



ECMWF 2016-2025 strategy: moving towards seamless ensembles

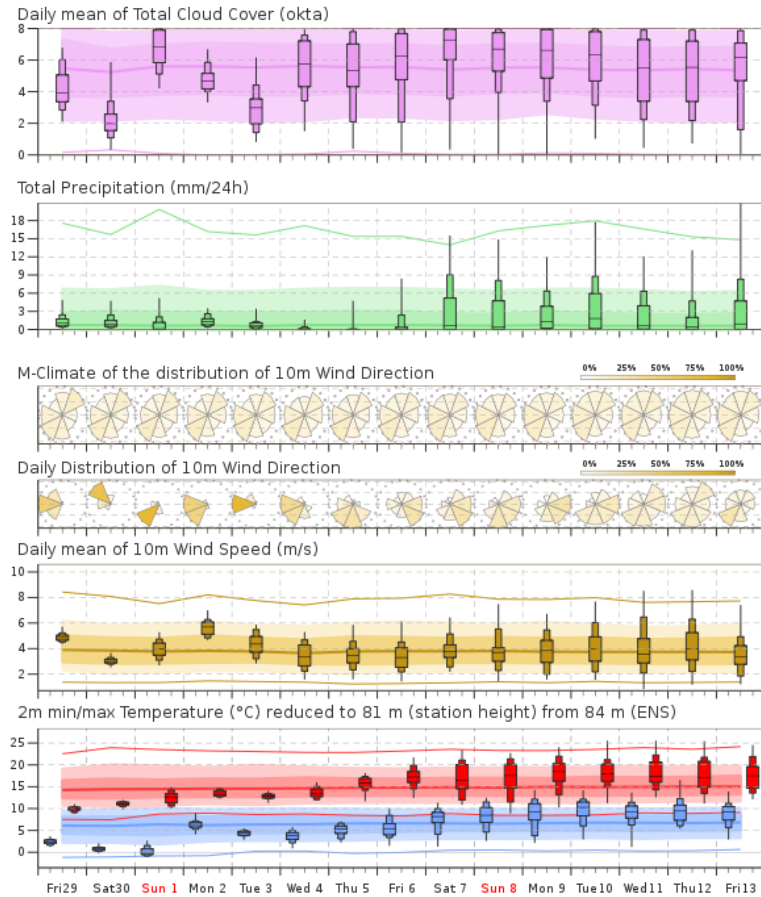
Peter Bauer, Andrew Brown, Roberto Buizza and Florence Rabier



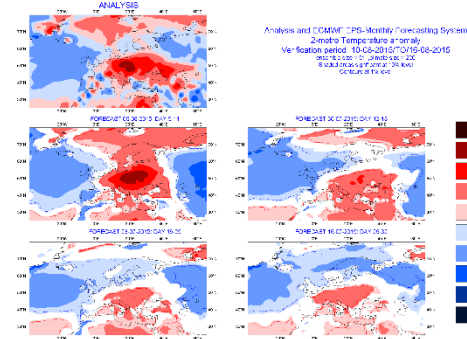
April 9, 2018

ECMWF FOCUS is on forecasts valid from 1 day to 1 year

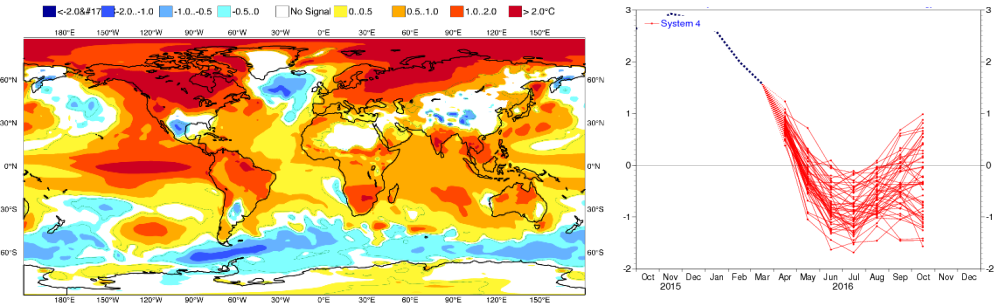
Medium-range



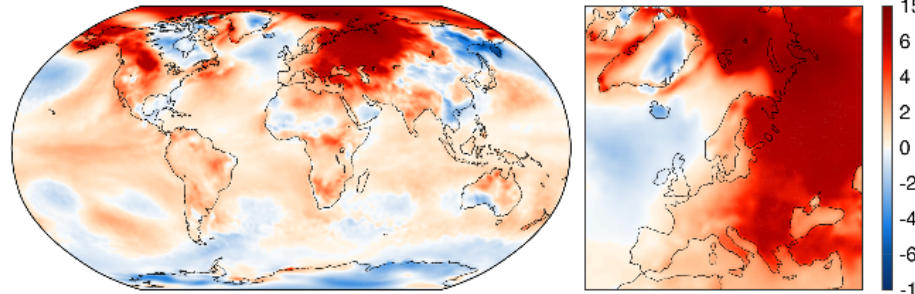
Monthly



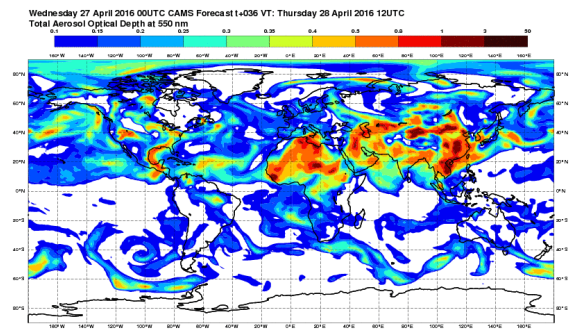
Seasonal



Global averages (climate indicators)

