# ECMWF Forecast Products

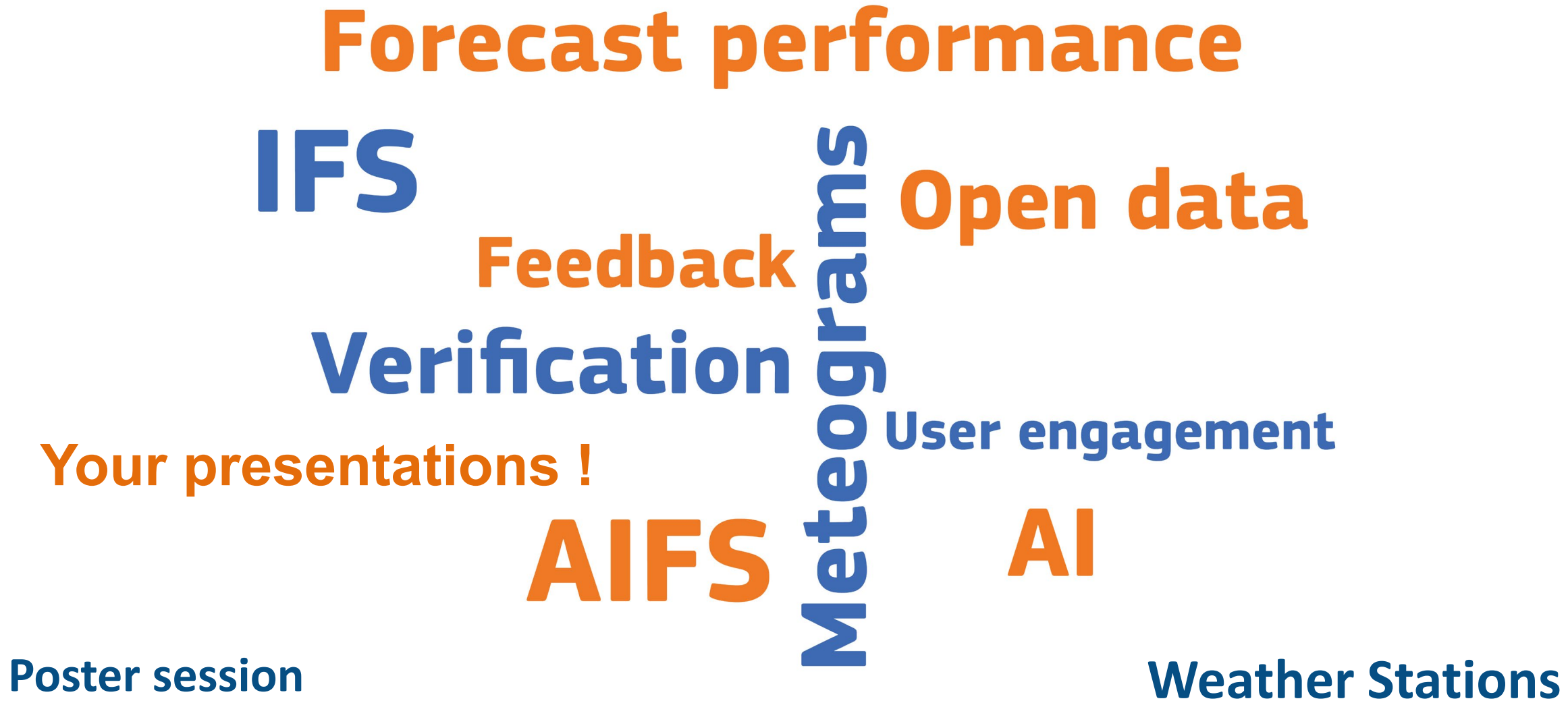
## Recent Advances, Future Directions

Matthieu Chevallier
Head of Evaluation, ECMWF

Contributions from many colleagues at ECMWF and beyond – Thank you !

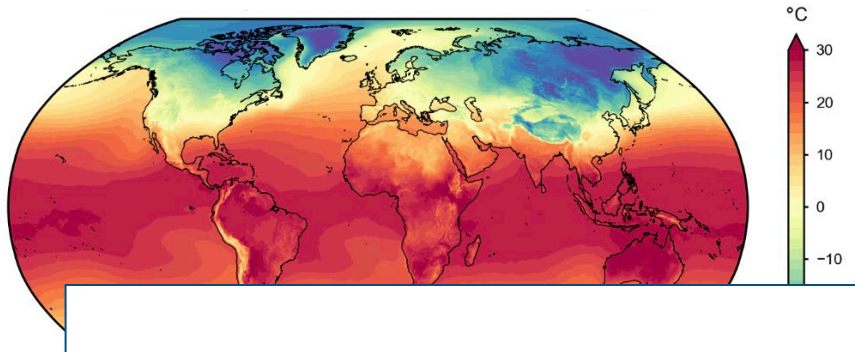
UEF 2025 – 16 September 2025

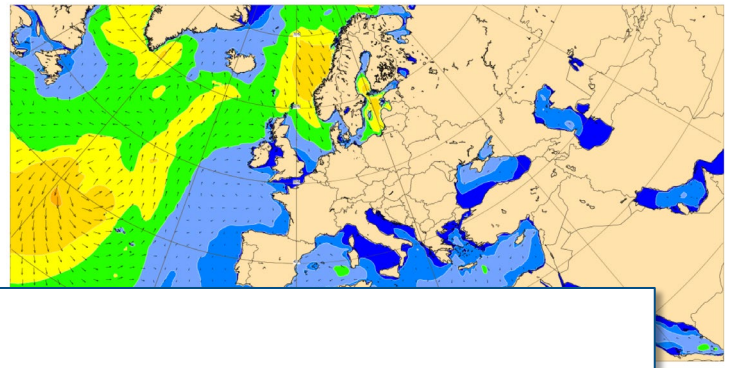
ECMWF


Forecast performance
IFS
Open data
Feedback
Verification
Meteograms
User engagement
Your presentations !
AIFS
AI
Poster session
Weather Stations

# Forecast data provision across multiple timescales

ERA5 monthly mean 2m temperature – Jan 2016



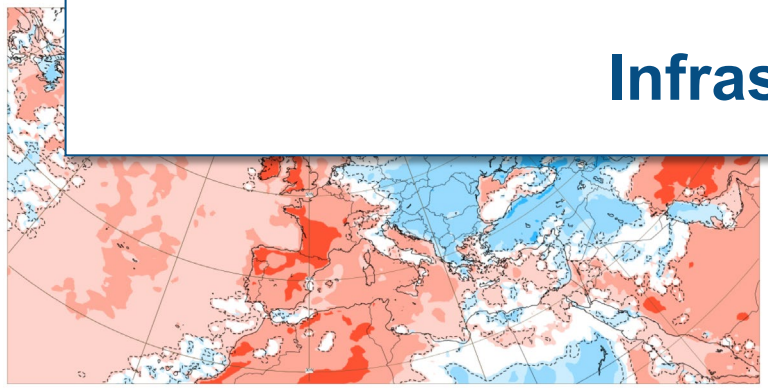
Significant Wave Height (m) – 04 Nov 2024

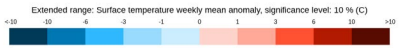
**Earth System**

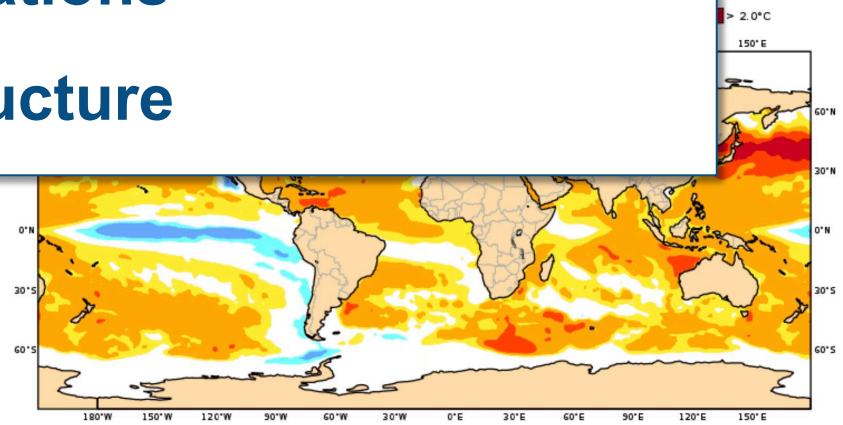
**Observations**

**Infrastructure**

2m temperature anomaly – 04-11 Nov 2024






Mean SST anomaly – Nov 2024

**Sub-seasonal** - 46 days - 36km

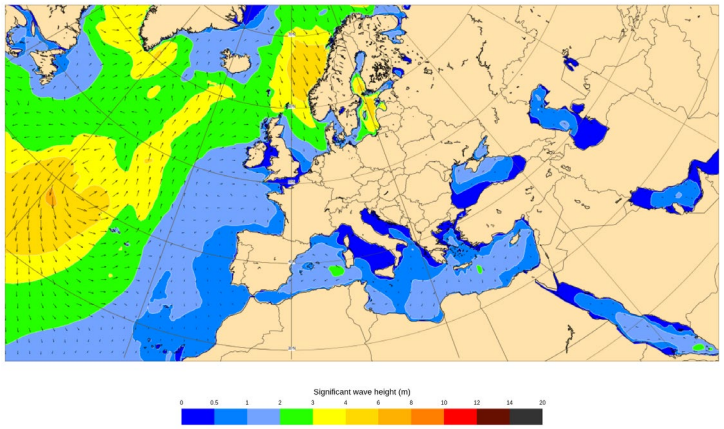
**Seasonal Forecast** - 7 months - 36km

ECMWF

# Forecast data provision across multiple timescales




**Reanalysis** – 1940-now – 36km




**Medium-range** - 15 days - 9km



**Sub-seasonal** - 46 days - 36km



Mean SST anomaly – Nov 2024

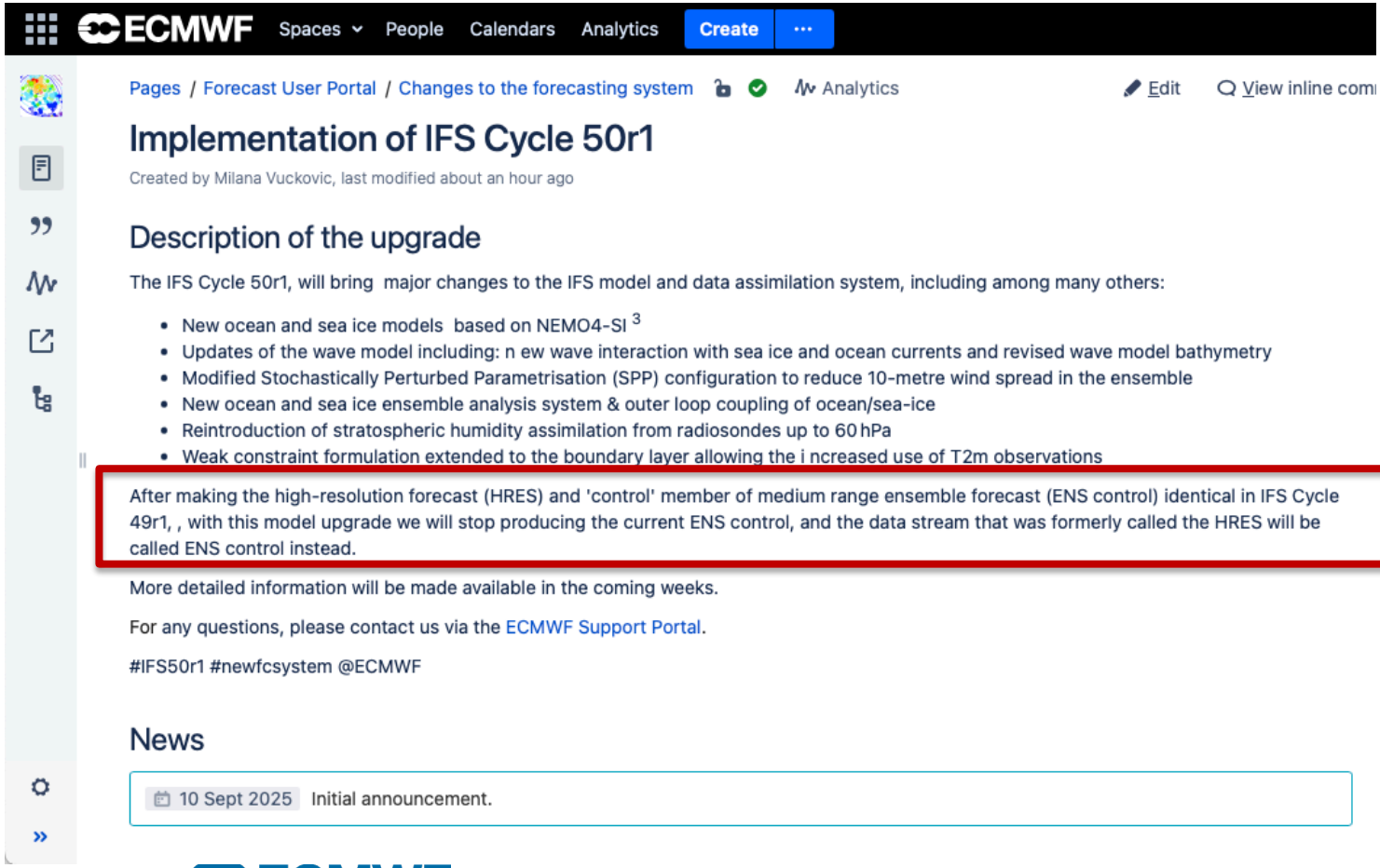
**Seasonal Forecast** - 7 months - 36km

ECMWF

# Medium-range forecasts

With **IFS Cycle 48r1**: 51-member medium-range ENS forecast at 9km resolution (same as HRES).

