# Met Office Forecasting

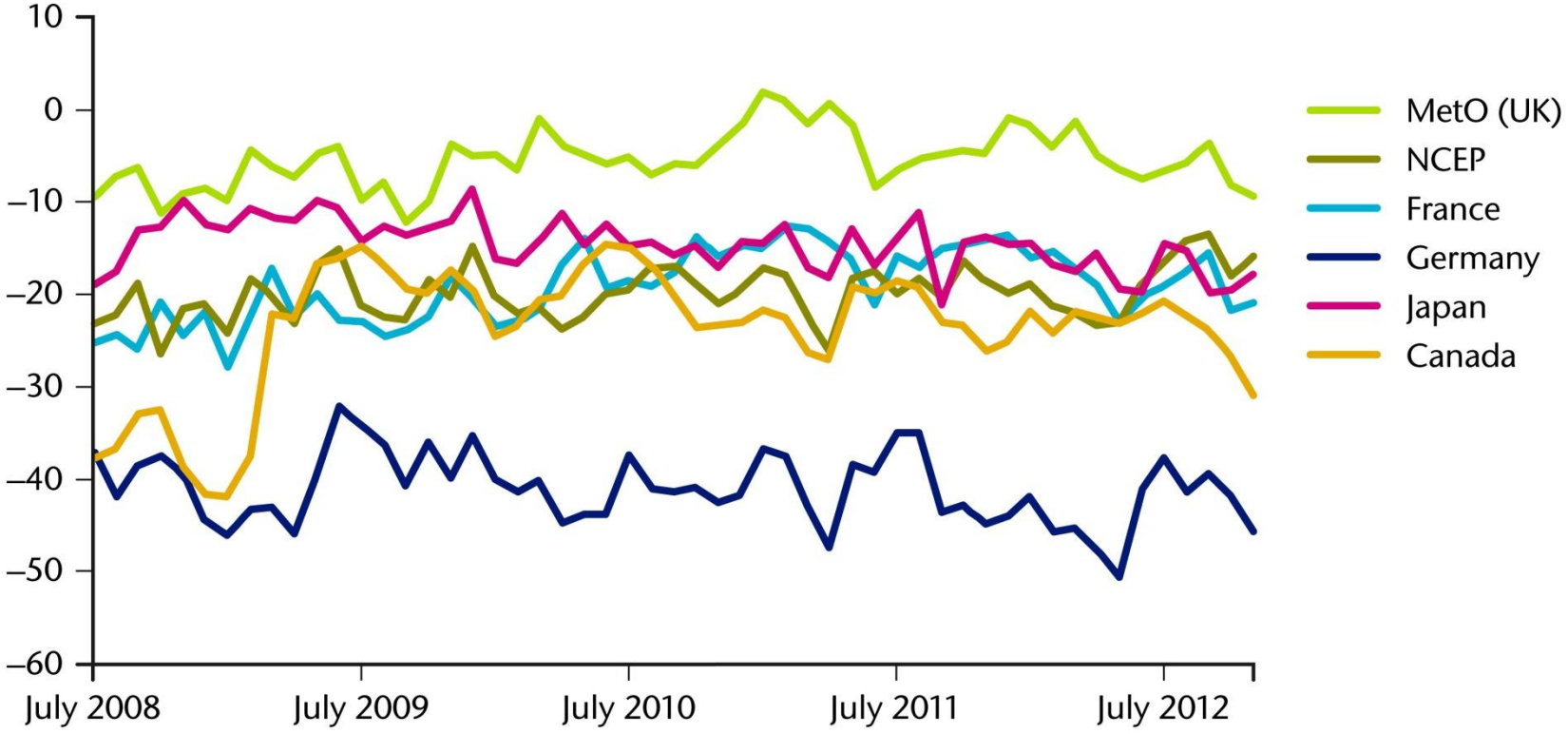
Dr Teil Howard – Senior Applied Scientist

# Who are we?

- **A world-leading weather and climate service, working closely with governments, individuals and organisations to share our expert scientific knowledge and advice**
- **A Trading Fund within the UK government Department for Business Innovation and Skills, operating on a commercial basis with customers across the world**
- **Over 500 scientists working across weather and climate science**
- **Scientific papers co-authored with scientists from 144 institutions across 44 countries - peer reviewed and published**
- **Over 300 qualified forecasters working in our operations centre**

# Our performance - how we compare to other National Met Services

Verification results plotted as a percentage difference to ECMWF



# Wind Production Forecast

# Wind Production Forecast

- WPF: A site specific forecast at customer defined height for wind farms
- WPF+: An upgraded version of WPF that uses customer observations to provide a more accurate forecast using basic nowcasting and Kalman filtering
- Customer obs can be protected so that they will not be used to improve another customer's forecast

# Wind Production Forecast

Blended data:

- More accurate
- Hourly data to T+14 days

Single models:

- Historic data available
- Usually Euro4
  - Hourly to T+57 hours 4 times a day
  - 3 hourly to T+120 hours 2 times a day

# Parameters

Surface/near surface:

- 10m wind speed and direction
- Shortwave radiation
- Mean sea level pressure
- Screen temperature
- Precipitation
- Sensible heat flux
- Lightning risk
- ….

Hub height:

- Wind speed
- Wind direction
- Wind gust
- Temperature
- Pressure
- Air density
- Relative humidity

# Probabilistic Wind Production Forecast

Percentiles:

- 2.5%, 5%, 10%, 20%, 25%, 30%, 40%, 50%, 60%, 70%, 75%, 80%, 90%, 95%, 97.5%

Other fields:

