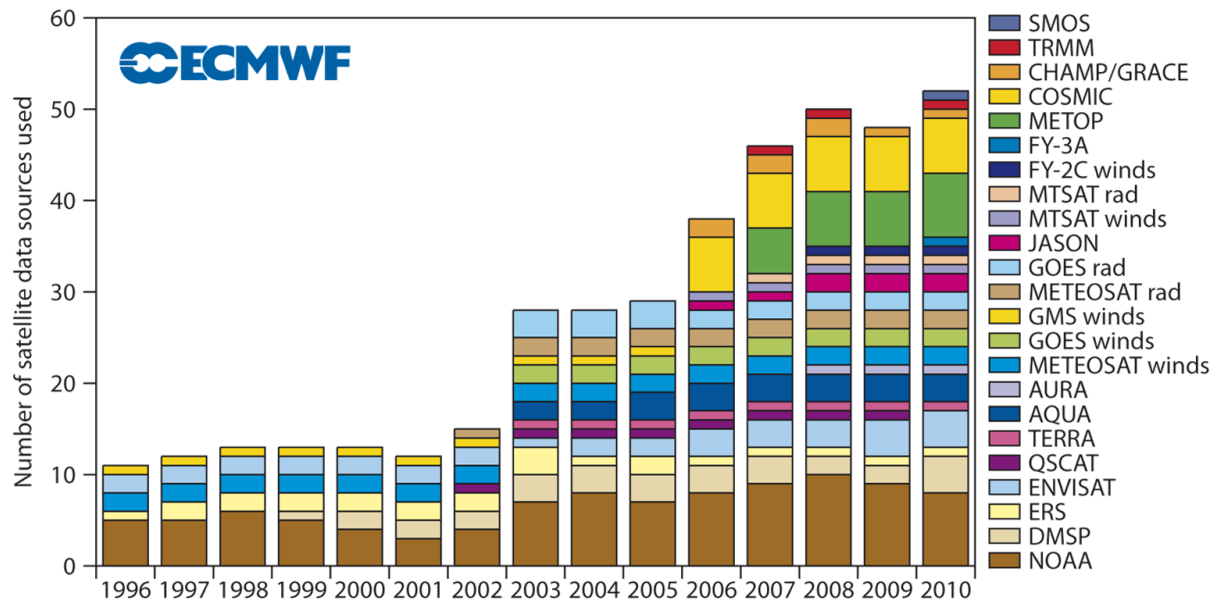
Approximately 20 million observations



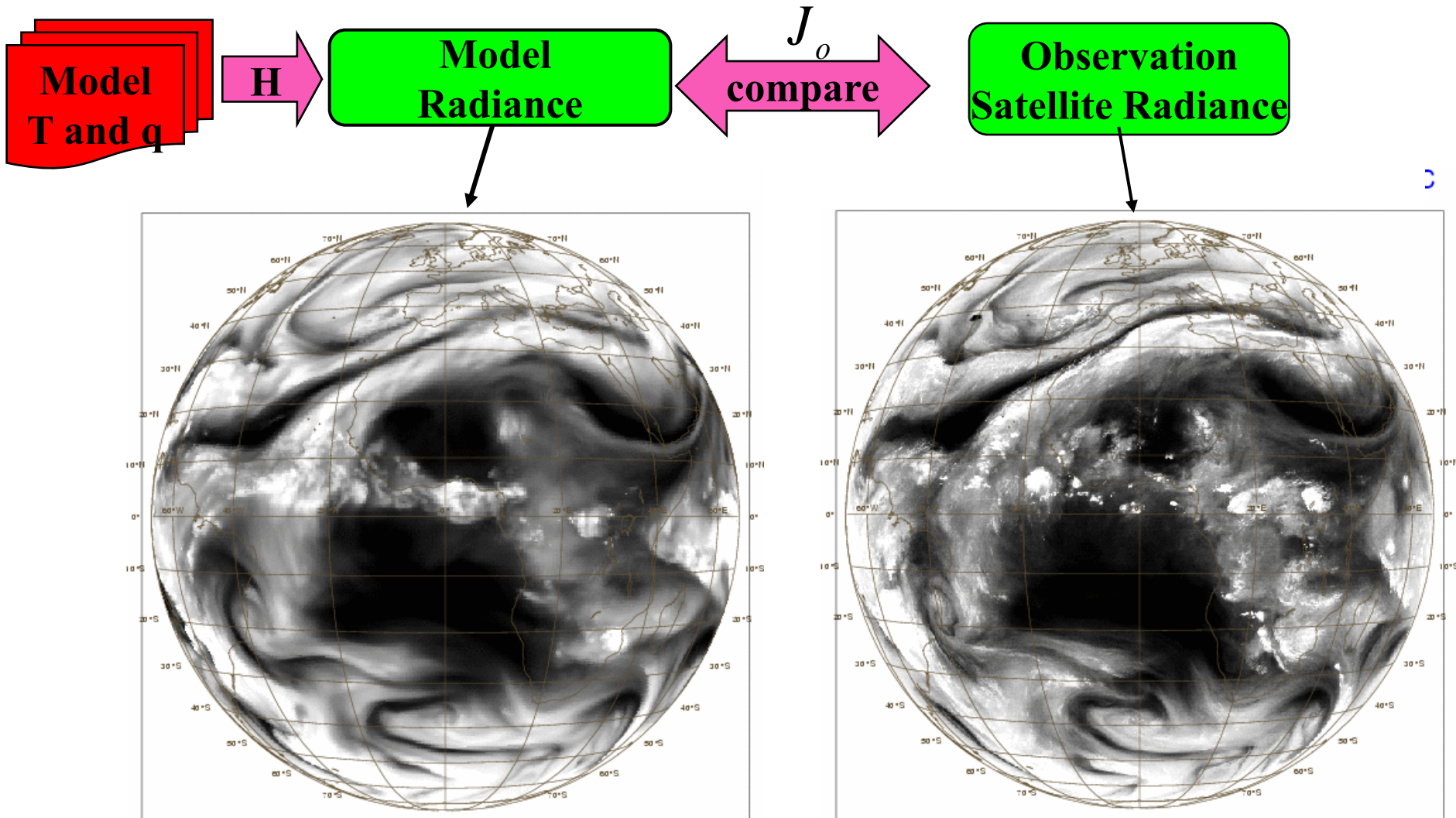
Model grid: T1279 (16 km)



Satellite data used by ECMWF

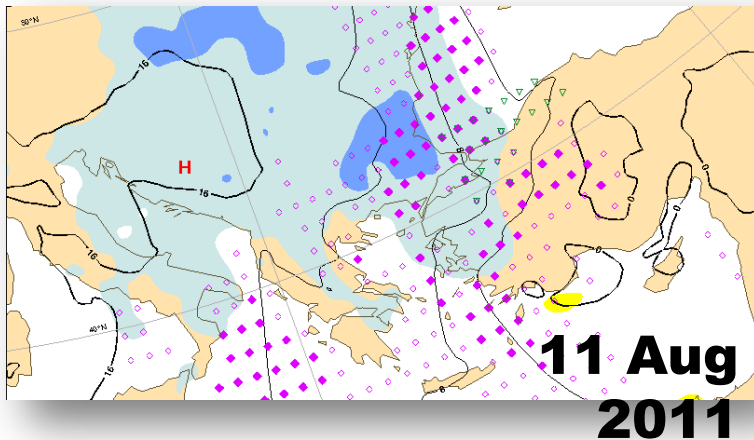


The variational method allows model radiances to be compared to observed radiances