With **IFS Cycle 49r1**: HRES and ENS control member are bit-identical (still 2 runs produced).



ECMWF Spaces People Calendars Analytics Create ···

Pages / Forecast User Portal / Changes to the forecasting system Analytics Edit View inline com

## Implementation of IFS Cycle 50r1

Created by Milana Vuckovic, last modified about an hour ago

### Description of the upgrade

The IFS Cycle 50r1, will bring major changes to the IFS model and data assimilation system, including among many others:

- New ocean and sea ice models based on NEMO4-SI 3
- Updates of the wave model including: n ew wave interaction with sea ice and ocean currents and revised wave model bathymetry
- Modified Stochastically Perturbed Parametrisation (SPP) configuration to reduce 10-metre wind spread in the ensemble
- New ocean and sea ice ensemble analysis system & outer loop coupling of ocean/sea-ice
- Reintroduction of stratospheric humidity assimilation from radiosondes up to 60 hPa
- Weak constraint formulation extended to the boundary layer allowing the i ncreased use of T2m observations

After making the high-resolution forecast (HRES) and 'control' member of medium range ensemble forecast (ENS control) identical in IFS Cycle 49r1, , with this model upgrade we will stop producing the current ENS control, and the data stream that was formerly called the HRES will be called ENS control instead.

More detailed information will be made available in the coming weeks.

For any questions, please contact us via the ECMWF Support Portal.

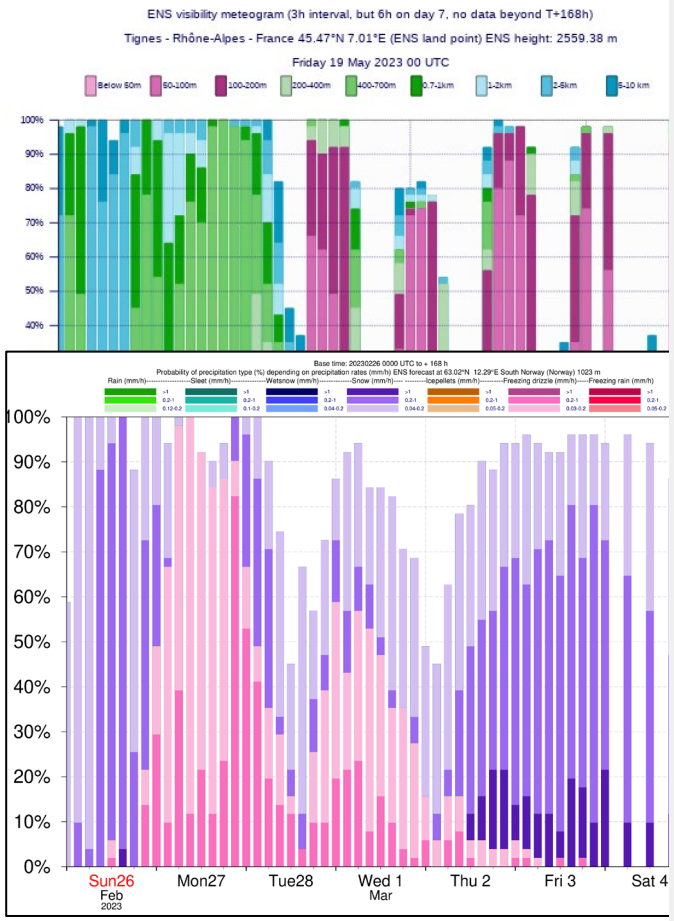
#IFS50r1 #newfcsystem @ECMWF

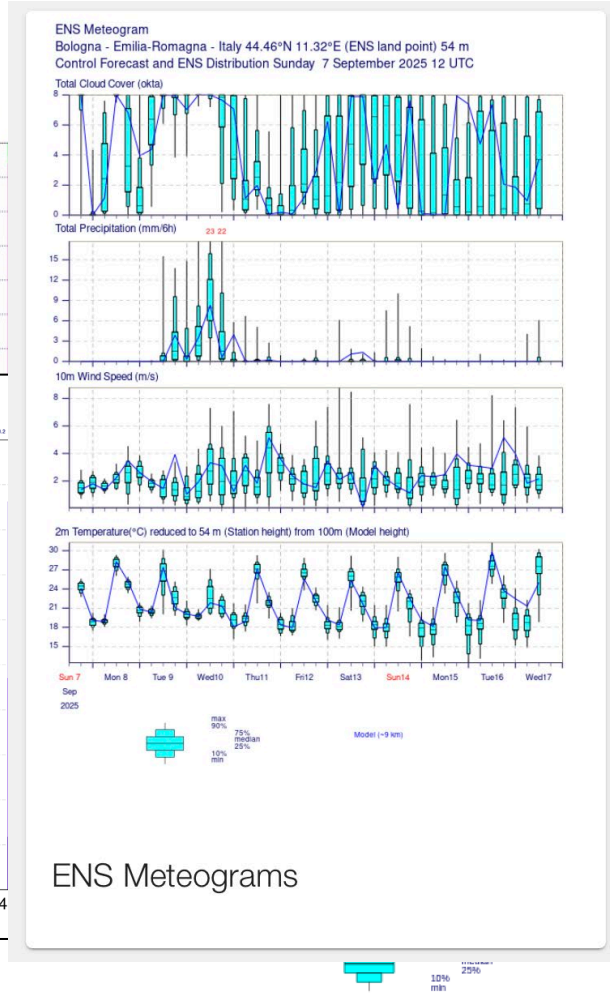
### News

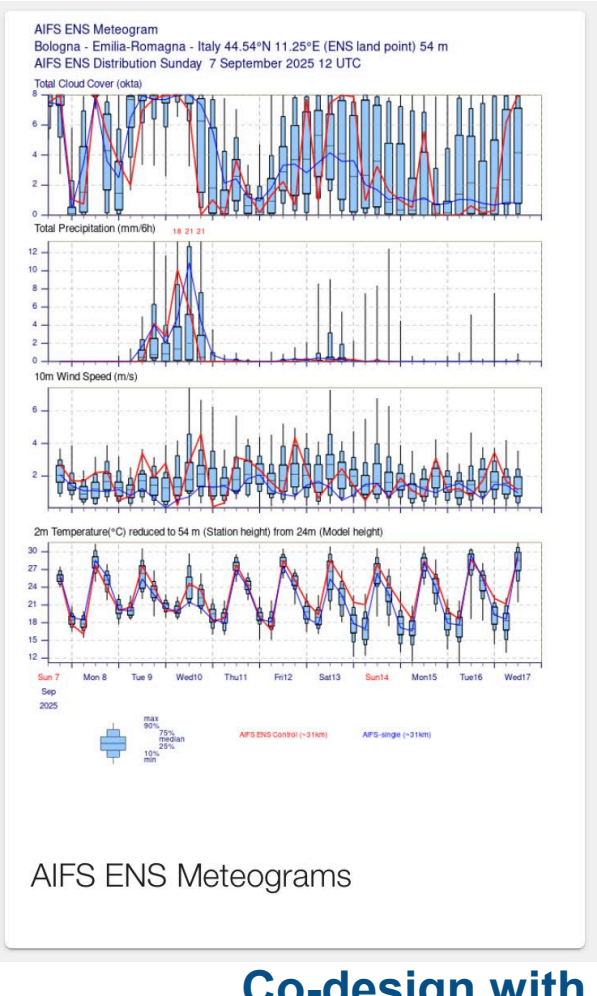
10 Sept 2025 Initial announcement.