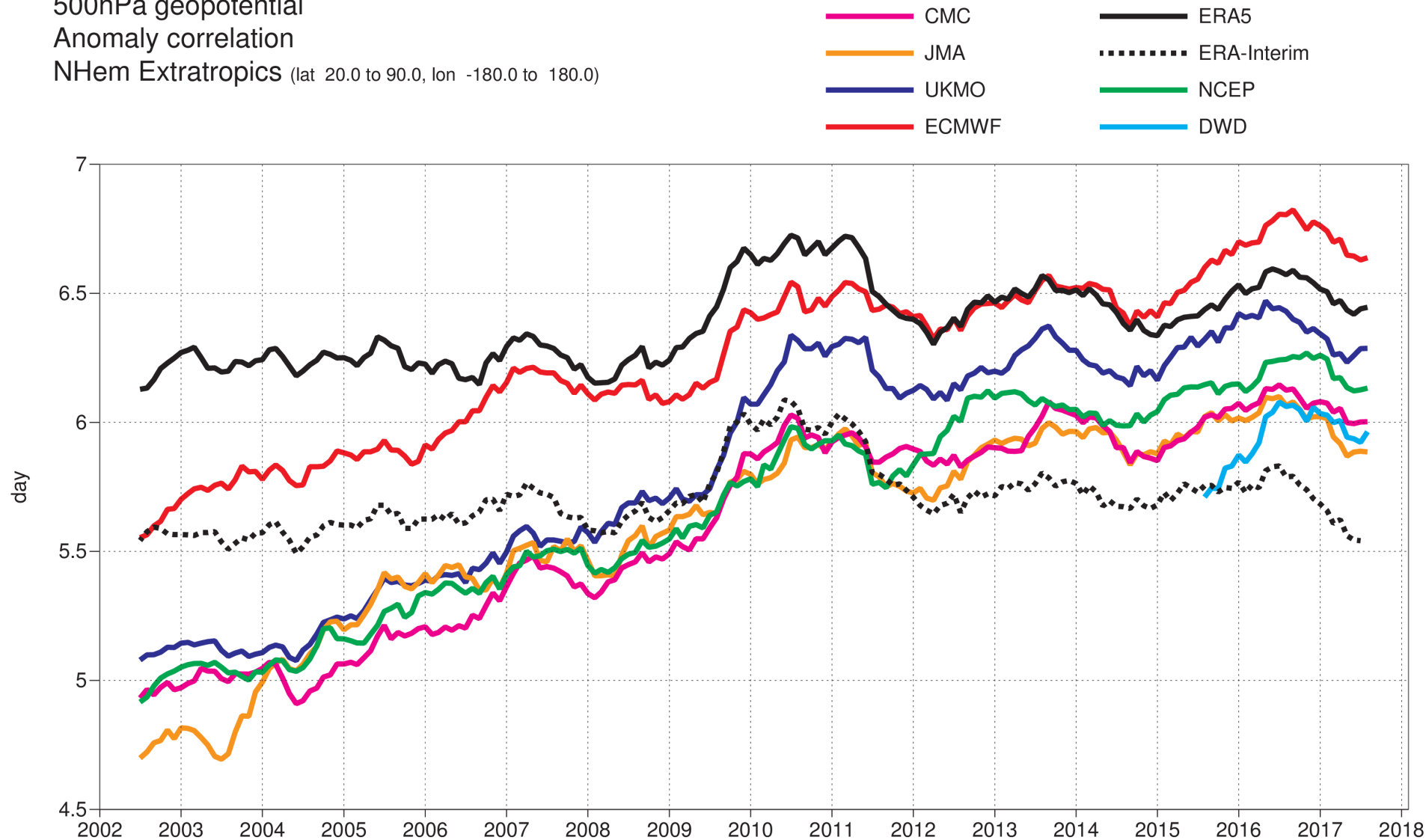


Aerosols Optical Depth



ECMWF aims for continuous improvements (the HRES)

500hPa geopotential
Anomaly correlation
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