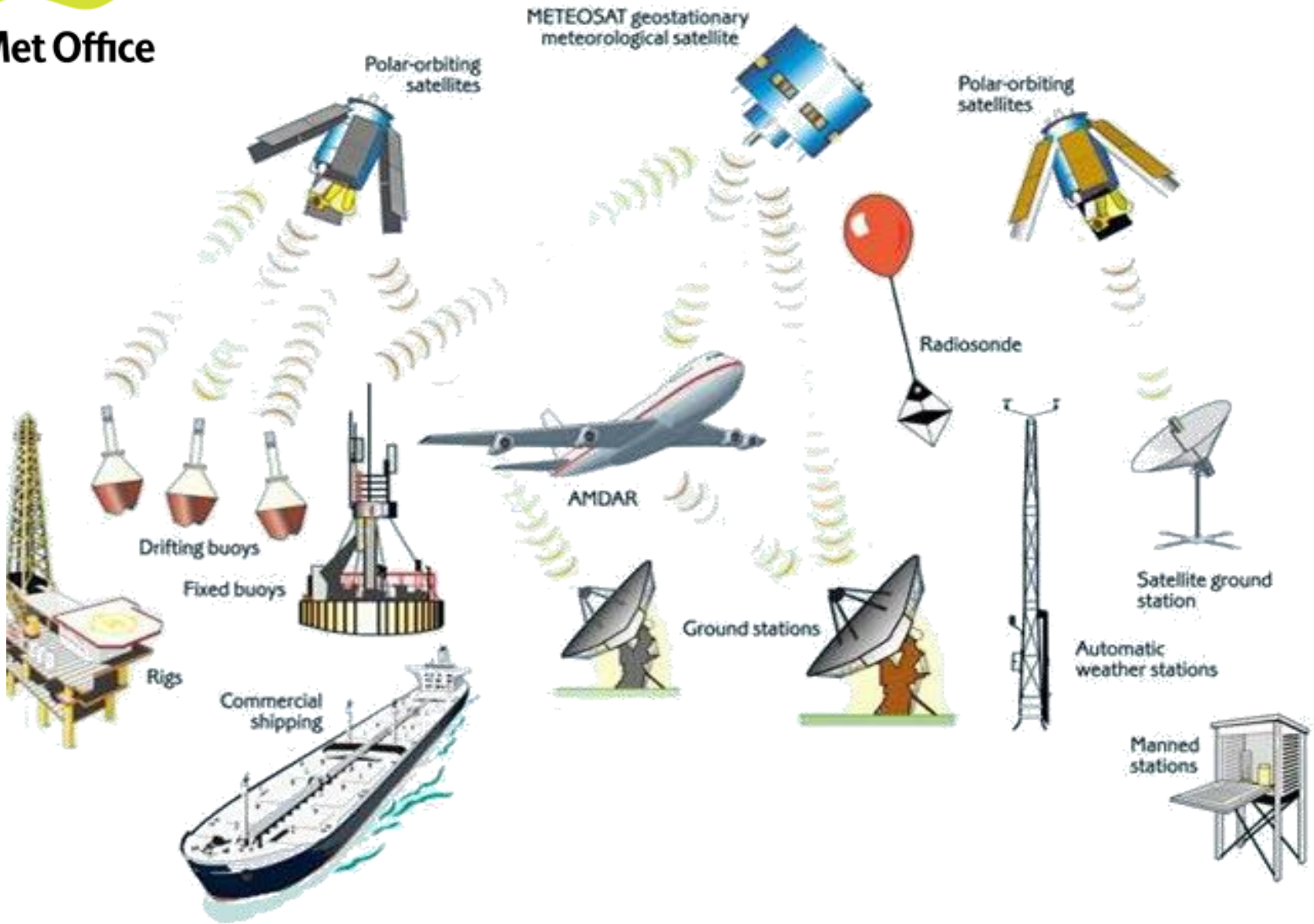
- Mean
- Mode
- Standard deviation

Time granularity:

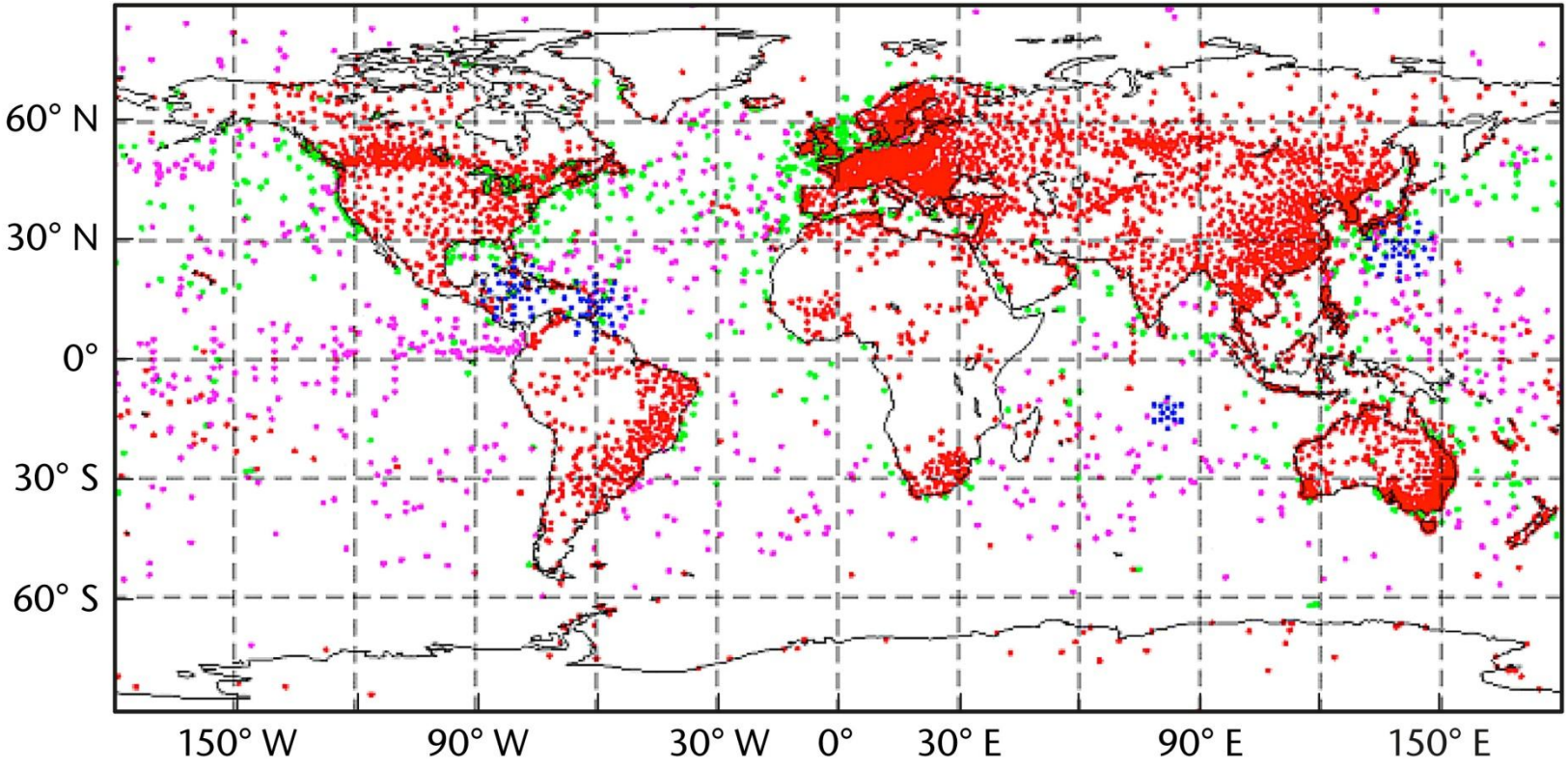
- Hourly to T+120 hours the 6 hourly to T+14 days