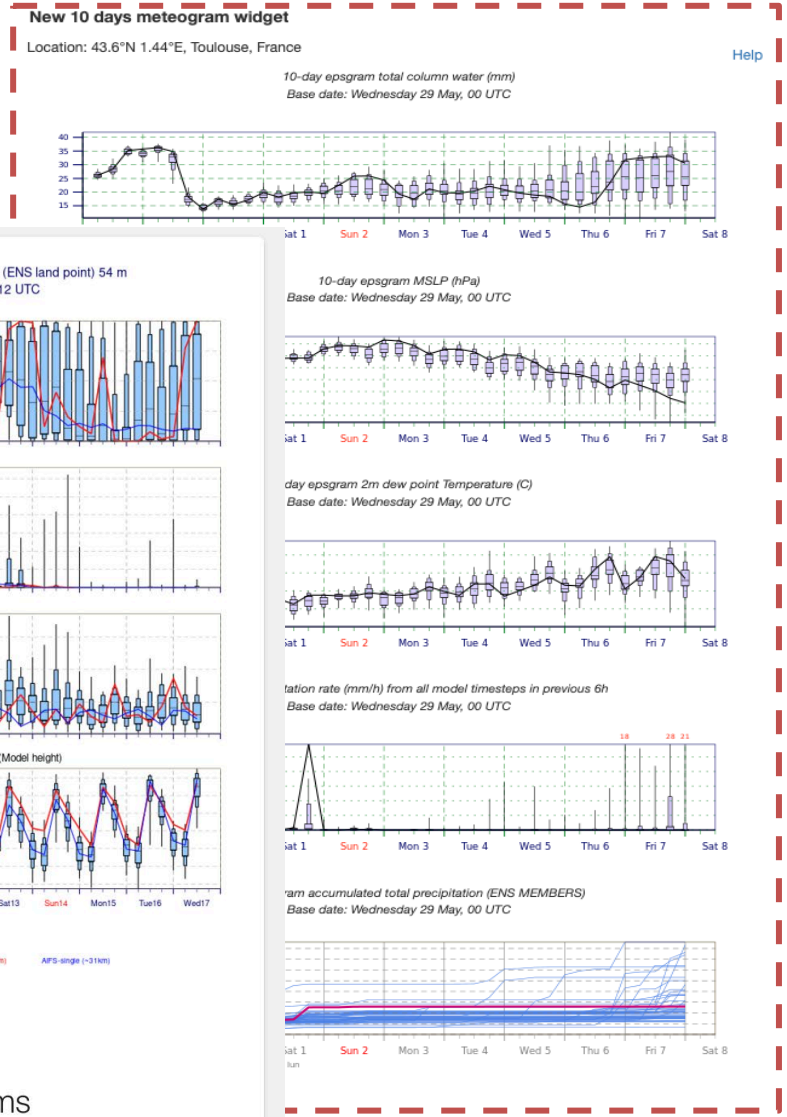
# Medium-range forecasts

## Meteograms



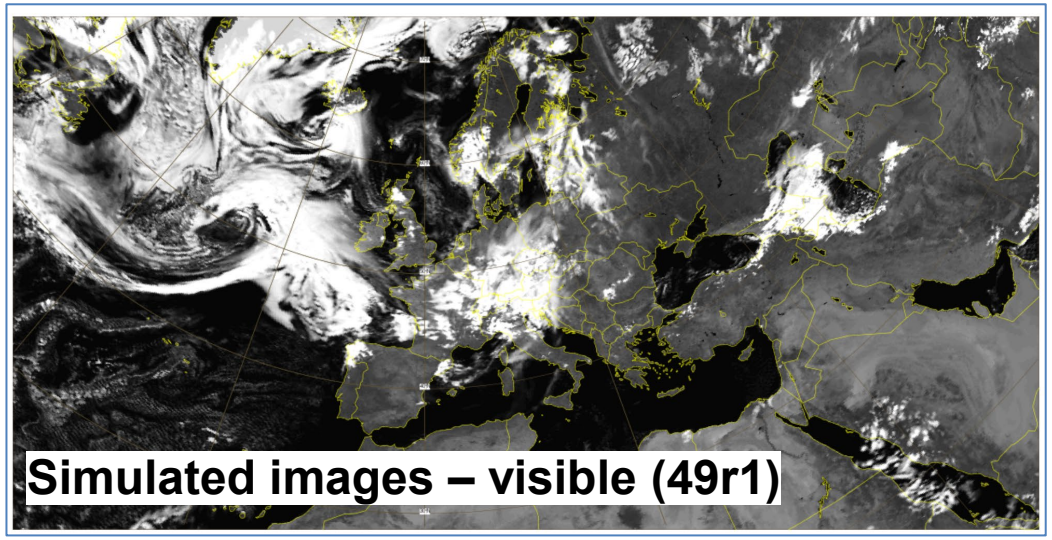



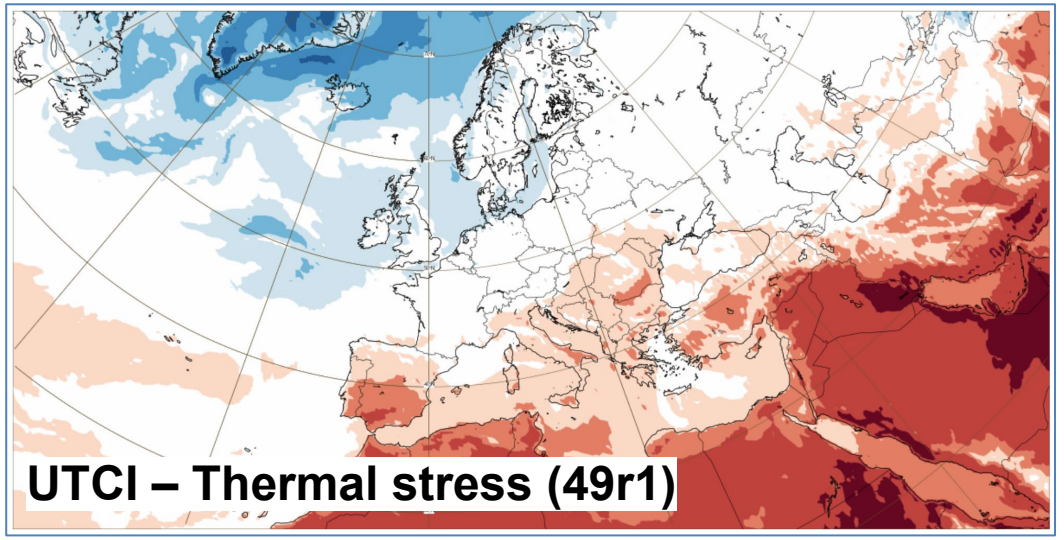



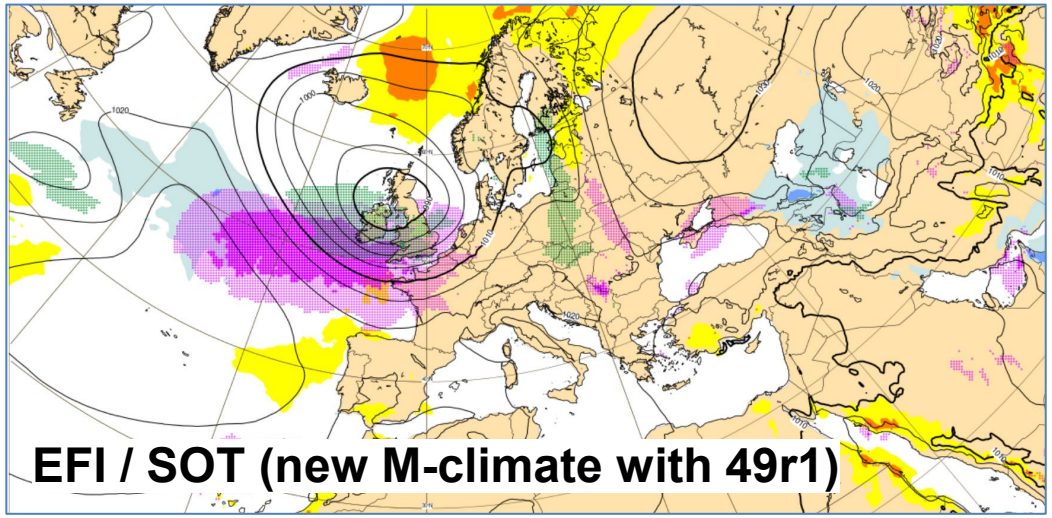




**Co-design with KNMI, OSMZ, DWD…**

# Medium-range forecasts



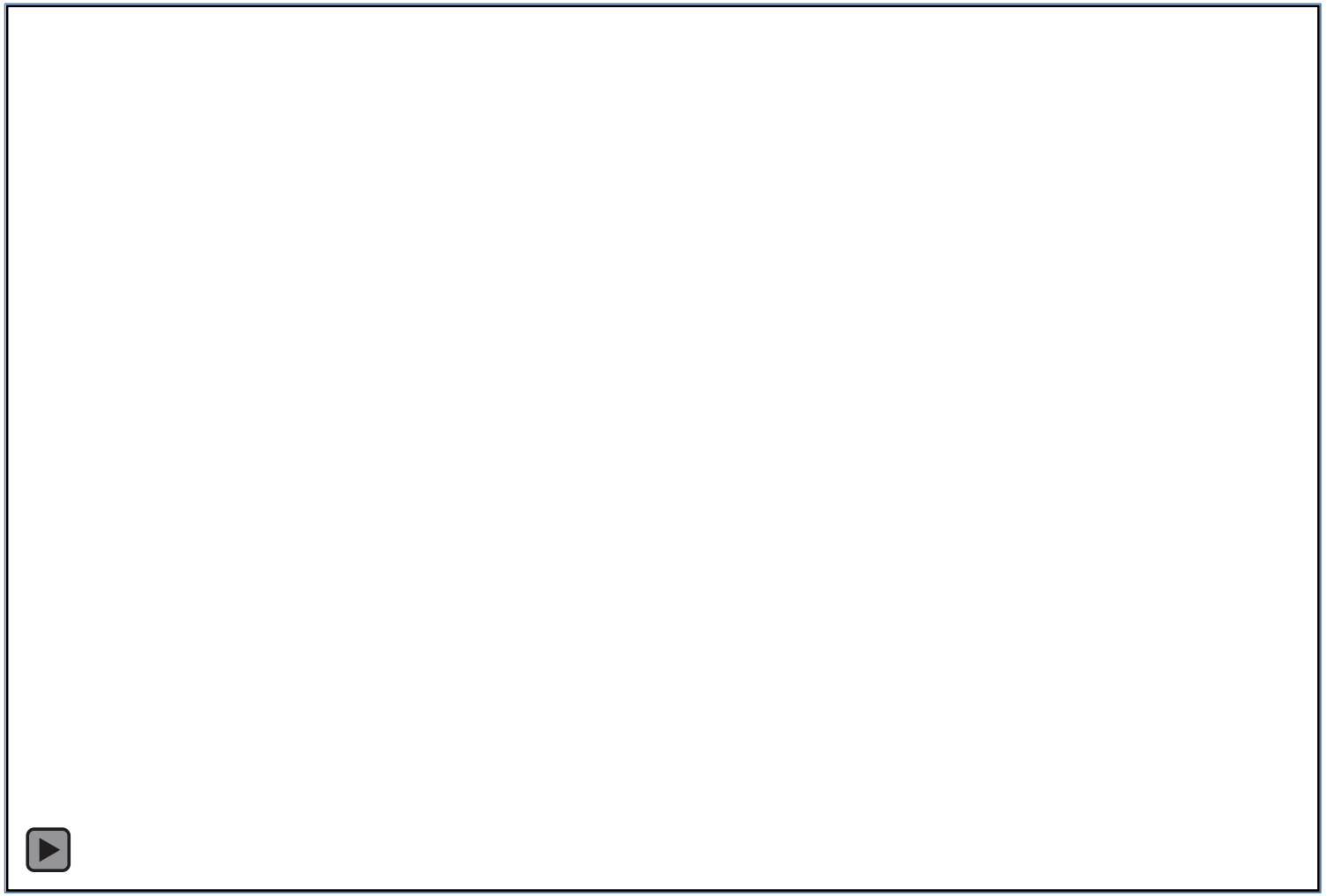

Support forecast users

Severe/high-impact weather forecasts

Beyond weather: impacts

# Medium-range forecasts

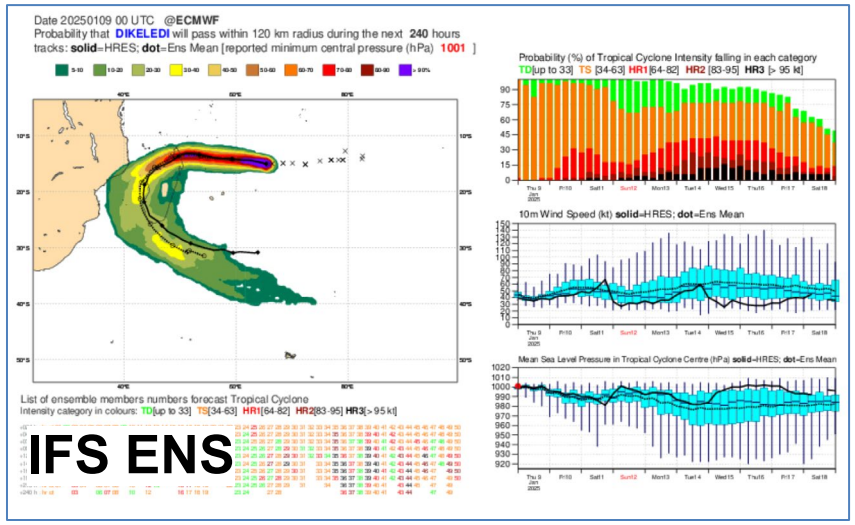
## Extratropical cyclone database – a collaboration with the UK Met Office

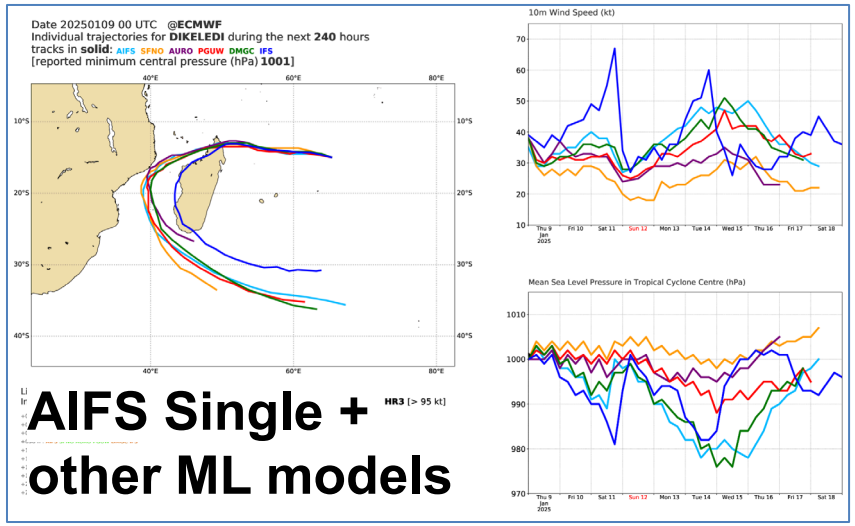


New version since December 2024
Coming:

