

Earth Sciences  
Department



**Barcelona  
Supercomputing  
Center**  
*Centro Nacional de Supercomputación*

# Forecast Briefing

## May 2026

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Earth Sciences department

Barcelona Supercomputing Center (BSC)

Tuesday 19<sup>th</sup> May 2026

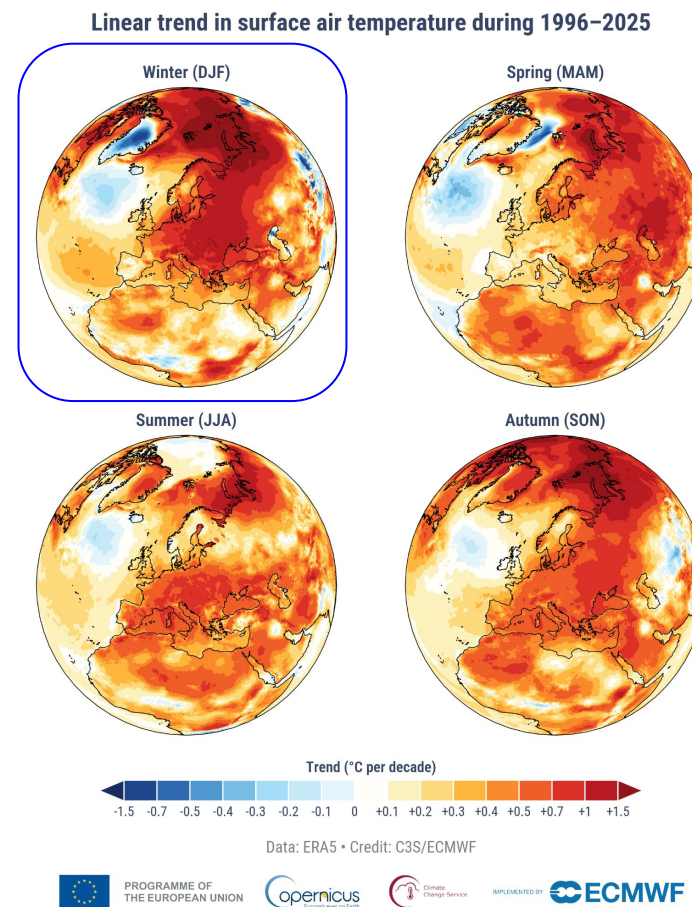
# Outline

- I. European state of the climate report 2025
- II. Recent state of the climate
- III. Tropical variability
- IV. Extratropical variability
- V. Seasonal forecasts

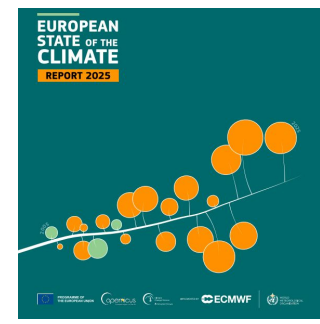
# I. European state of the climate report 2025

# I. 2025 European state of the climate report

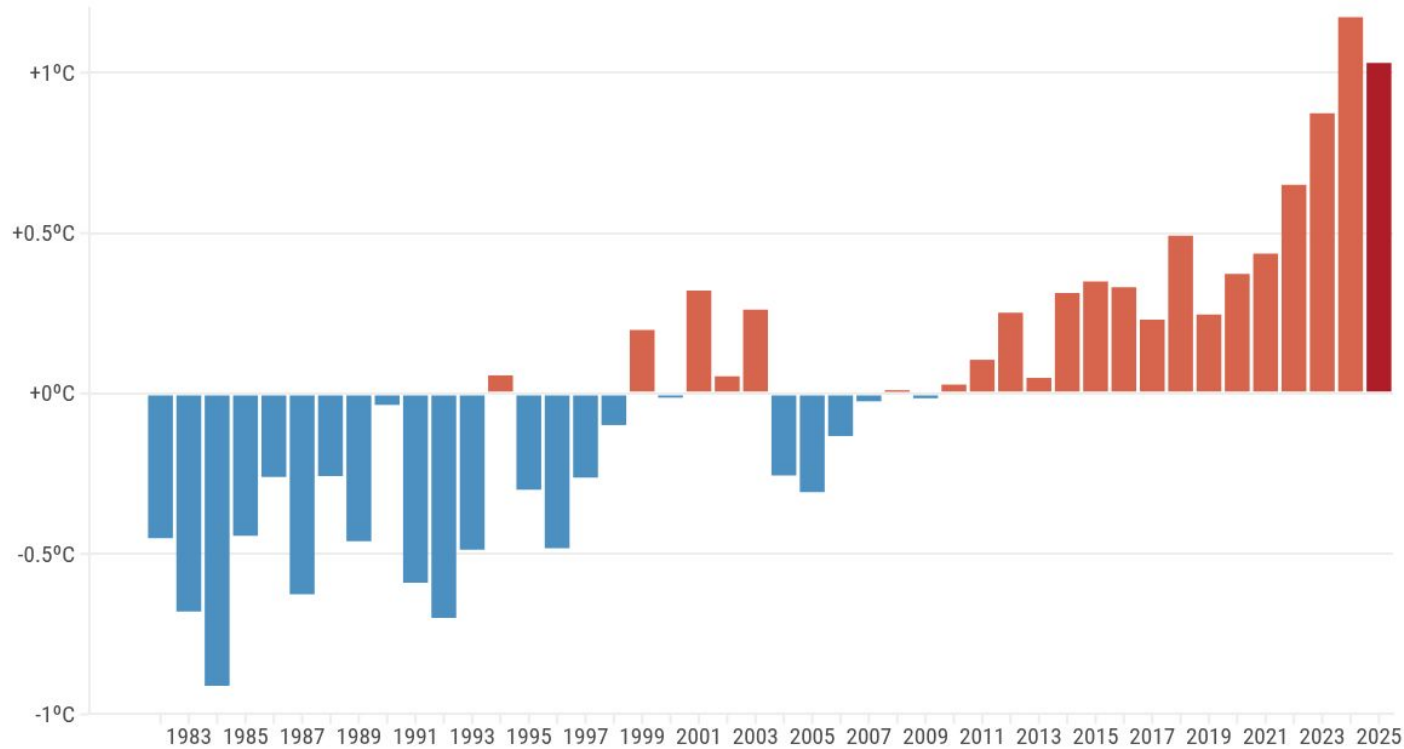
- Europe is the fastest warming continent on Earth 2.5°C (by including the Arctic (fastest warming region), much faster than the global average (1.4°C).
  - Changing weather patterns, with a significant increase in heat stress days.
  - Reduced air pollution due to more severe regulations: Aerosols reduce incoming solar radiation. -> reduced cooling effect.
  - Decreasing snow cover, reduced albedo effect. Also in the Arctic -> albedo feedback
  - Svalbard (Norway) is one of the fastest warming places on Earth (+2.6°C in 2024)



# I. 2025 European state of the climate report



### SST anomalies for the Mediterranean Sea



Data: C3S Global Sea and Sea Ice Surface Temperature v1.0 (1982–2025) • Reference period: 1991–2020 • Credit: C3S/ECMWF

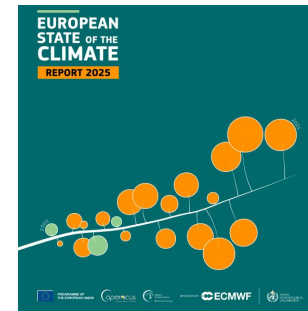
Fuel for high precipitation events and DANAs

Due to recent warming of the Mediterranean Sea, the 2024 Valencian DANA produced an estimated 31% more precipitation than it would have in a cooler climate.

↓

The key role of Mediterranean and North Atlantic sea surface temperatures on the 2024 record-breaking Valencia precipitation event

Ramiro I. Saurral<sup>a,b,c,d,\*</sup>, Diego A. Campos<sup>a,e</sup>, Katherine Grayson<sup>a</sup>, Vladimir Lapin<sup>a</sup>, Paloma Trascasa-Castro<sup>a</sup>, Etienne Tourigny<sup>a</sup>, Markus G. Donat<sup>a,f</sup>, Stefano Materia<sup>a,g</sup>, Eric Ferrer<sup>a</sup>, Francisco J. Doblas-Reyes<sup>a,i</sup>



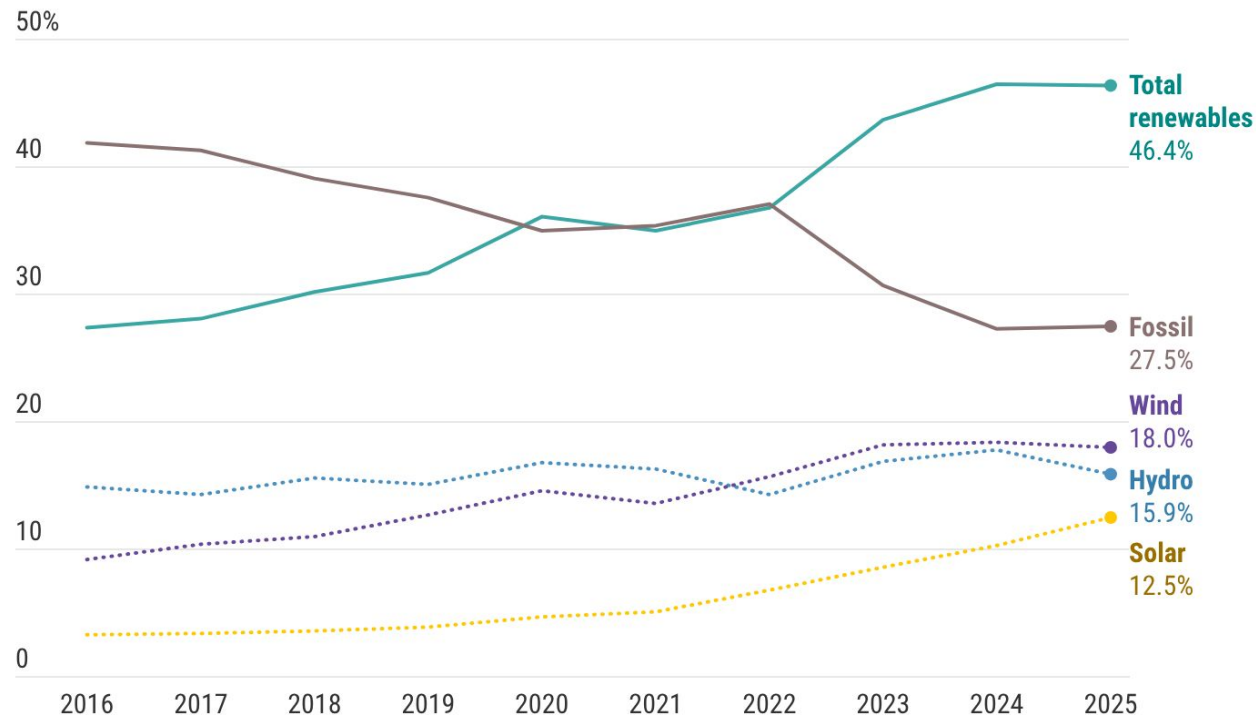
# I. 2025 European state of the climate report

In 2025, 46.4% of Europe's electricity generation came from renewables. Solar + wind surpassed fossil fuels.