# How do we produce the forecast?

# Observations



# Our observations - Surface



# Supercomputer upgraded 2012

## IBM Power 775 supercomputer

- Peak performance is now 1,200,000,000,000,000 (1,200 trillion) calculations per second
- Equivalent to about 30,000 desktop PCs
- Storage for 40,000,000 gigabytes of data
- Equivalent to 50 million CDs or 750 million 4-drawer filing cabinets

# Our deterministic NWP models

**Global**

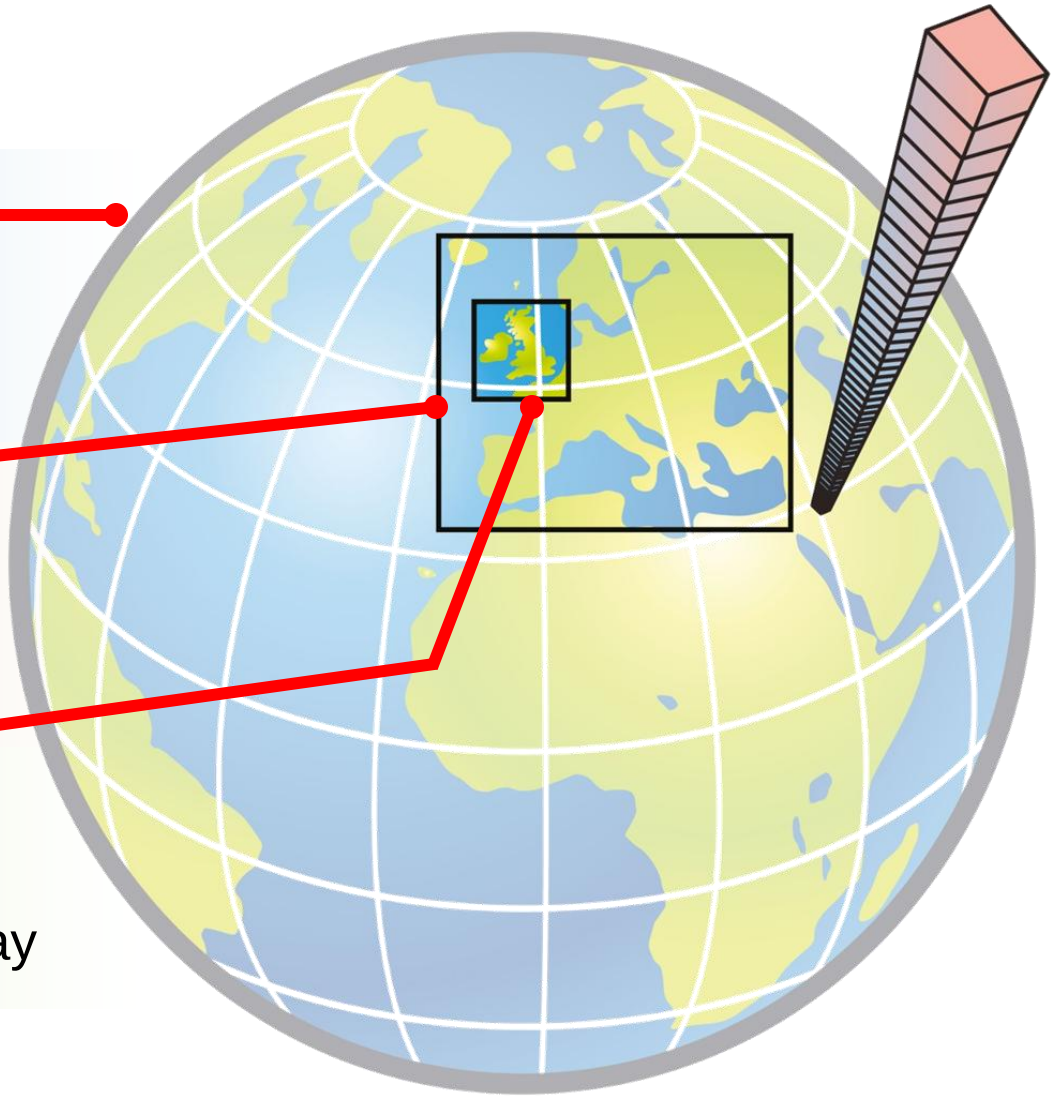
- 25km 70 Levels
- 48hr forecast twice/day
- 144hr forecast twice/day

