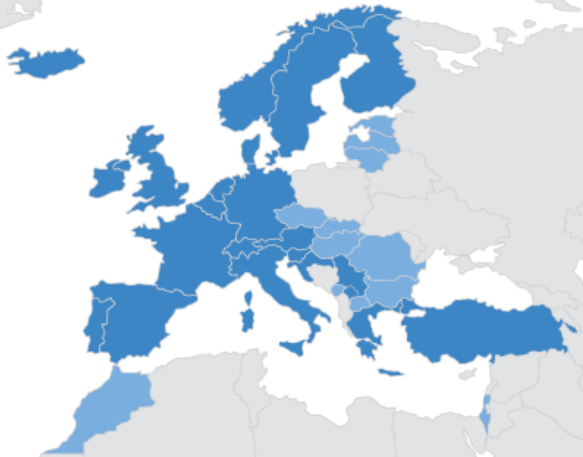
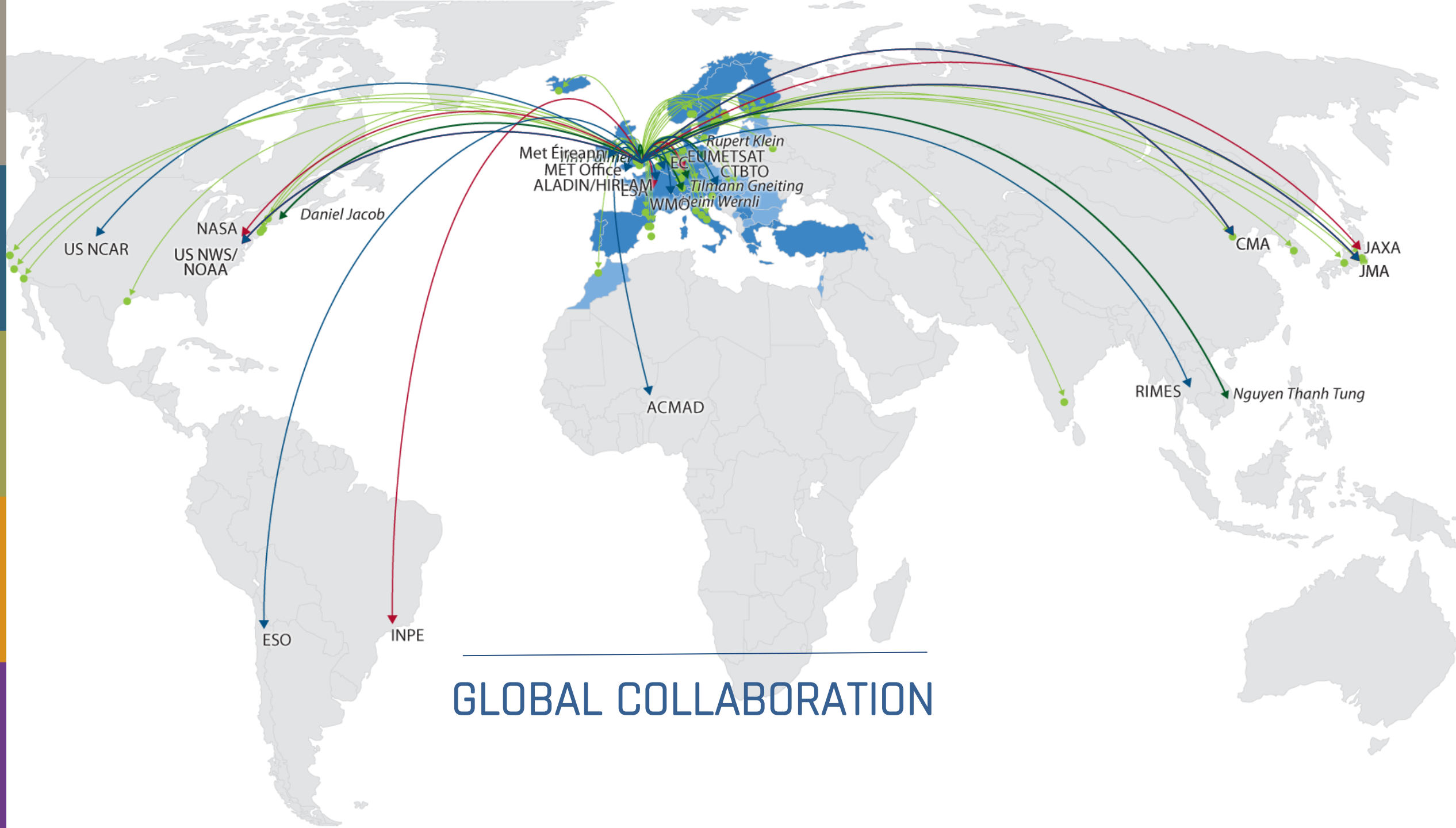
ECMWF beyond 2017

June 9, 2017



ECMWF's role is to address the critical and most difficult research problems in medium-range NWP that no one country could tackle on its own