Solar power reached a record contribution in 2025 due to increasing solar capacity across Europe, with +65 GW. Onshore and offshore wind capacity increased by 19 GW.

## New record for solar power generation in Europe

Percentage of the total annual actual electricity generation for Europe from different sources



Total renewables indicates the contribution from solar, wind and hydro power combined.

Data: Ember • Credit: Rabobank/C3S/ECMWF

- I. European state of the climate report 2025
- II. Recent state of the climate

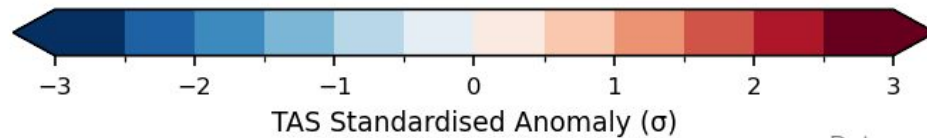
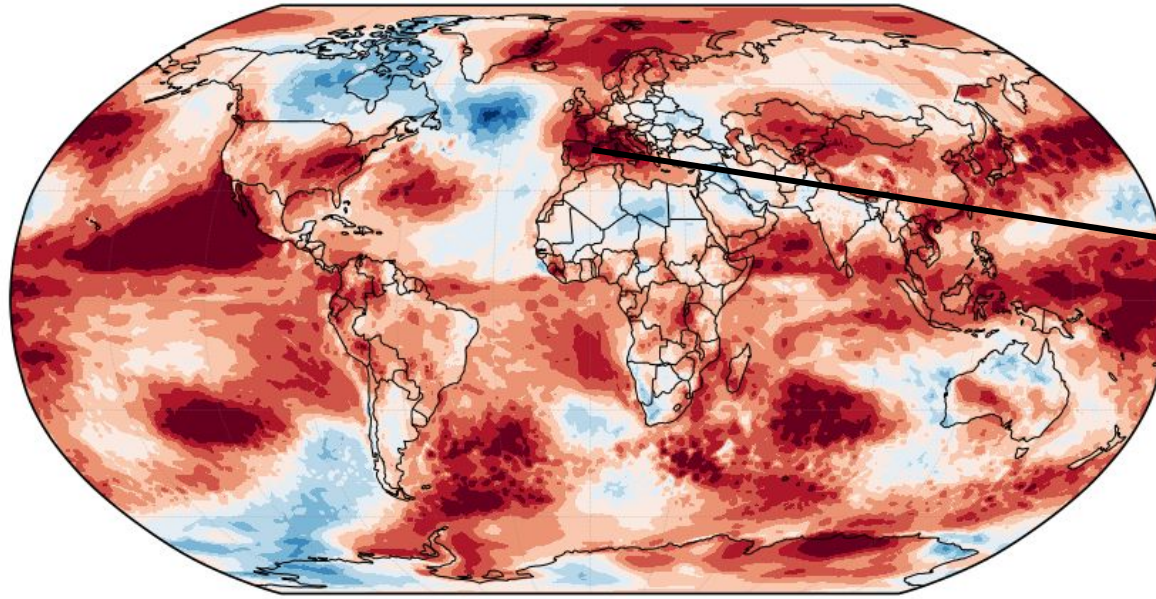
## II. Recent state of the climate

### Temperature



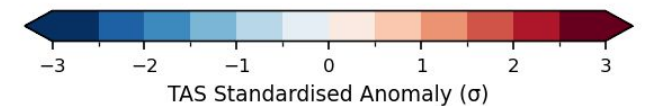
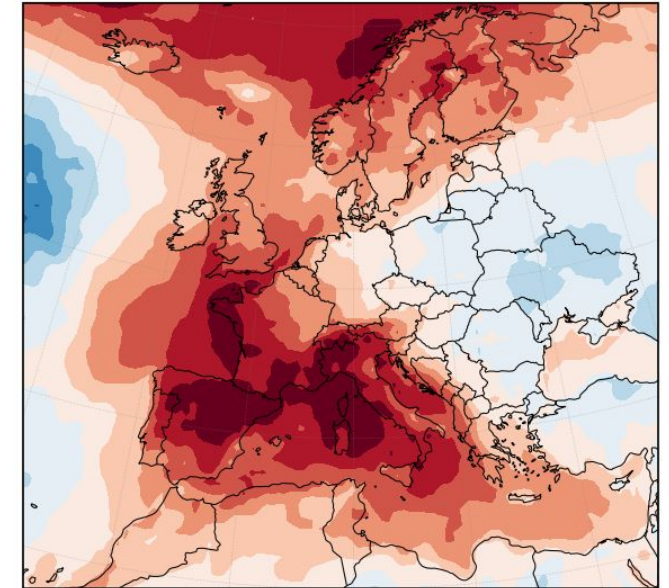
**1.43°C** above April 1850-1900 (ERA5)

**TAS Standardised Anomaly — April 2026**  
Ref: 1991-2020



Data source: ERA5

**TAS Standardised Anomaly — April 2026**  
Ref: 1991-2020



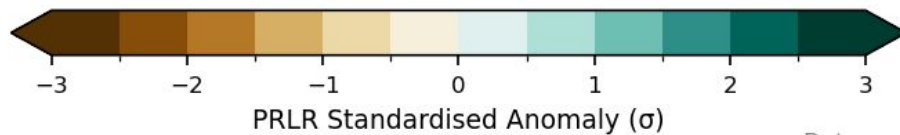
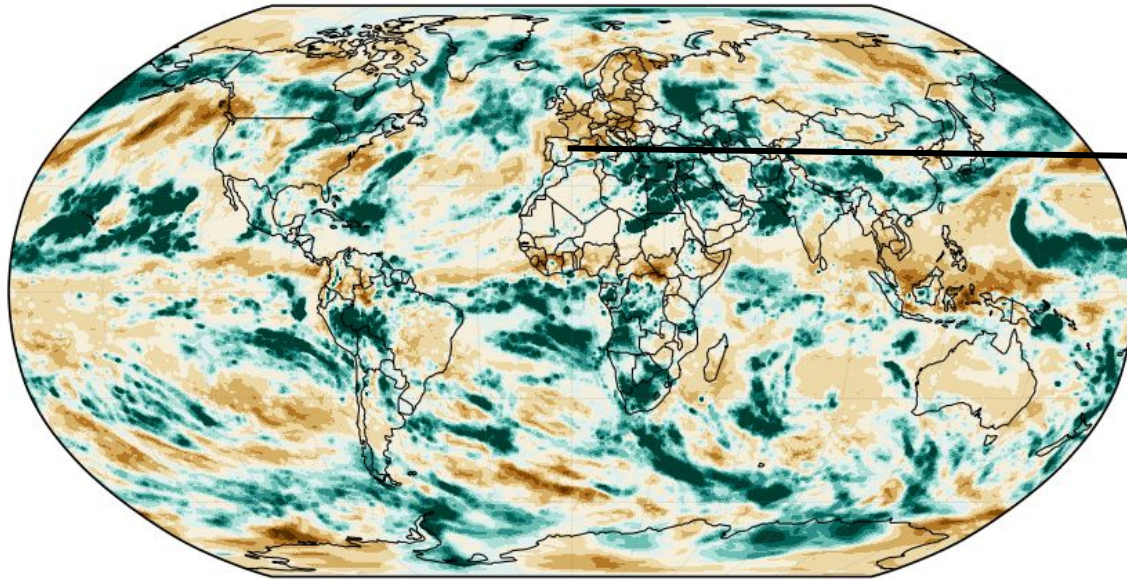
Data source: ERA5

- Overall warm anomalies except for Canada, North and SW of Africa, North of Australia.
- Europe had a significant temperature contrast, between way above normal in the South and North, and cool anomalies over eastern Europe.

## II. Recent state of the climate

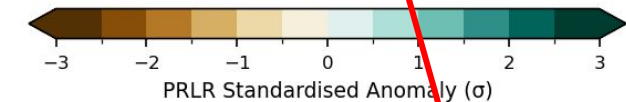
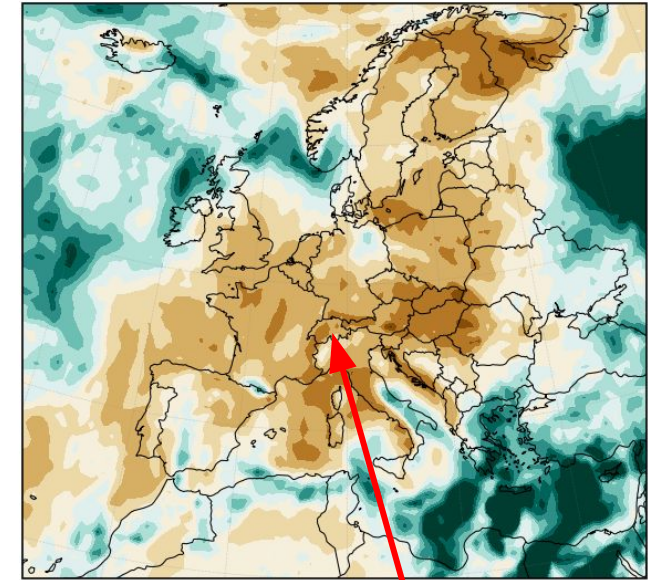
### Precipitation