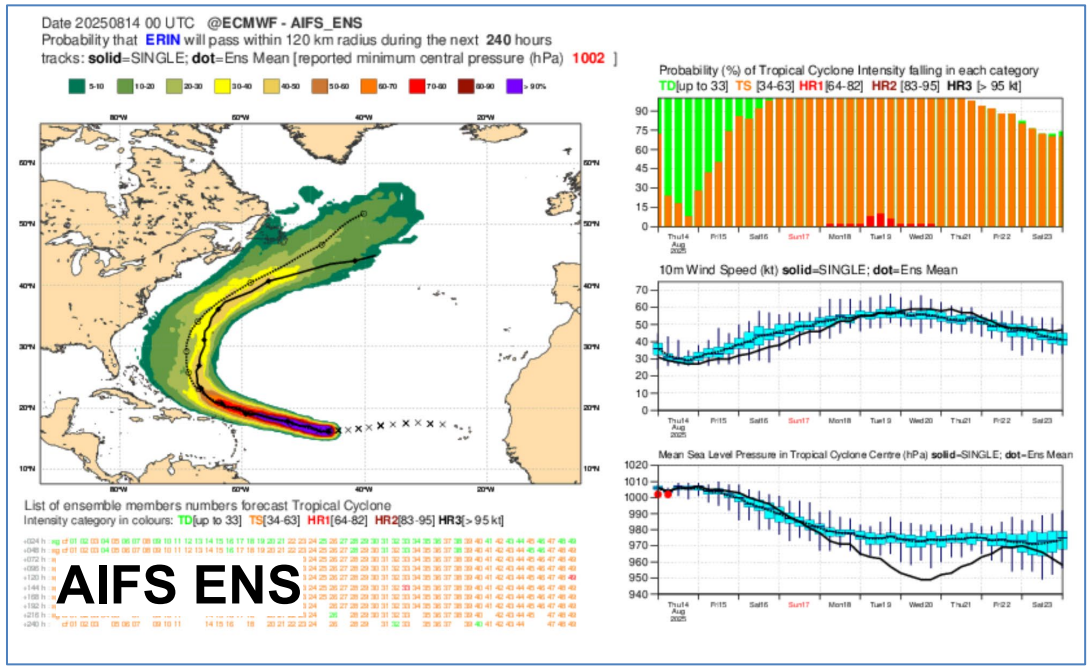
- 6-hourly time step (12h for now)…
- AIFS?

# Medium-range forecasts




## Tropical cyclones – IFS and AIFS !




Evaluation and intercomparison with meteorological services and WMO RSMC (e.g. Météo France/La Réunion)

# What next for the AIFS?

- Expanded products – waves, snow depth, raised model top – in upcoming AIFS 2.

- Beyond in **medium-range forecasting**:
  - Further expansion to ocean in 2026.
  - EFI in 2026.
  - Higher temporal resolution – 1-hourly data – in 2026.
  - Higher spatial resolution also in development.
  - Interested to hear your thoughts on product expansion.

- Real-time sub-seasonal system with dissemination by 2026
  - Including reforecasts.

- Real-time AIFS composition forecasts.

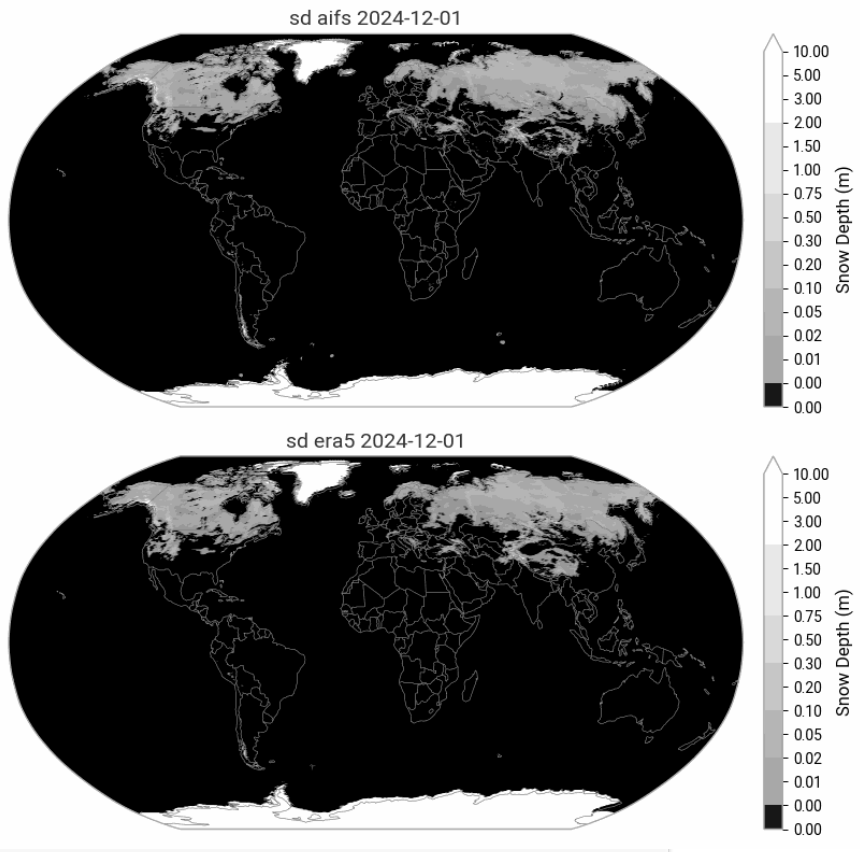



**Fig:** snow depth in the AIFS (top) and ERA5 (bottom)

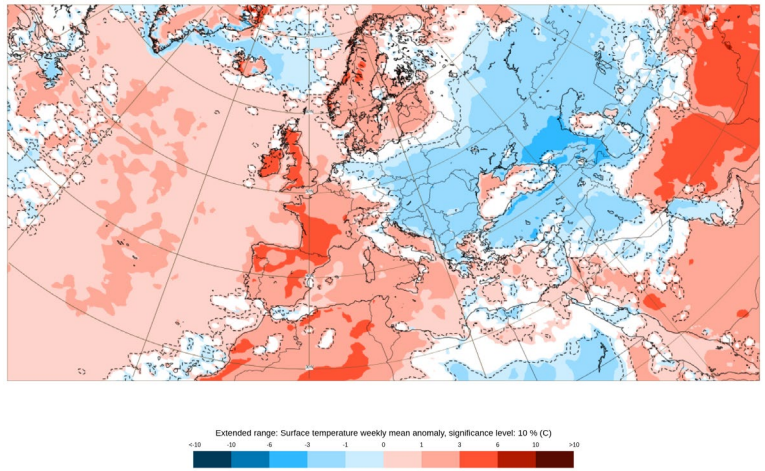
# Forecast data provision across multiple timescales



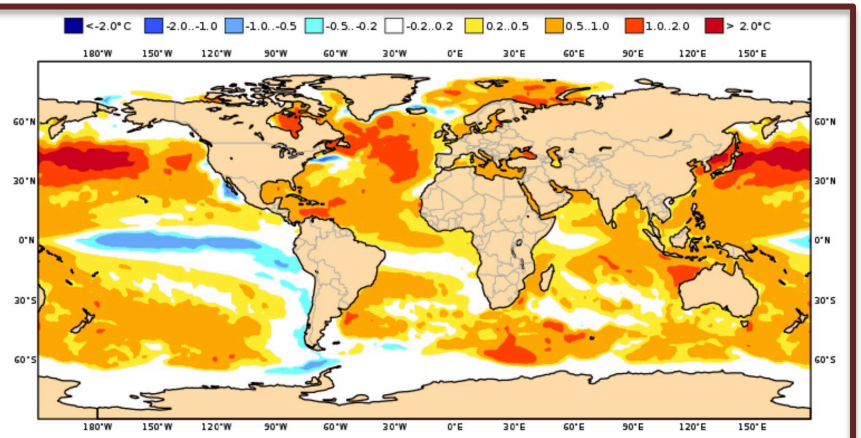
**Reanalysis** – 1940-now – 36km



**Medium-range** - 15 days - 9km



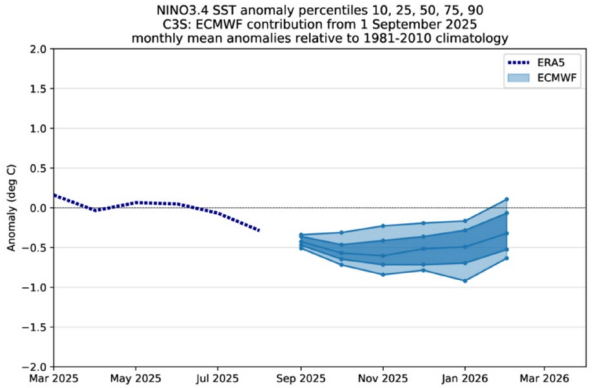

**Sub-seasonal** - 46 days - 36km




**Seasonal Forecast** - 7 months - 36km

# Seasonal forecasts

- **Upgrade of ECMWF Seasonal forecasting system in 2026**
  - Larger ensembles, more frequent updates, longer forecasts (up to 2 years).
  - Graphical products will be displayed on ecCharts!



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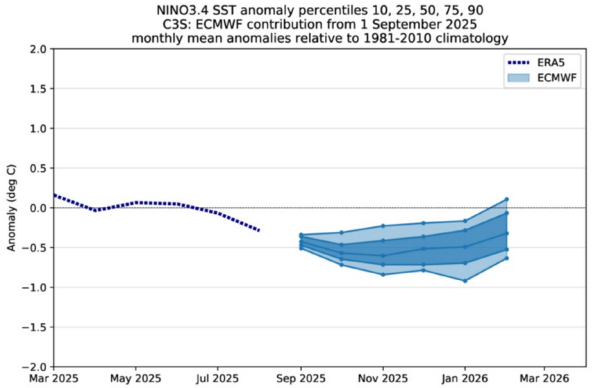
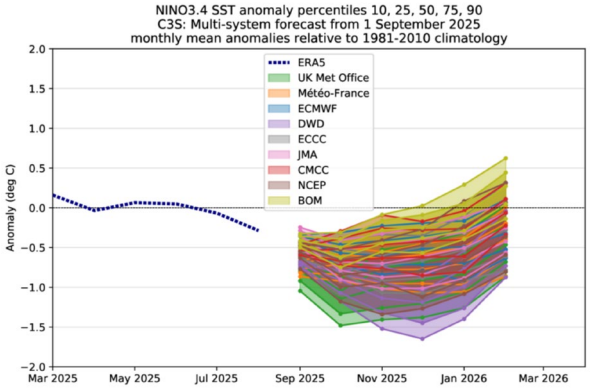
  - Graphical products will be displayed on ecCharts!
- **Multi-system seasonal forecasts**
  - Continuous enhancement of contributing systems
  - New graphical products
  - A new member in 2025 (Bureau of Meteorology, Australia)




