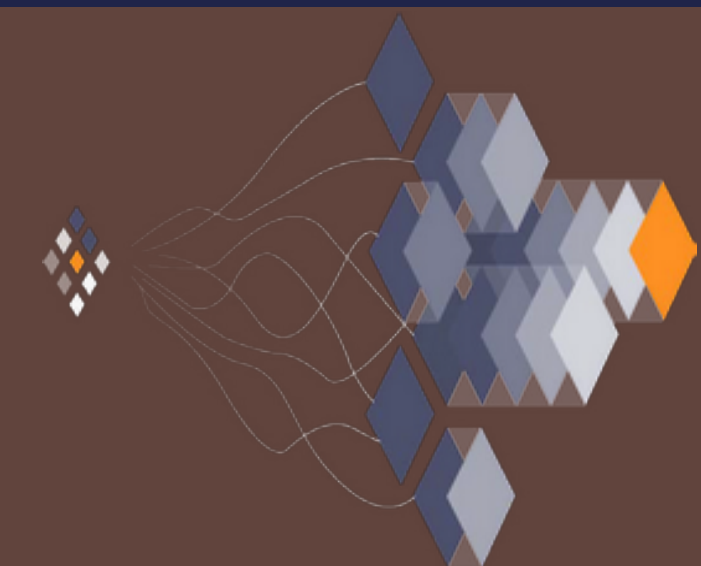# ECMWF report to ACCORD
## 7 December 2022

**Science & Technology**

**Impact**

**Organisation & People**

# Overview

- Bologna Data Centre formally handed over to ECMWF in April
- Bonn: 120 staff on site and hosting agreement to be signed 9 December
- ECMWF model and products now running on new HPCF in Bologna and DHS fully migrated
- Results from 47r3 show increased upper air medium-range forecast skill as well as for surface parameters
- Promising results for 48r1 on both medium and extended range
- ERA5 back extension from 1940-1958 completed
- Sustainable workshop with SPARC General Assembly running simultaneously across three continental hubs
- Collaboration between ECMWF and WMO for the production of the first joint State of the Europe Climate
- Engagement with EUMETNET for the provision of High Value Datasets through the European Weather Cloud
- CAMS National Collaboration Programme start with Denmark, France, Germany and Italy
- Launch of EU initiative Destination Earth and first major Destination Earth contracts issued
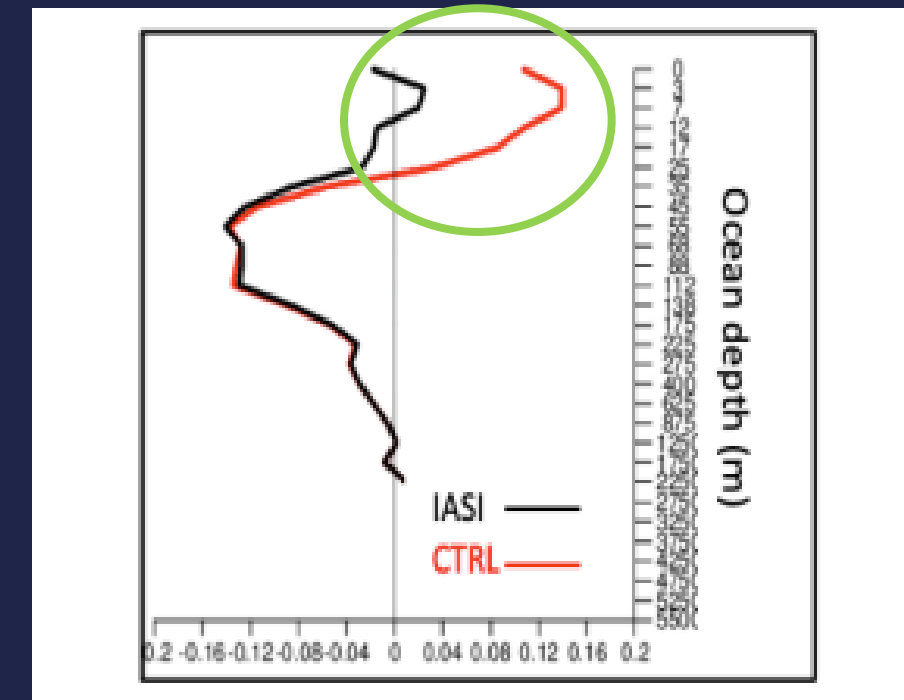- European Weather Cloud to go operational at the start of 2023

…and also:
- 30 years of ensemble forecasting at ECMWF
- 25 years of 4D-Var
- 6 months to 9km-ensemble