**PRLR Standardised Anomaly — April 2026**  
Ref: 1991-2020



Data source: ERA5

**PRLR Standardised Anomaly — April 2026**  
Ref: 1991-2020



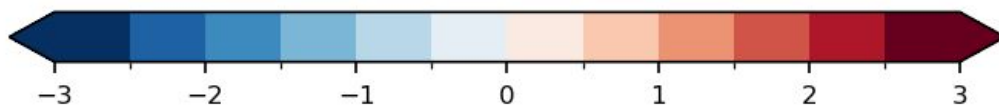
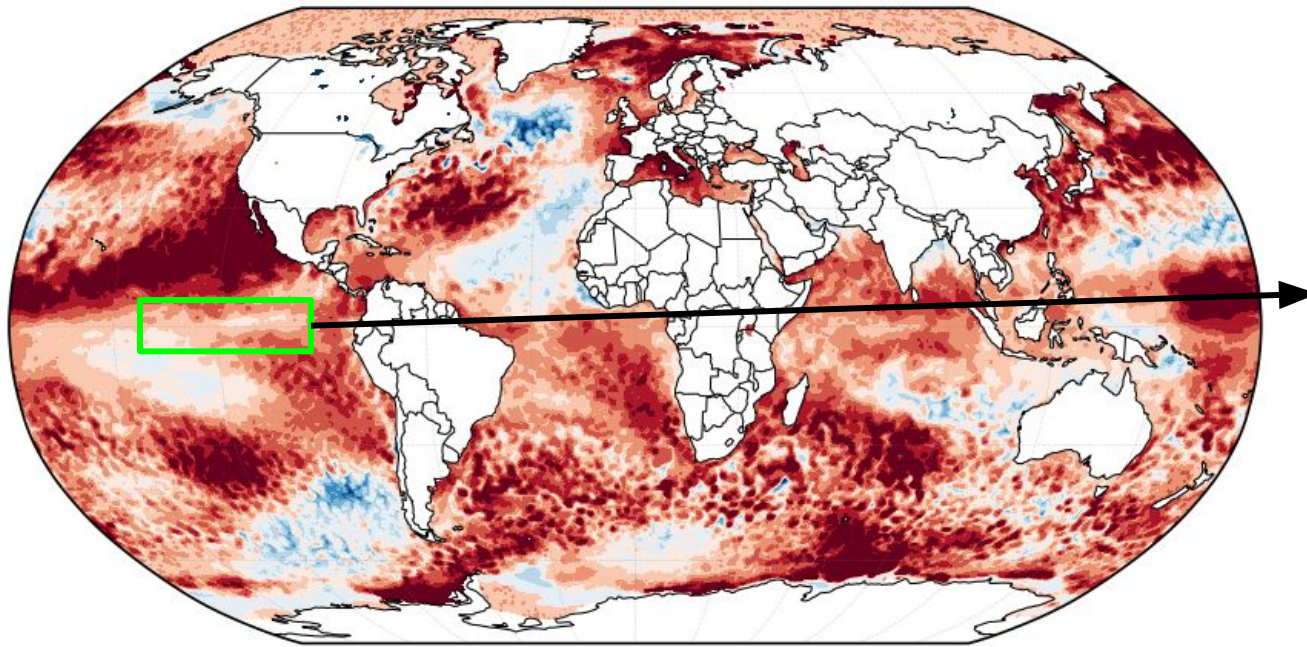
Data source: ERA5

- Record breaking rain and floods in Canada (snowmelt), Brazil. Arabian Peninsula, Afghanistan, S China, S Africa and New Zealand.
- Drier conditions over most of Europe (except isolated patches), with some areas of Switzerland under **drought watch** conditions.
- Ireland and the UK suffered storm Dave, Greece was hit by storm Erminio, Turkey and N Caucasus impacted by floods.

## II. Recent state of the climate

### Sea surface temperature (SST)

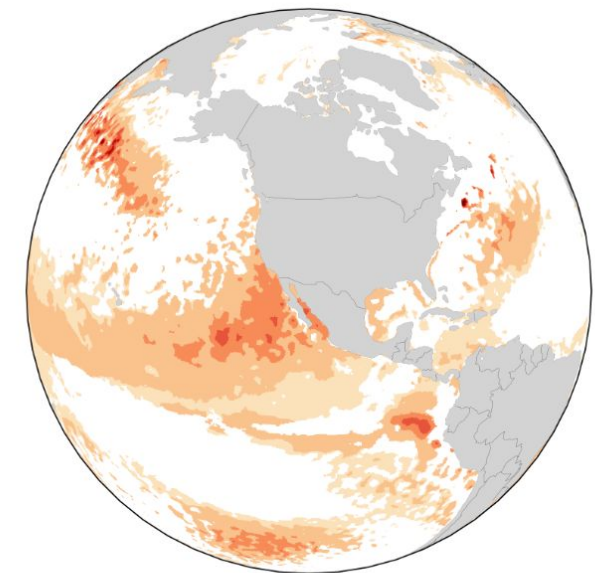
**TOS Standardised Anomaly — April 2026**  
**Ref: 1991-2020**



TOS Standardised Anomaly ( $\sigma$ )

Data source: ERA5

- 2<sup>nd</sup> warmest on record (after 2024).
- Strong heatwave off the West coast of US and Mexico, with heavy implications on wildlife and fisheries.
- ONI FMA: 0.1°C



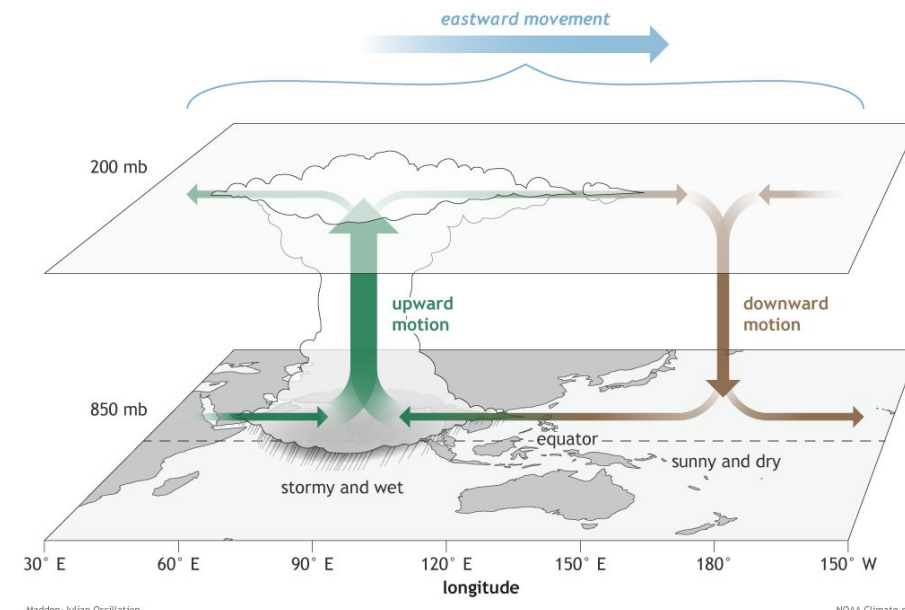
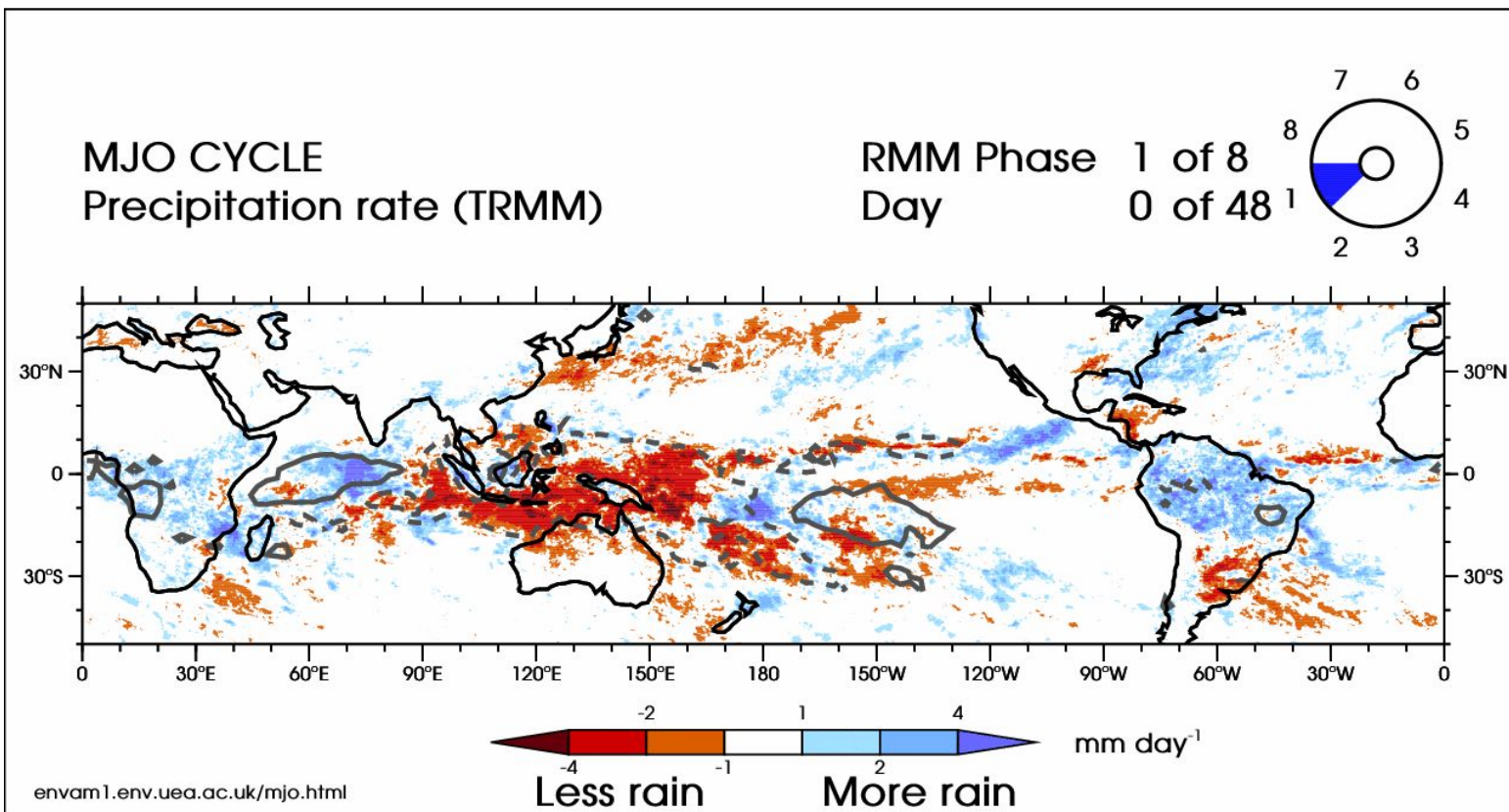
Past 30 Days Marine Heatwave Magnitude (°C)

- I. European state of the climate report 2025
- II. Recent state of the climate
- III. Tropical variability