Climate Change Service

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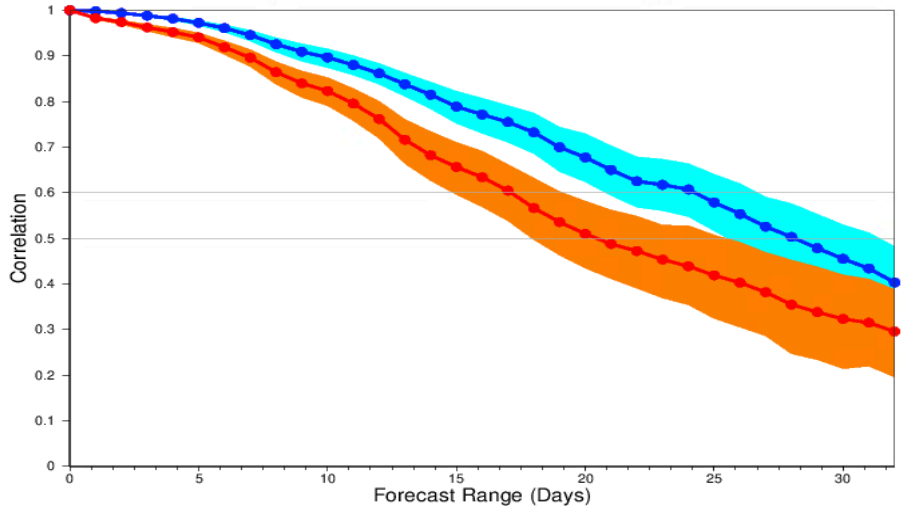
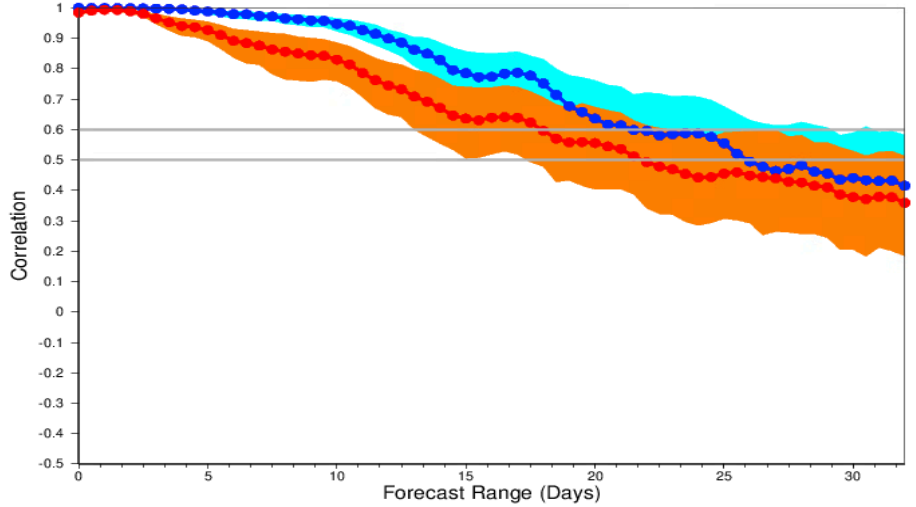
# Sub-seasonal forecast – improvements in 20 years

MJO 28 days (+8 days)

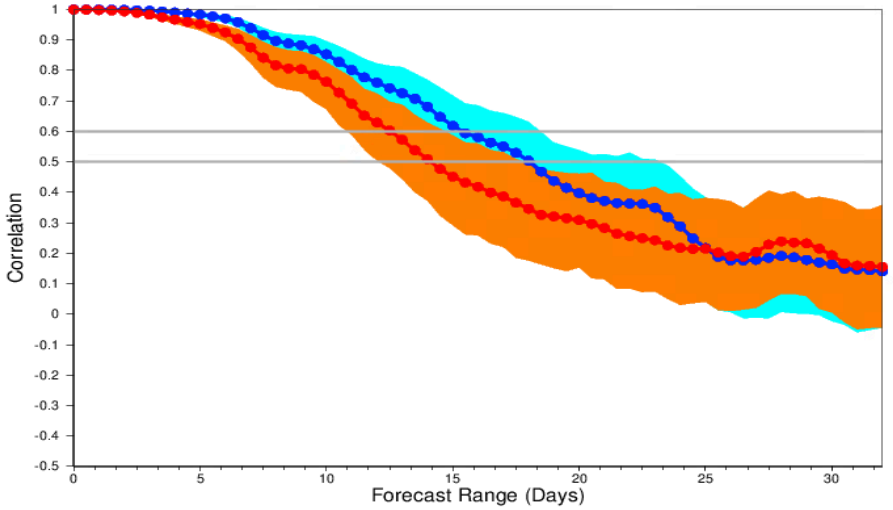



SSW 26 days (+4 days)

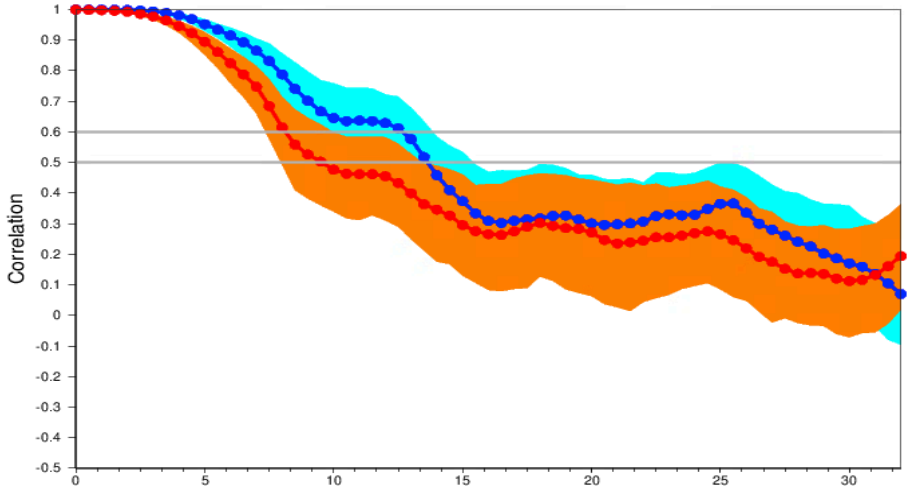



**48r1 (2024)**
**28r1 (2004)**

PNA 18 days (+4 days)



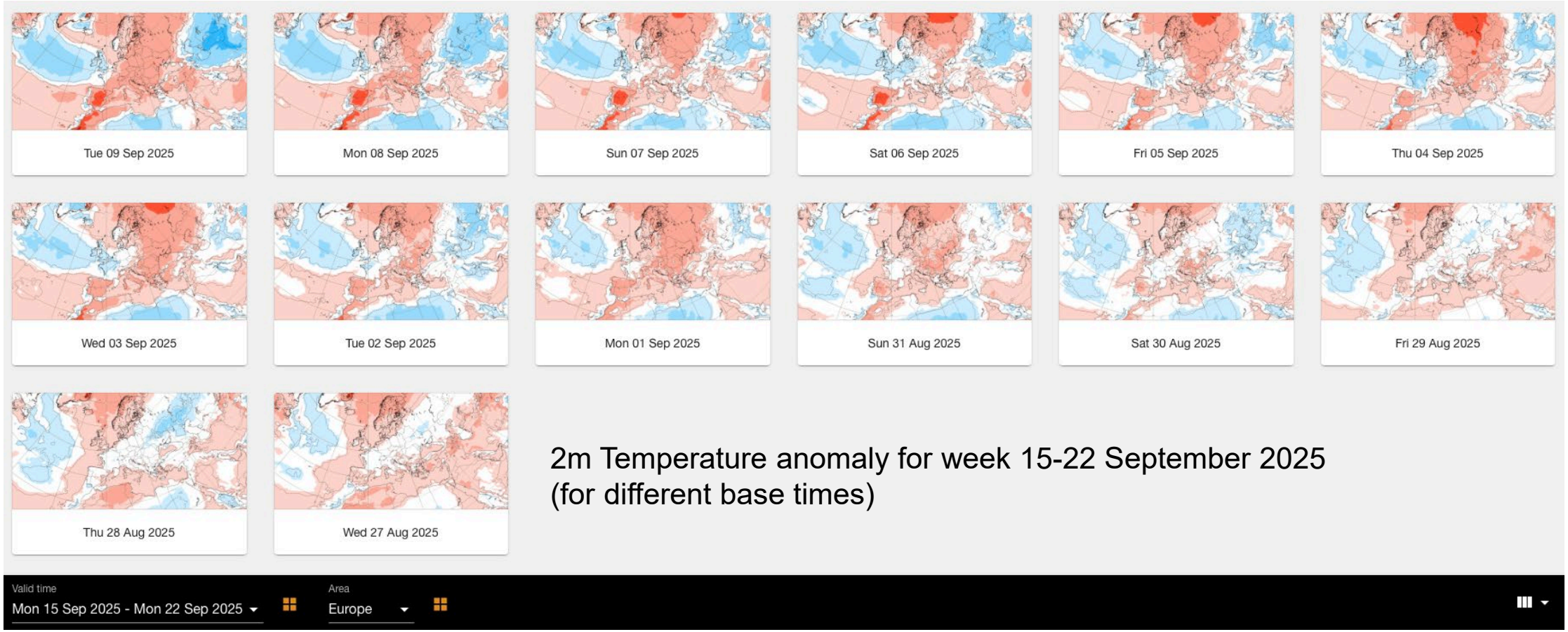

NAO 14 days (+4 days)



# Sub-seasonal forecast – changes in products

With **IFS Cycle 48r1**: 101-member (TCo319) **forecast** running every day from day 0 to day 46.

With **IFS Cycle 49r1**: new Sub-seasonal **reforecast** initialised every odd day of the month (new model Climate).

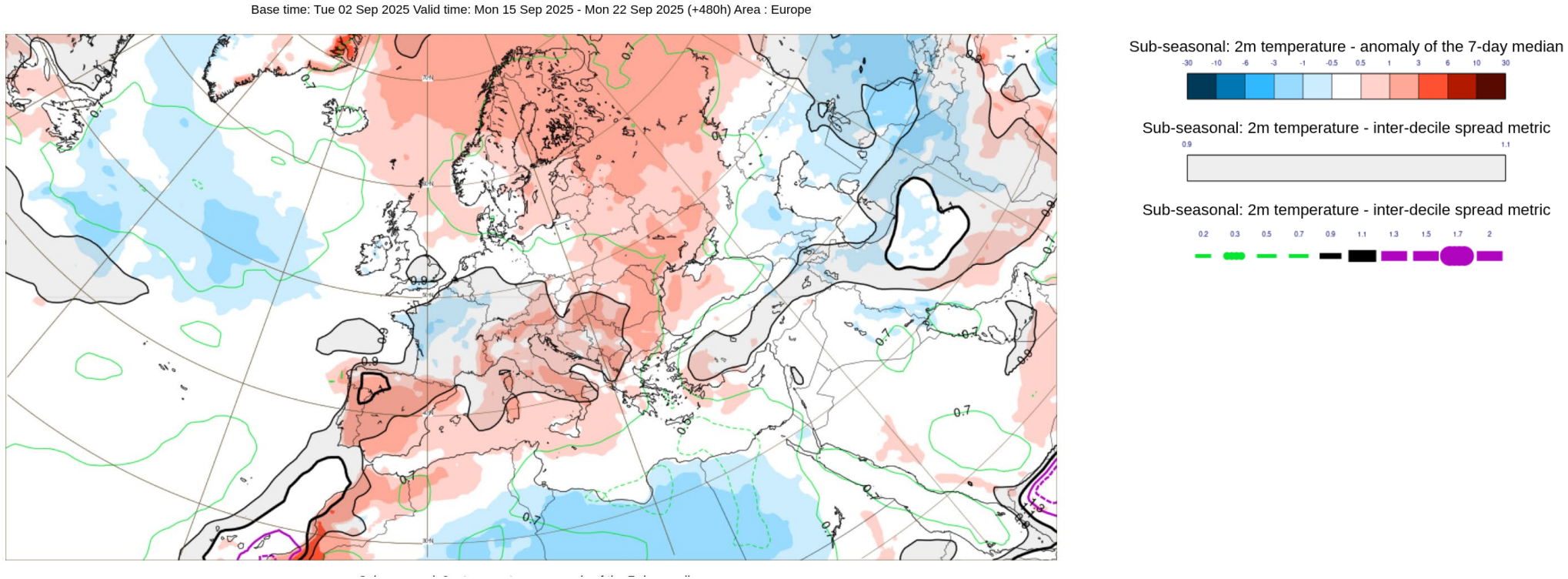



2m Temperature anomaly for week 15-22 September 2025
(for different base times)

# Sub-seasonal forecast – supporting users in use and interpretation

Work with Member and Co-operating States on **user-relevant verification and products** (2025-2027)