**Euro4**

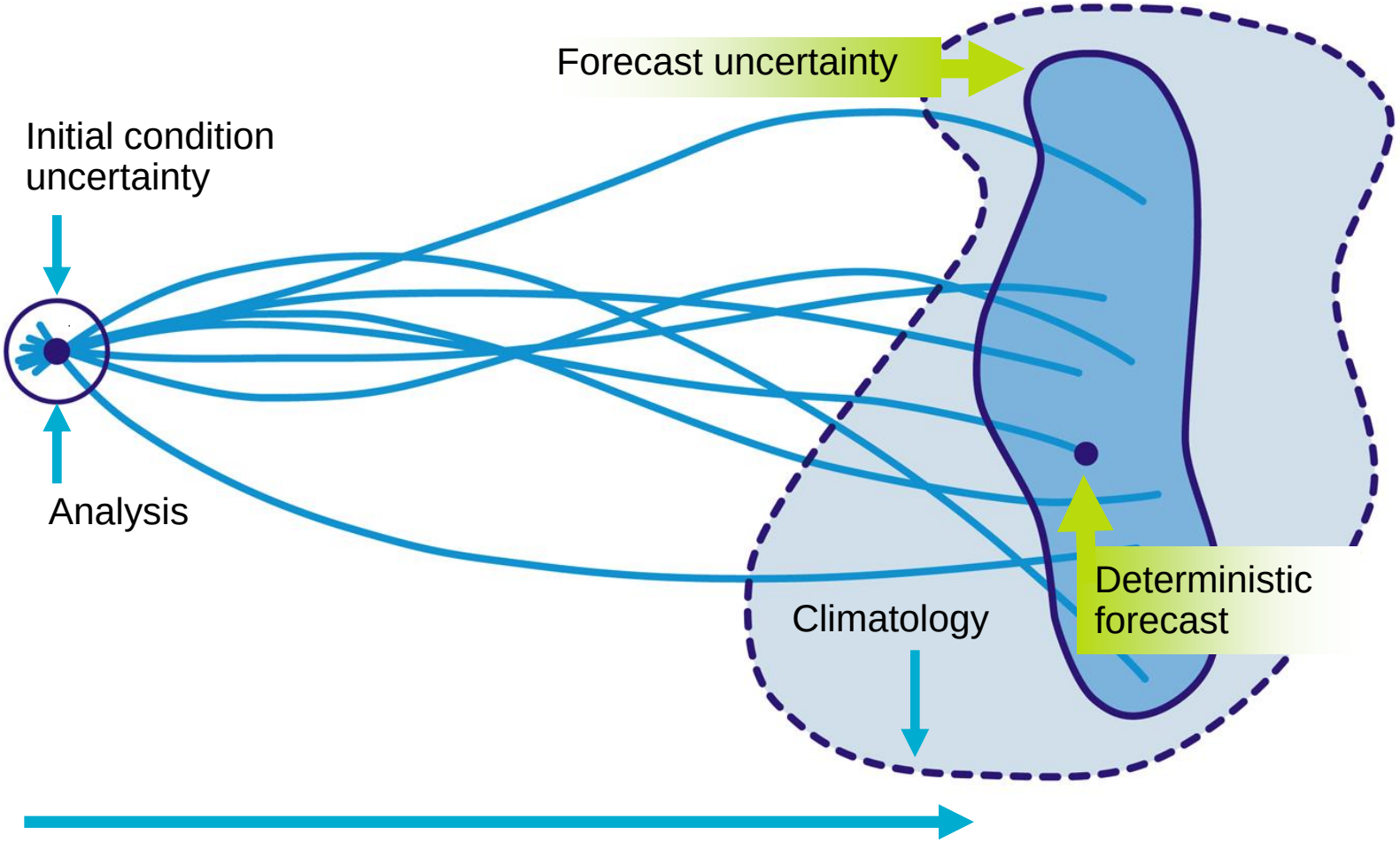
- 4km 70 Levels
- 60hr forecast twice/day
- 120hr forecast twice/day

**UKV**

- 1.5km 70 Levels
- 36hr forecast eight times/day



# Ensembles



# Our probabilistic NWP models

**MOGREPS-15**

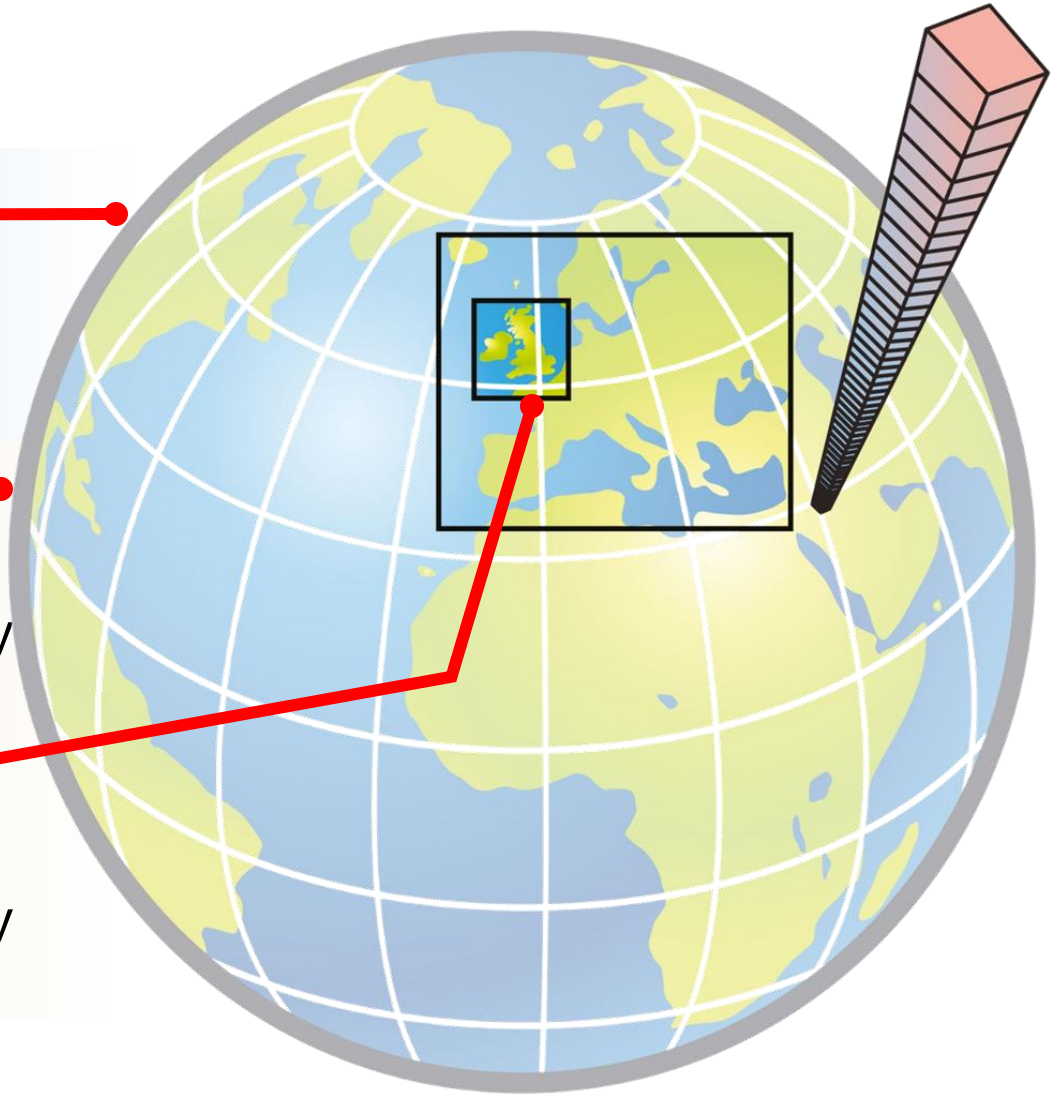
- 60km 70 Levels
- 15 day forecast twice/day
- 24 members