PLAYING A UNIQUE ROLE



GLOBAL COLLABORATION

WMO SCORES: **CONTINUAL IMPROVEMENTS**





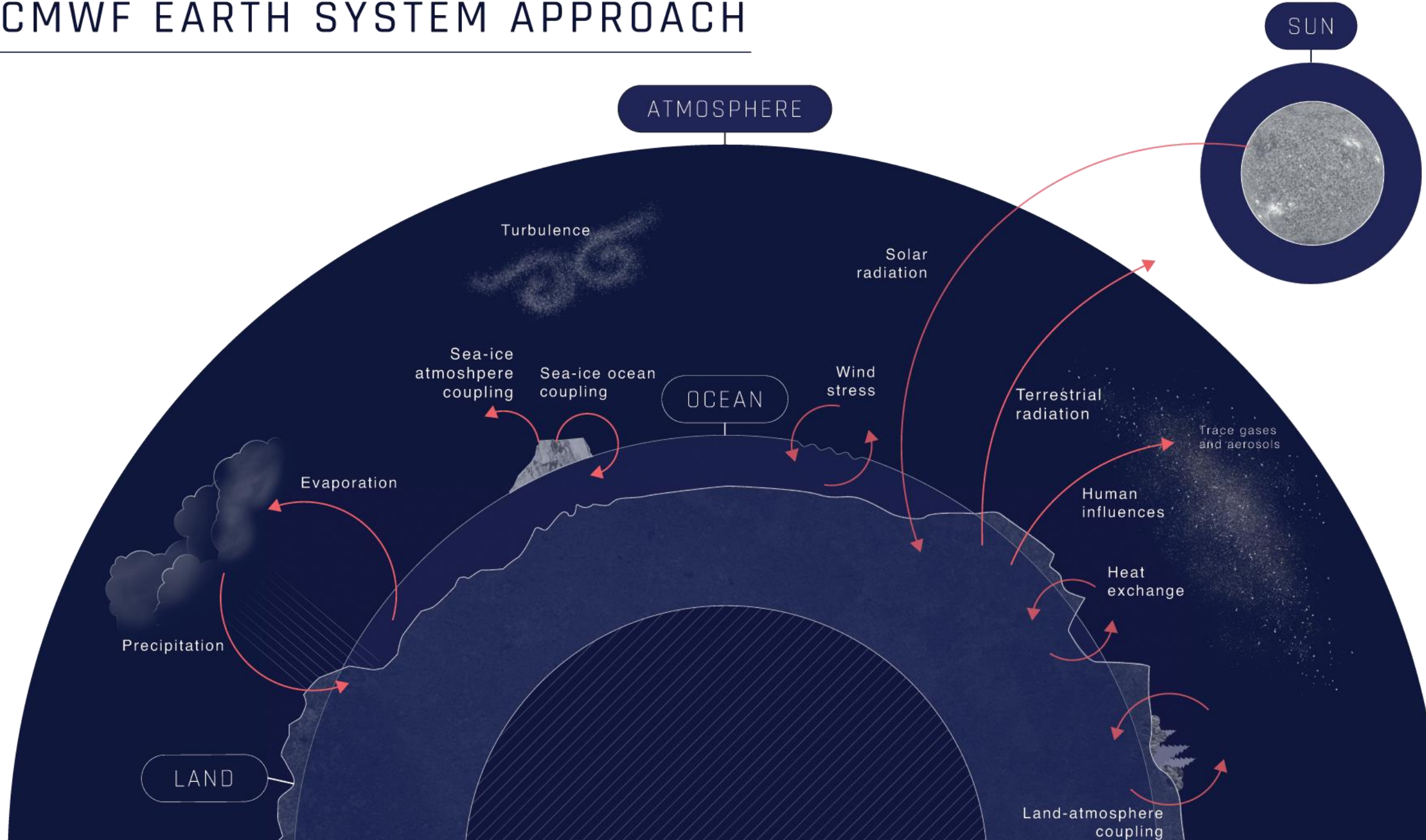
LOOKING AHEAD

ECMWF EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

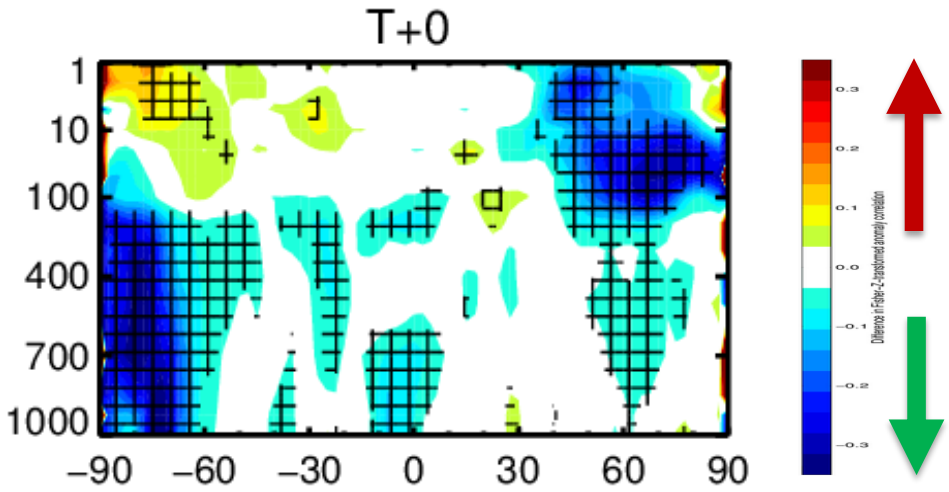
THE STRENGTH OF A COMMON GOAL

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

ECMWF EARTH SYSTEM APPROACH

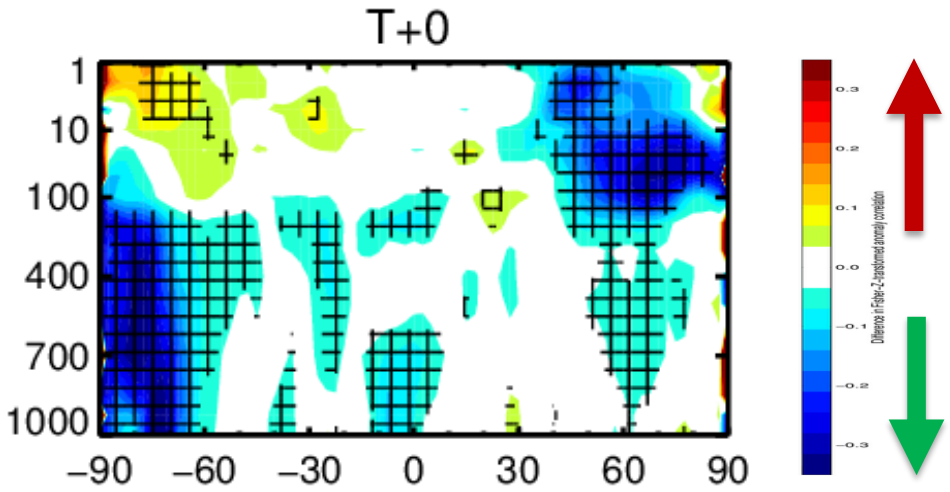