### III. Tropical variability

### Madden-Julian Oscillation (MJO)

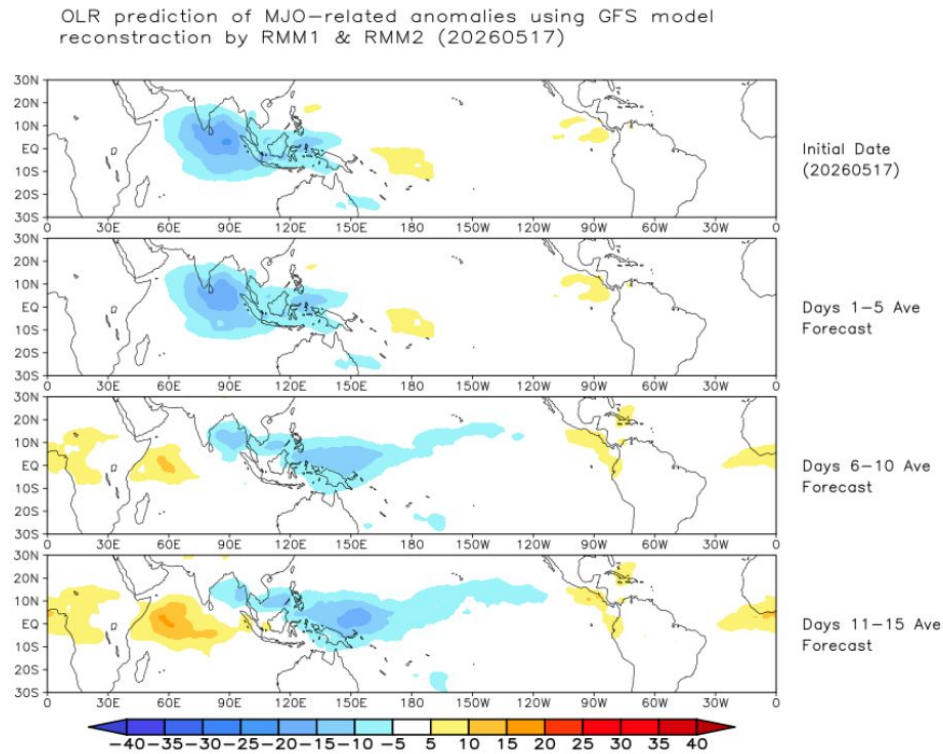
- The MJO is the leading mode of tropical subseasonal variability with a 20–90 days time scale. It is an important source of regional climate variability and predictability across the globe at subseasonal time scales.



# III. Tropical variability

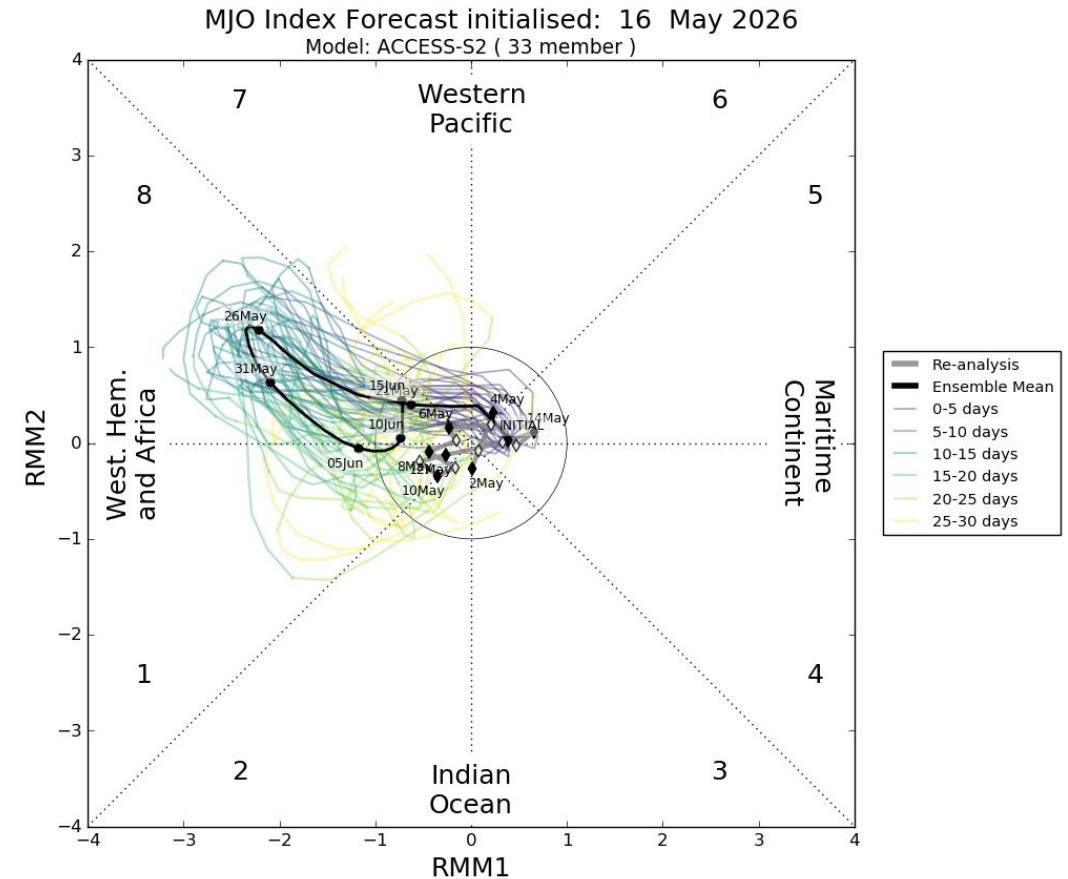
## MJO forecasts

- OLR anomalies [W/m<sup>2</sup>] (ensemble mean GEFS)



Low OLR (enhanced convection) / High OLR (suppressed convection)

- Evolution of last days of observations + ensemble forecast

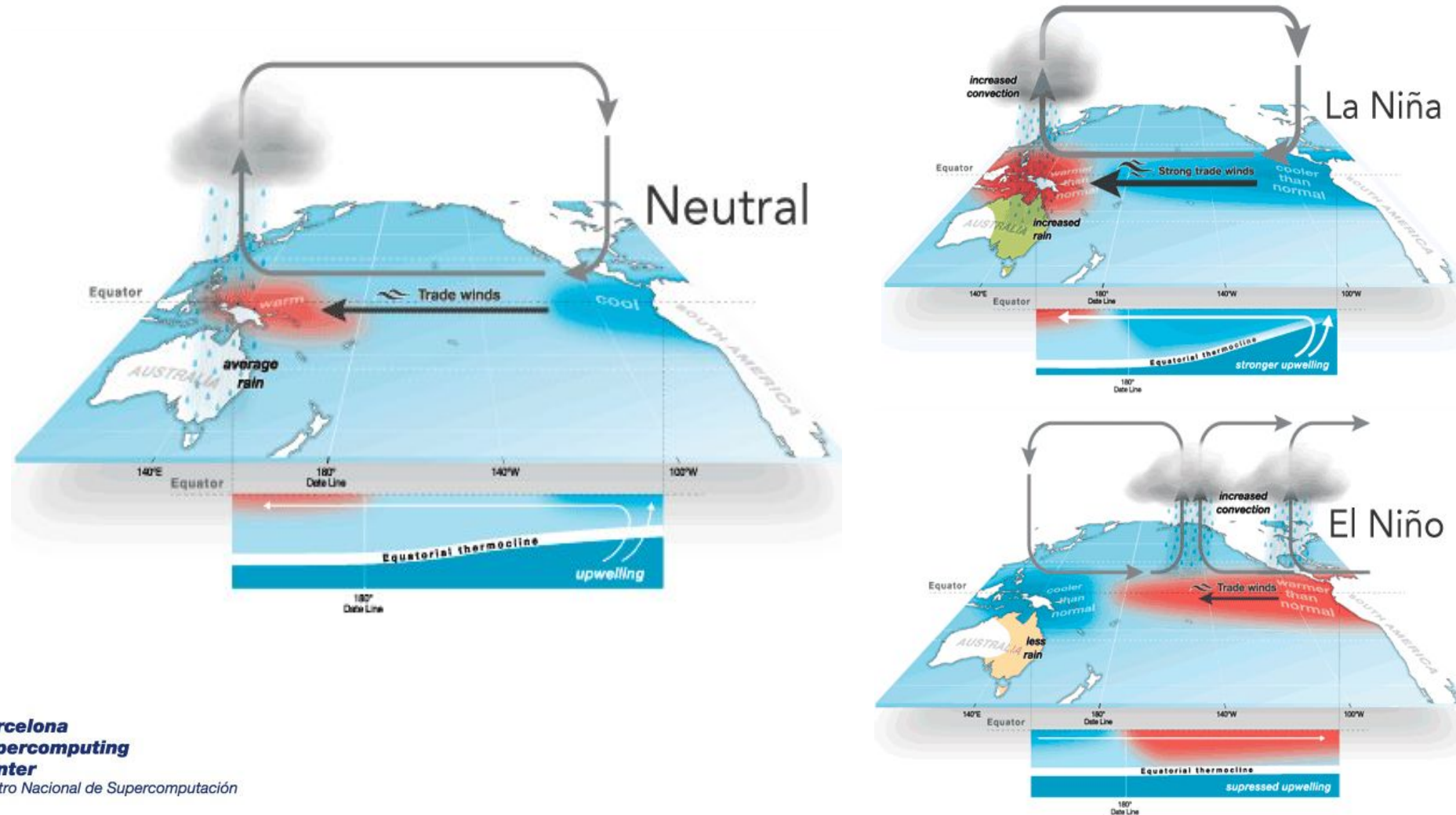


- MJO has remained inactive during the past weeks, although the forecasts now point to a relatively strong pulse by the end of May in phase 8.