# …and ocean changes feedback to atmosphere

NEMOVAR SST changes forced by **3x IASI**, **2x CrIS** and **AIRS** radiances after 2 weeks of assimilation
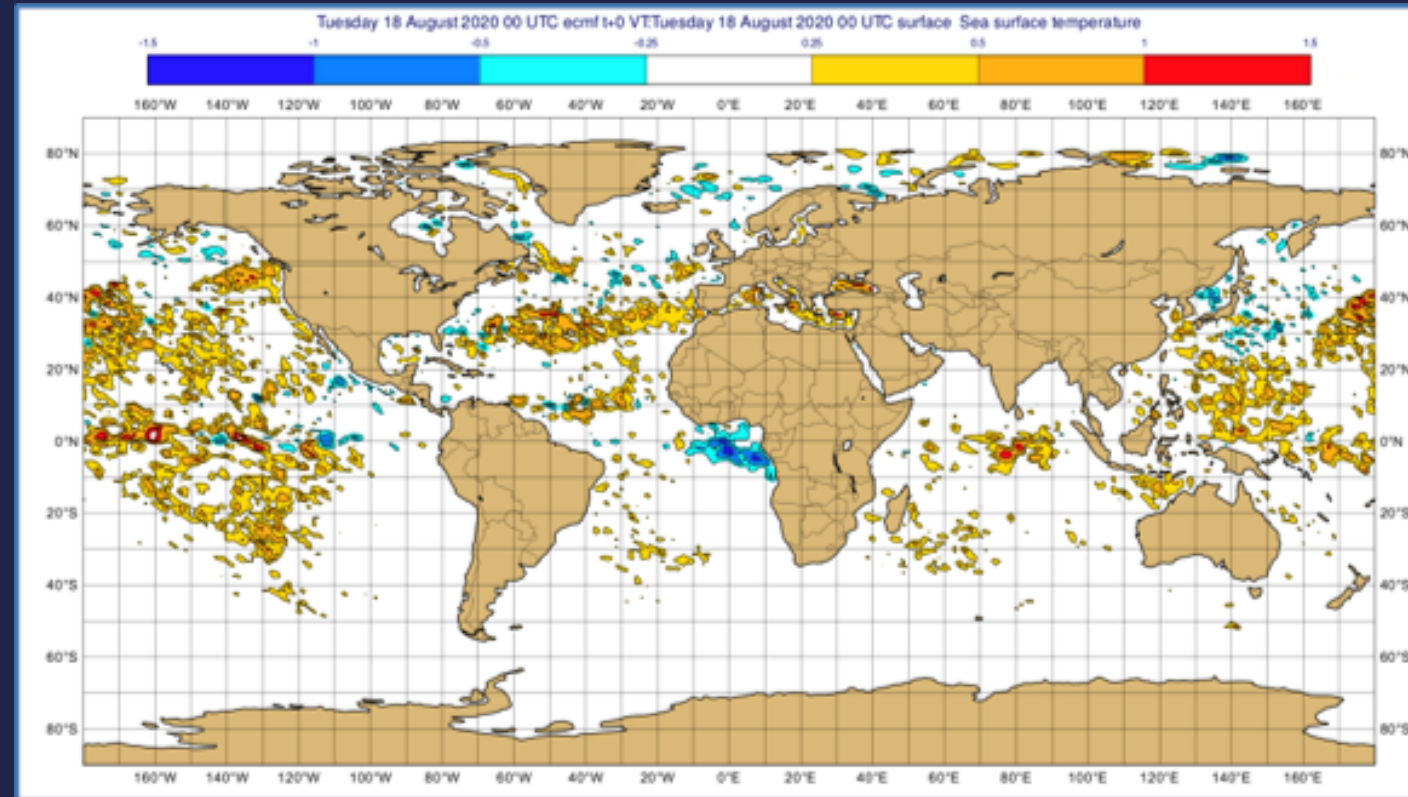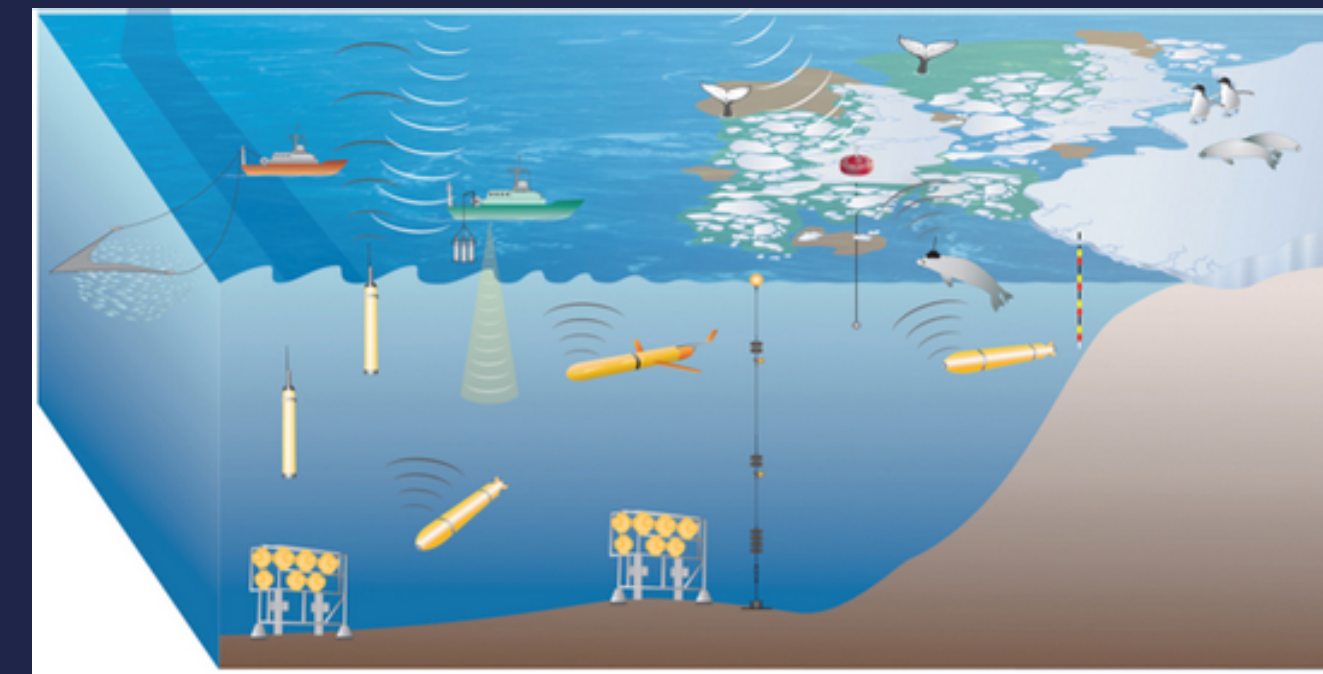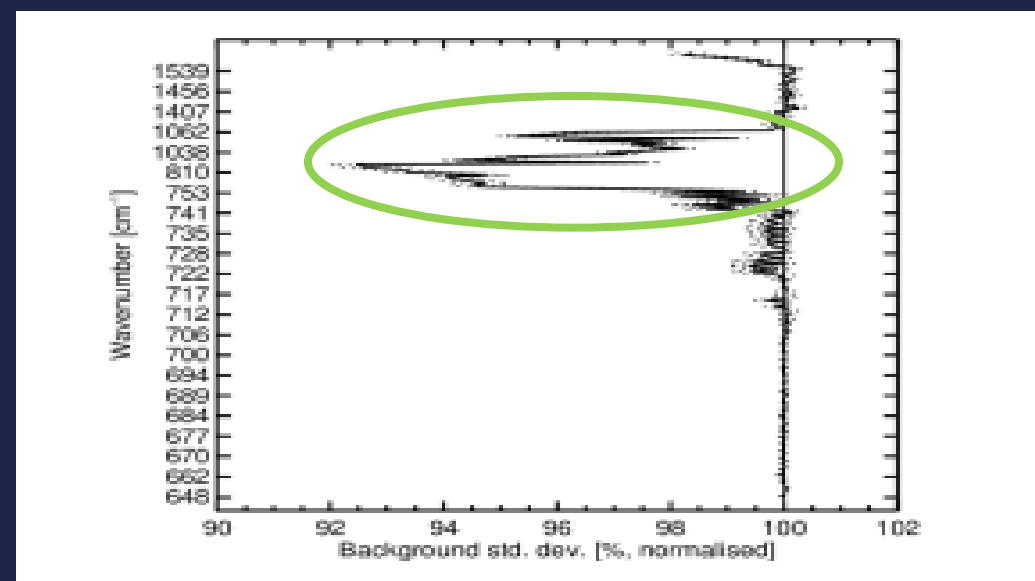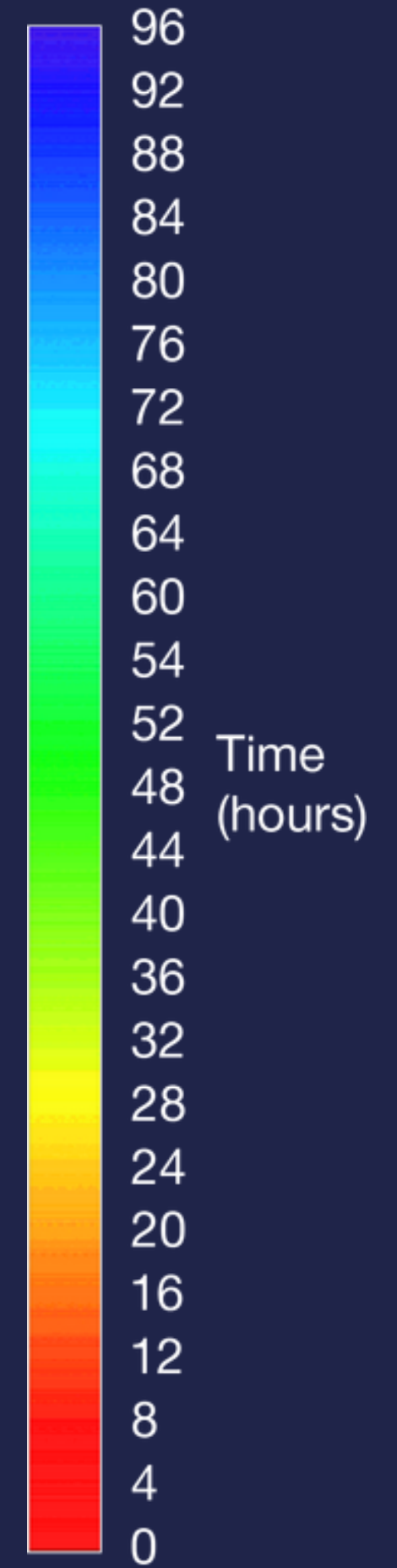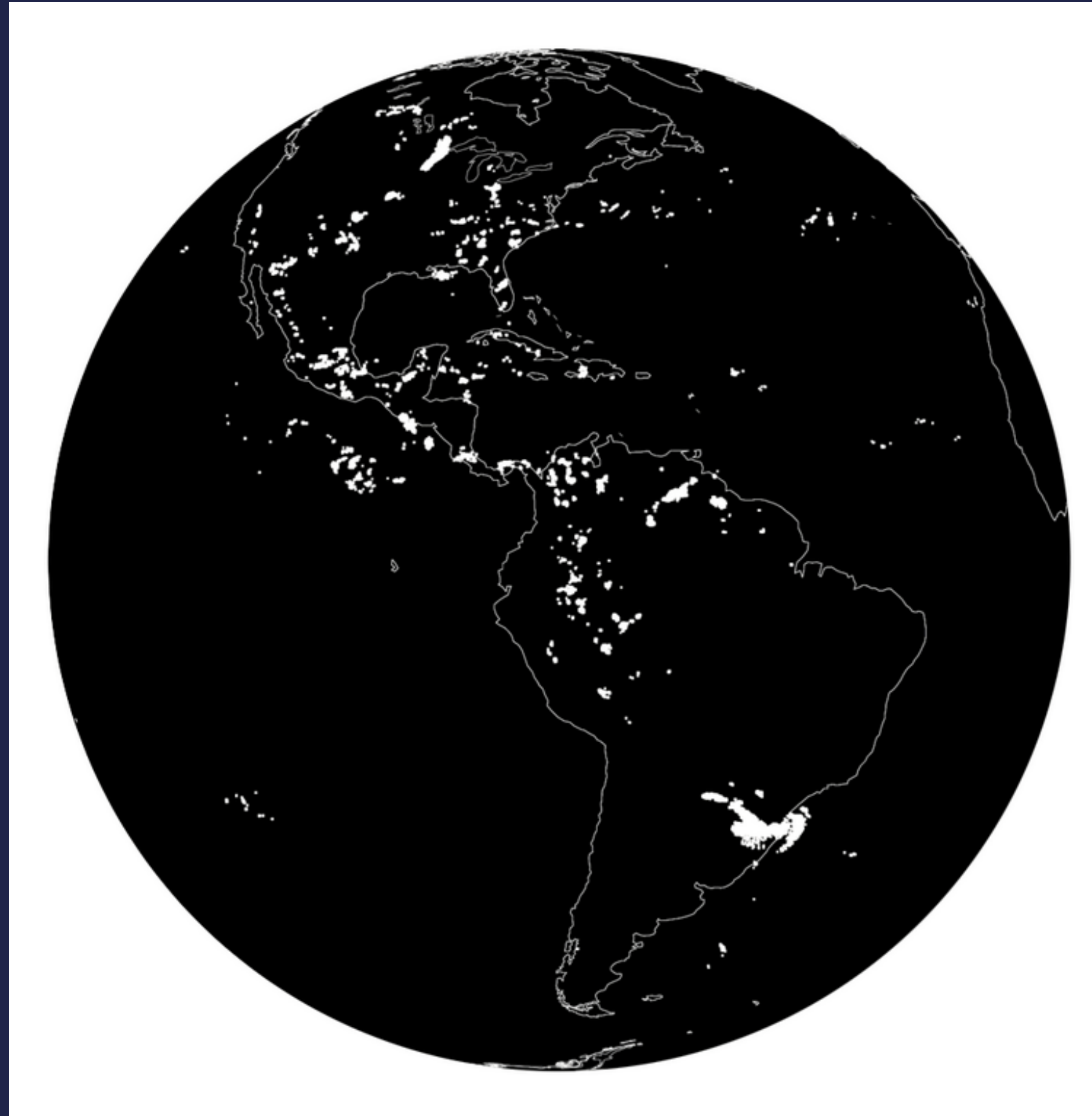
ARGO floats