FROM COUPLED MODELLING TO DATA ASSIMILATION: CERA-20C



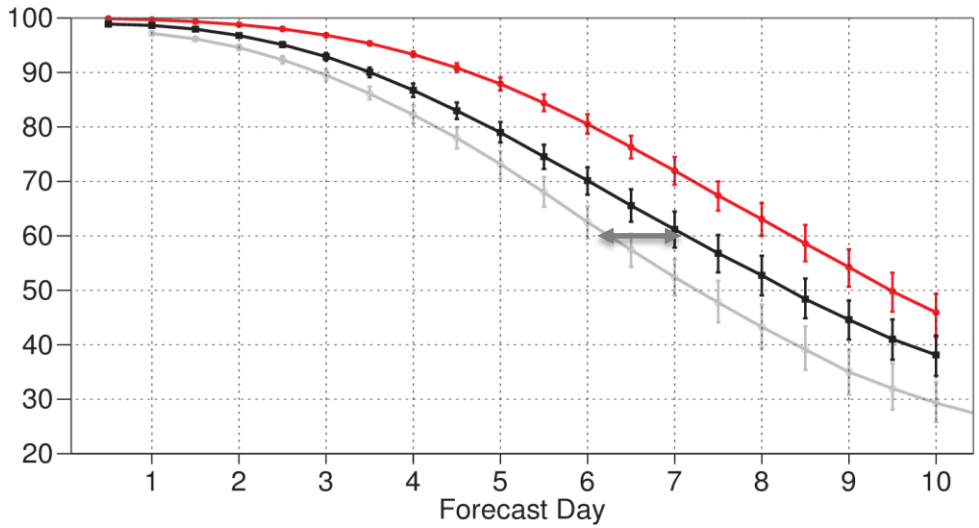
Clear benefits for the analysis if coupled data assimilation

FROM COUPLED MODELLING TO DATA ASSIMILATION: CERA-20C



Clear benefits for the analysis if coupled data assimilation

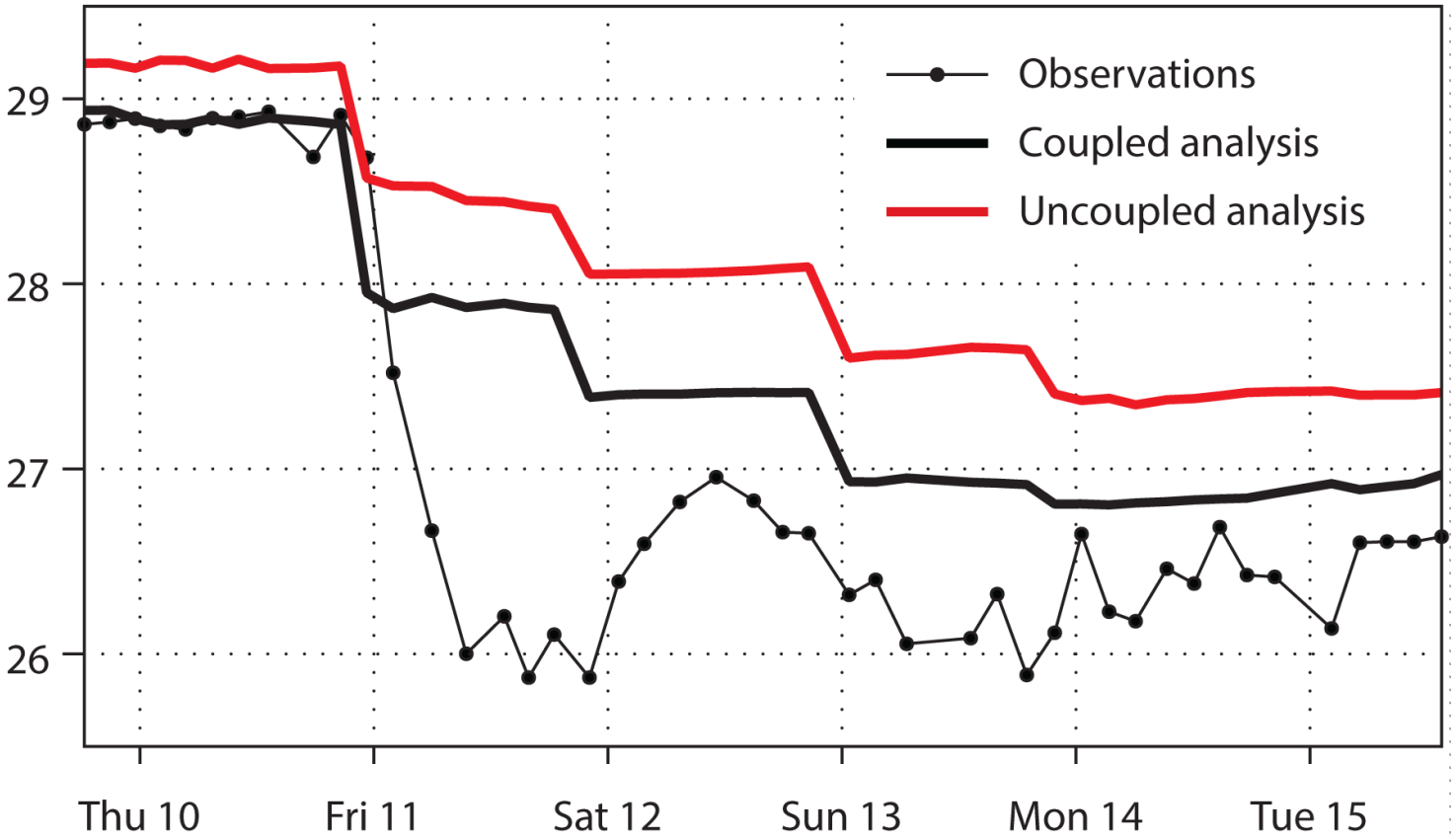
Anomaly correlation for geopotential height at 500hPa in the Northern hemisphere, with respect to ERA-Interim analysis