**MOGREPS-G**

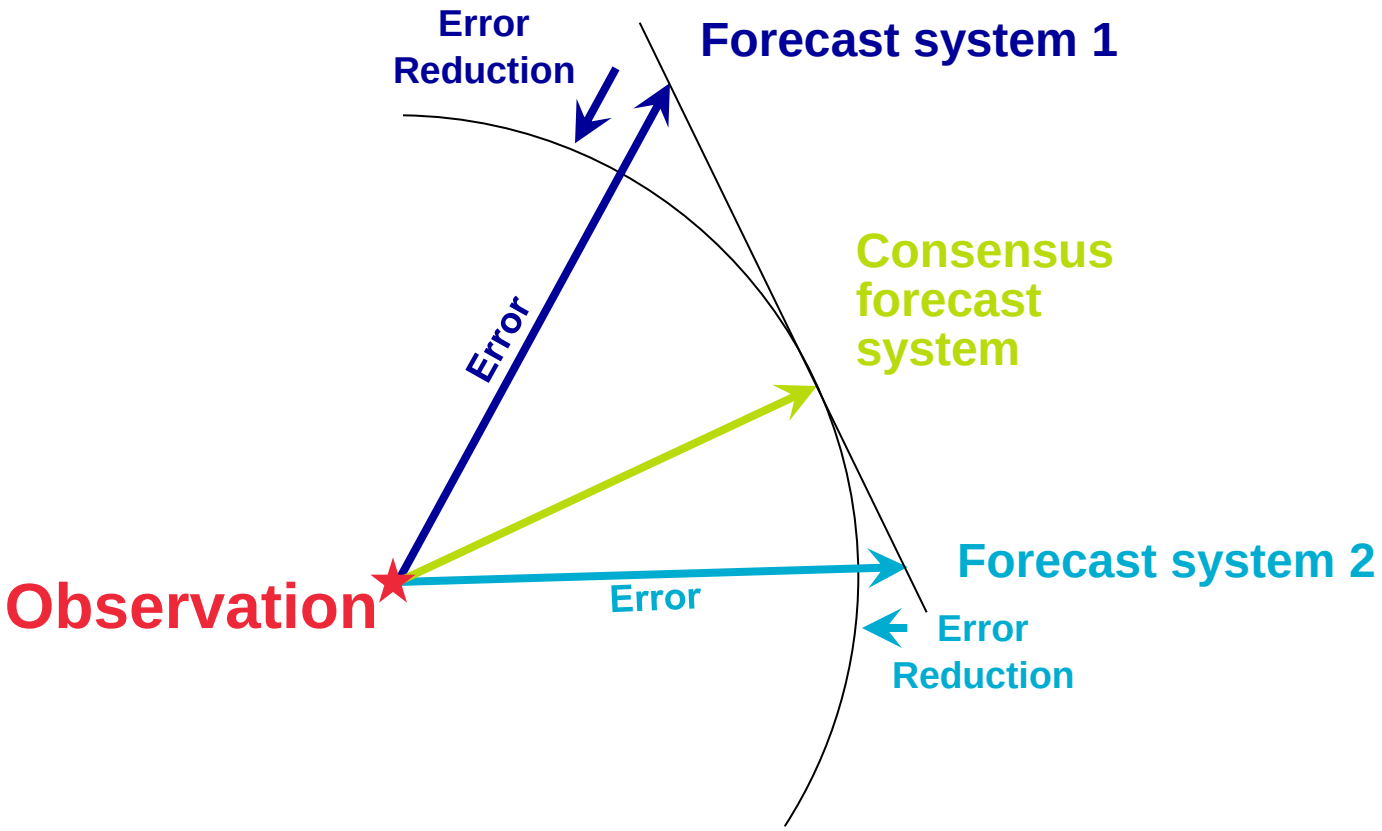
- 32km 70 Levels
- 72hr forecast four times/day
- 12 members