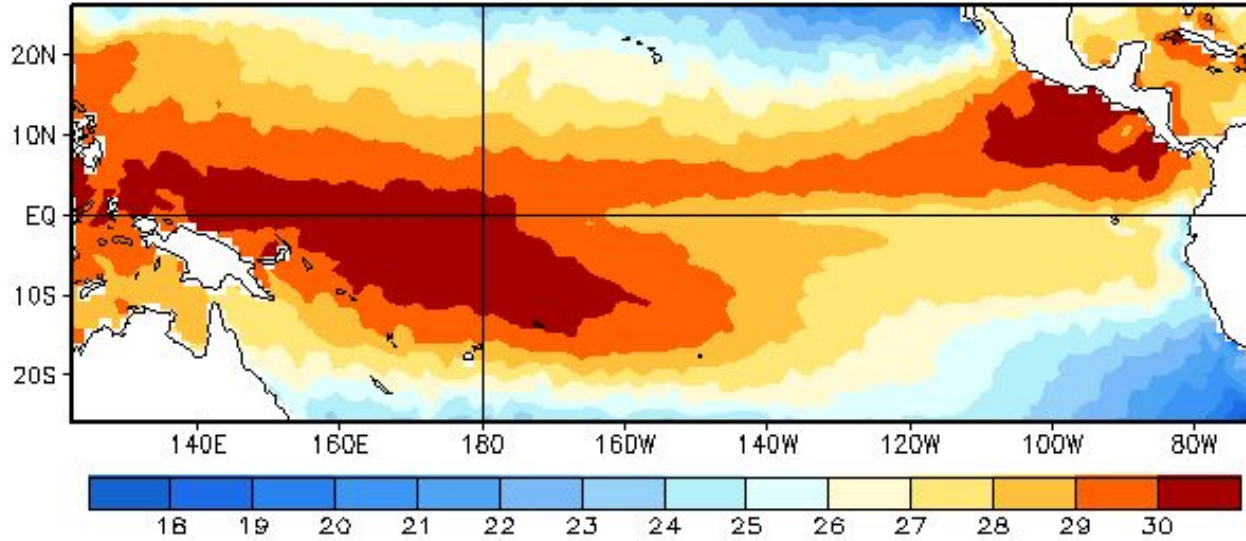
### III. Tropical variability

## El Niño-Southern Oscillation (ENSO)

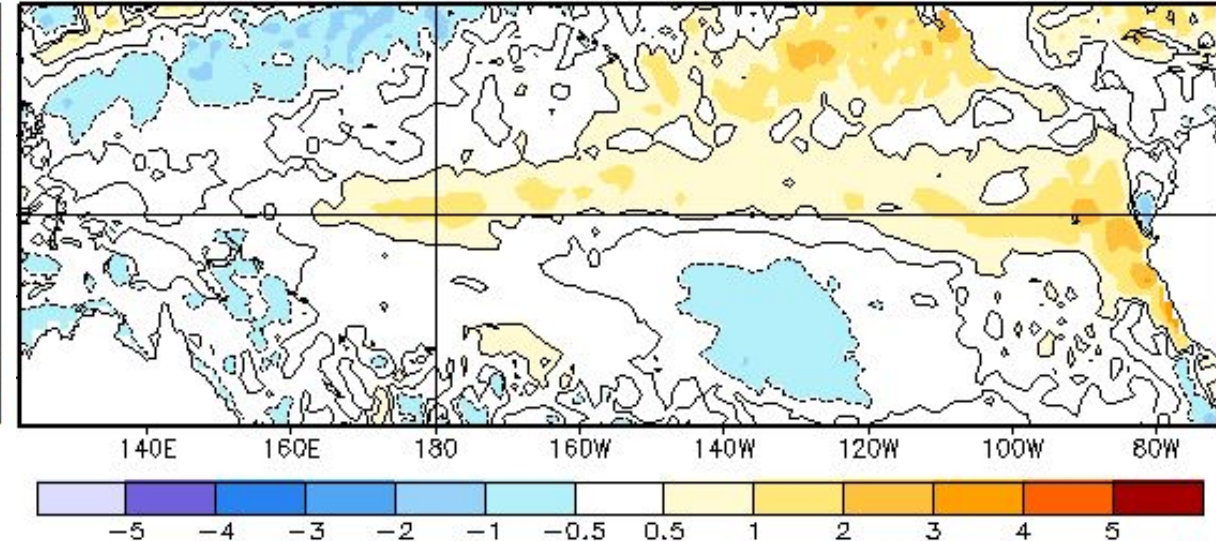
- ENSO is the leading mode of natural variability at seasonal to interannual (S2I) time scales and is considered as an internally occurring coupled ocean-atmosphere phenomenon.



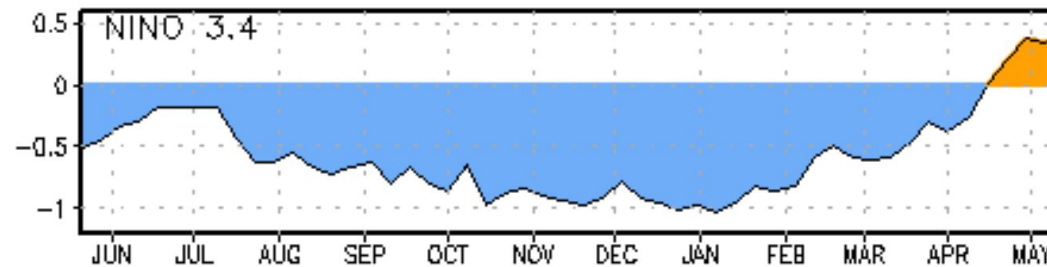
Observed Sea Surface Temperature (°C)



Observed Relative Sea Surface Temperature Anomalies (°C)



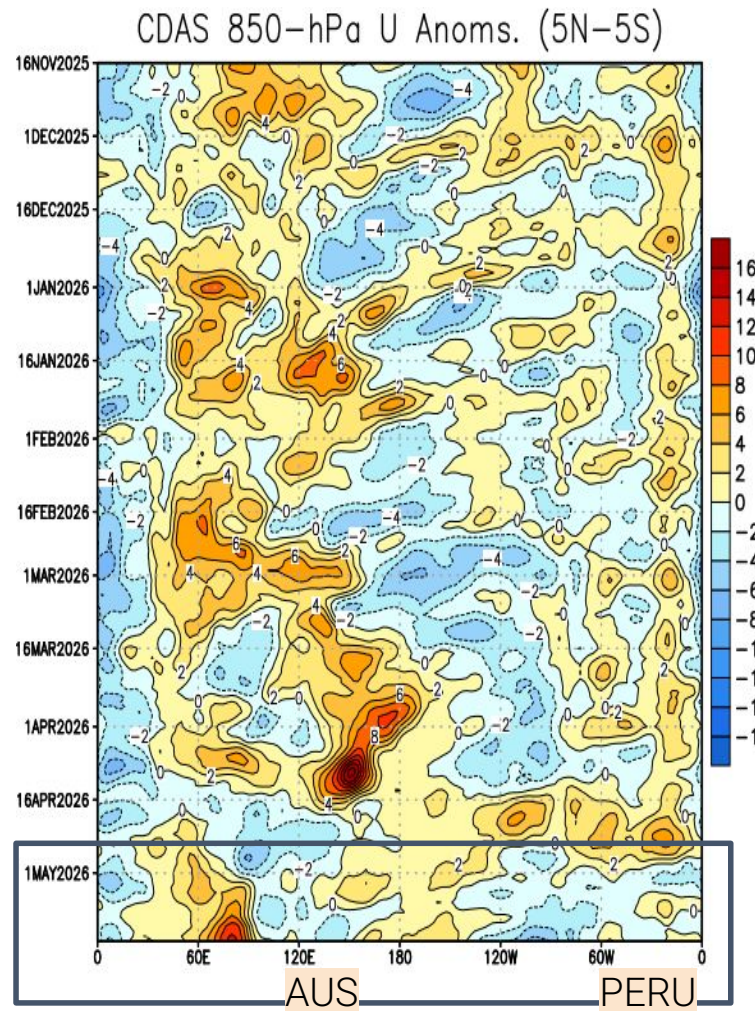
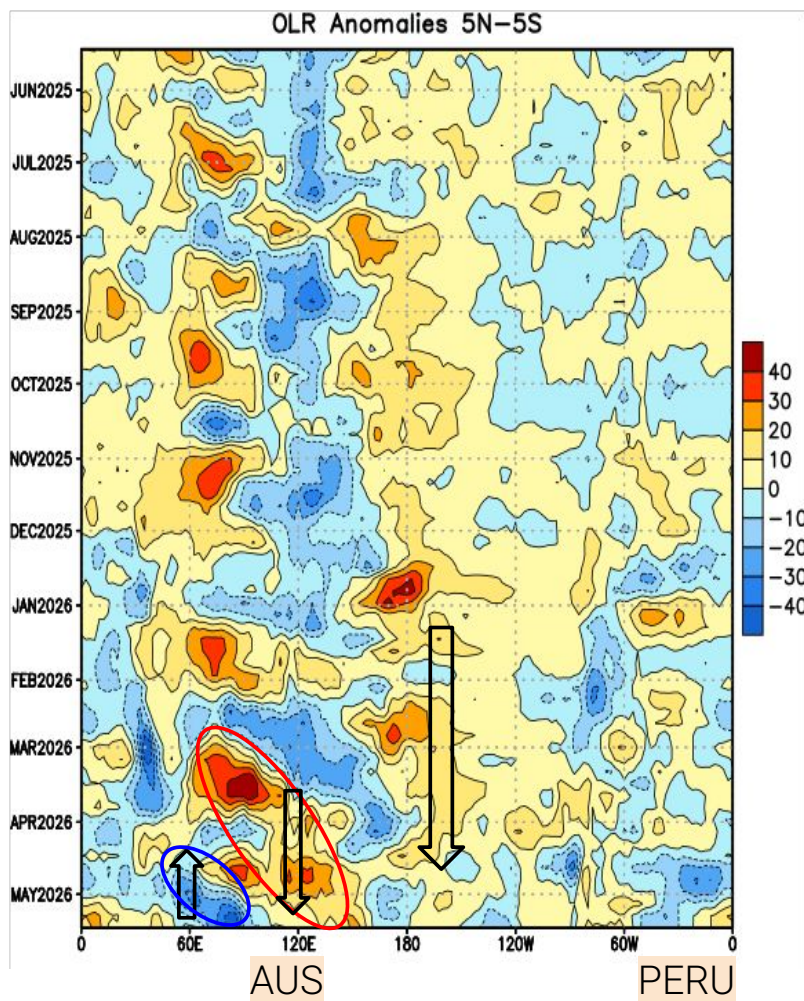
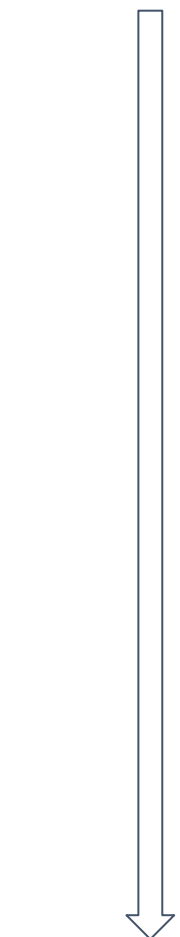
7-day Average Centered on 13 May 2026



# III. Tropical variability

## El Niño-Southern Oscillation (ENSO) - The atmosphere

Past



Data updated through 15 MAY 2026

- The equatorial ocean response to wind perturbations is linear/additive.
- The equatorial ocean responds to the zonally integrated zonal wind stress.
- Ongoing and future conditions in the tropics don't look favorable towards another major downwelling kelvin wave.

Blue = negative OLR, enhanced convection/rainfall.