And forecast skill improved by ~0.7 day

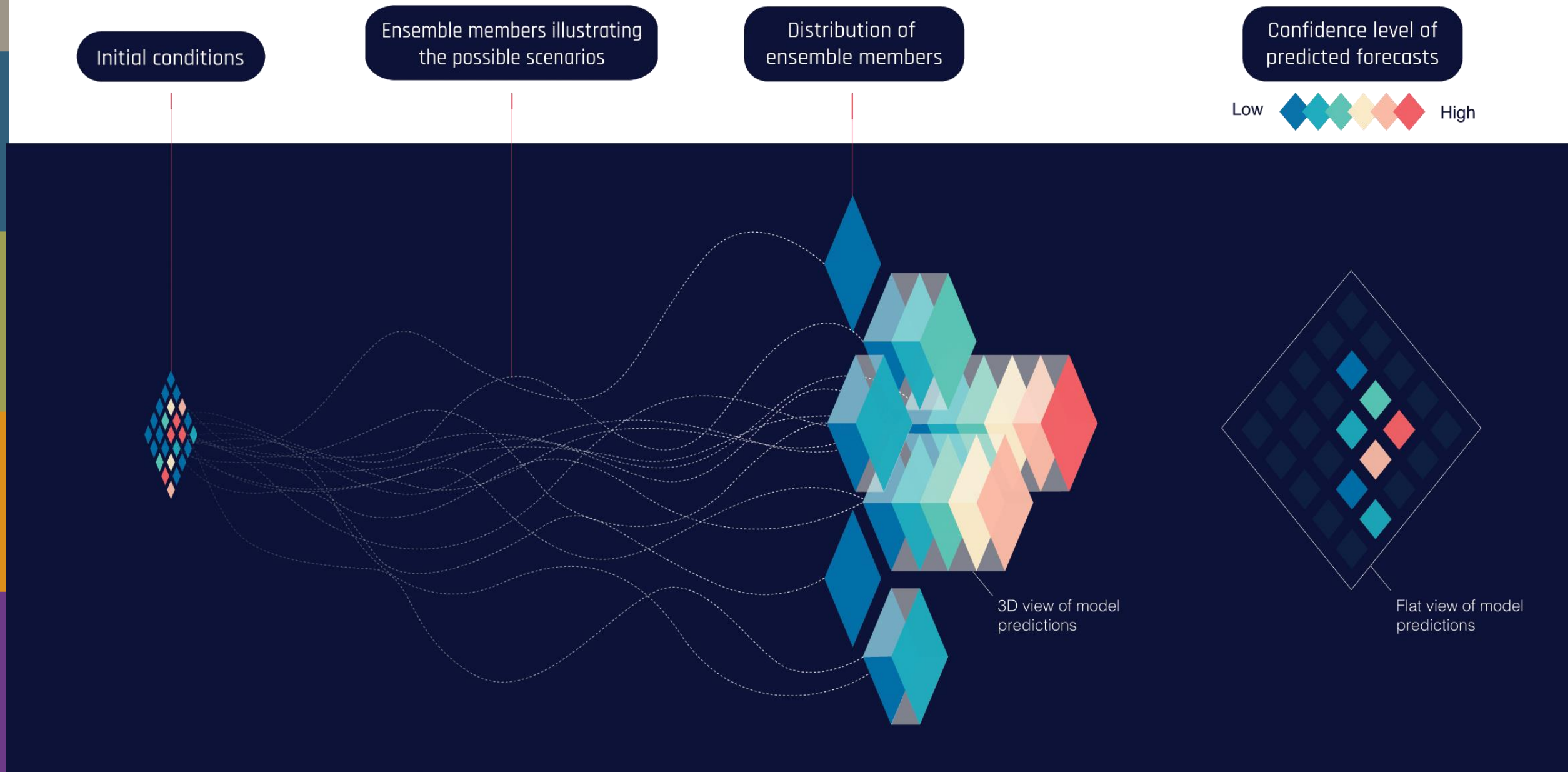
THE STRENGTH OF A COMMON GOAL:

IMPACT OF COUPLED ASSIMILATION DURING A CYCLONE



The dotted line shows the time series of ocean temperature observations at a depth of 40 metres by an Argo float located on the track of the cyclone Phailin. The temperature drop on Friday 11 October 2013 is due to the cold wake induced by the cyclone. The difference between the red and the black thick lines shows the impact of using a coupled assimilation system. The coupled analysis (black line) is closer to the in-situ observations partly through the better use of surface wind satellite measurements.

ECMWF ENSEMBLE PREDICTION



ENSEMBLE PREDICTION: CHANGING EMPHASIS

Best possible DA and best single-state forecast and an ensemble to estimate uncertainty for all time-scales?