Assimilating infrared radiances in coupled 4D-Var / NEMOVAR produces a better ocean surface **and** sub-surface (verified by in situ ocean observations) which simultaneously feeds back to **improved atmospheric weather forecasts**
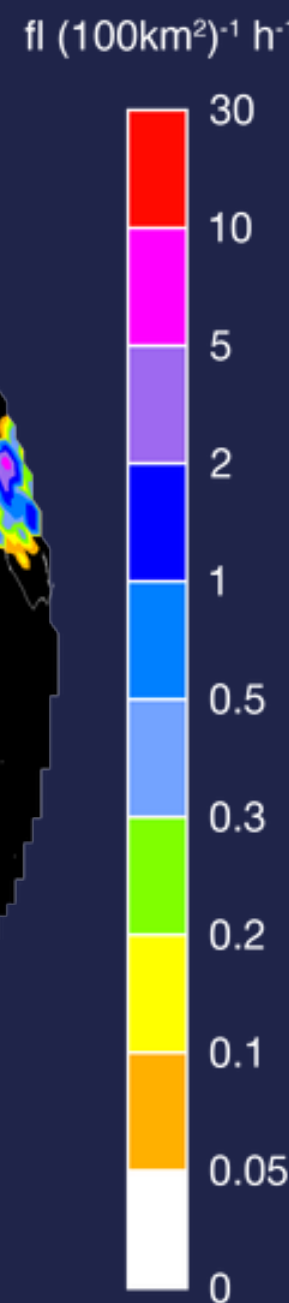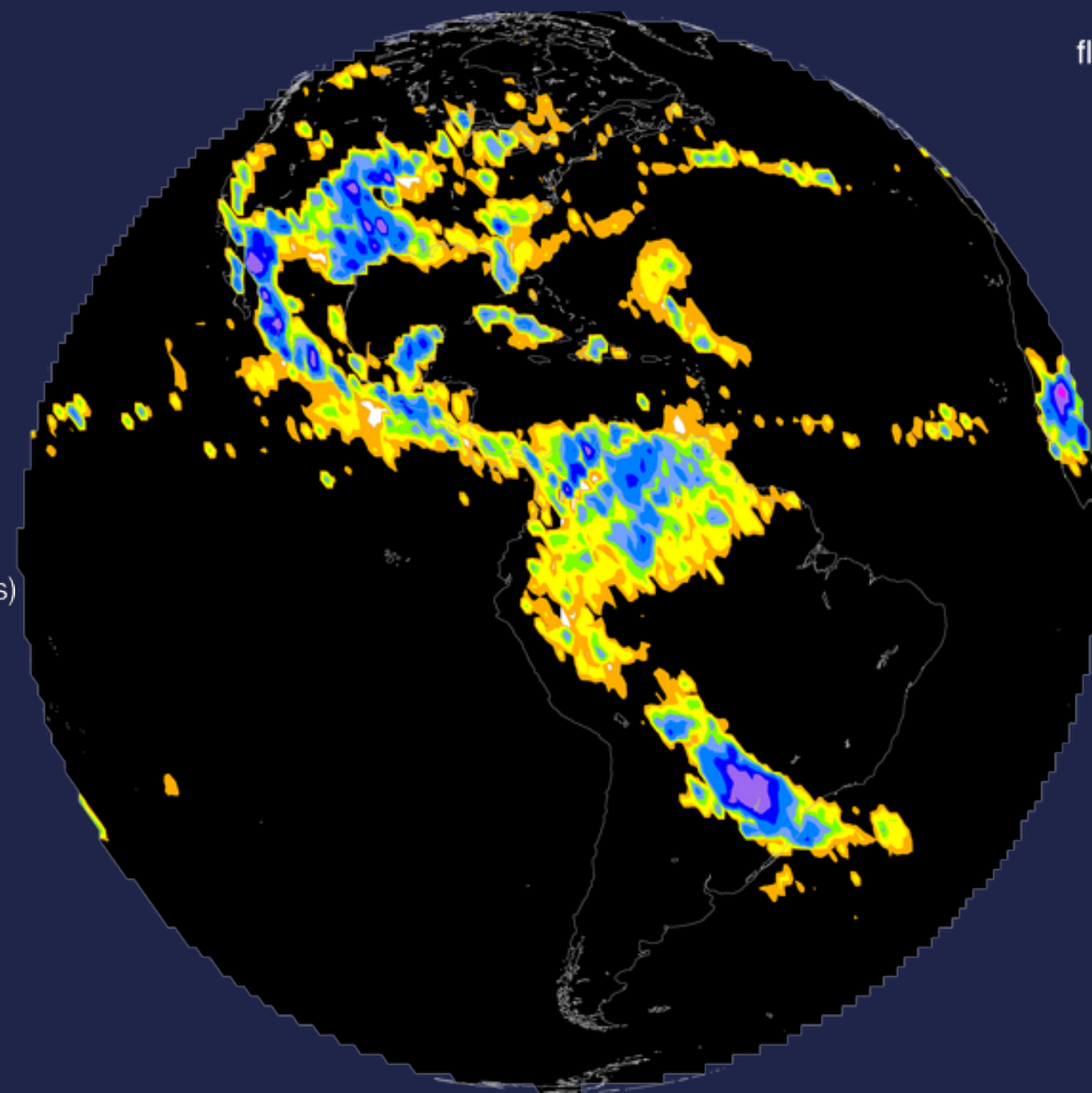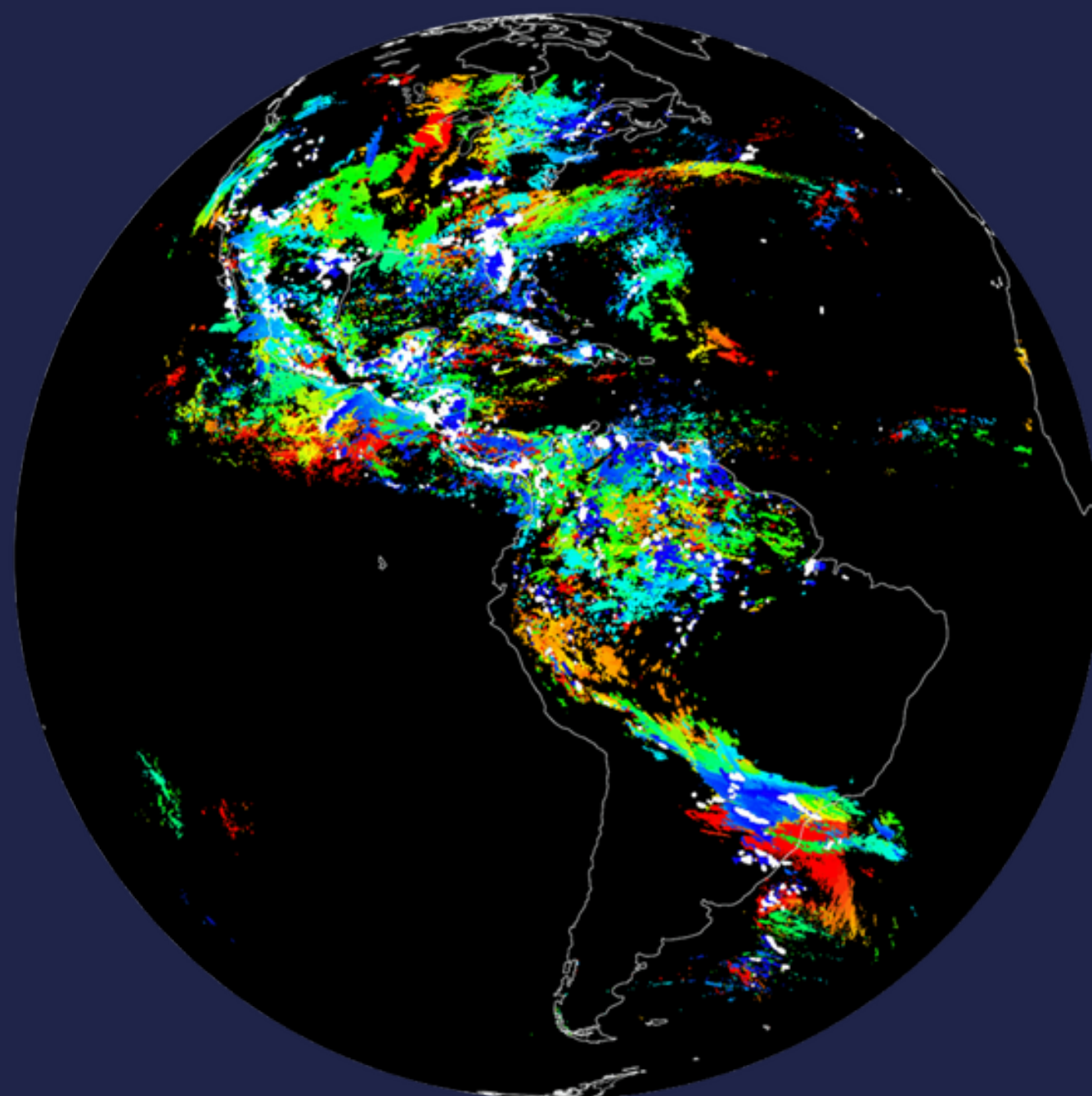
Changes have *memory* in the ocean and feed back to <u>improve radiance use in the atmosphere</u>
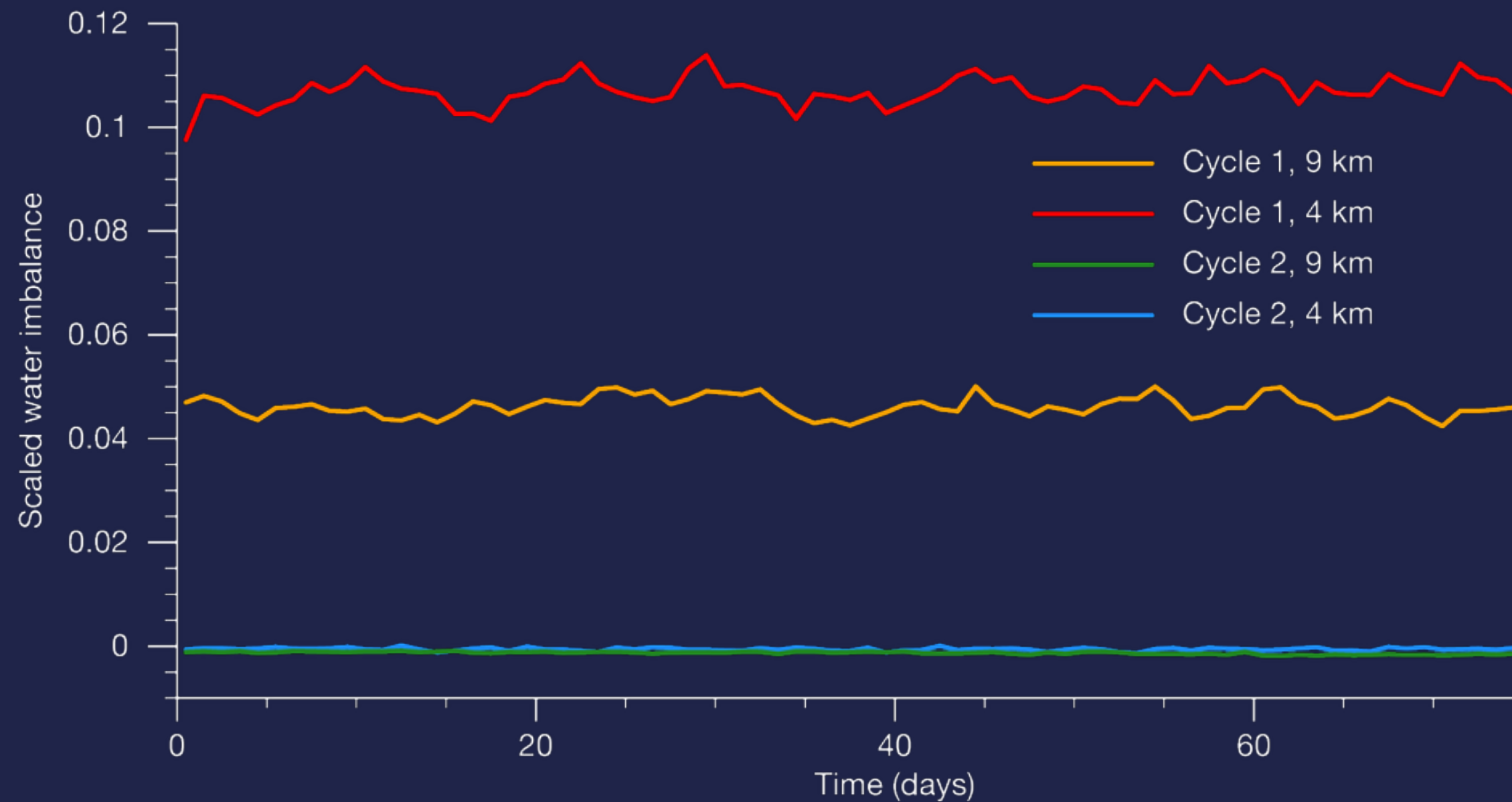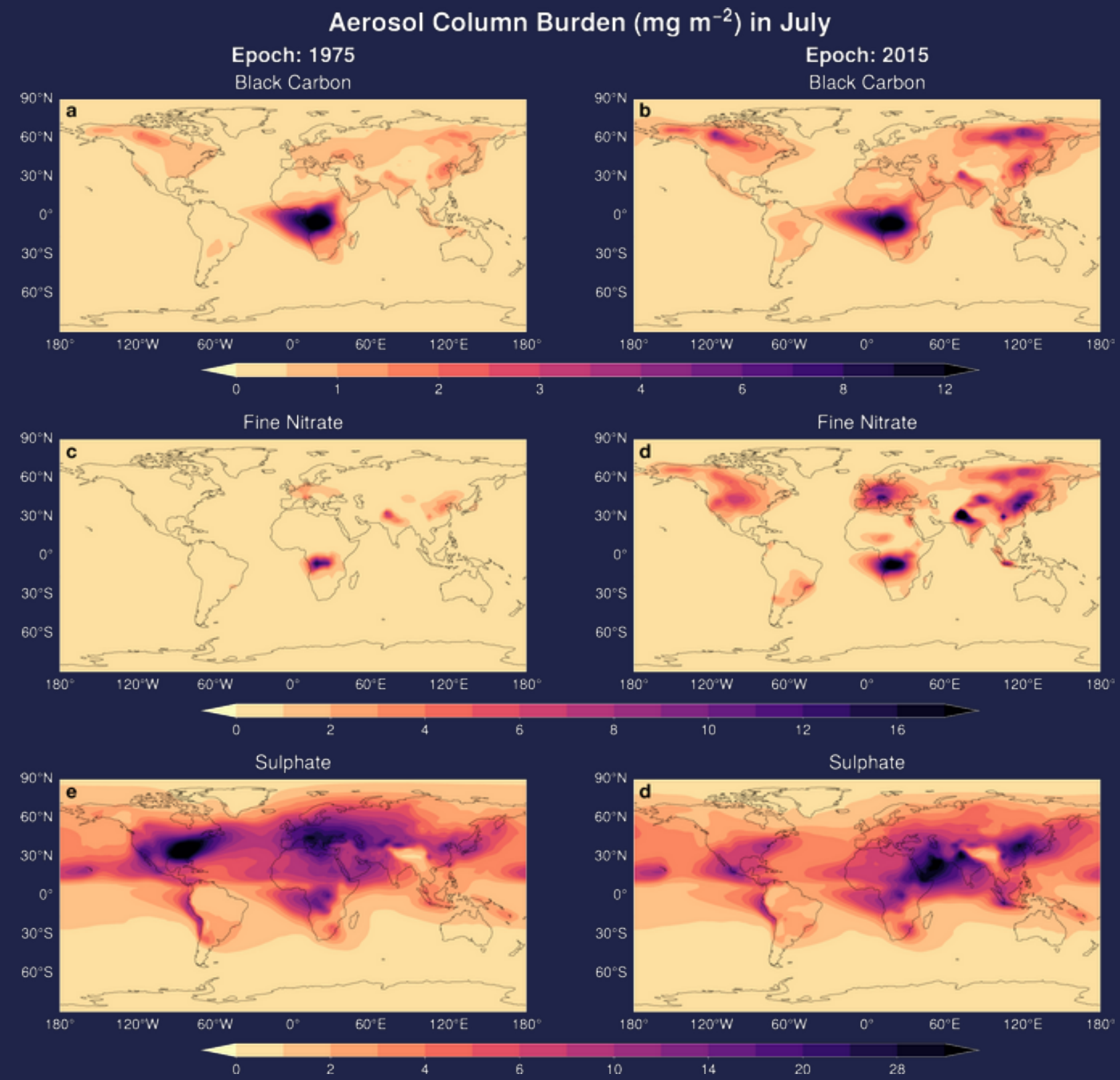
ECMWF