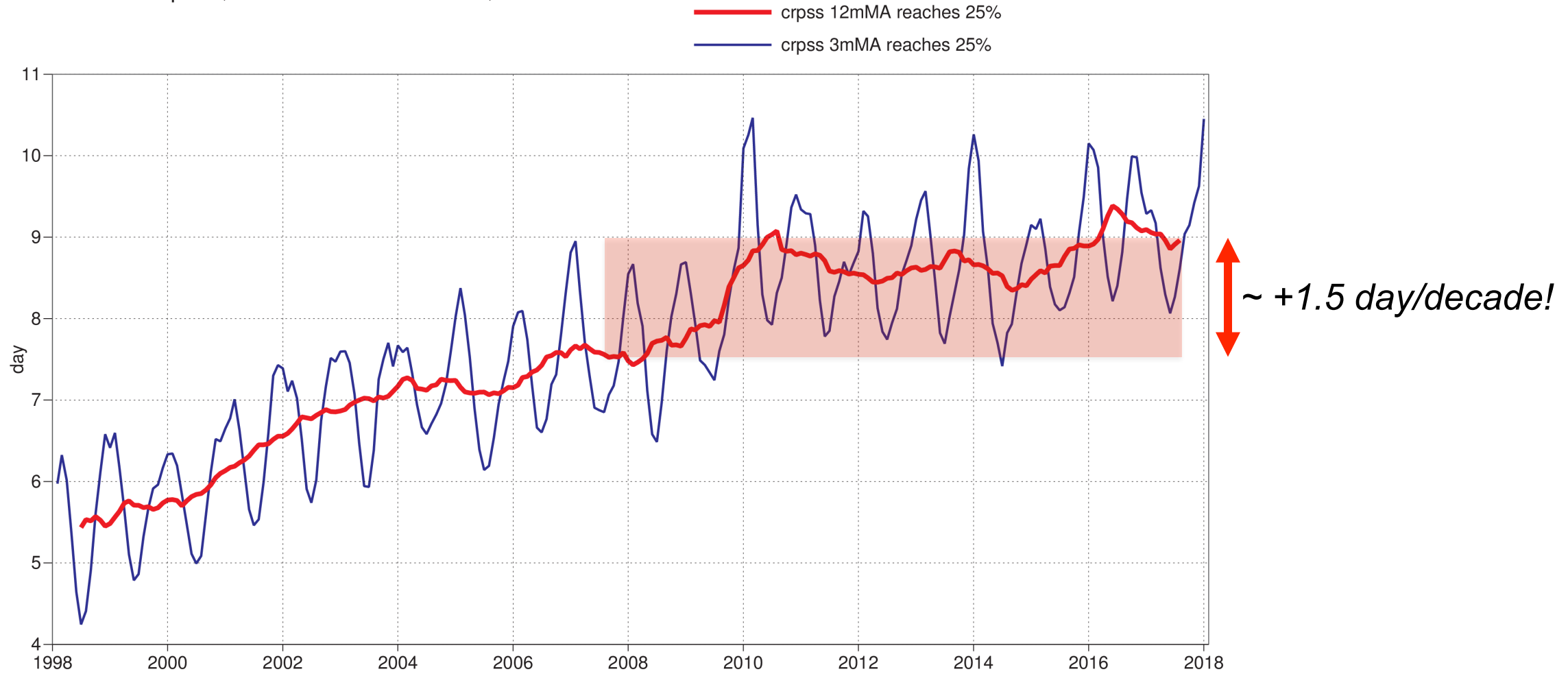


ECMWF aims for continuous improvements: ENS medium-range

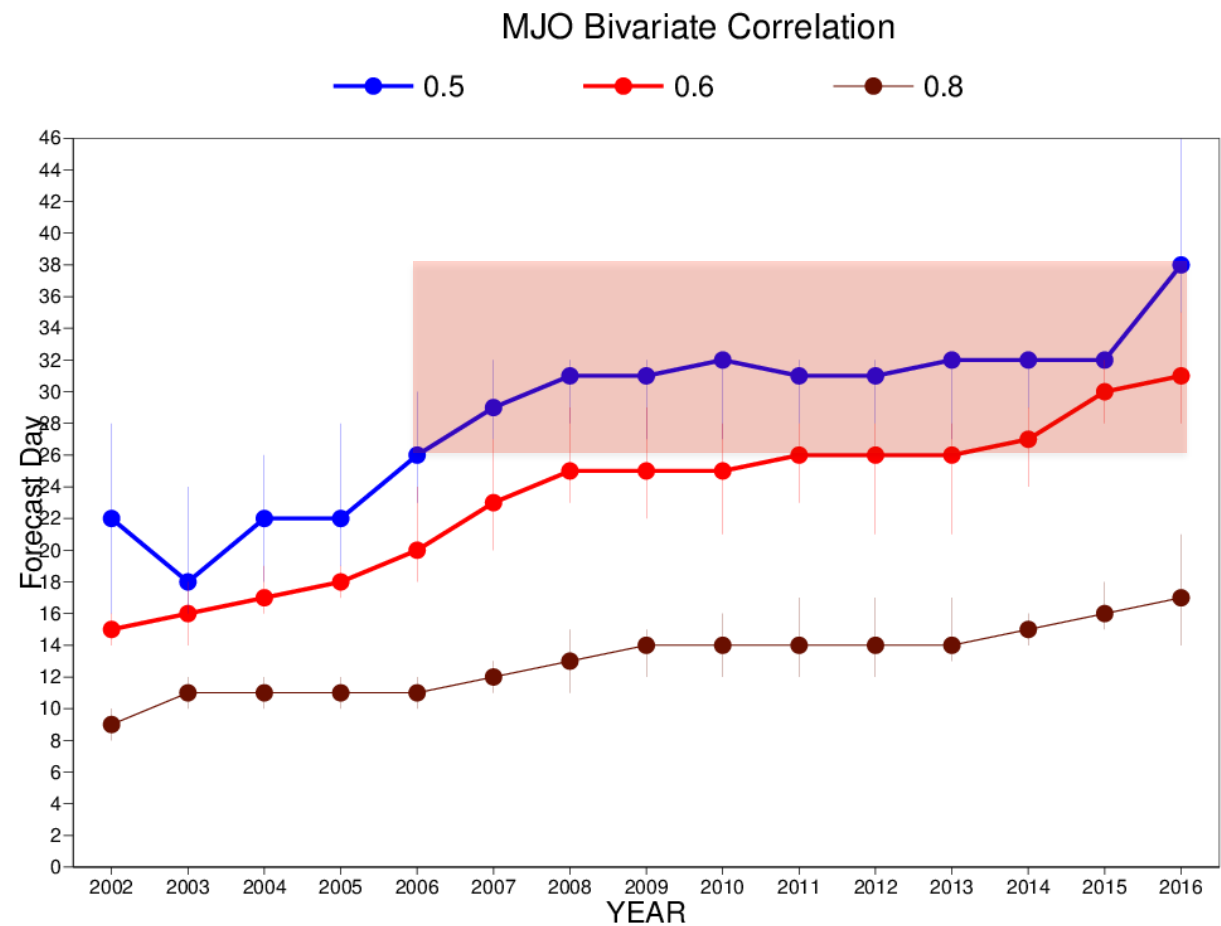
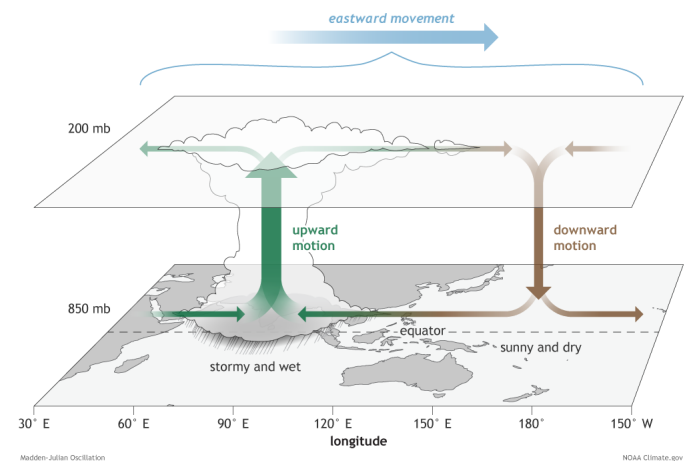
850hPa temperature

Lead time of Continuous ranked probability skill score reaching 25%

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)



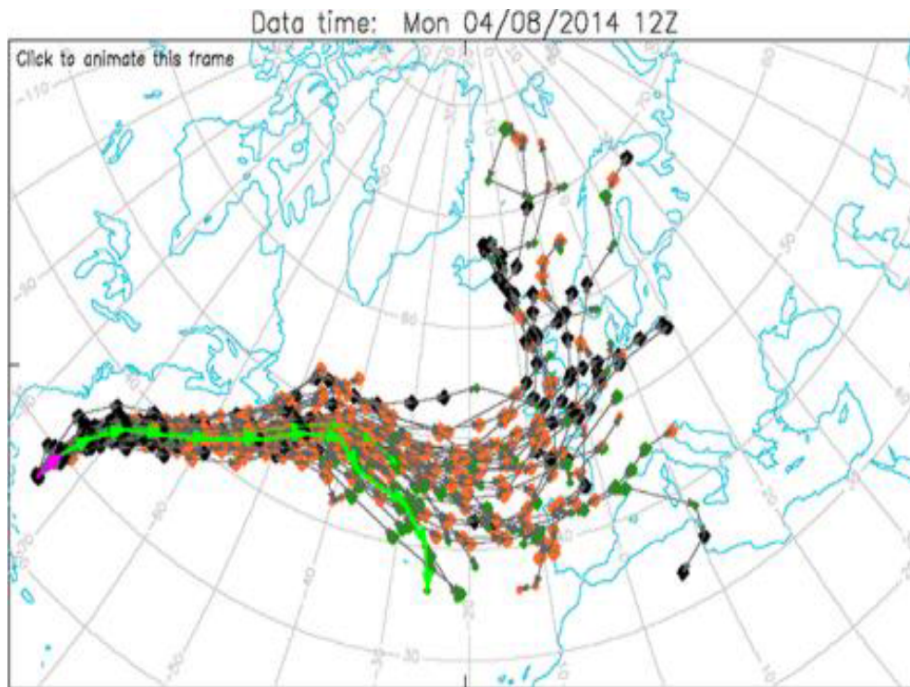
ECMWF aims for continuous improvements: ENS monthly fcs