Or

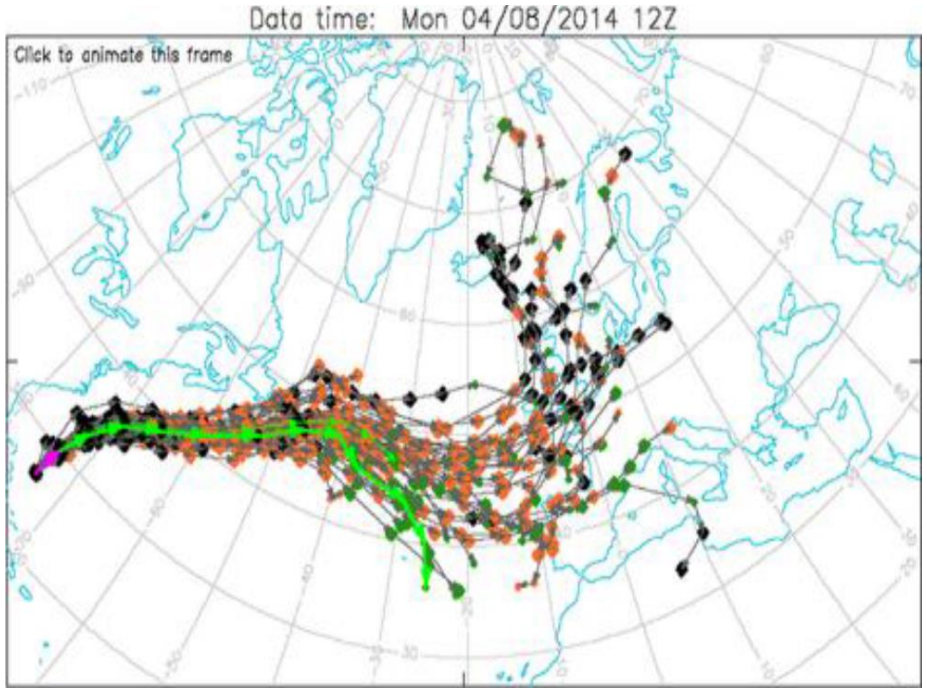
Ensembles describing the range of likely outcomes of the future atmosphere together with an estimate of their likelihood, starting from the best-possible DA

(valid in the medium-range, collapsing to above in the short range for synoptic scales)

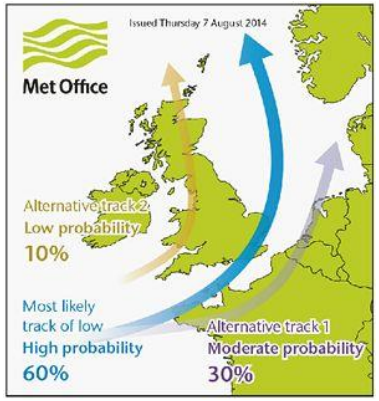
WHAT DOES THE ENSEMBLE PROVIDE?

A range of future scenarios consistent with our knowledge of the initial state and model capability

- Explicit indication of uncertainty in today's forecast
- Potential of unusual events
- Range of ensemble based products for different users