# Preparing for MTG-I

# Preparing for MTG-I

# Water conservation in the IFS:
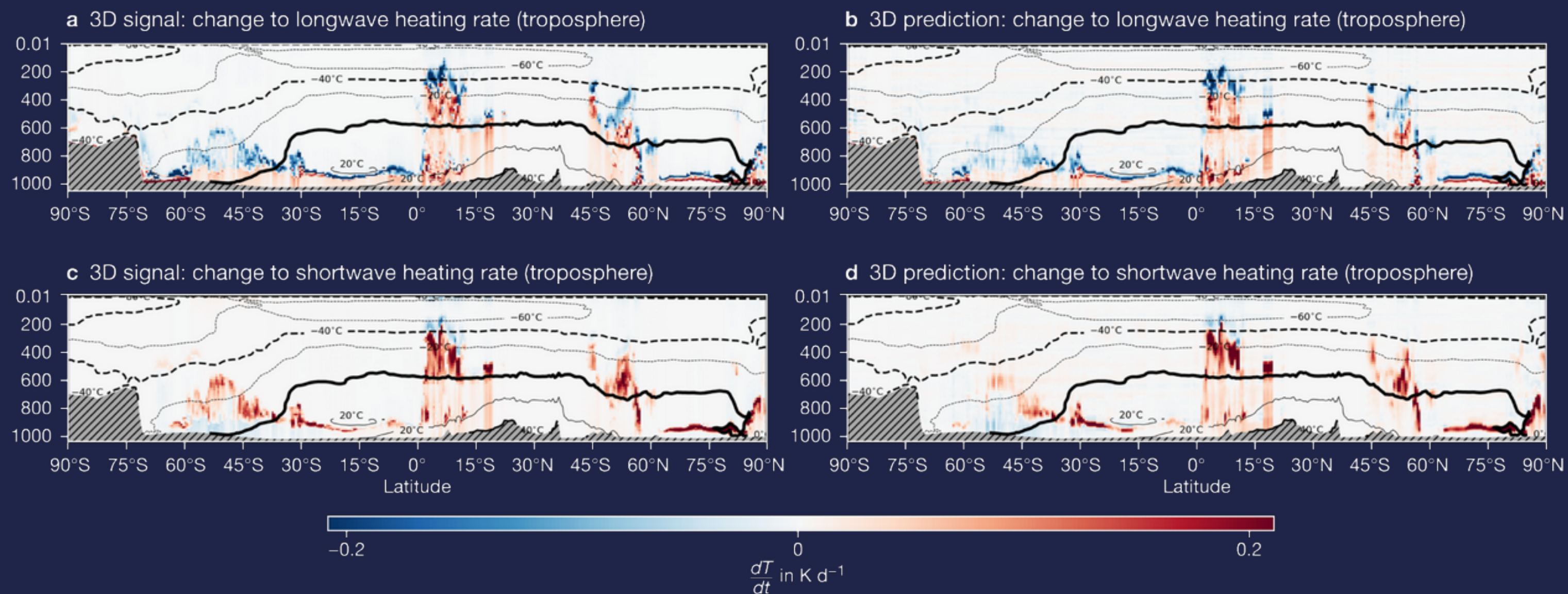## *Positive results highlighted by NextGEMS experiment*
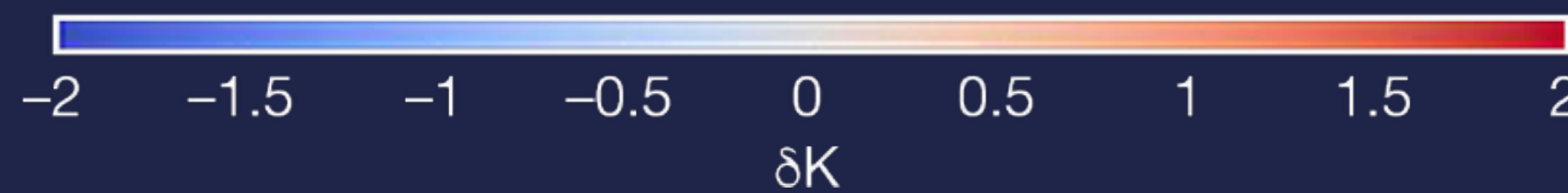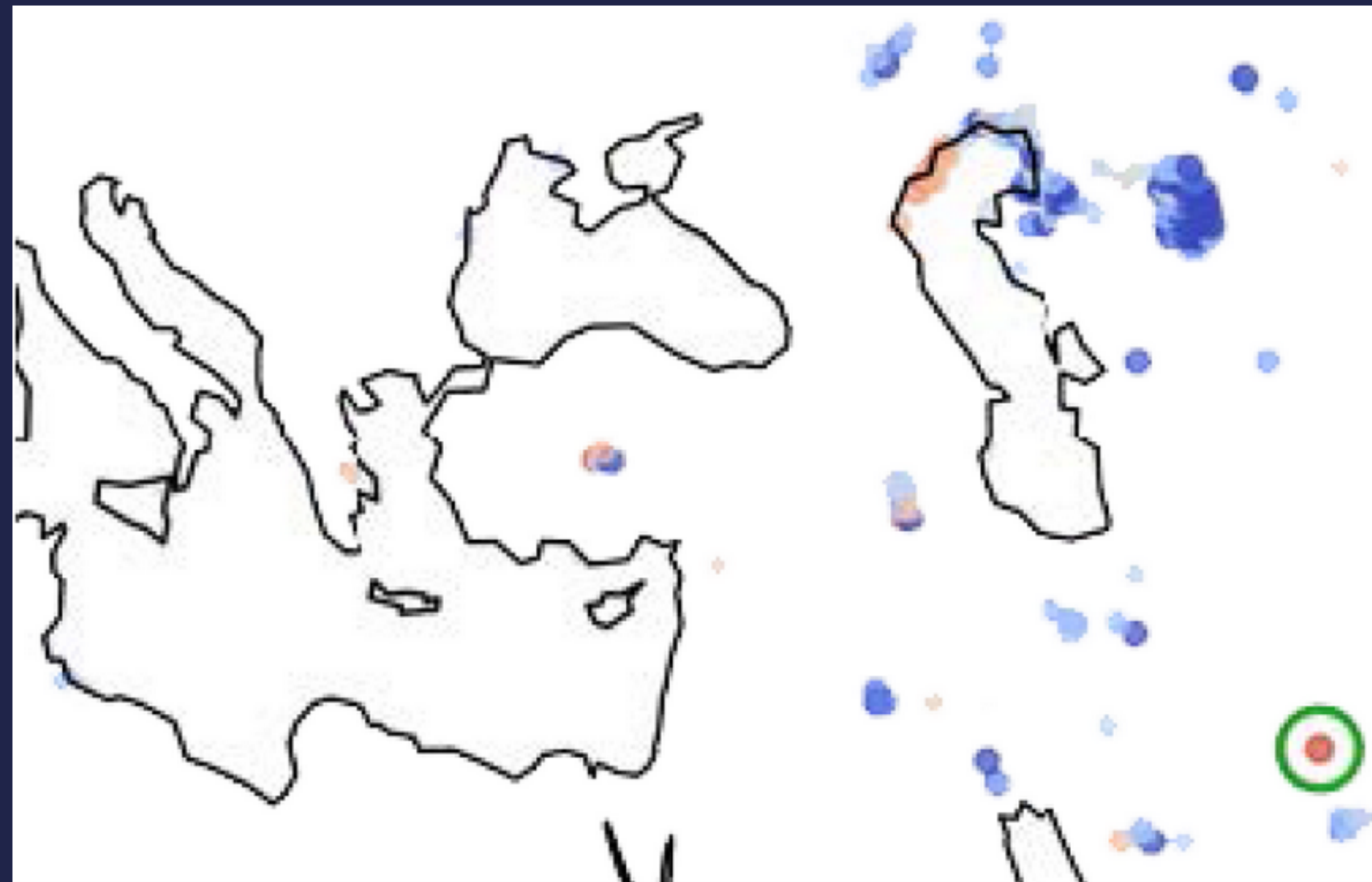
# Time-varying aerosols for reanalyses and seasonal