A **new experimental product** for sub-seasonal forecast interpretation (introduced in June 2025 in OpenCharts)

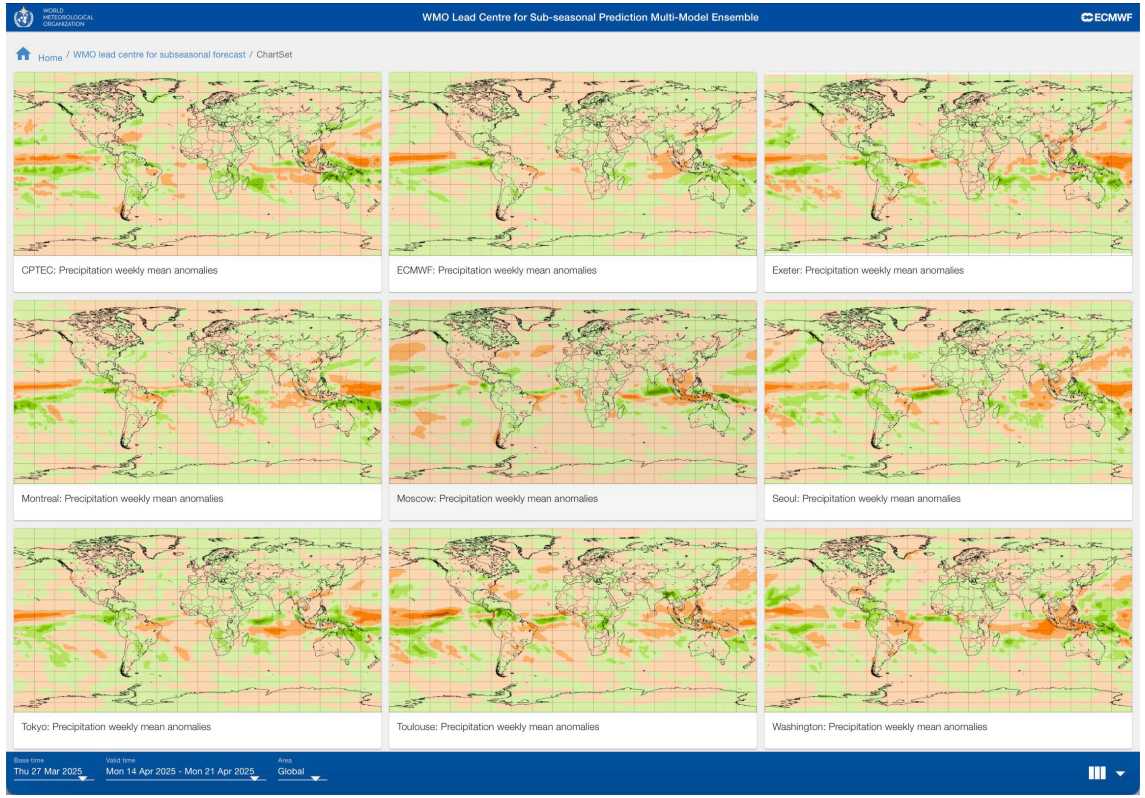



**Quantile-based weekly guidance map**

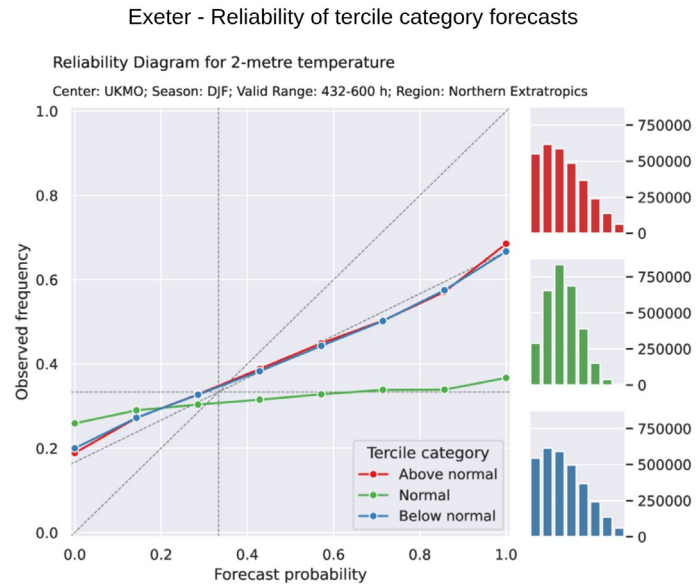
# Sub-seasonal forecast – multi-system

ECMWF hosts WMO Lead Centre for **Sub-seasonal Predictions Multi-Model Ensemble** (since 2023).

Built on the legacy of the WWRP/WCRP **S2S** project and relies on S2S archive infrastructure.



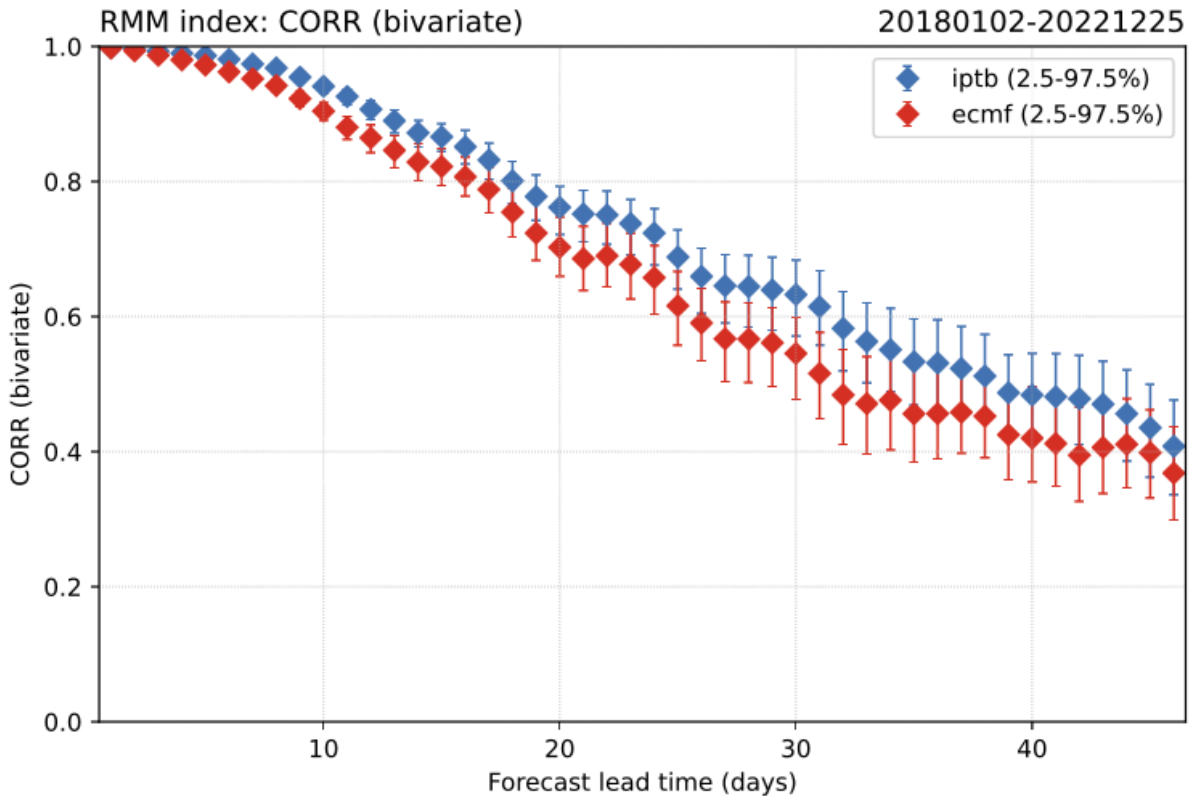

Near real-time forecast charts (updated weekly)




Verification statistics from reforecasts

# Sub-seasonal forecast – with AI

## AIFS for subseasonal vs IFS



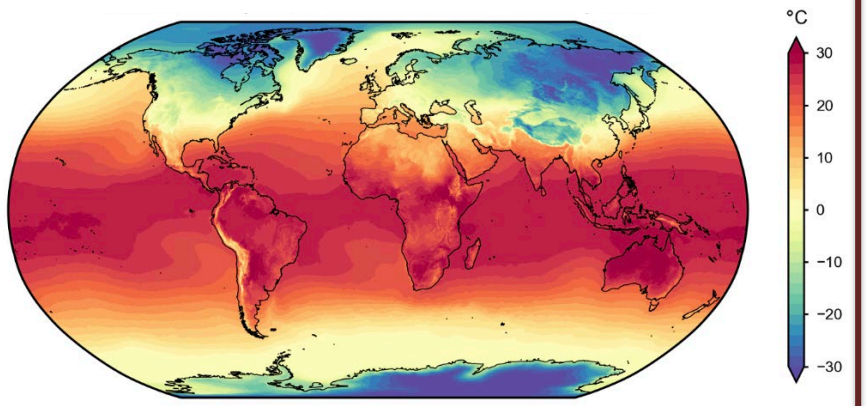

Evaluation:

- 5-year evaluation period (2018-2022)
- Weekly initialized reforecasts

- **MJO correlation in week 3 and 4 is improved by ~10% wrt to IFS**
- AIFS shows improvement upon IFS up to week 4 in the troposphere

**Real-time AIFS sub-seasonal system with dissemination in 2026.**

# Forecast data provision across multiple timescales

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ECMWF

# Climate Monitoring

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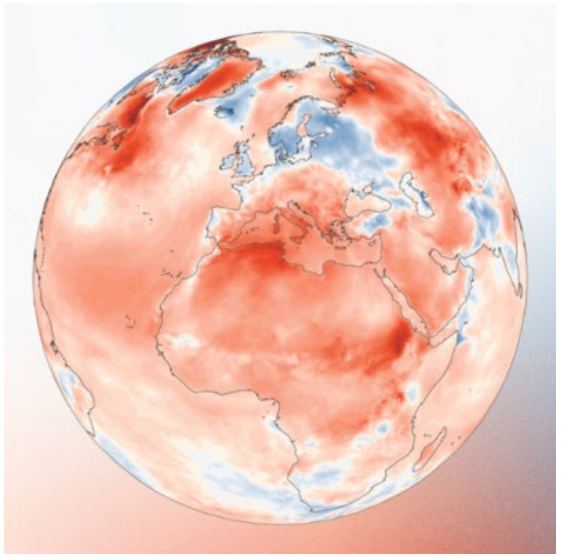
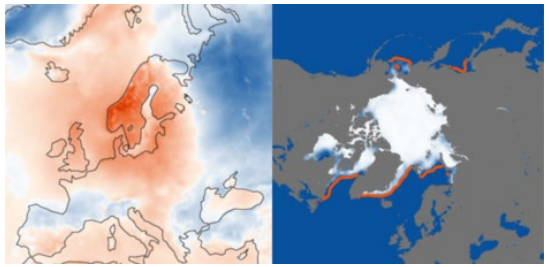
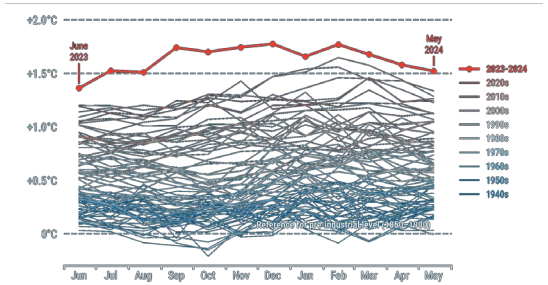
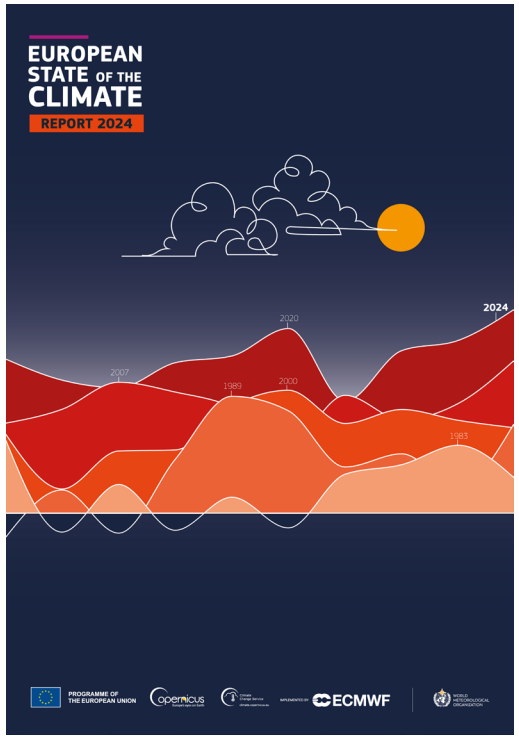
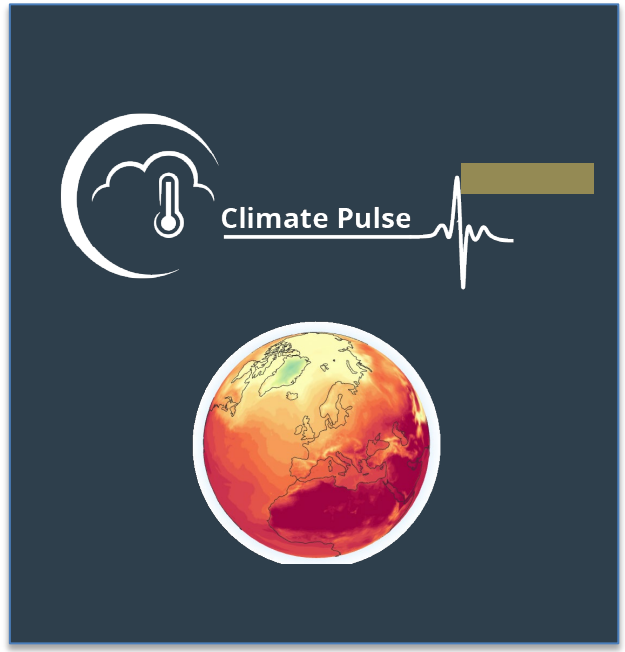