**MOGREPS-UK**

- 2.2-4km 70 Levels
- 36hr forecast four times/day
- 12 members



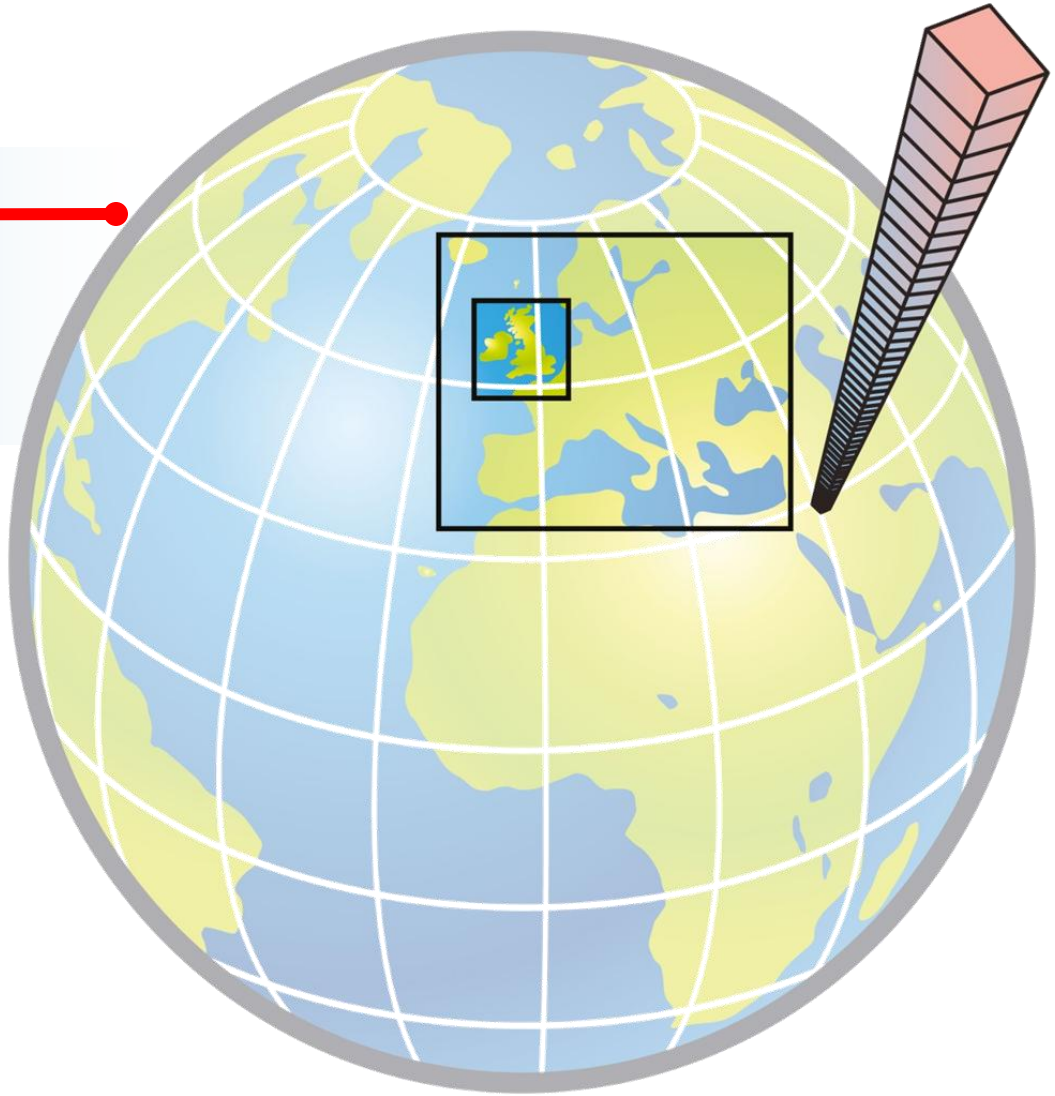
# Combining forecast systems



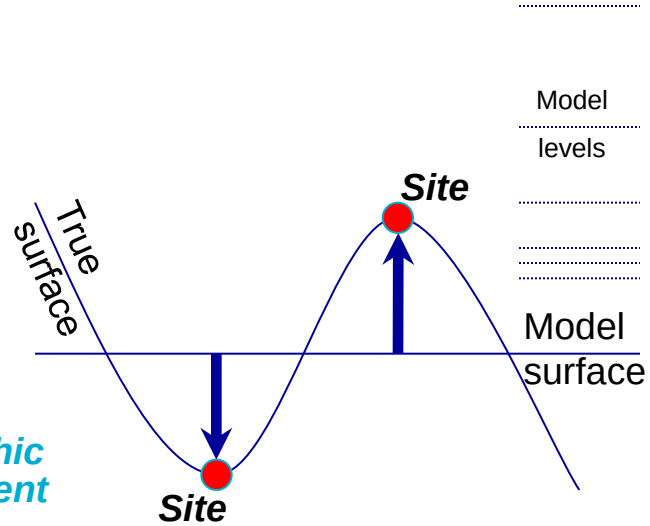
# Models from other centres

**ECMWF**

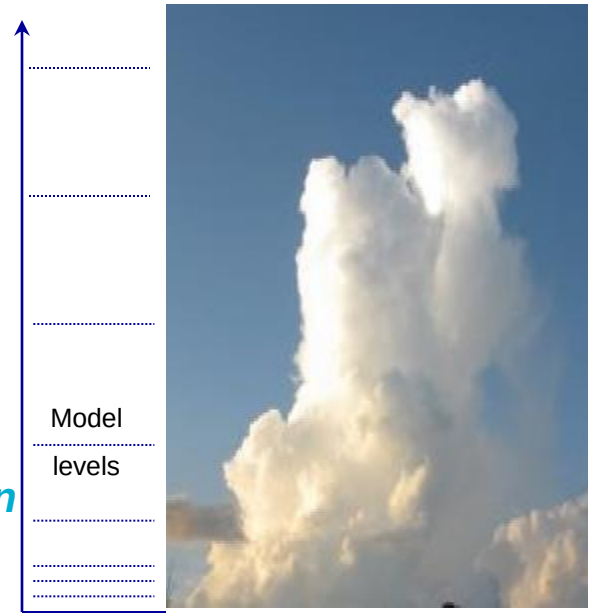
- 16km 137 Levels
- 15 day forecast twice/day
- 51 members