Aerosol Column Burden (mg m$^{-2}$) in July

# Representing the effect of 3D cloud effects using neural network emulators

## ...*at almost no additional computational cost*



a 3D signal: change to longwave heating rate (troposphere)

b 3D prediction: change to longwave heating rate (troposphere)

c 3D signal: change to shortwave heating rate (troposphere)

d 3D prediction: change to shortwave heating rate (troposphere)

$\frac{dT}{dt}$ in K d$^{-1}$

ECMWF

# Using Machine Learning in NWP

ECMWF new HPCF

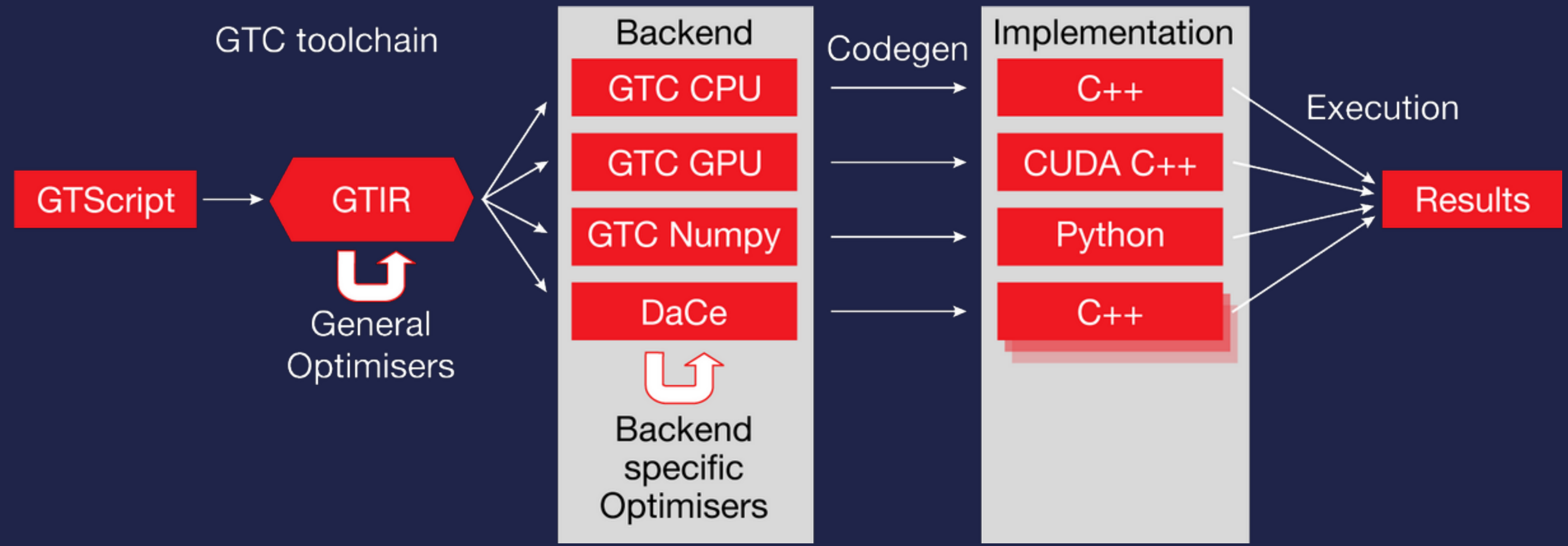…as if you were there…

GREEN LIGHTS FOR OPERATIONS!!!!