**Global Climate Highlights**

**Monthly Bulletins**

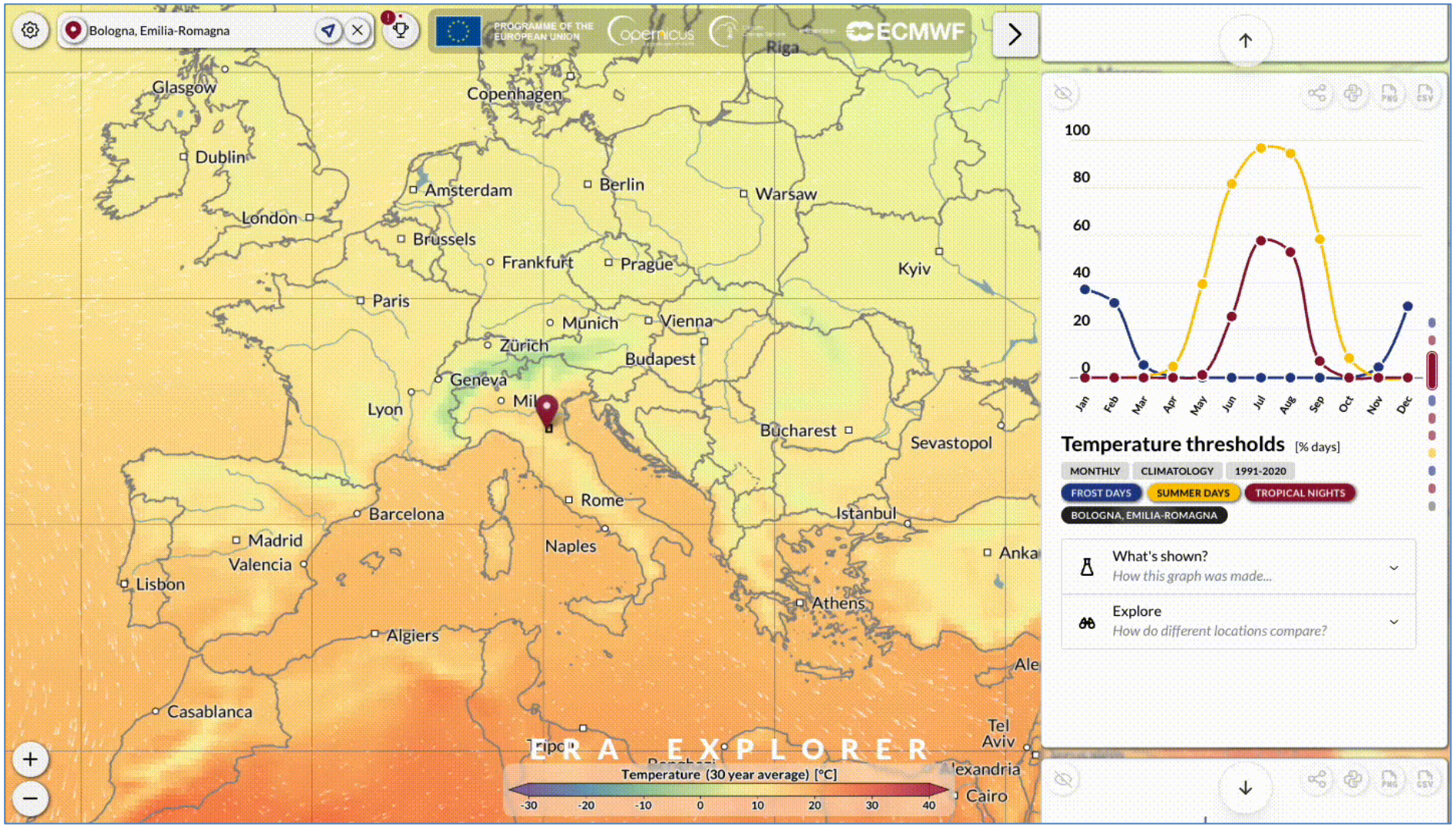
**European State of the Climate**

**Climate Pulse**

# Reanalysis – climate statistics

Climate Change Service
climate.copernicus.eu

ASPECT



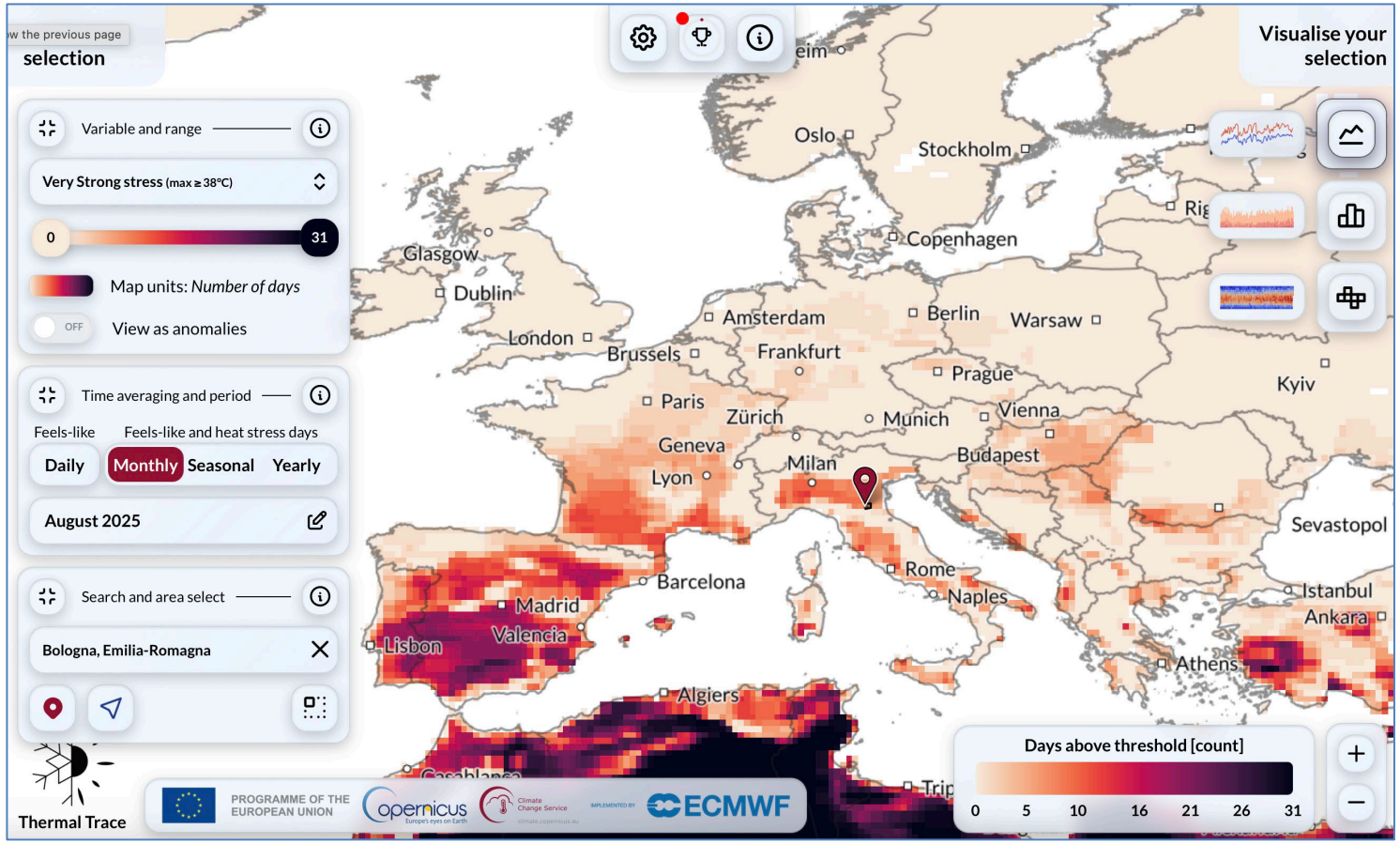

## ERA Explorer

Powered by the Climate Data Store

Built on a new ZARR archive of selected ERA5 variables

# Reanalysis – monitoring

Climate Change Service
climate.copernicus.eu




## Thermal Trace

Visualising decades (80+ years) of heat and cold stress data

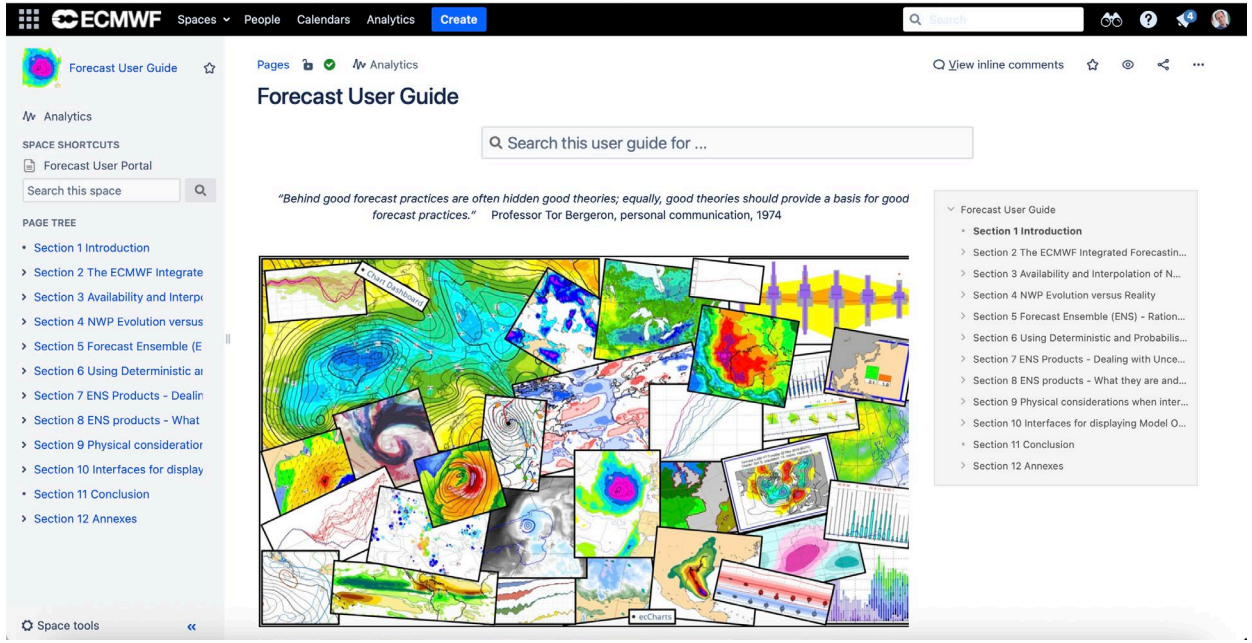
Based on ERA5-HEAT – Universal Thermal Comfort Index (UTCI)