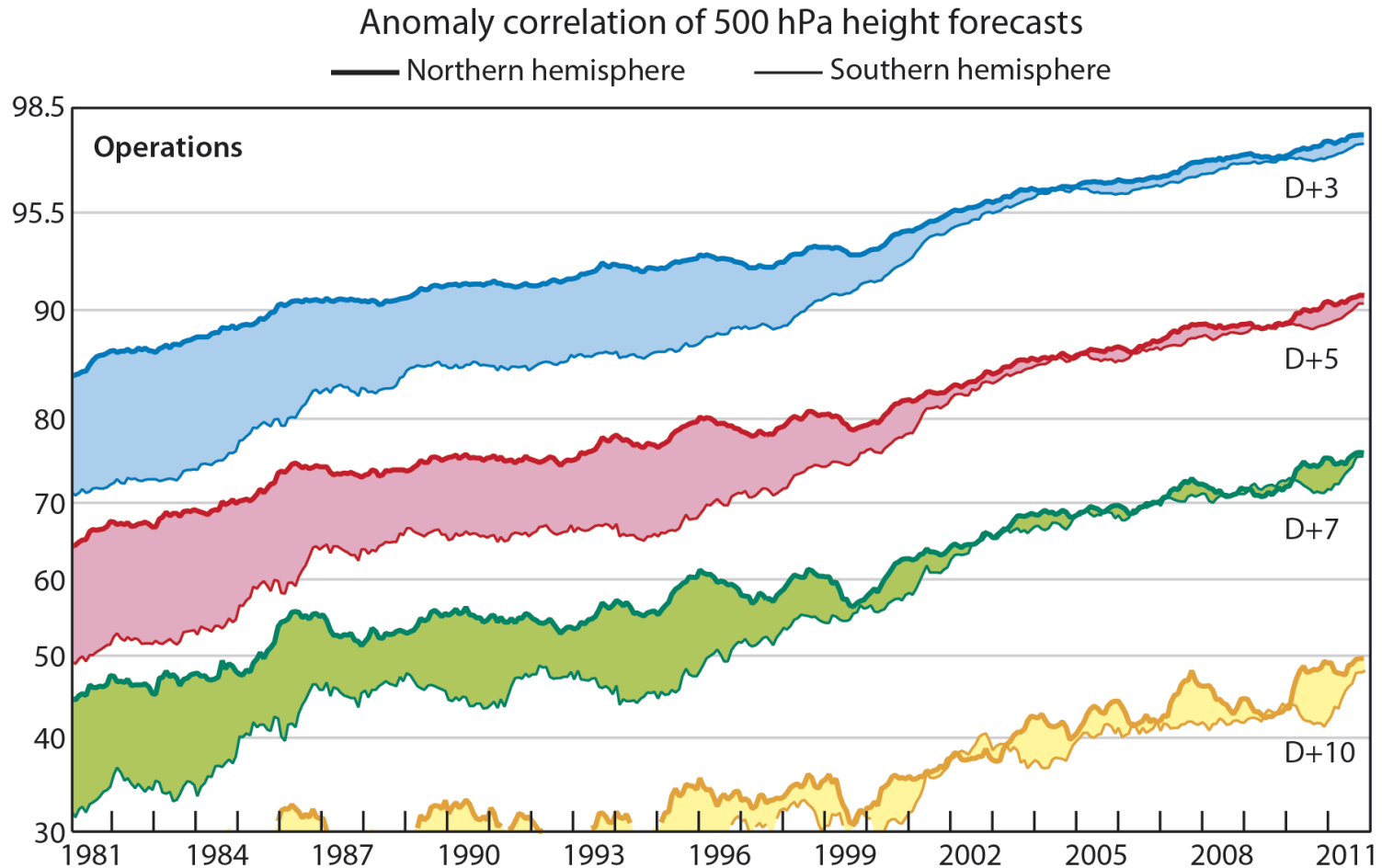
The operational forecasting system

- **High resolution forecast (HRES):** twice per day
16 km 91-level, to 10 days ahead
- **Ensemble forecast (ENS):** twice daily
51 members, 30/60 km 62-level, to 15 days ahead



- **Monthly forecast (ENS extension):** twice a week (Mon/Thursdays)
51 members, 30/60 km 62 levels, to 1 month ahead
- **Seasonal forecast (SEAS):** once a month (coupled to ocean model) 41 members, 125 km 62 levels, to 7 months ahead

Evolution of ECMWF scores comparison northern and southern hemispheres

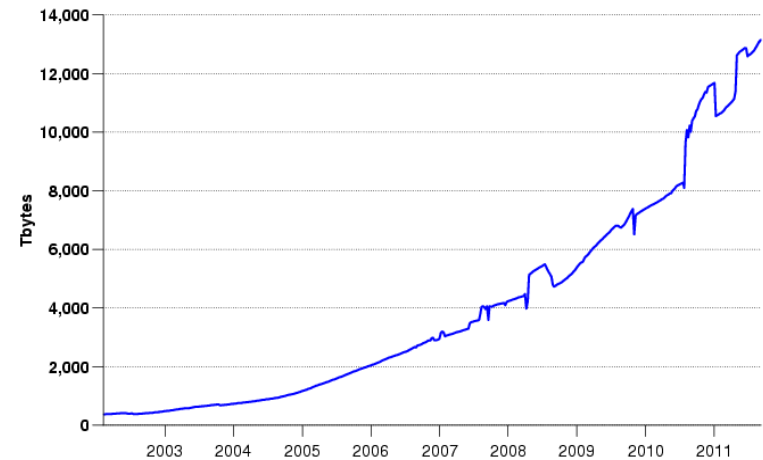


Courtesy of ECMWF. Adapted and extended from Simmons & Hollingsworth (2002)