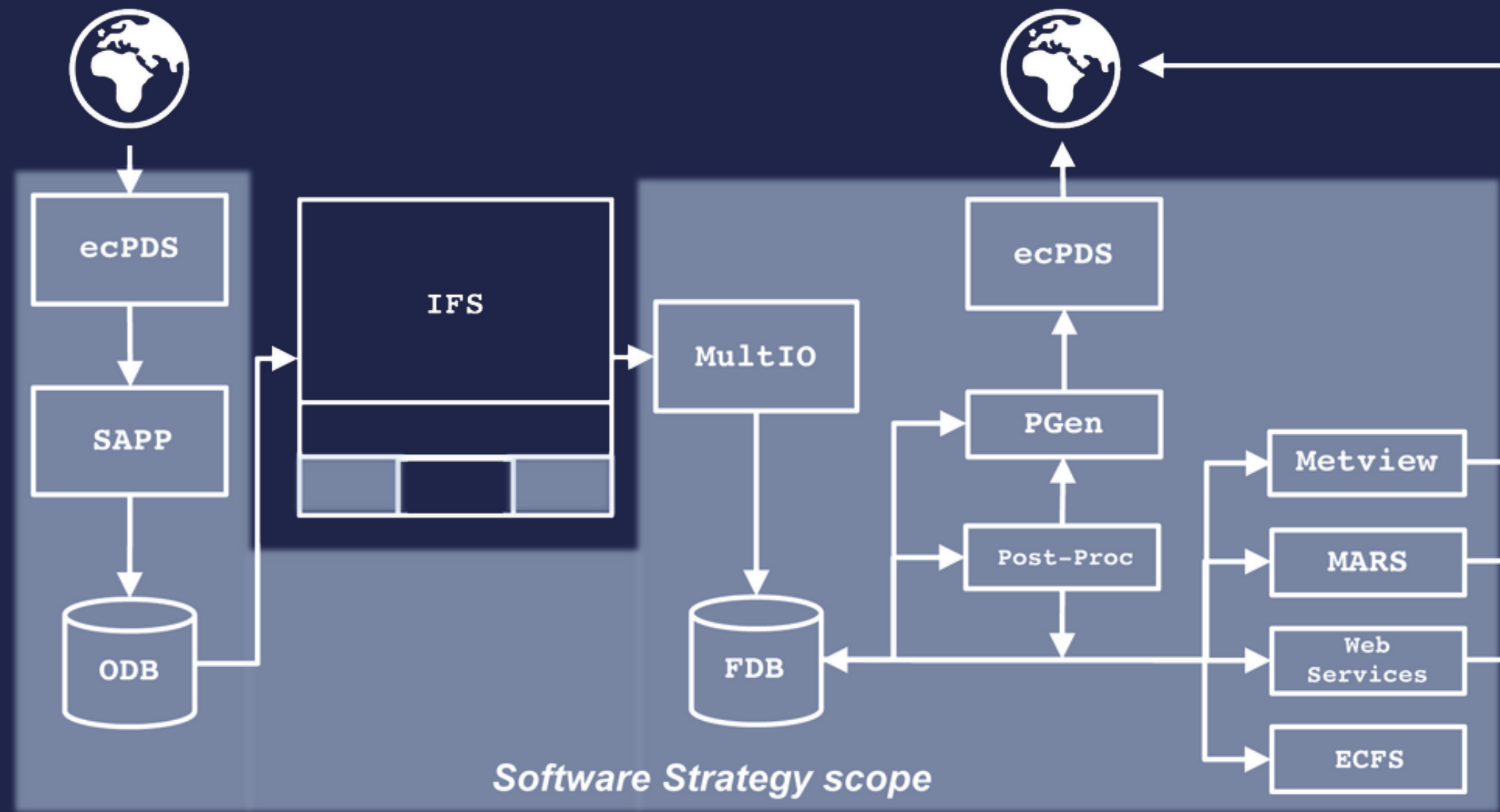Photographer: Stefano Marzoli
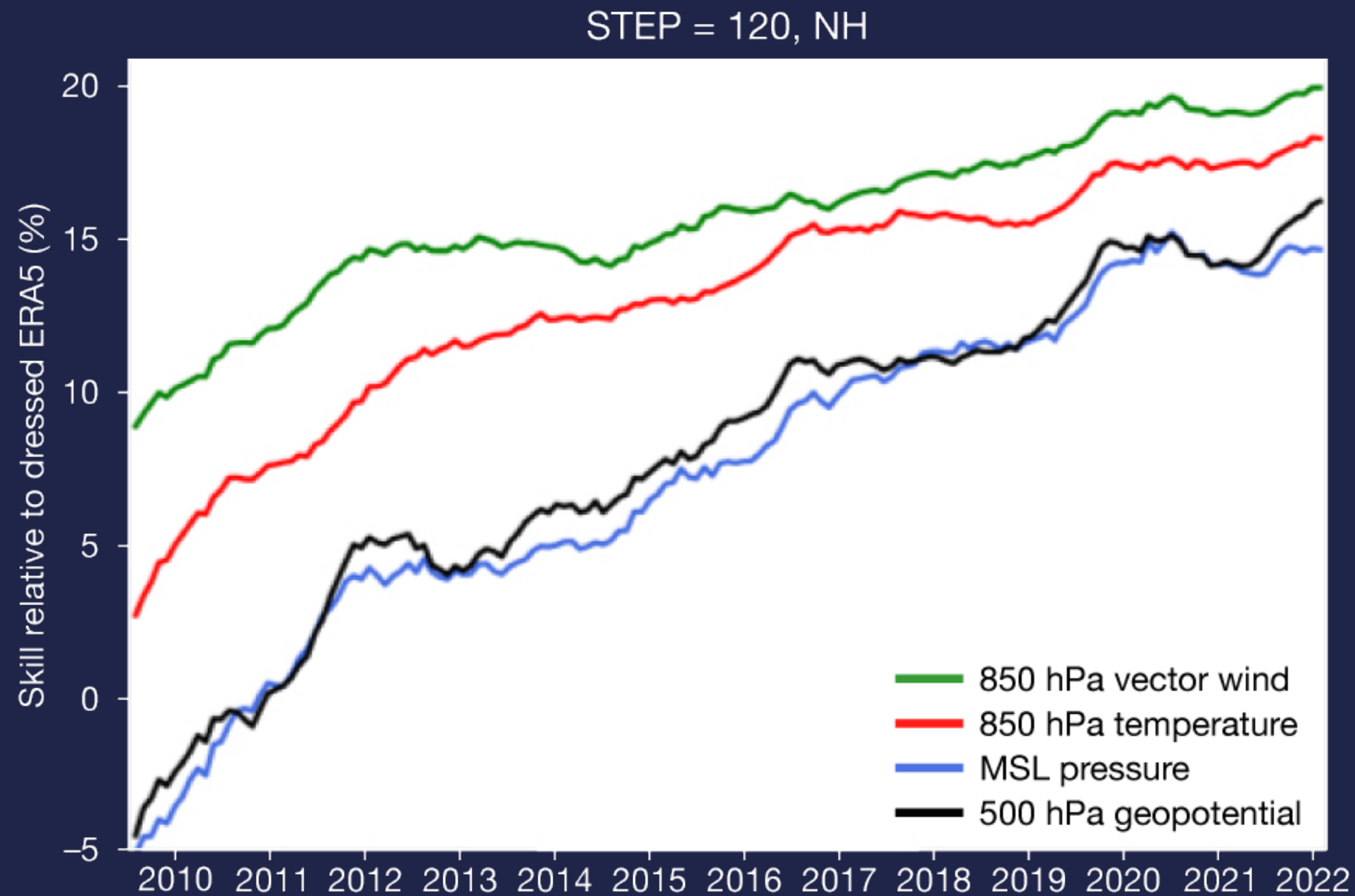
# Hybrid 2024 - performance of spectral transforms
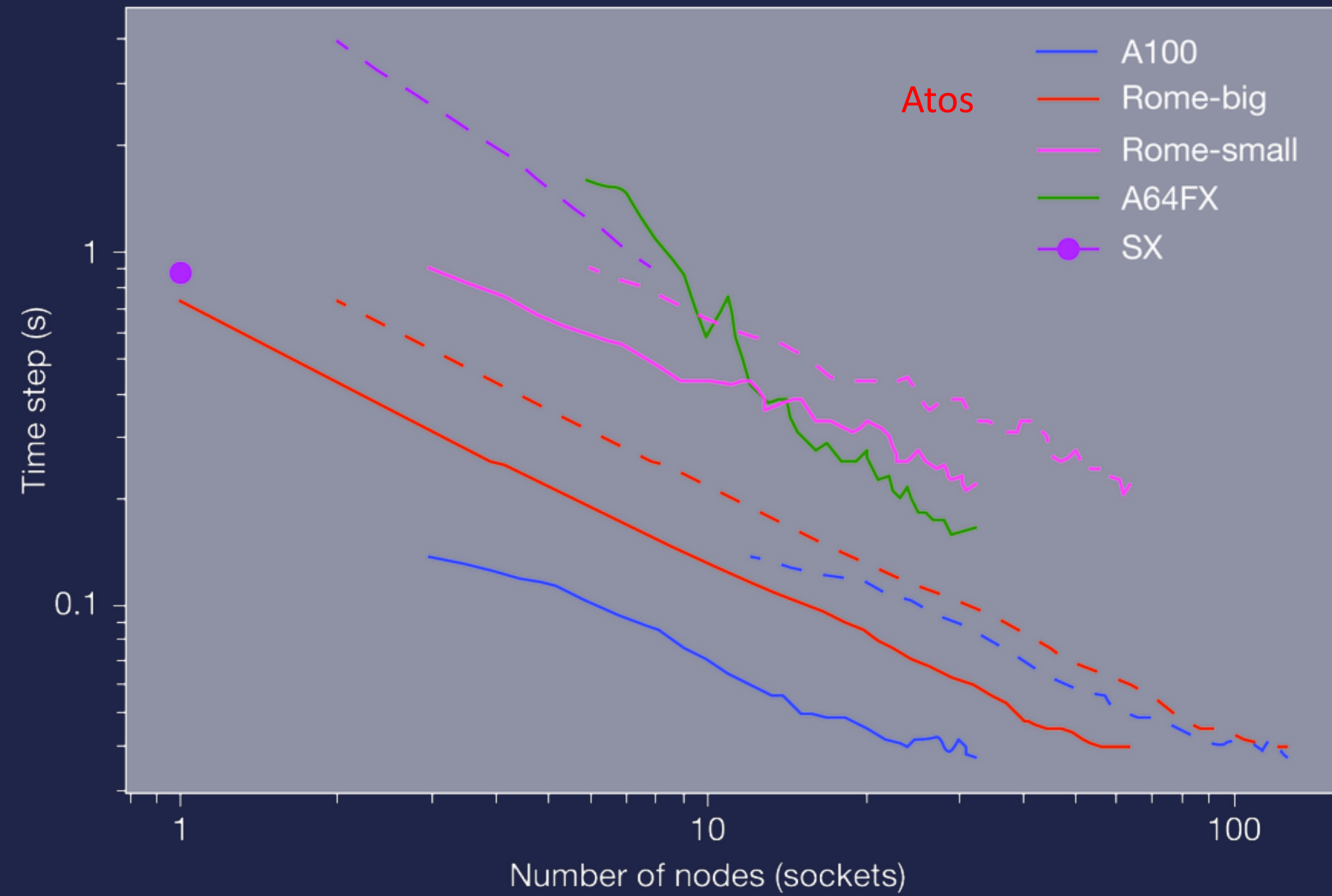
# Portability of the IFS

# Software Strategy 2023-2027

# 47r3 confirms its positive impact



STEP = 120, NH

Legend:
- 850 hPa vector wind (green)
- 850 hPa temperature (red)
- MSL pressure (blue)
- 500 hPa geopotential (black)
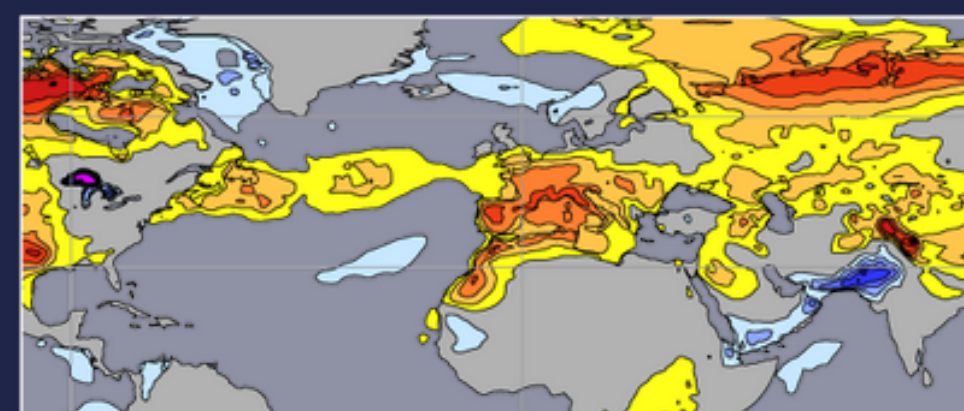
Y-axis: Skill relative to dressed ERA5 (%)
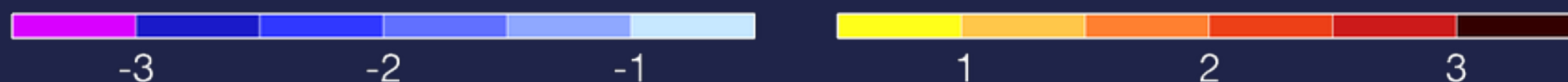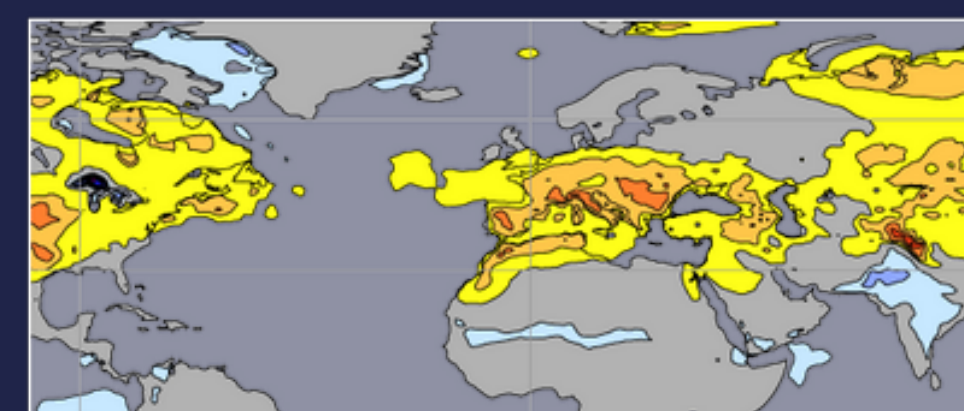
# European heatwave