Red = positive OLR anomalies, subsidence, suppressed rainfall

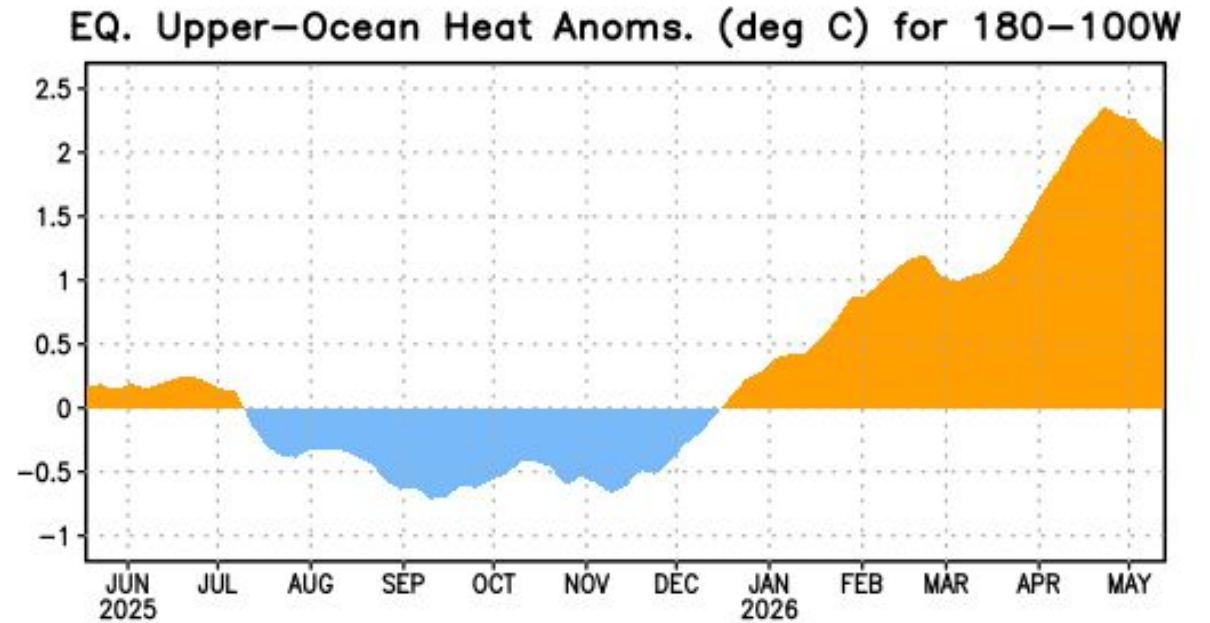
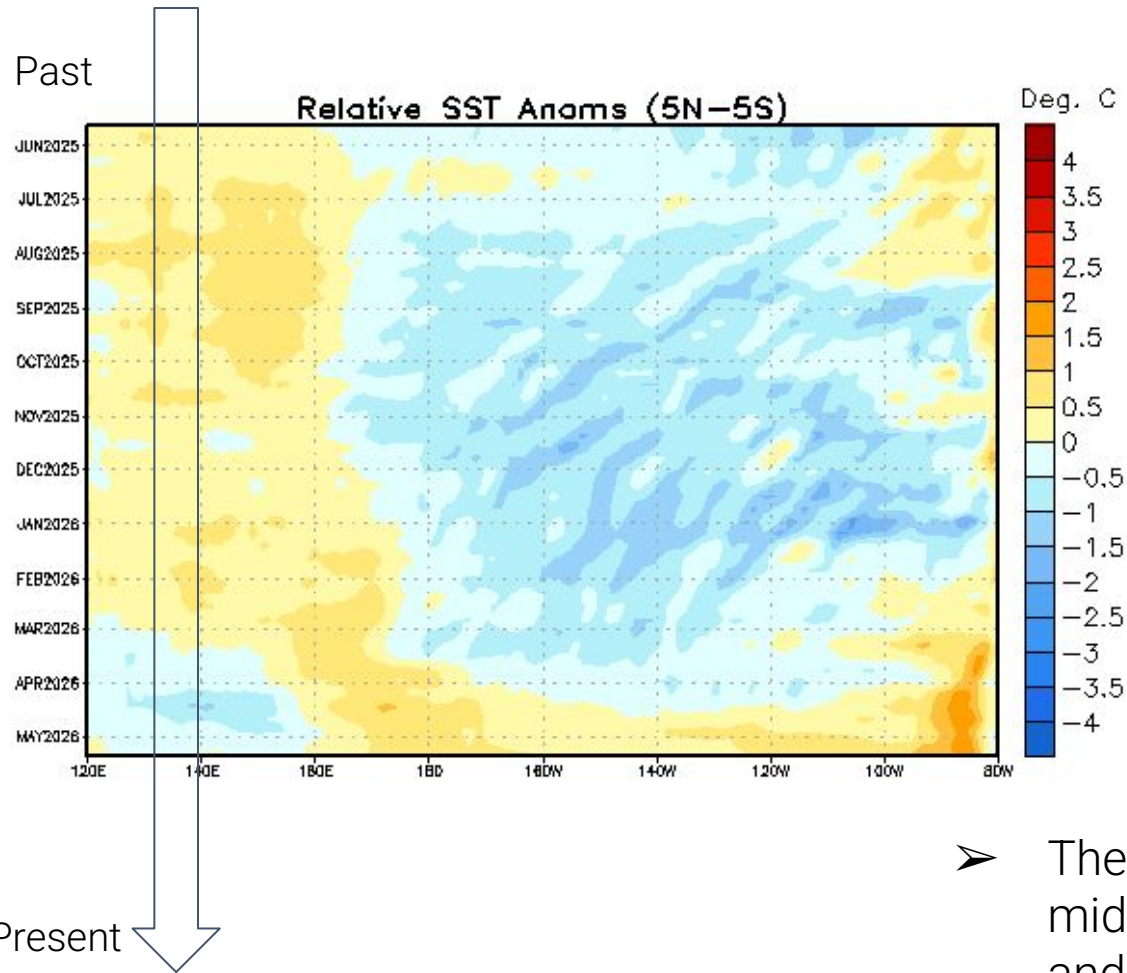
Blue = easterly wind anomalies

Red = westerly wind anomalies

### III. Tropical variability

### El Niño-Southern Oscillation (ENSO) - The ocean

[source](#)

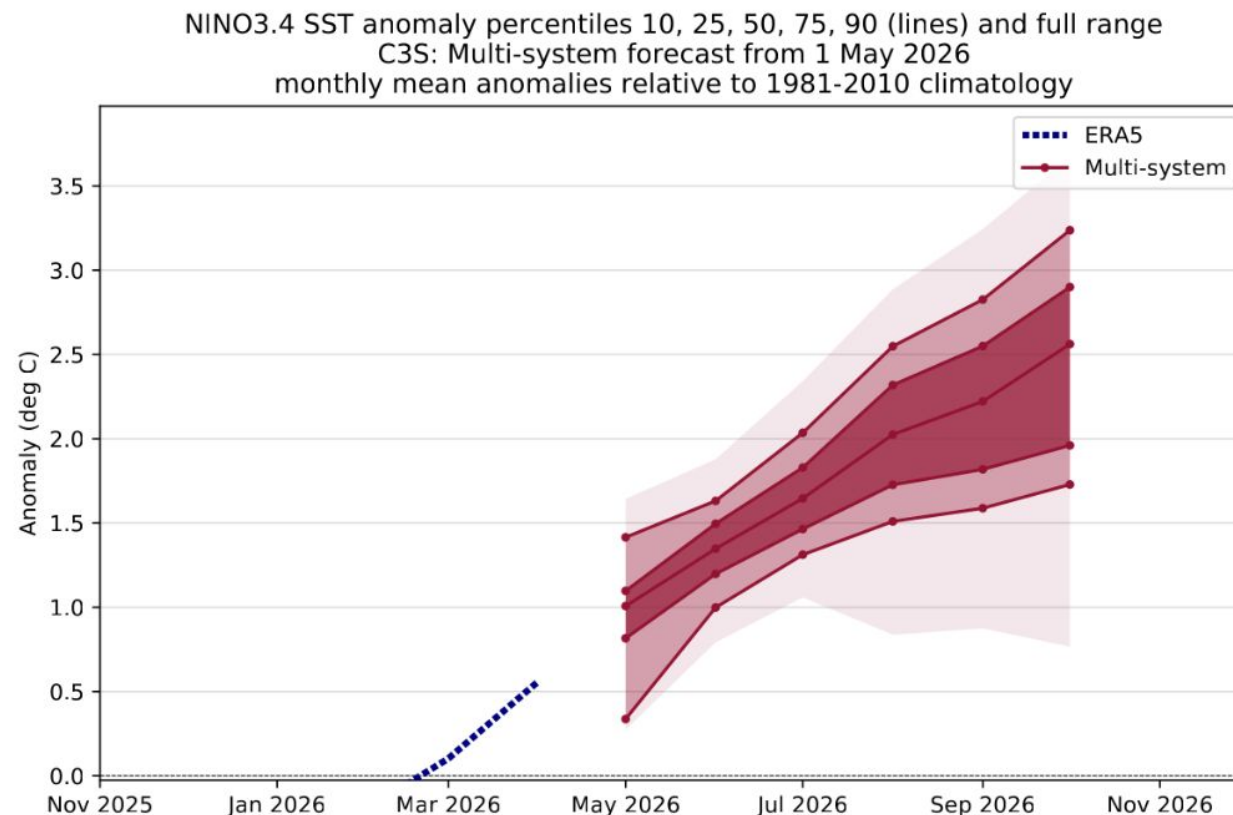


- The Eastern Pacific upper ocean has been warming since mid-December. It remained steady in March to quickly rocket in April and slightly decay beginning of May.
- Neutral/Positive SST anomalies have started to emerge in most of the Trop. Pacific basin (temp. Dipole cold/warm flip)