The ECMWF archive

- The largest NWP archive worldwide
- Built since ECMWF operations started in 1979
- Holds more than 35 petabytes
- More than 40 terabytes added daily
- Contains:
 - All observations used
 - All analyses
 - All forecasts
 - Reanalyses
 - Research experiments and projects
- Accessible by registered users in the Member States

Grand Total of MARS Archive
11 February 2002 - 12 September 2011



ECMWF Objectives

- **Operational forecasting up to 15 days ahead (including ocean waves)**
- **R & D activities in forecast modelling**
- **Data archiving and related services**
- **Operational forecasts for the coming month and season**
- **Advanced NWP training**
- **Provision of supercomputer resources**
- **Assistance to WMO programmes**
- **Management of Regional Meteorological Data Communications Network (RMDCN)**

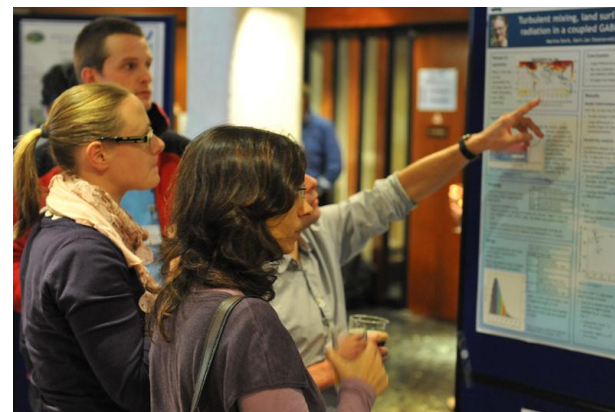
ECMWF – other activities

- **Reanalyses (ERA-15, ERA-40, ERA-Interim)**
- **Boundary conditions for Limited Area Models (LAM)**
- **Data Services**
 - ➔ **Provision of real-time data**
 - ➔ **Provision of archived data and products**
 - ➔ **Provision of software**

Education and training

● Training Courses

- Numerical methods
- Data assimilation & use of satellite data
- Parametrization of diabatic processes
- Predictability, diagnostics and long-range forecasting
- Use and interpretation of ECMWF products
- Computer user training courses



● Seminars

- Research Seminar
(on 'Data assimilation for atmosphere and ocean' in 2011)
(**Seasonal Prediction: Science and Applications in 2012**)
- Meteorological Operational Systems (biennial)
- Large-scale Computing (biennial)

● Workshops

A photograph of a snowy outdoor environment. In the foreground, a paved path leads towards a building with a stone facade and vertical wooden slats. The ground is covered in snow, and there are some people walking in the distance. The overall scene is bright and wintry.

A warm welcome to all participants!

- **The forecasting systems: observations & models**
- **Operational forecasting / Lab Sessions**
- **Discussion and exchange of ideas**

ECMWF Products – for NMHSs of WMO members

- **Services**

Conventional GTS, ftp data downloads, WEB plots, EUMETCast

- **Data resolution**

0.5° × 0.5° global, (tropic belt for vorticity and divergence parameter)

- **“Essential” Products**

MSL pressure

850 hPa temperature and winds

500 hPa geopotential height

EPS mean and standard deviation of all above parameters

Validity: Analysis, 24, 48, 72, 96, 120, 144, 168, 192, 216, 240 hour forecasts

- **Frequency**

Twice per day, based on 00 and 12 UTC data

- **Format**

WMO FM92-Ext GRIB edition 2

ECMWF Products – for NMHSs of WMO members

- **“Additional” Products**

700, 500, 200 hPa winds

850, 700 hPa Relative Humidity

700 hPa vorticity and divergence

Significant wave height, wave mean period, wave mean direction

EPS event probabilities total precipitation >10/20 mm, 10m wind gusts >15/25m/s,
significant wave height > 2/4/6/8m

Seasonal System sea surface temperature anomalies

Tropical Cyclone Tracks (WMO FM-92 BUFR)

- **Products only available as WEB Products**

Extreme Forecast Indices

EPSgrams (site specific forecasts of near surface weather parameters up to 10 days)