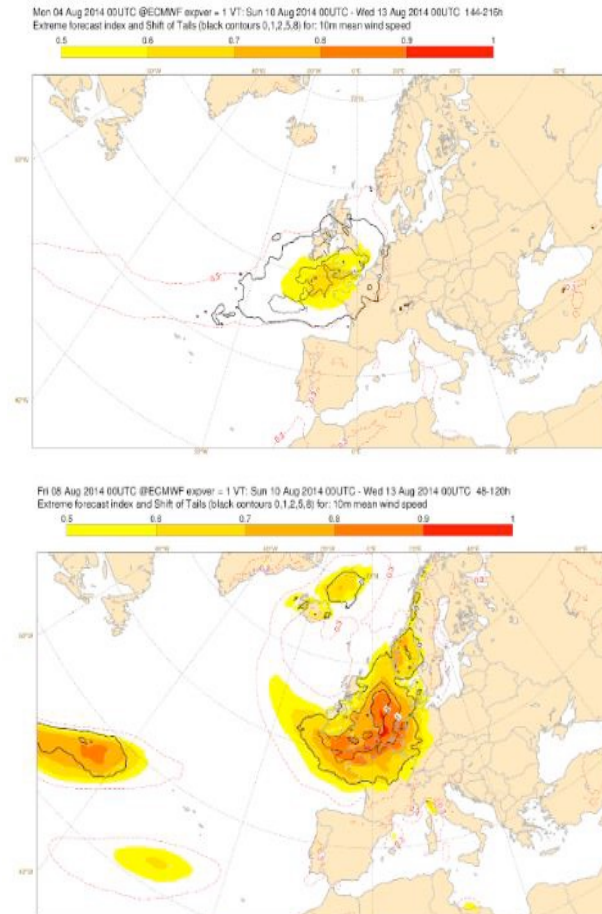
2016-2025 STRATEGY: two of our key challenges

The size of the challenge # 1 – High-impact weather

Severe weather: Hurricane Bertha



The difficulty: Sharp ensembles two weeks ahead



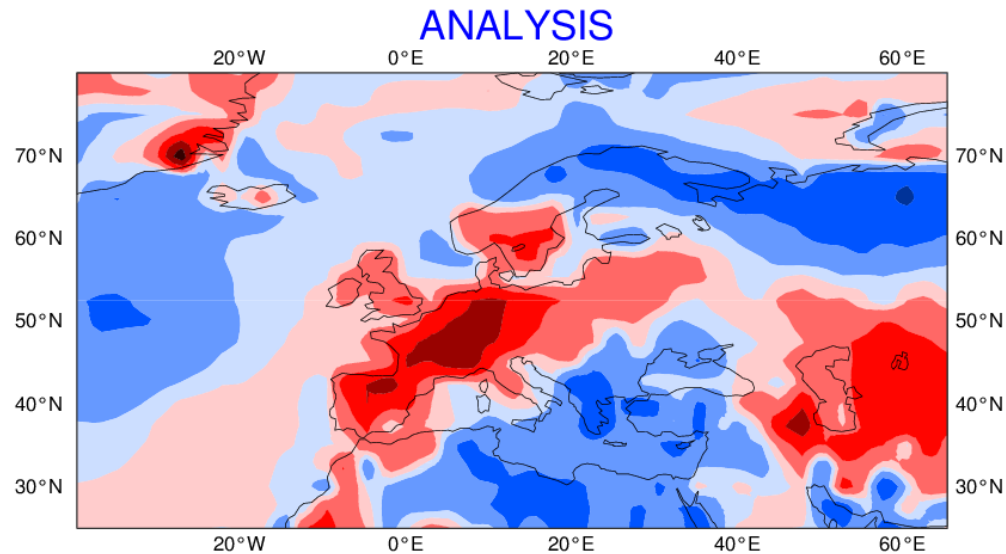
6-9 days

2-5 days

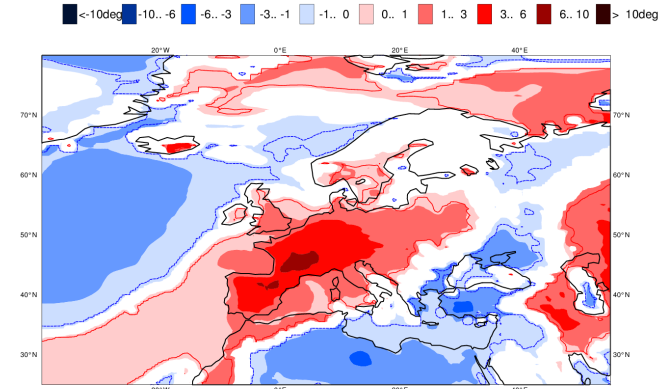
2016-2025 STRATEGY: two of our key challenges

The size of the challenge # 2 – Regional-scale anomalies

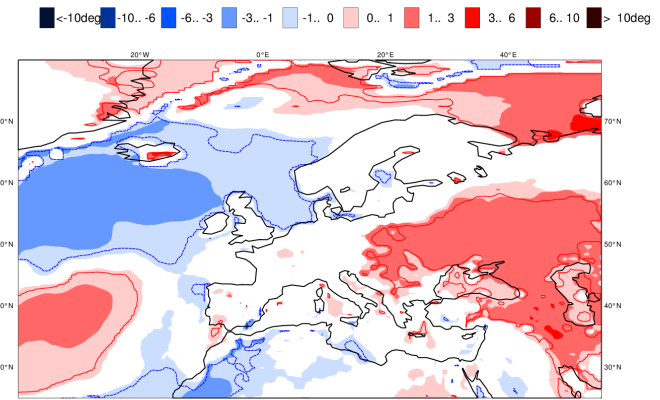
European heat wave 29 June – 5 July 2015