### III. Tropical variability

## ENSO forecasts: C3S multi-system

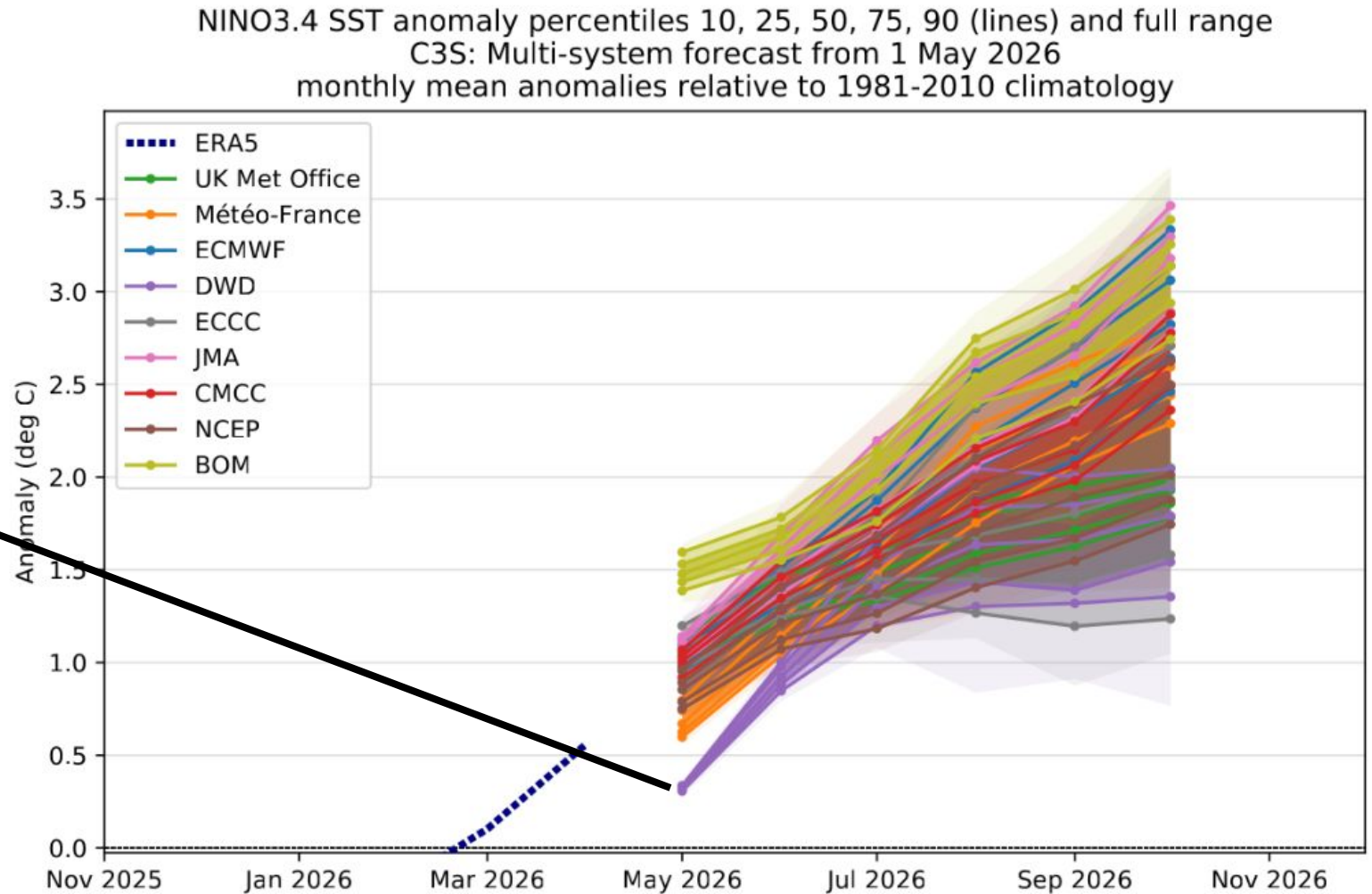
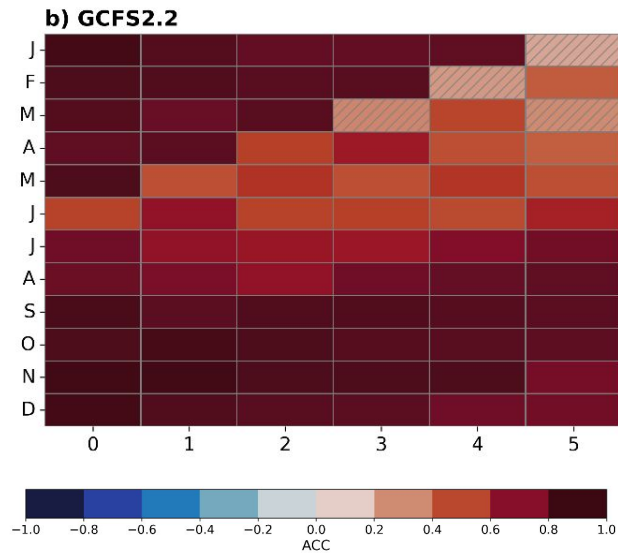
- In the C3S multi-system, 50 % of the ensemble members fall above the 2.5 °C threshold as early as October 2026.
- The amplitude of ENSO (SST anomalies) is quite sensitive to the reference period. Here C3S is using 1981-2020.
- Moreover, C3S does not use a **3-month running mean**, which is the standard procedure to establish if ENSO is active.
- Note also that C3S, compared to other operational centers, is not using the relative Oceanic Niño Index (RONI).



### III. Tropical variability

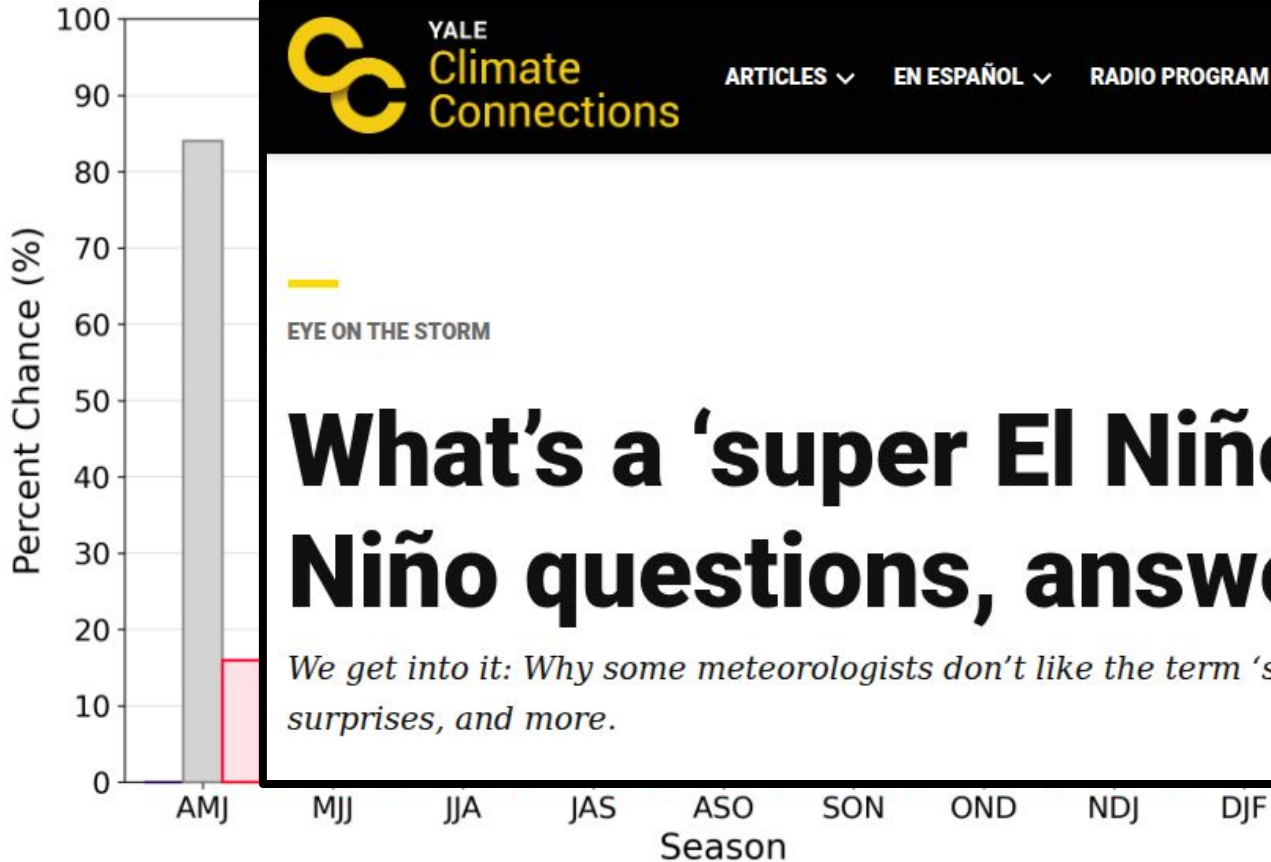
### ENSO forecasts: C3S multi-system

- Although the signal is strong, there is still a lot of spread in the multi-system ensemble. We are now emerging from the **springtime predictability barrier** (SPB).



### NOAA CPC ENSO Strength Probabilities (issued May 2026)

based on thresholds in ERSSTv5 Relative Niño 3.4 index/PONI



➤ The probability of having a strong or very strong El Niño by NDJ has increased since April.

of having a

**YALE Climate Connections**

ARTICLES ▾ EN ESPAÑOL ▾ RADIO PROGRAM ▾ ABOUT ▾

NEWSLETTER 🔍

**EYE ON THE STORM**

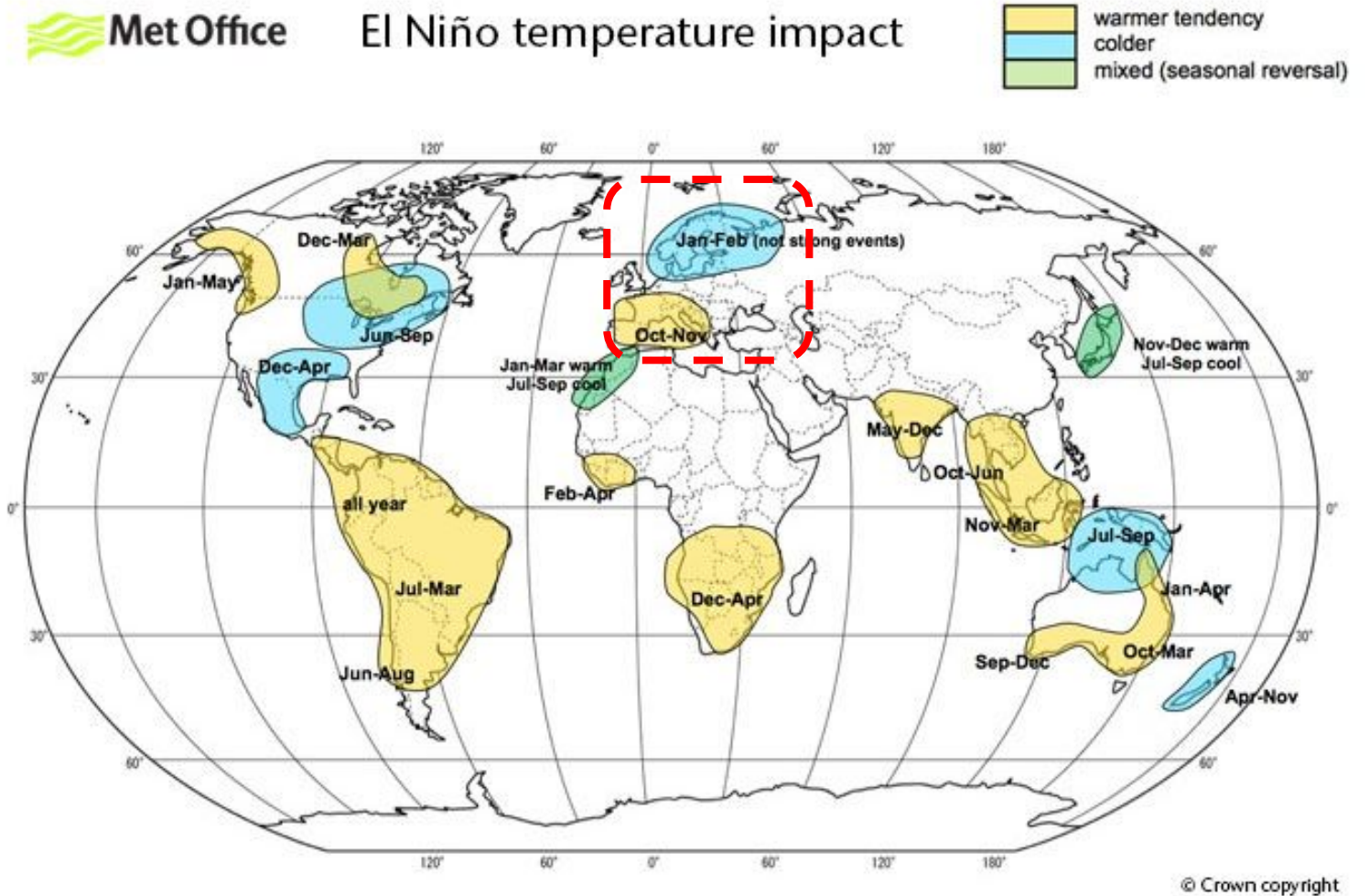
# What's a 'super El Niño'? And other El Niño questions, answered