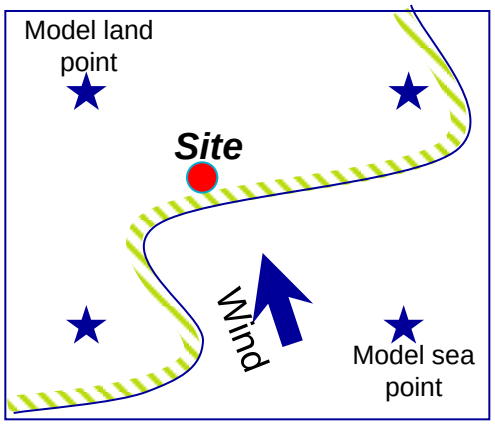
# Site specific processing




***Orographic Adjustment***

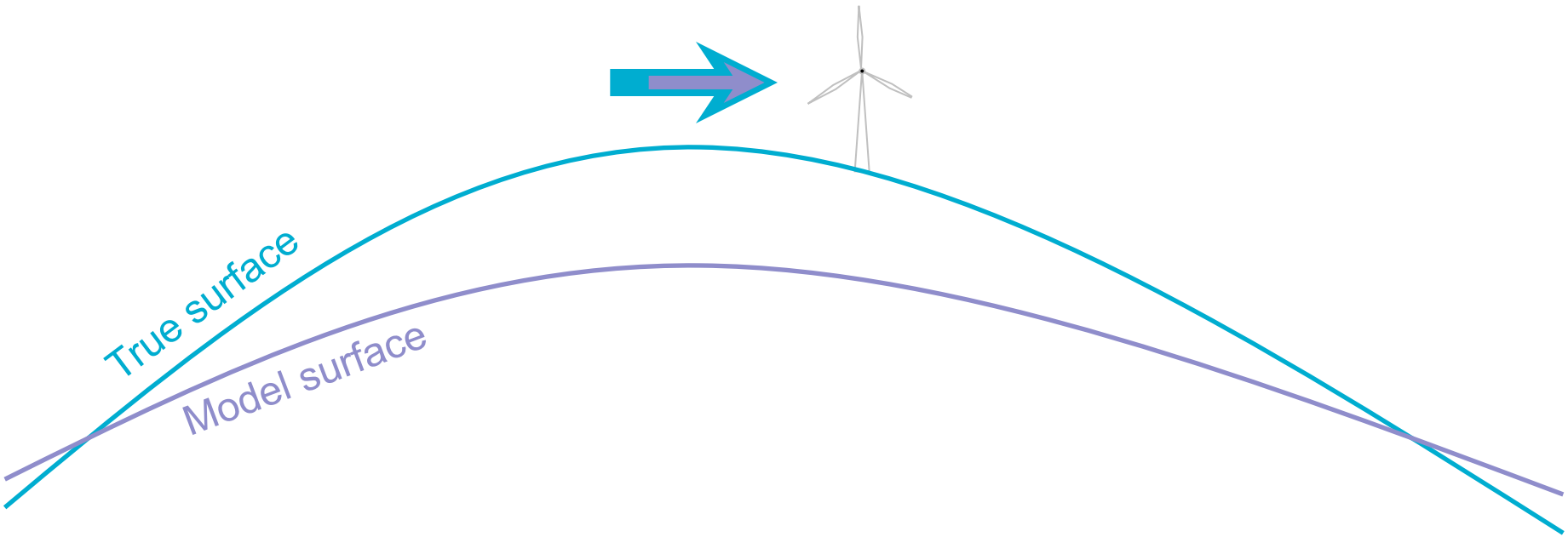



***Convection Diagnosis Procedure***



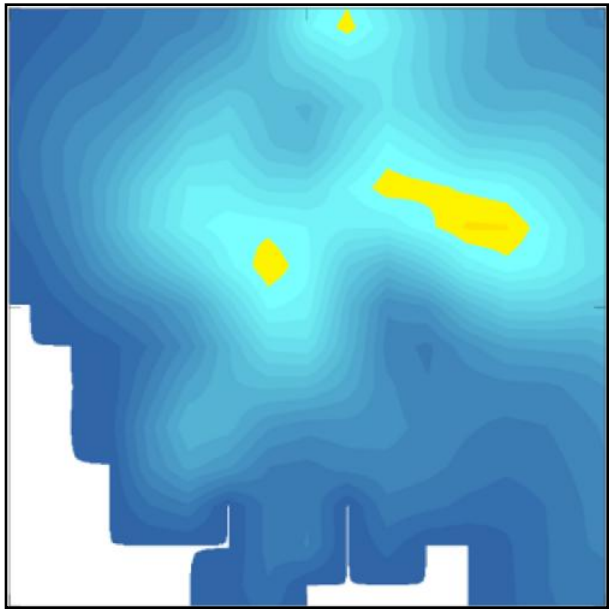

***Coastal Adjustment***

# Wind corrections

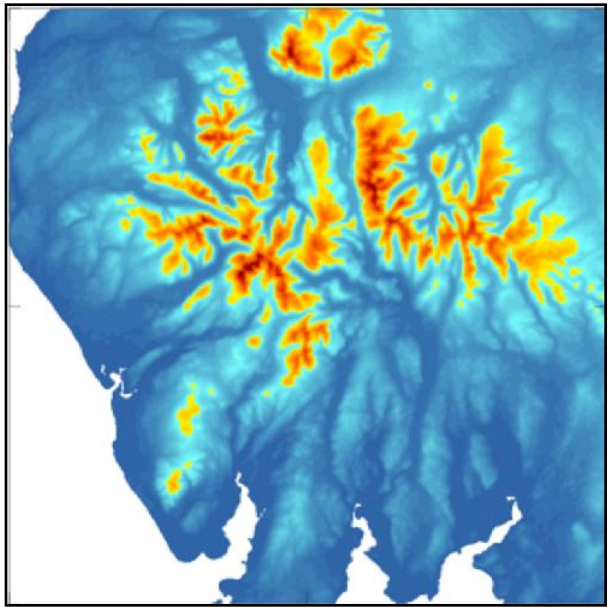