Forecast week 1.5



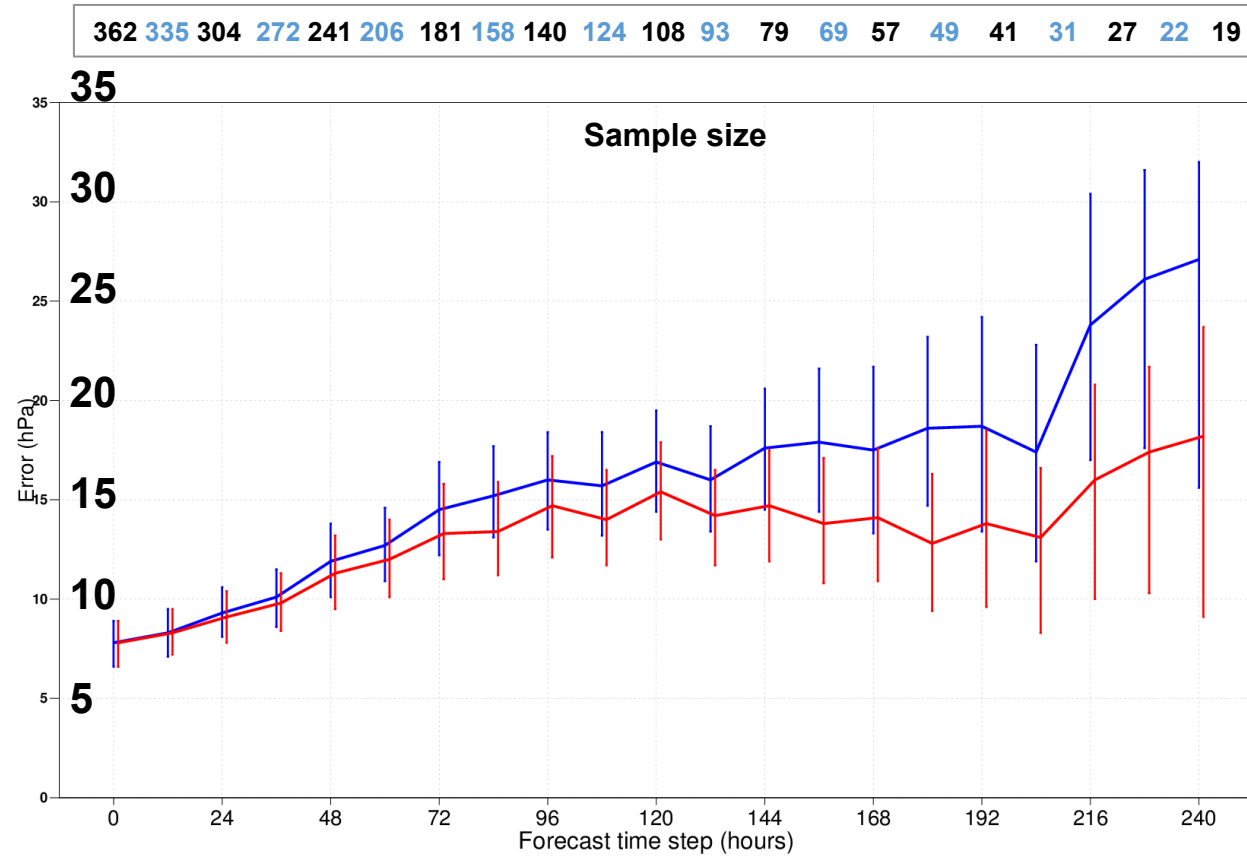
Forecast week 2.5



The ECMWF 2016-2025 strategy relies on three pillars

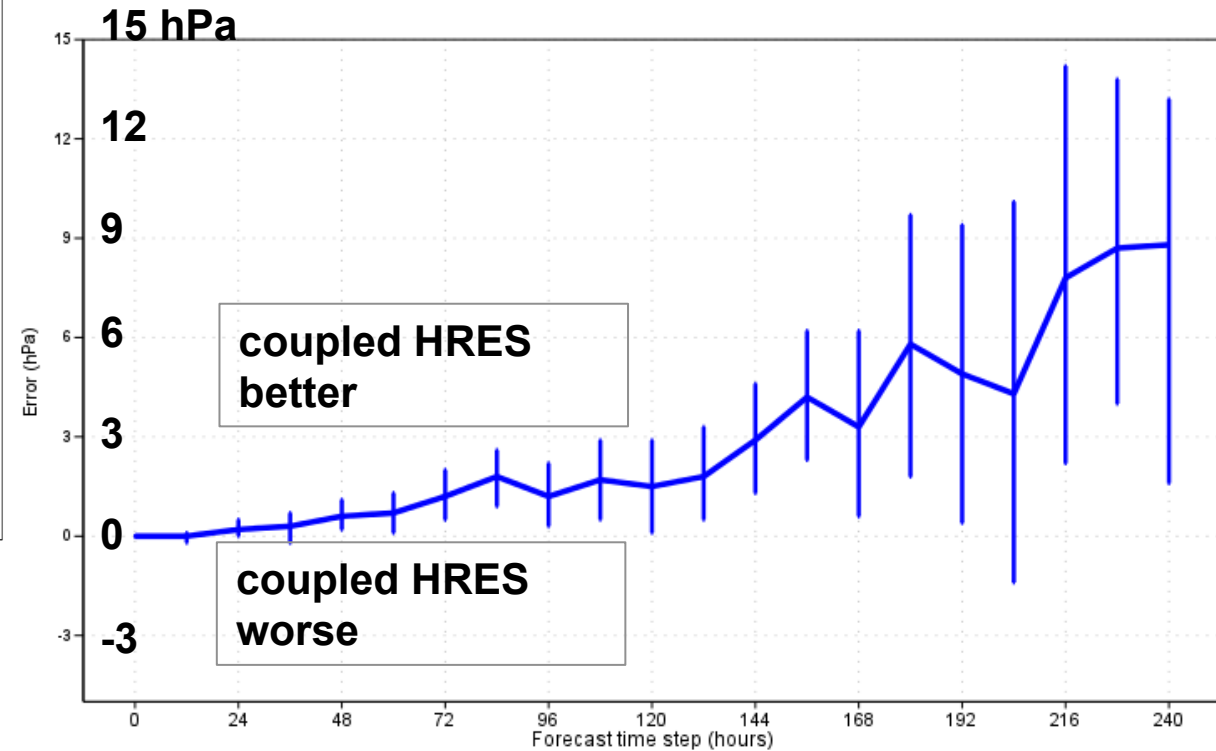
1. An **Earth-system** approach encompassing key components
2. A **high resolution ensemble** reaching 5km in 2025
3. **Scalability** of our coding allowing us to make the most of future computing technology