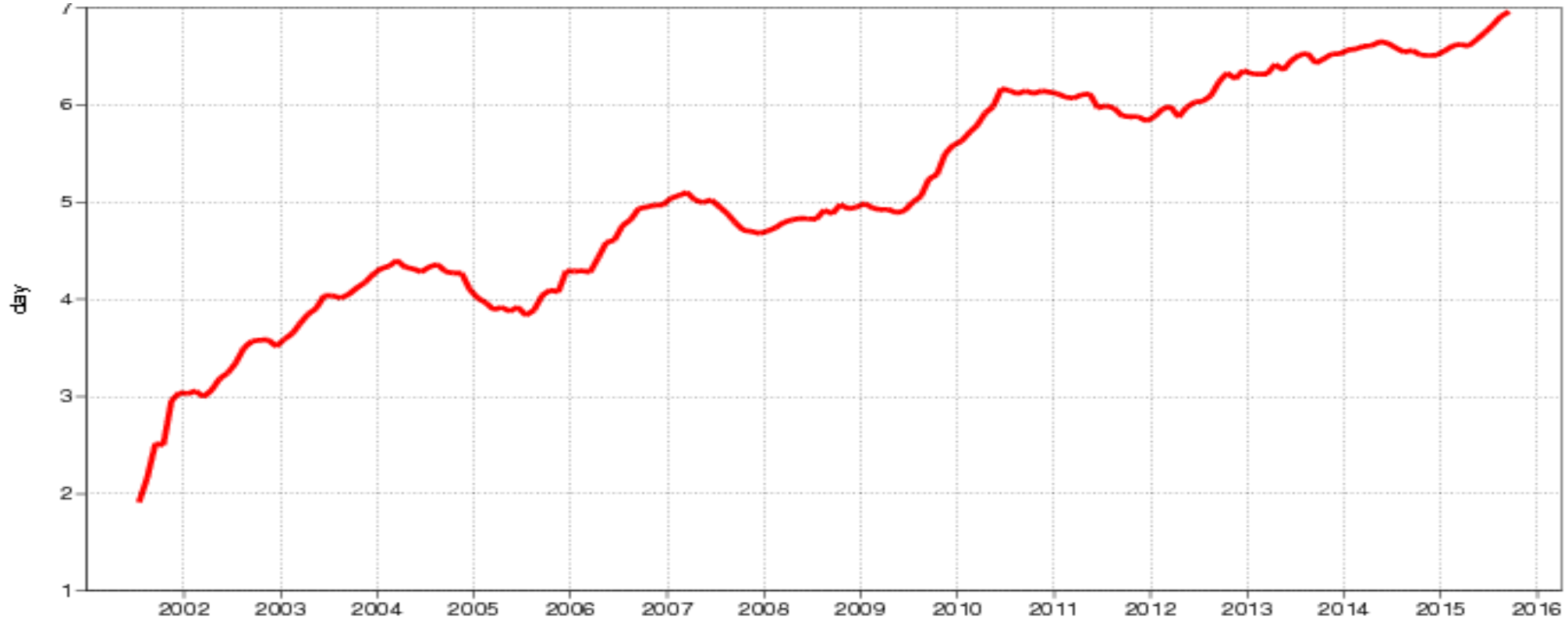


Severe weather: Hurricane Bertha

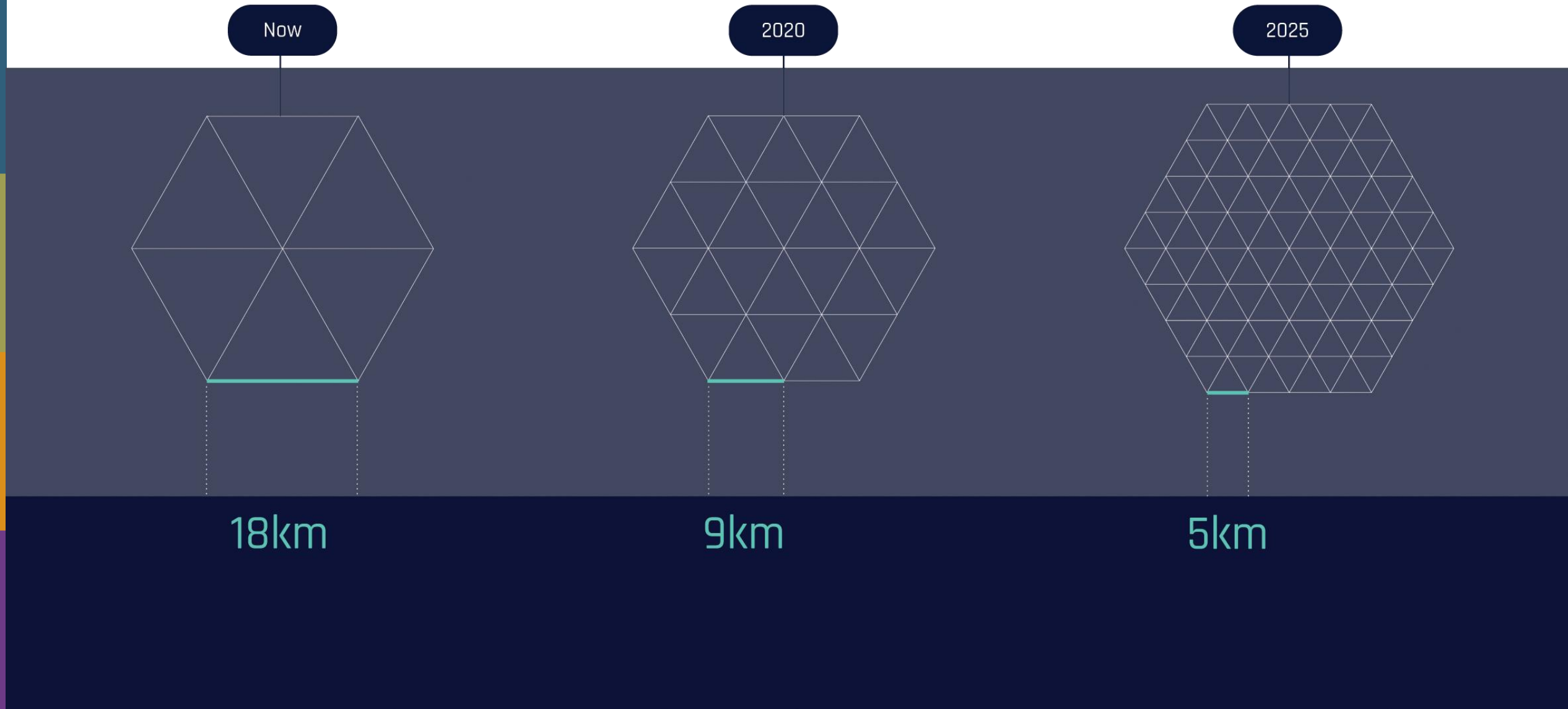


CONTINUOUSLY AIMING TO IMPROVE

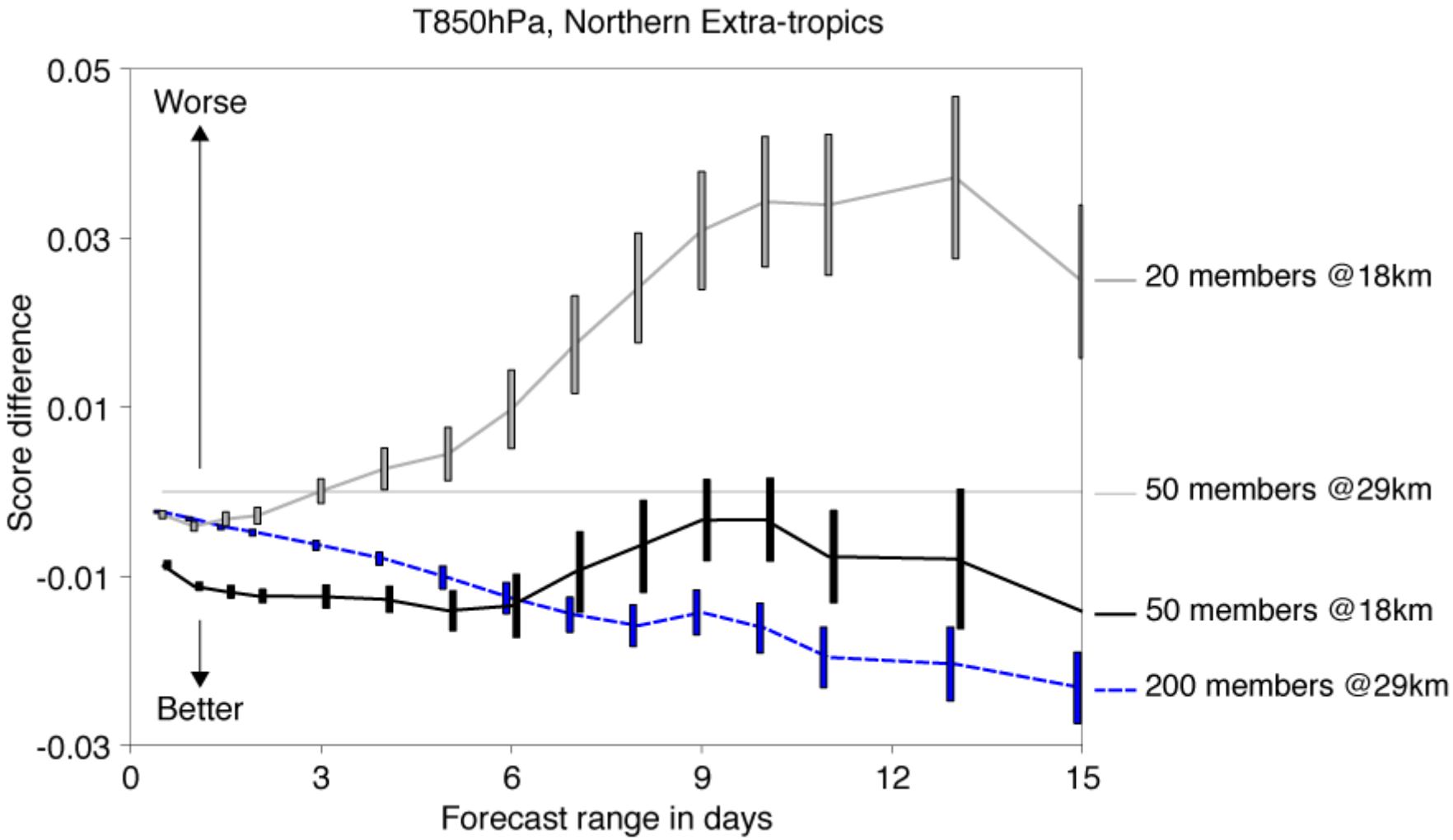
Total precipitation
Continuous ranked probability skill score
Extratropics (lat -90to -30.0 and 30.0 to 90, lon -180.0 to 180.0)