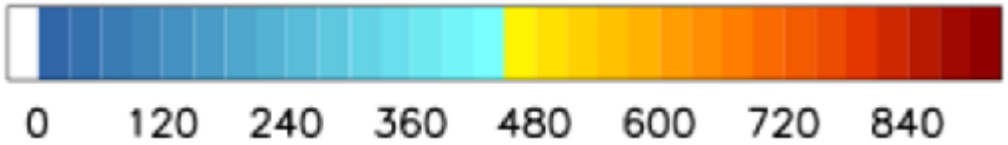
# Example: The Lake District

4 km model orography



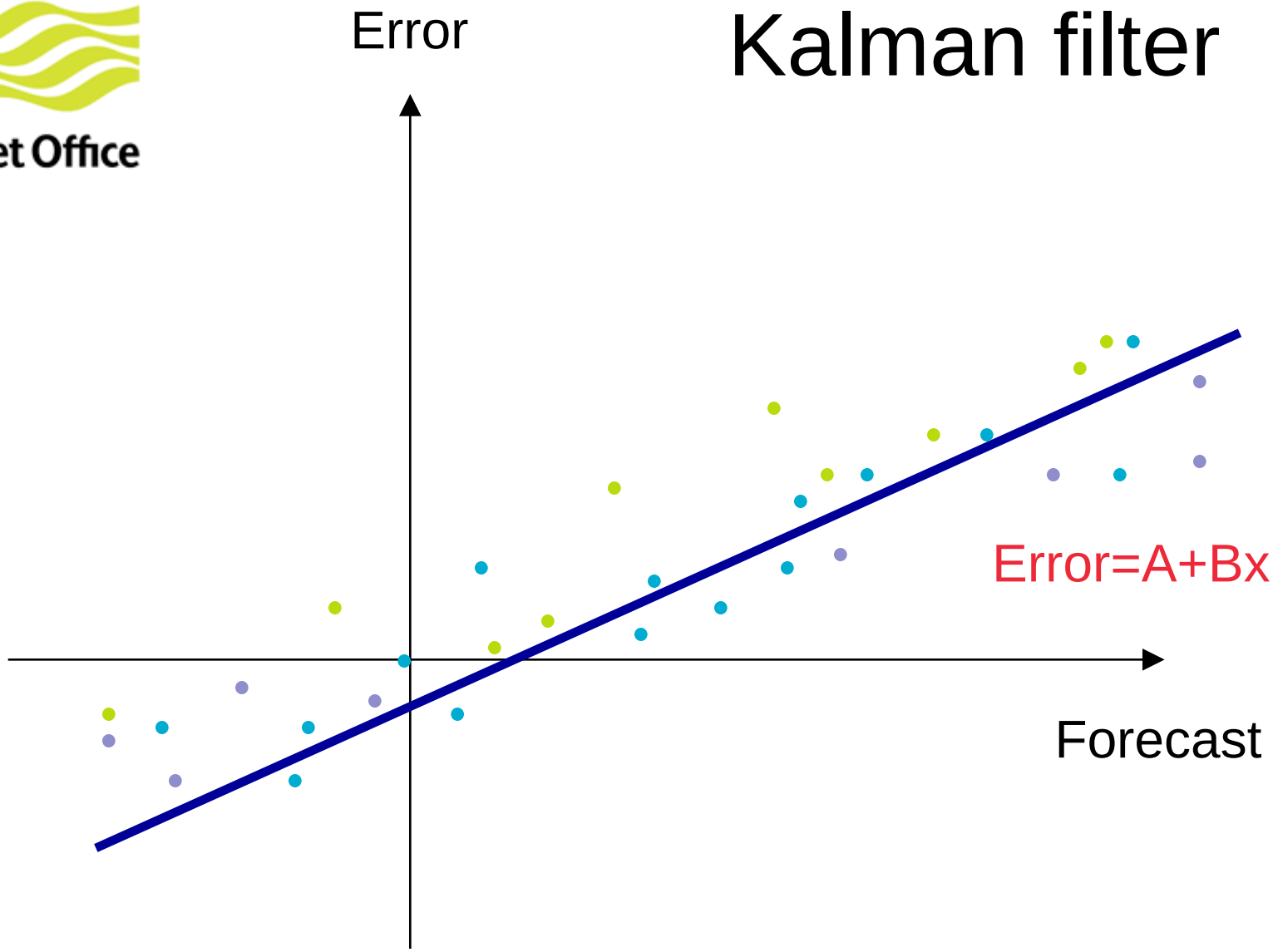
Terrain at 100 m resolution



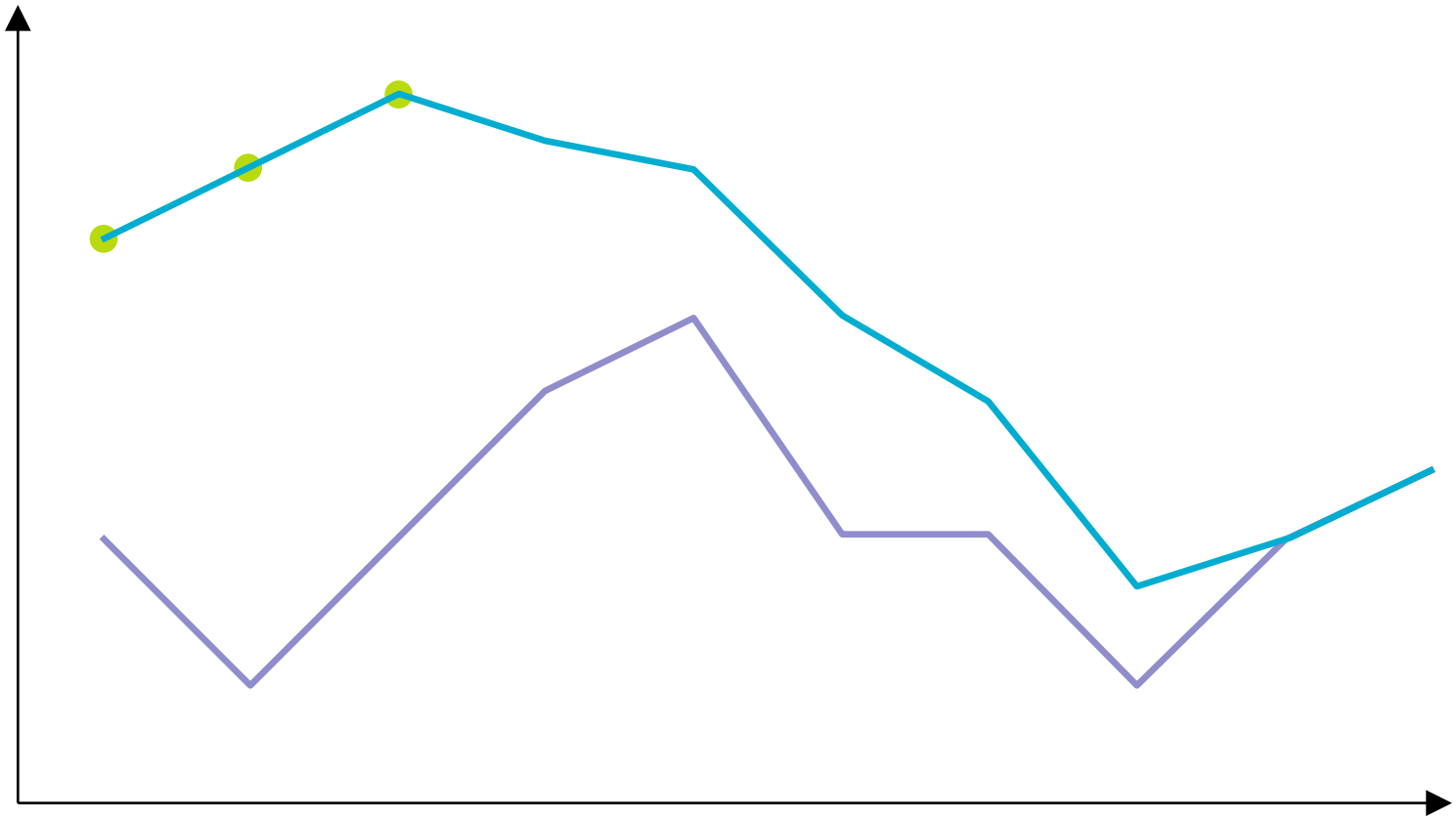



**Height in Metres**

# Kalman filter



# Basic nowcasting



Raw forecast + observations = Basic Nowcast

# Questions