1. Moving towards an Earth-system approach in FCs and ICs

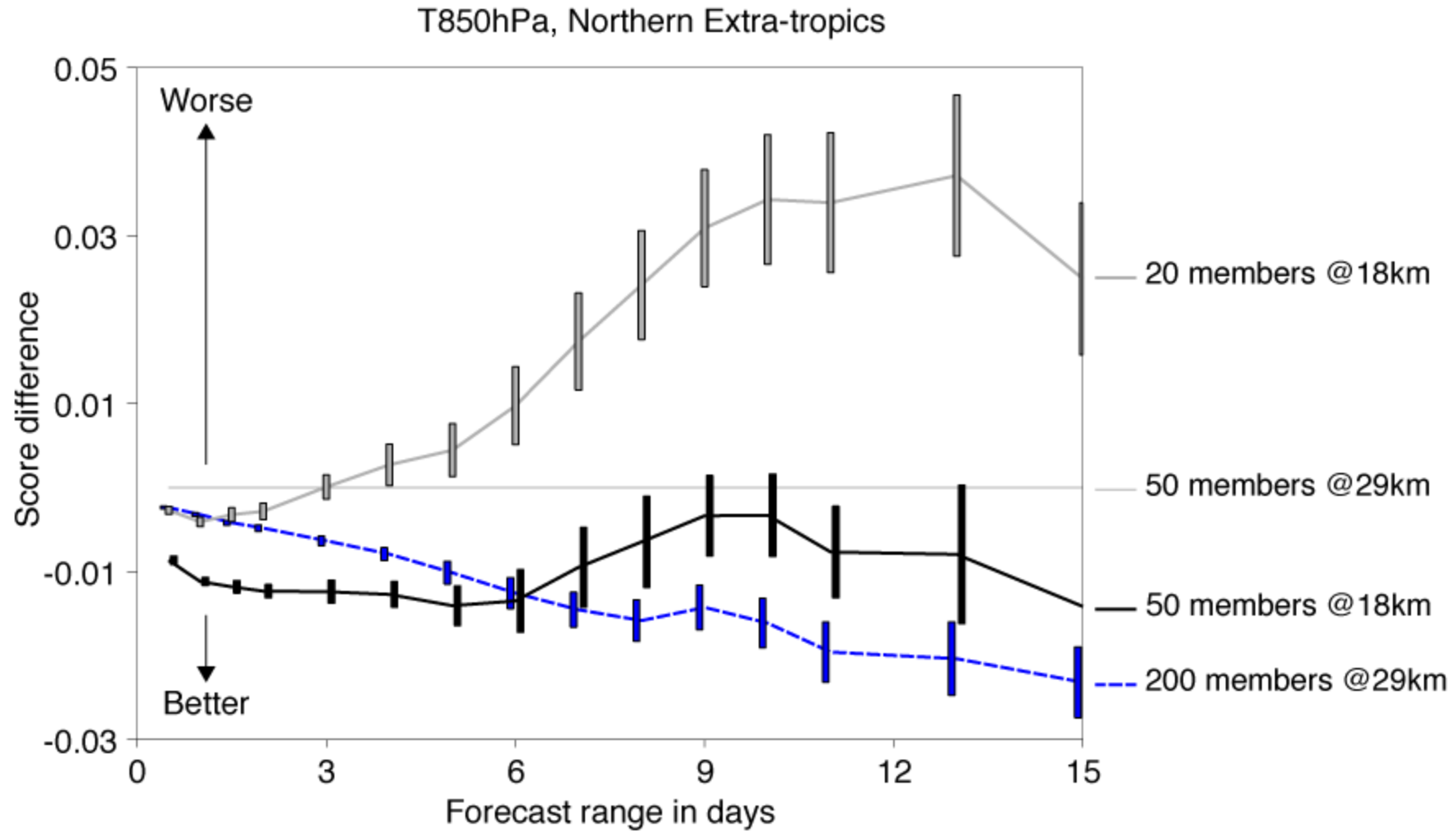


Difference of the mean absolute intensity errors (hPa)
VT: 2016-05 to 2017-01 (homogeneous samples/all basins) .
Bars: 95% confidence interval

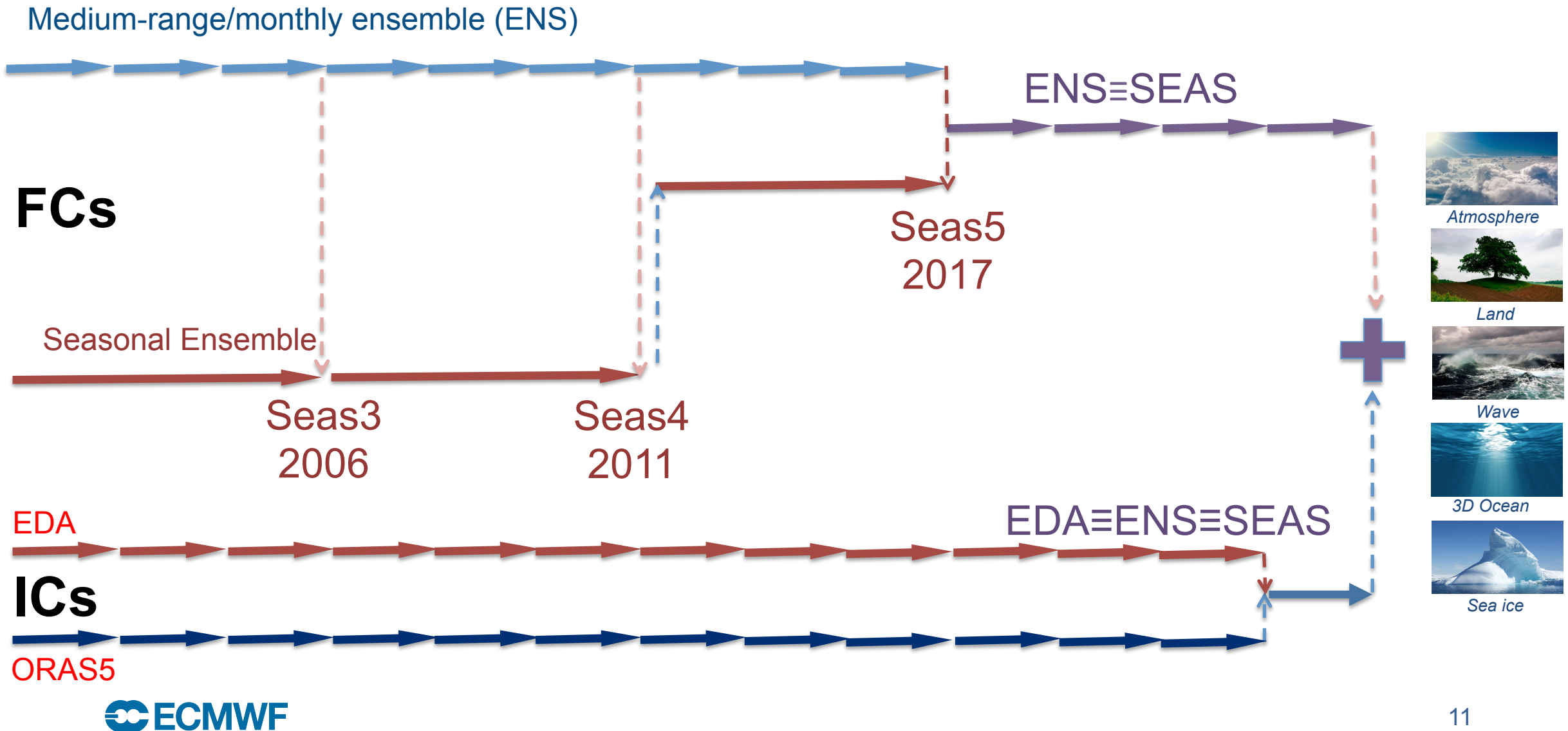
Uncoupled & Coupled HRES TC forecast of the mean absolute intensity error (hPa). VT: 2016-05 to 2017-01 (homogeneous samples/all basins)
Bars: 95% confidence interval