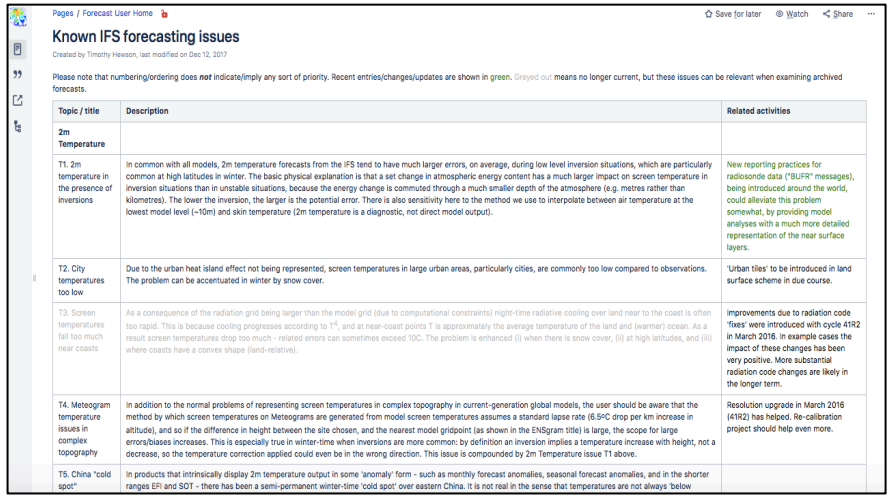
# ECMWF forecast product development

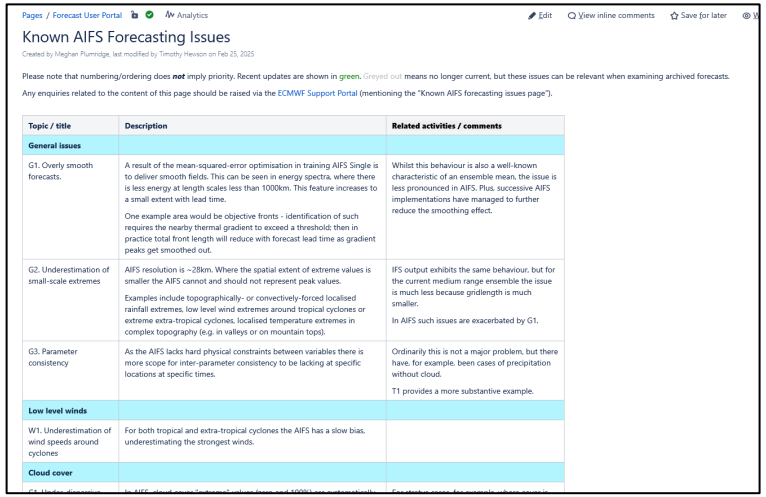
- Driven by science and innovation… and users' needs
- Keywords: high-impact weather, ensembles, Earth System, climate monitoring, verification, accessibility, graphical products, open data… machine learning !
- Programmes (e.g., Copernicus, Destination Earth), projects, and collaborations as support for development and value multipliers.
- Engagement and co-development with Member and Co-operating States is instrumental.

- **The future: user-oriented products, fueled with machine learning, accessible, more integrated, more and more co-development.**

# Forecast user resources




**Training** | Workshops | Seminars | Education material | eLearnin

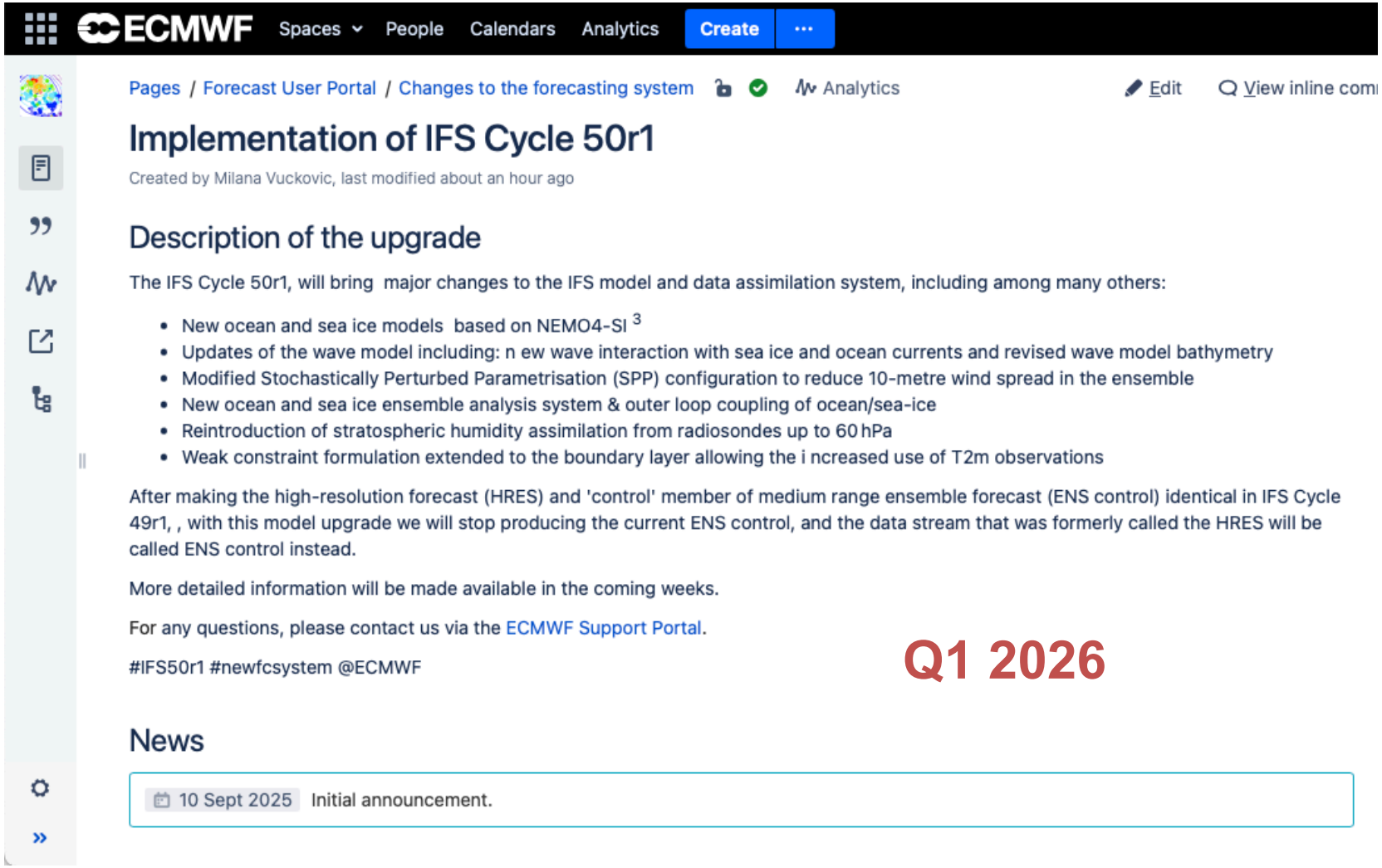

## Training course: Use and interpretation of ECMWF products

**ECMWF | Reading | 6-9 October 2025**

## Your feedback is key!

ECMWF EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

# Stay tuned ! IFS Cycle 50r1



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Pages / Forecast User Portal / Changes to the forecasting system Analytics Edit View inline com

## Implementation of IFS Cycle 50r1

Created by Milana Vuckovic, last modified about an hour ago

### Description of the upgrade

The IFS Cycle 50r1, will bring major changes to the IFS model and data assimilation system, including among many others:

- New ocean and sea ice models based on NEMO4-SI [3]
- Updates of the wave model including: n ew wave interaction with sea ice and ocean currents and revised wave model bathymetry
- Modified Stochastically Perturbed Parametrisation (SPP) configuration to reduce 10-metre wind spread in the ensemble
- New ocean and sea ice ensemble analysis system & outer loop coupling of ocean/sea-ice
- Reintroduction of stratospheric humidity assimilation from radiosondes up to 60 hPa
- Weak constraint formulation extended to the boundary layer allowing the i ncreased use of T2m observations

After making the high-resolution forecast (HRES) and 'control' member of medium range ensemble forecast (ENS control) identical in IFS Cycle 49r1, , with this model upgrade we will stop producing the current ENS control, and the data stream that was formerly called the HRES will be called ENS control instead.

More detailed information will be made available in the coming weeks.

For any questions, please contact us via the ECMWF Support Portal.

#IFS50r1 #newfcsystem @ECMWF

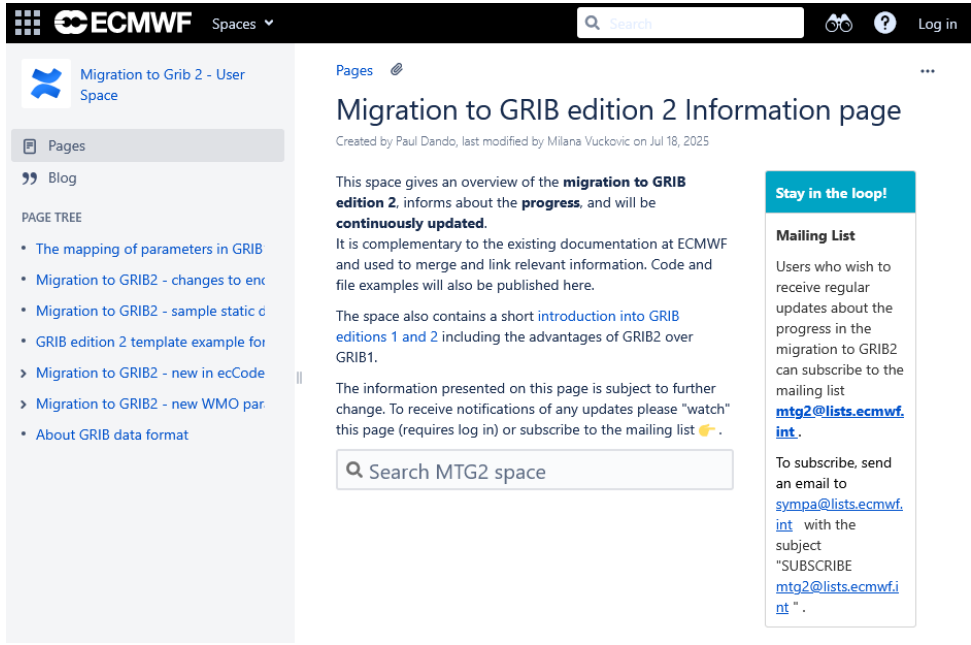
**Q1 2026**

### News

10 Sept 2025 Initial announcement.

# Stay informed ! Migration to GRIB2

- **Full GRIB2 introduced in operation in Cycle 50r2 ~Q3 2026**
- Migration to GRIB edition 2 Information page
  - ecCodes changes to parameters
  - Details for how to access test data
  - Updated regularly




- ecCodes release notes

- Sign up to the mailing list - mtg2@lists.ecmwf.int

**Mailing List**

Users who wish to receive regular updates about the progress in the migration to GRIB2 can subscribe to the mailing list **mtg2@lists.ecmwf.int** .

To subscribe, send an email to sympa@lists.ecmwf.int with the subject "SUBSCRIBE mtg2@lists.ecmwf.int " .

- Watch the Migration to GRIB2 webinar recording on YouTube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# Thank you

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