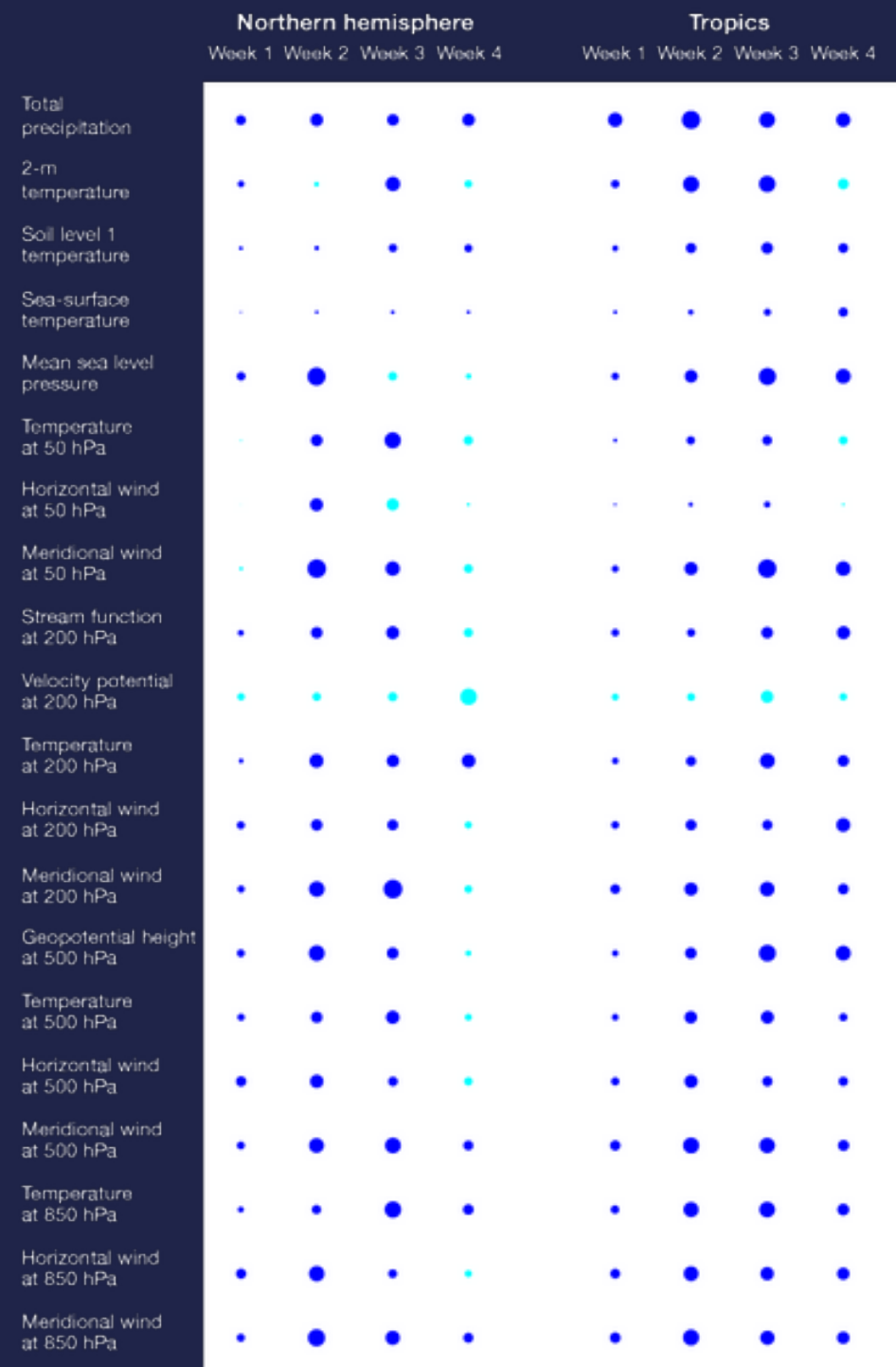ERA5 temperature anomaly | Ensemble mean, week-2 forecasts | Ensemble mean, week-6 forecasts
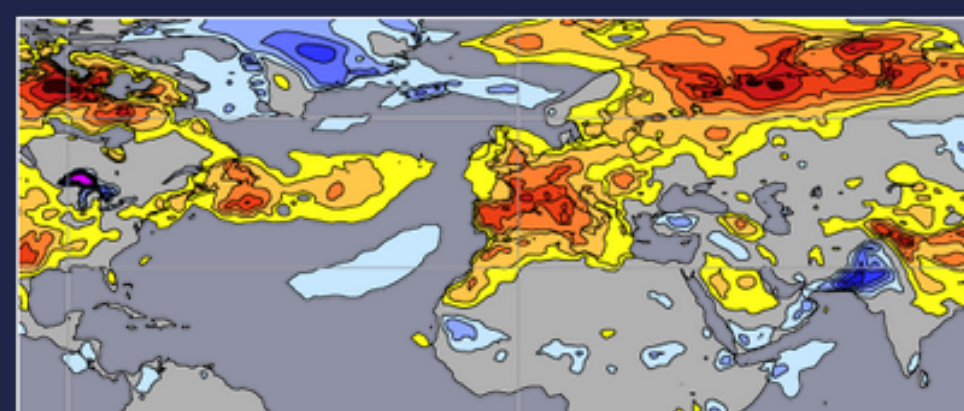
Two-metre temperature anomaly (°C)

# Extended range upgrade in 48r1



Application to LC-SSFMME and GPC-SSF

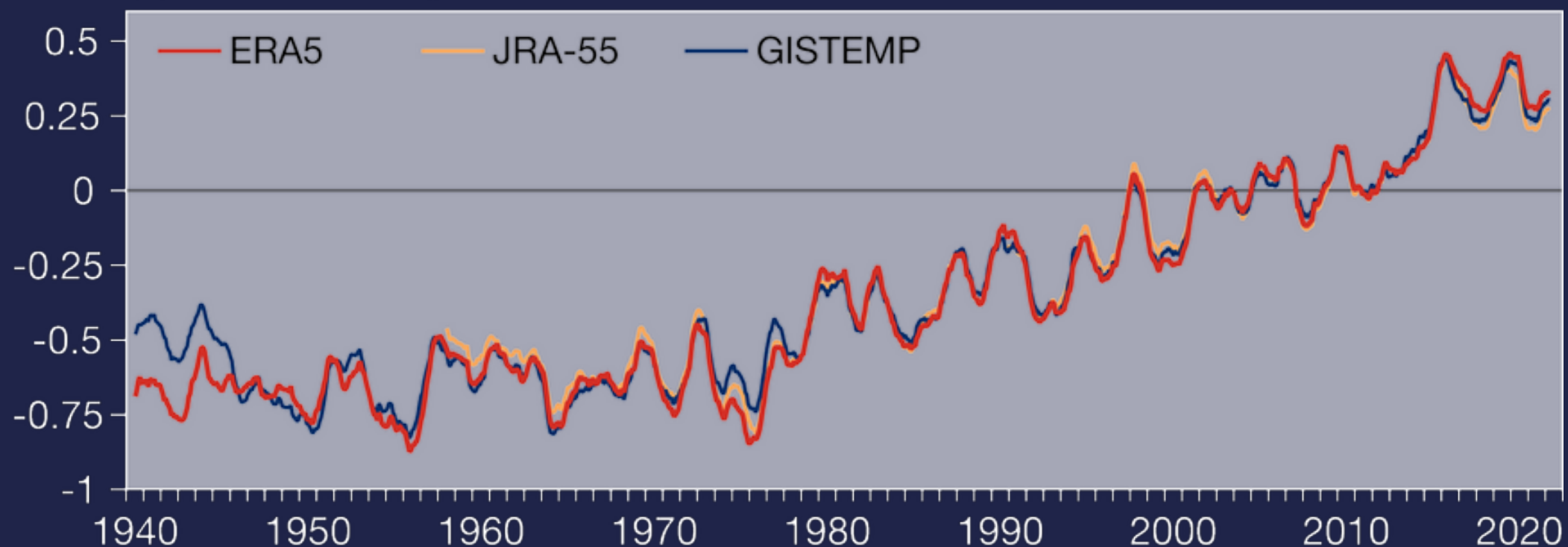Lead Centre for Sub-Seasonal Forecast Multi-Model Ensemble