2. Future ensembles: higher res and/or more members

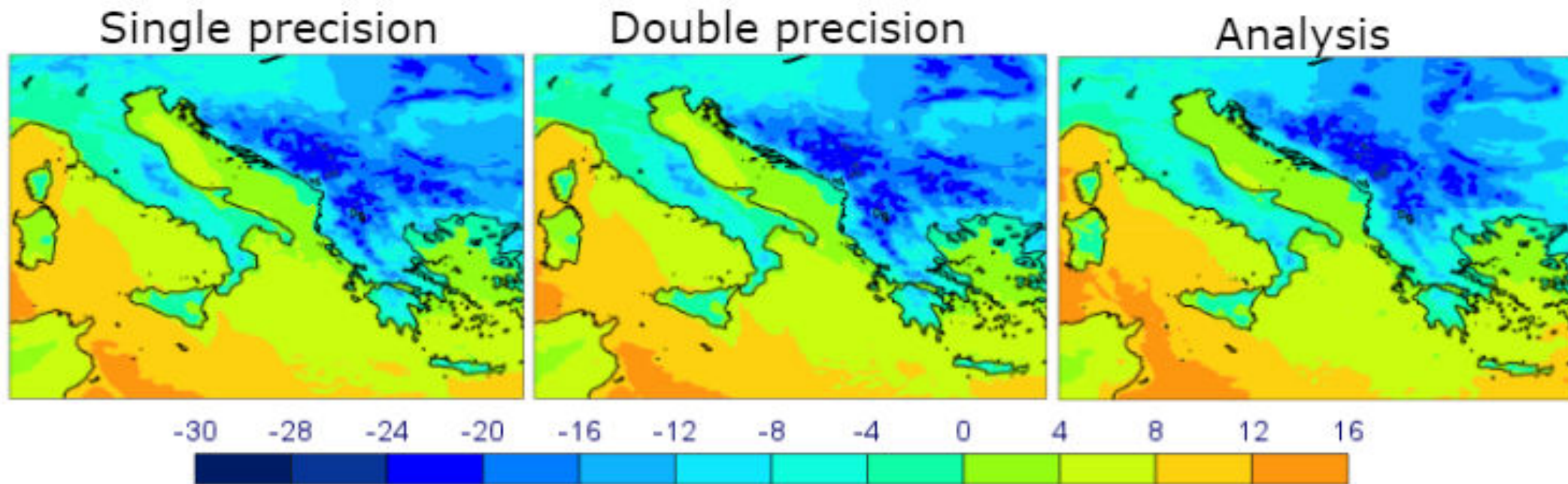


2. Future ensembles: moving towards a unified approach

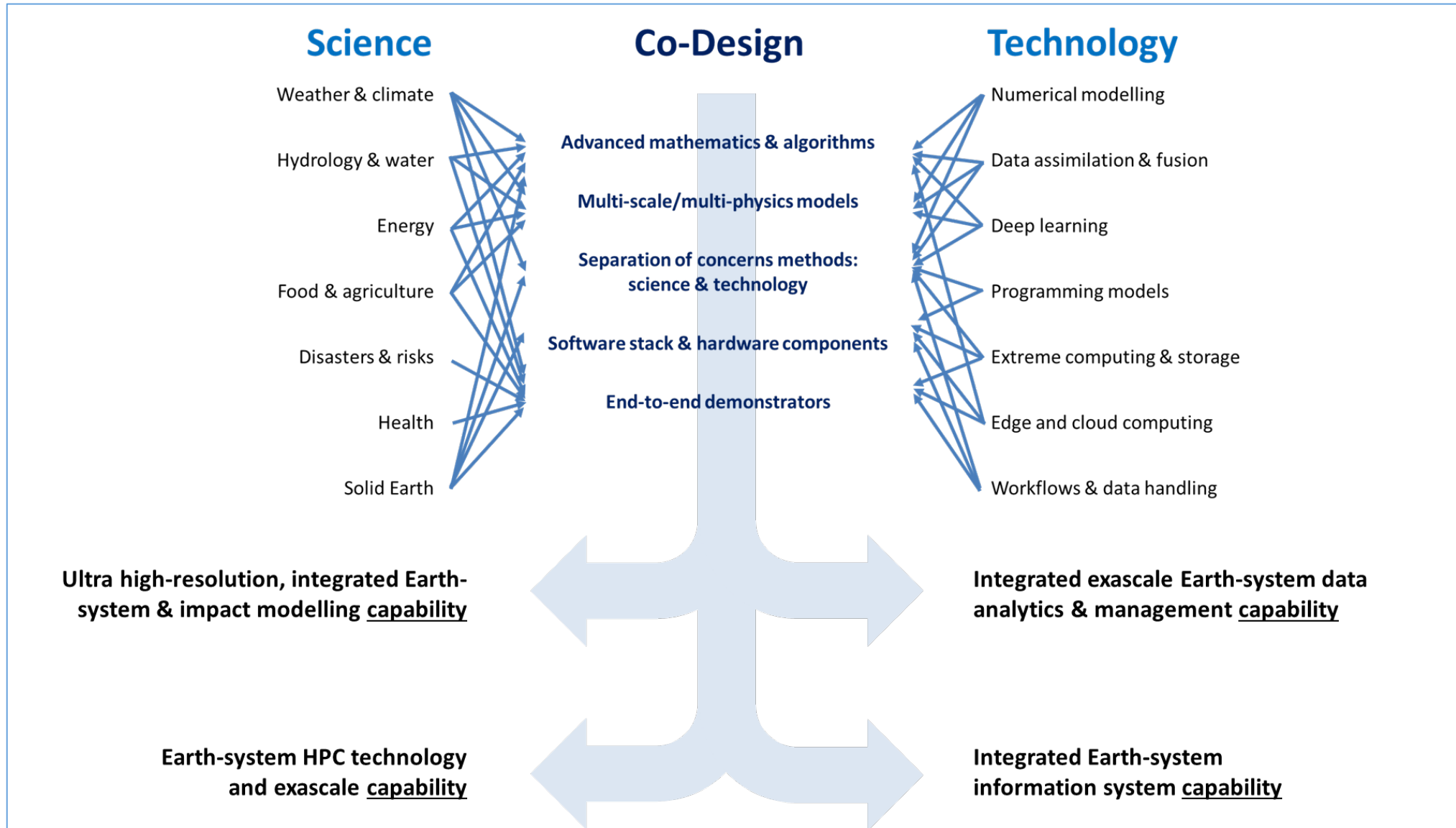


3. Scalability: single-precision as a way to gain efficiency

Surface temperature for five day forecasts for 8th January 2017 0:00 UTC (9km resolution, TCo1279). Differences between single and double precision are very small.



3. ExtremeEarth: a proposal for a European flagship program



Copernicus beyond 2020

Copernicus will continue to be a public service, driven by the needs of policy and public administrations and fostering economic development in Europe