INCREASED HORIZONTAL RESOLUTION OF ENSEMBLE FORECASTING



REACHING 5KM RESOLUTION BY 2025



ECMWF COPERNICUS SERVICES: STEADILY PROGRESSING

Atmosphere Monitoring Service - CAMS

Forecasts and informs on impacts

Detects emissions and estimate surface fluxes

Quantifies transport, removal and transformations of atmospheric constituents

CAMS in three figures

280 million observations processed every 12 hours

Data from 70 satellite instruments are received and used

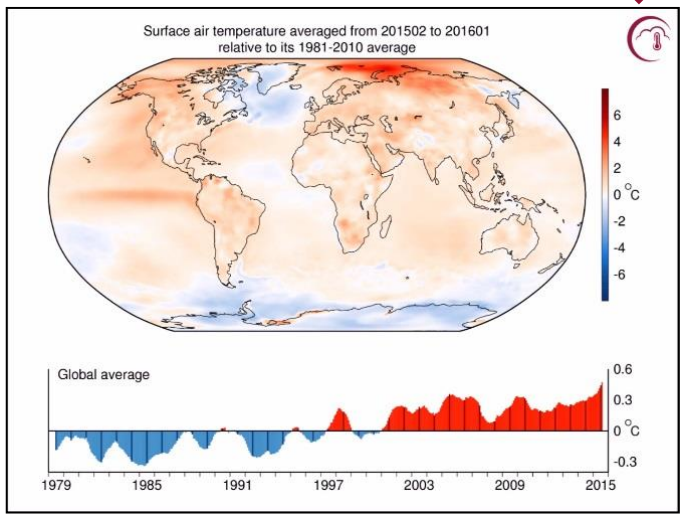
delivers everyday 14,000 maps online

ECMWF COPERNICUS SERVICES: STEADILY PROGRESSING

Climate Change Service –C3S

C3S: Monitors and analyses the Earth System to build a global picture and provide the data, tools and products needed by policy makers, societal and economic sectors to mitigate and adapt to a changing climate.

- The climate is changing and with it an increase in extreme weather events such as flooding, heat wave and drought.



- C3S data provide the evidence.
- Released online, the C3S maps show the trends clearly and provide key indicators of climate change.

- The data captured, analysed and tailored by C3S helps sectors affected to identify the risks, to adapt and identify business opportunities.