Global Producing Centre for Sub-seasonal forecasts
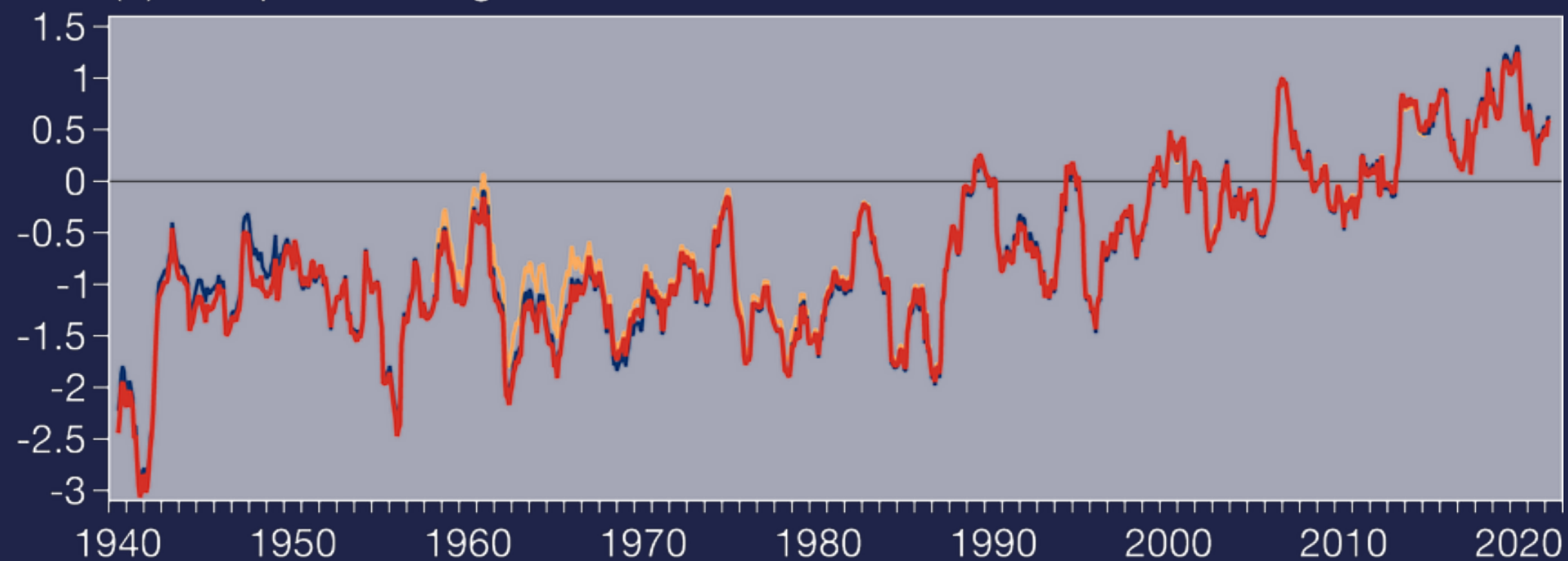
# C3S: ERA5 back extension 1940



12-month running mean 2m temperature anomaly (°C) wrt 1991-2020
(a) Global average
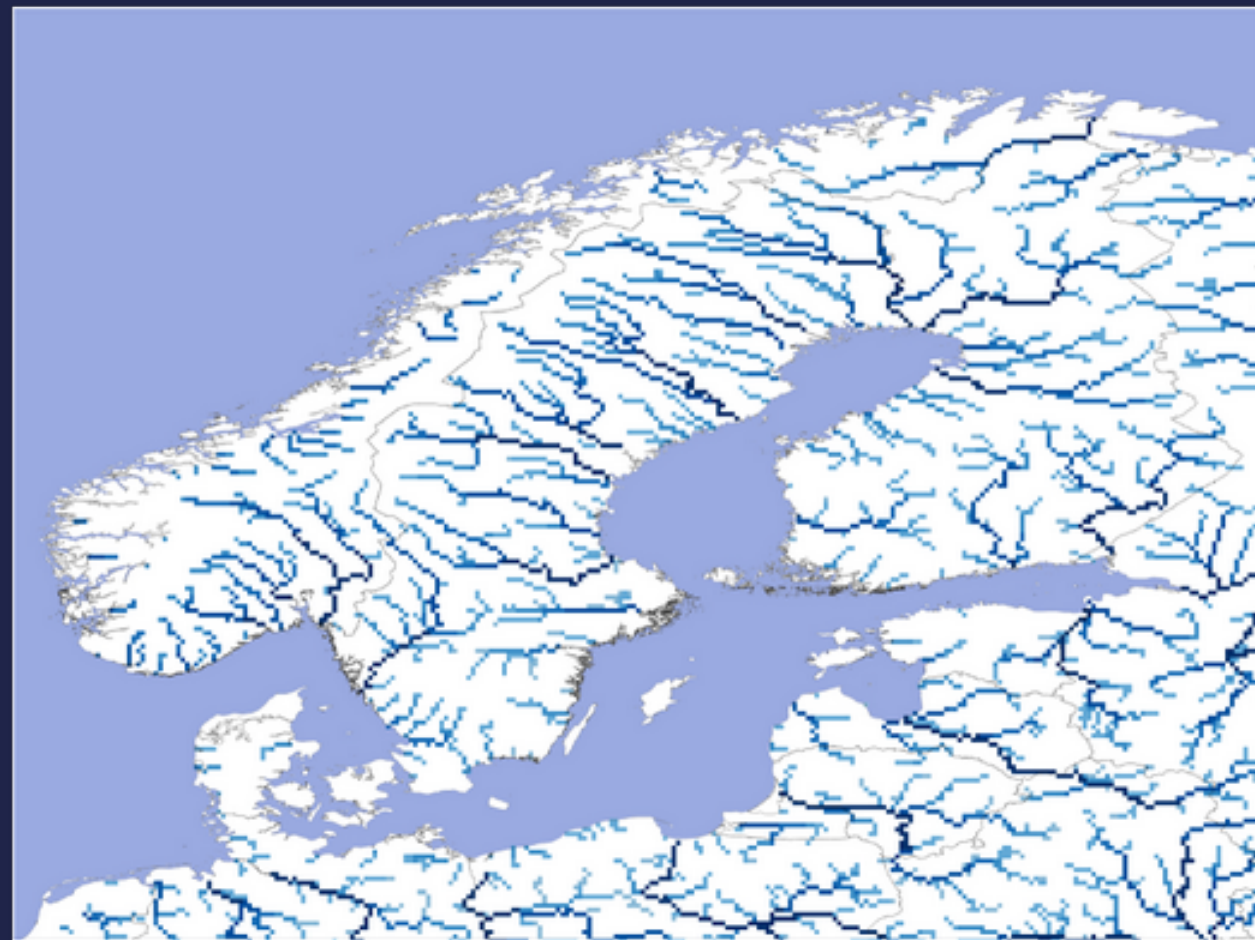
(b) European average

ECMWF

# GloFAS upgrade made possible with new HPCF

Representation of rivers in Scandinavia in GloFAS



Representation of rivers in Scandinavia in GloFAS v3.1

Representation of rivers in Scandinavia in GloFAS v4.0

# Open data

Approx. 700Gb open data produced per day

**ECMWF Real-time Open Data Delivery statistics**
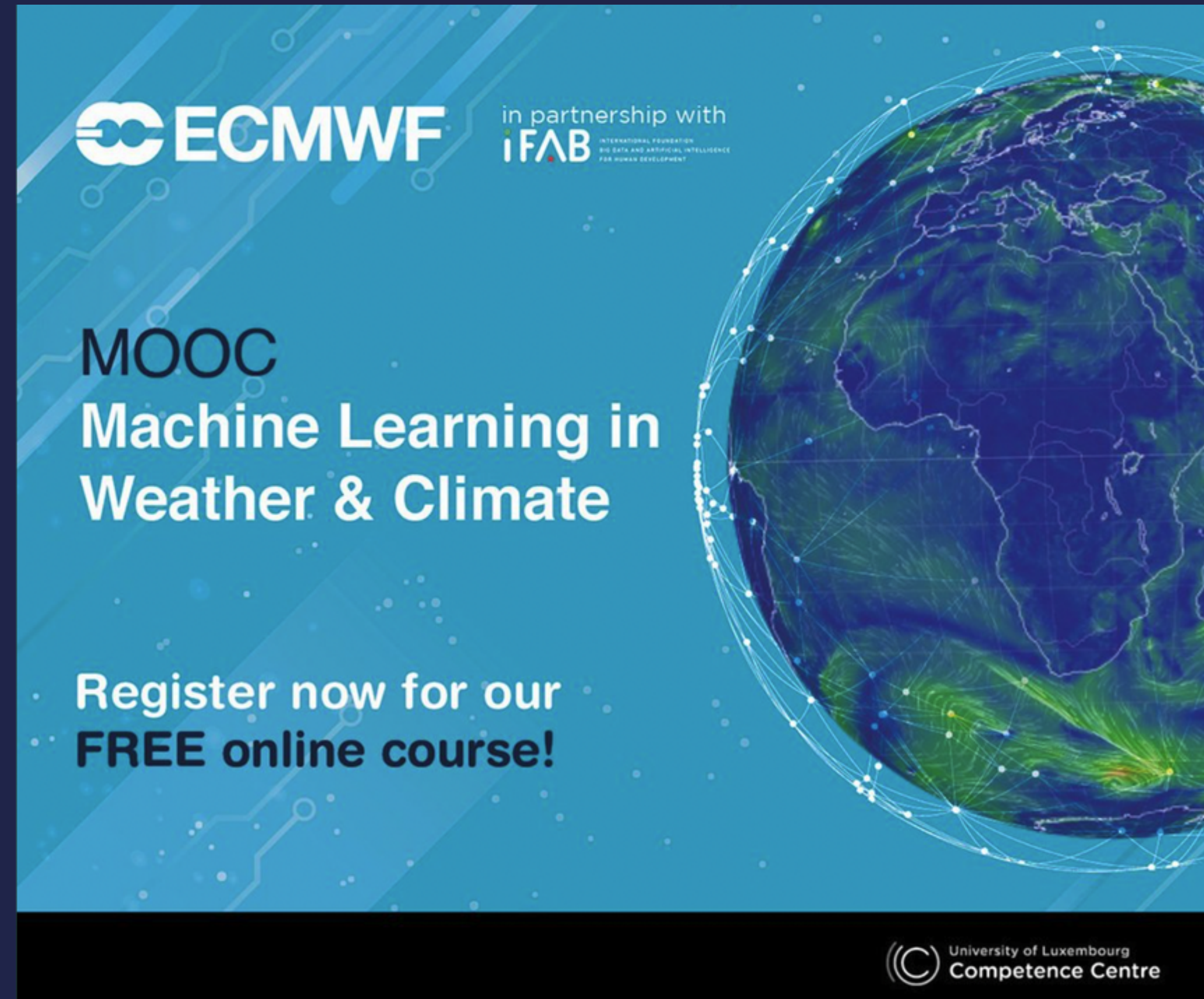
**2021**
2.8TB/day
38,000 requests / day

**2022**
7.5 TB/day
860,000 requests / day

Delivery via Microsoft Azure
Reported 5.5TB in one week and
400k user retrievals

+ new contract with Amazon

# MOOC https://moodle.ecmwf.int/pages/index.html

# ECMWF **Council 105**
## 1-2 December 2022