C3S beyond 2020

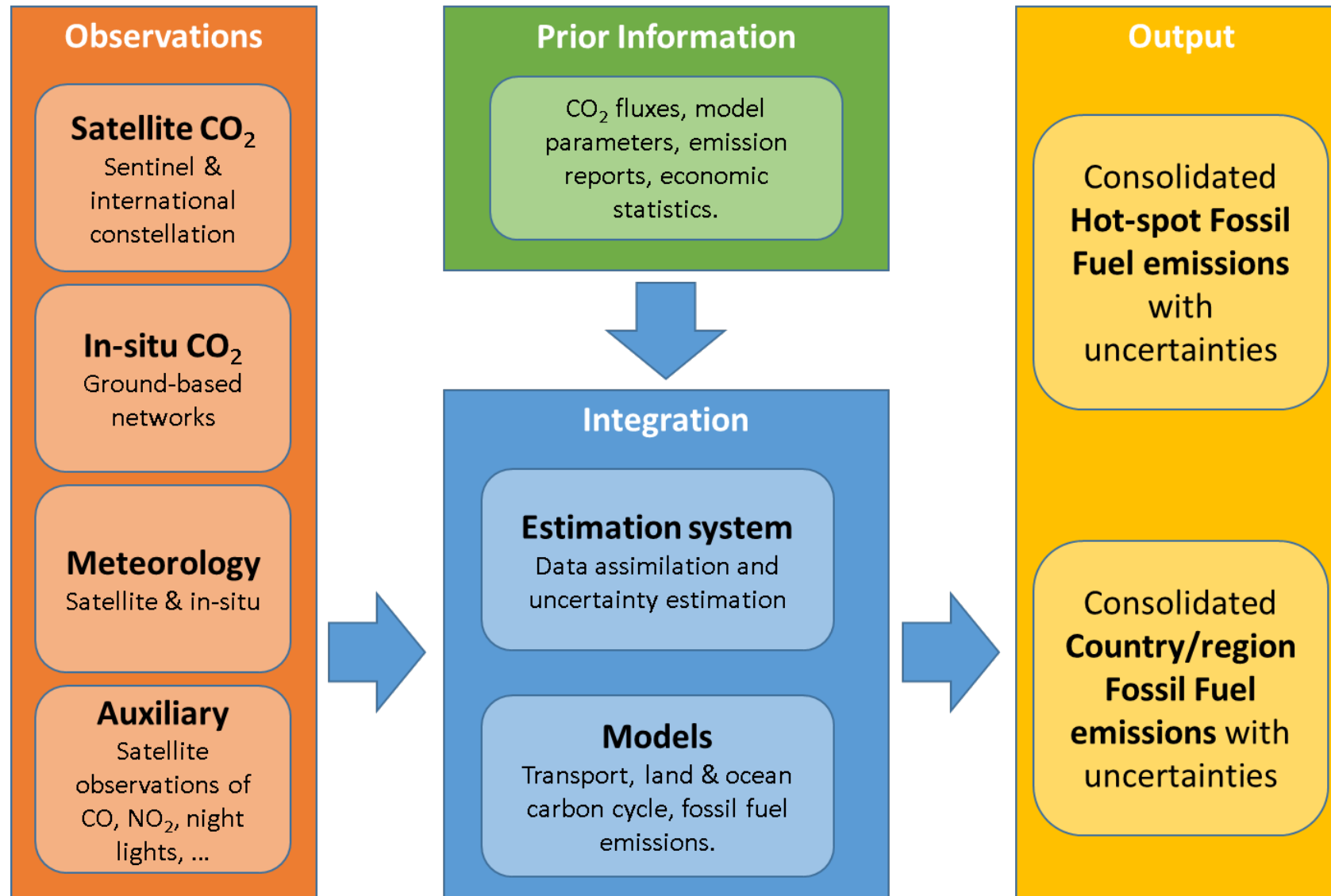
- Preparation for a CO₂ Observatory (in support to UNFCCC) – *mutualized with CAMS*
- Attribution Service
- Decadal Prediction Service (including verification)
- New coupled reanalysis (2021-2023) and new centennial reanalysis (2023-2025)
- Fast track response Service



CAMS beyond 2020

- Quantification of emissions: crucial for monitoring the effectiveness of abatement strategies (short- to long-term) and consolidating bottom-up reported estimates
- Hourly NO₂ emissions will (probably) be THE “headline” application for Sentinel-4
- Priority (joint with C3S): CO₂ emissions from fossil fuel combustion

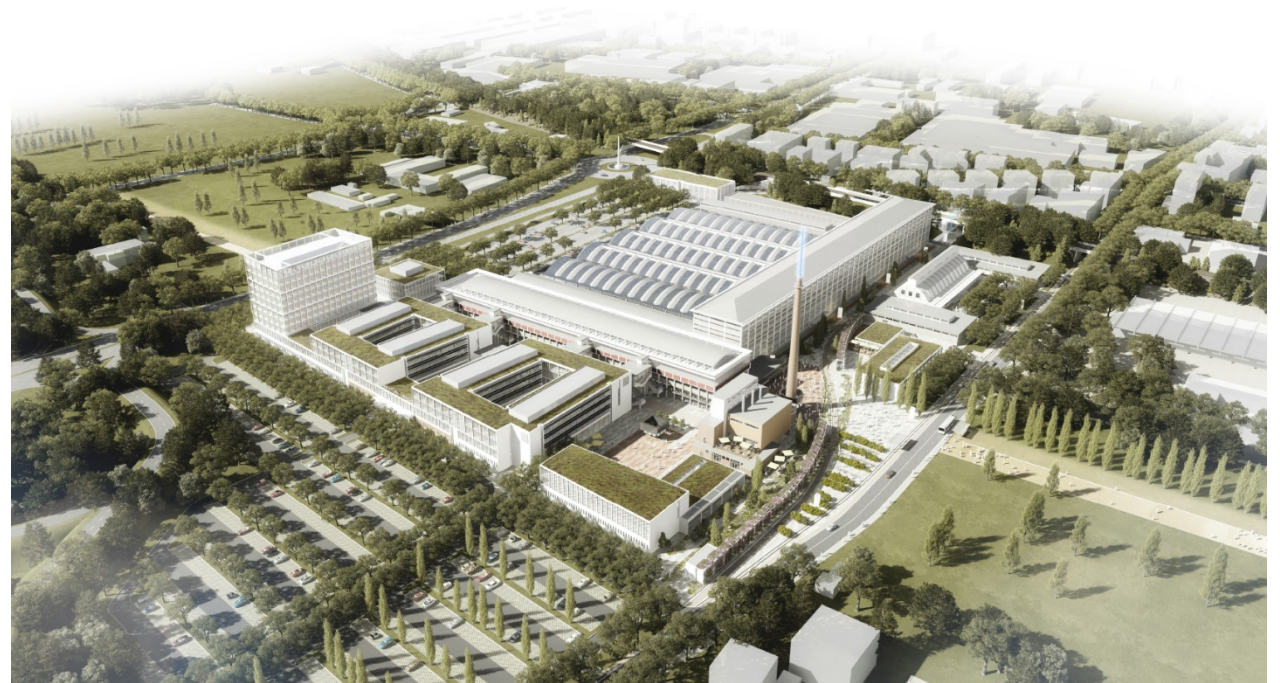
Copernicus beyond 2020 might include CO₂ emission monitoring



The ECMWF new Data Center will be in Bologna



We have now reached the full capacity of our current data centre, and to be able to implement the 2016-2025 strategy we will be moving our Data Center to Bologna.



Conclusions

Research and development for weather and climate are converging, and tools and techniques are becoming increasingly similar.

ECMWF is more and more involved in Earth-system modelling, assimilation and predictability, all fundamental areas to understand the past and the present, and to give us insights into the future. From June 2018, all our forecasts will be generated using a coupled ocean (waves, sea-ice, 3D), land and atmosphere model. Work is progressing towards coupled assimilation.

ECMWF will continue to support all the Copernicus activities.