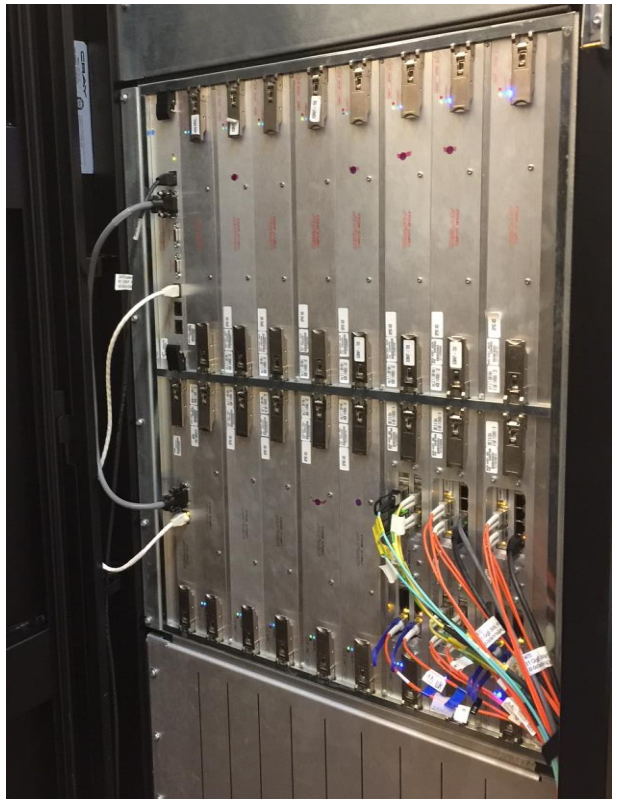


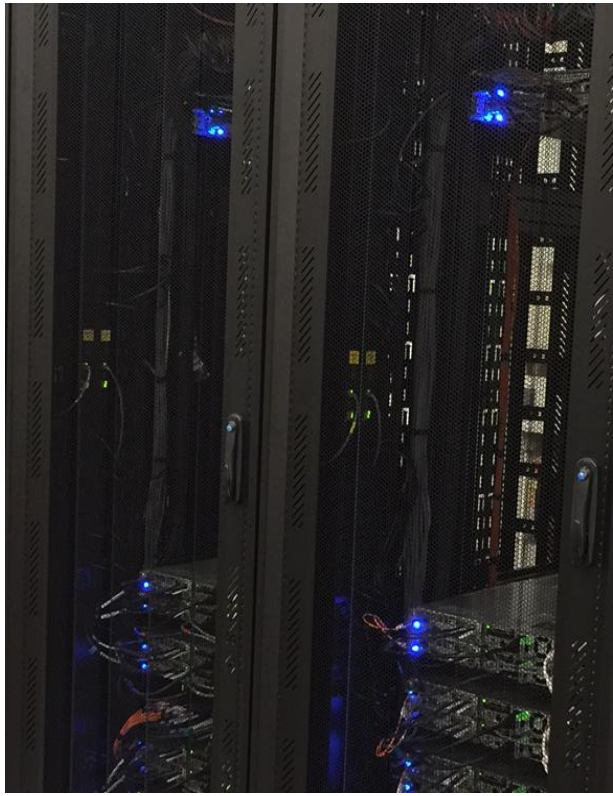


SCALABILITY

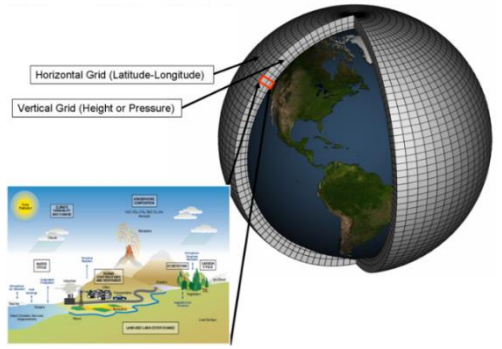
ECMWF EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

HIGH PERFORMANCE COMPUTING AT ECMWF: **TODAY**



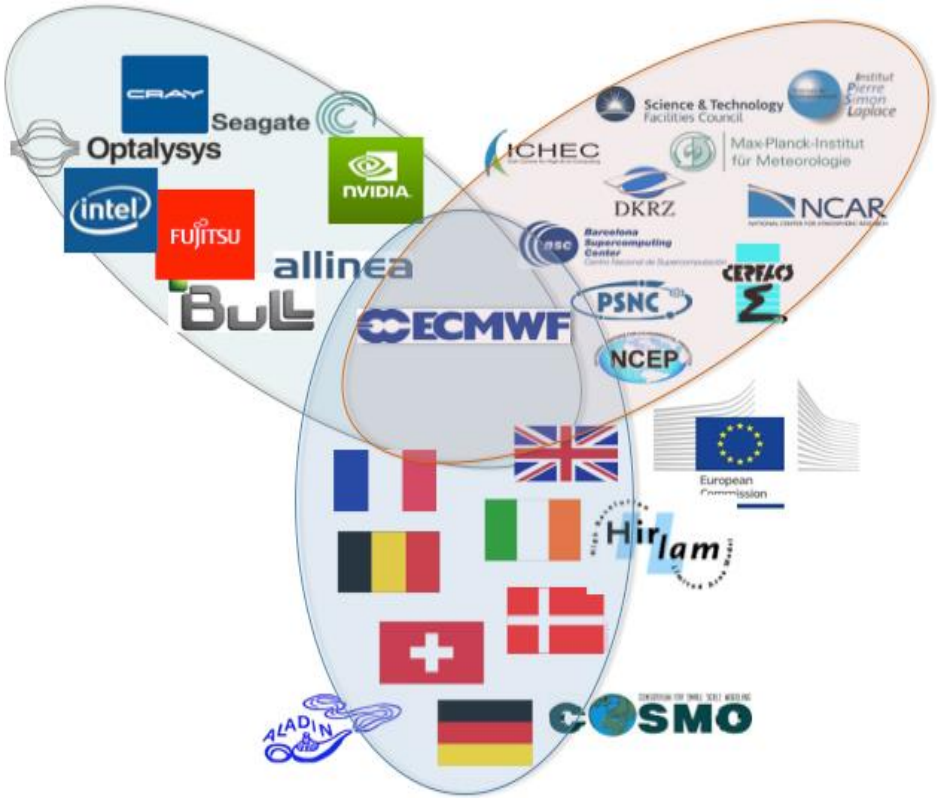


SCALABILITY: A CHALLENGE FOR NWP



		OBSERVATIONS	MODELS
TODAY	volume	40 million = **4×10^7**	10 million grid points 100 levels 10 prognostic variables = **1×10^{10}**
	type	98% from 60 different satellite instruments	physical parameters of atmosphere, waves, ocean
		OBSERVATIONS	MODELS
TOMORROW	volume	100-200 million = **$1\text{-}2 \times 10^8$**	500 million grid points 200 levels 100 prognostic variables = **1×10^{13}**
	type	98% from 80 different satellite instruments	physical and chemical parameters of atmosphere, waves, ocean, ice, vegetation
		FACTOR 5	FACTOR 1000

SCALABILITY COLLABORATIVE APPROACH



Thank you...

ECMWF

STRATEGY 2016–2025

THE STRENGTH OF A COMMON GOAL


ECMWF