*We get into it: Why some meteorologists don't like the term 'super El Niño,' why climate change can lead to El Niño surprises, and more.*

### III. Tropical variability

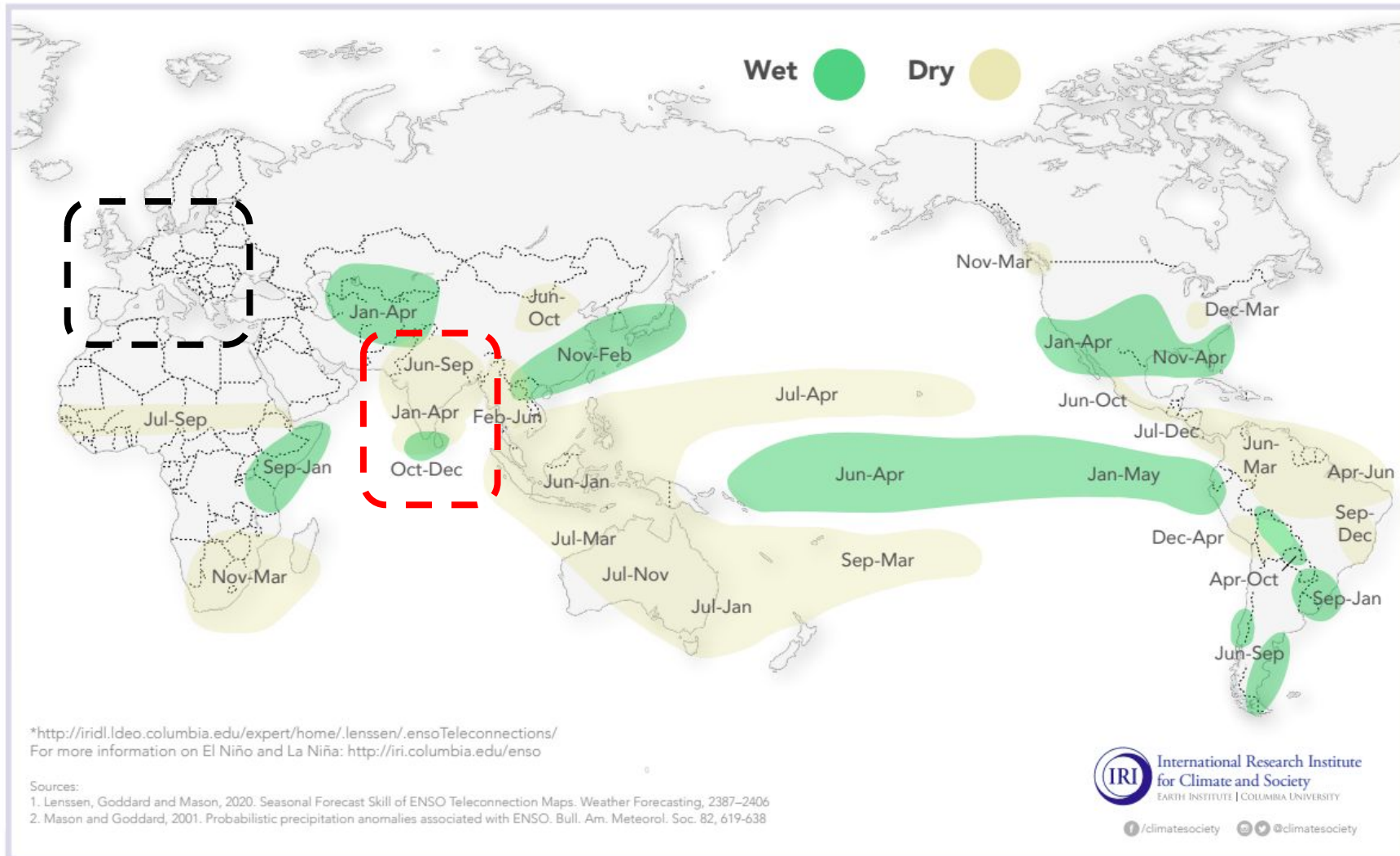
- While El Niño is responsible for widespread climate extremes across many regions of the planet, **its impact on Europe and the Iberian Peninsula during the summer (JJA) preceding its onset is negligible.**
- The European climate response to El Niño will become noticeable in boreal winter (DJF) via modulation of the North Atlantic Oscillation. We'll keep our eyes peeled!

### ENSO impacts: Temperature

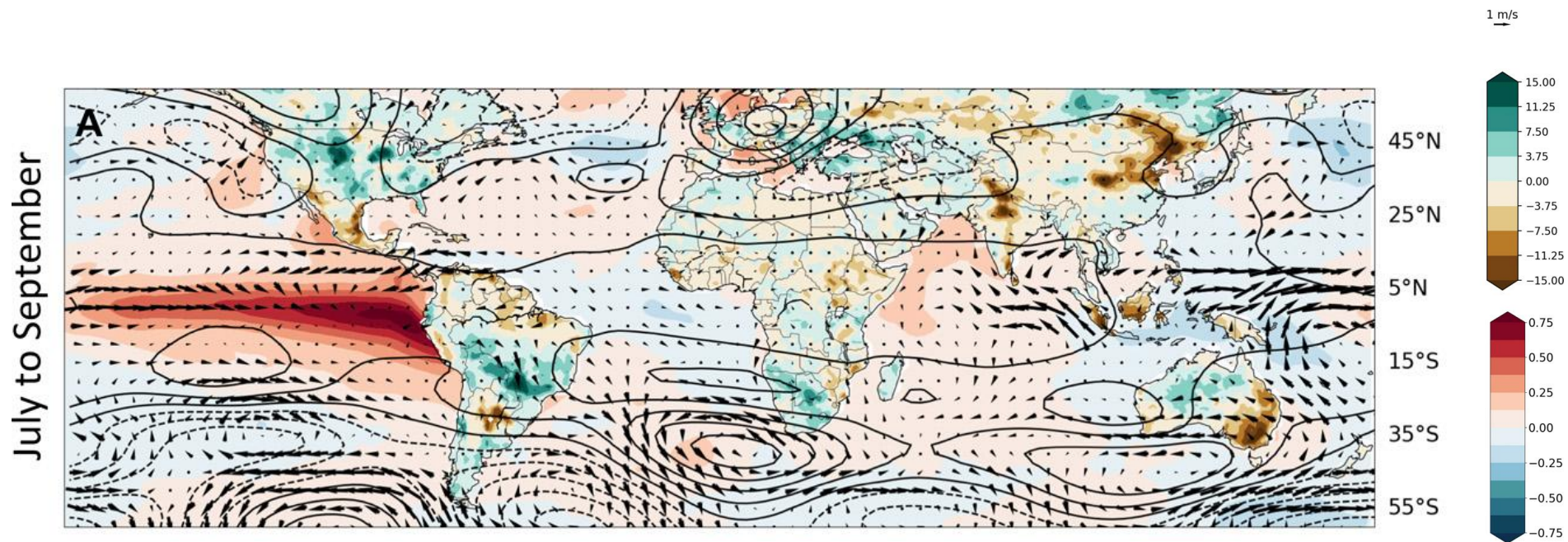


### El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. The regions and seasons shown on the map below indicate typical but not guaranteed impacts of La Niña. For further information, consult the probabilistic information\* that the map is based on.

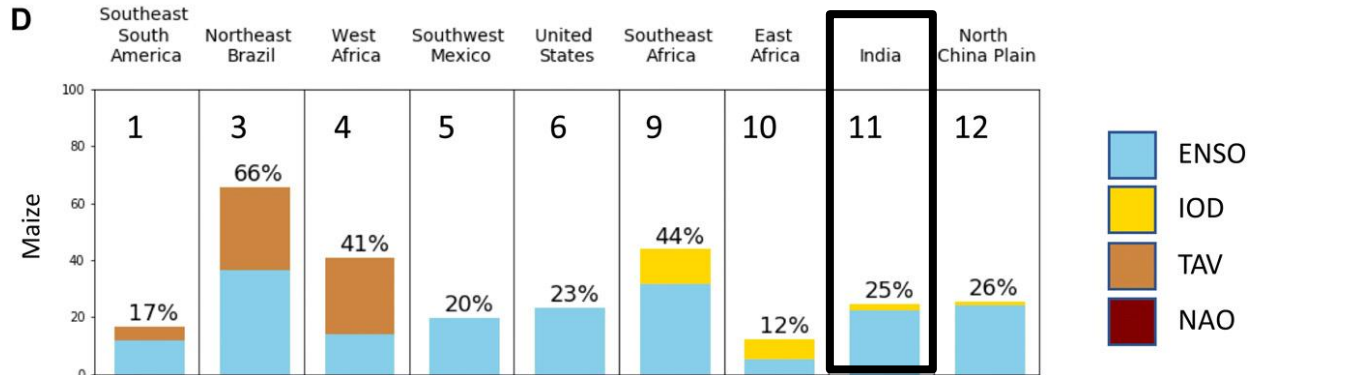
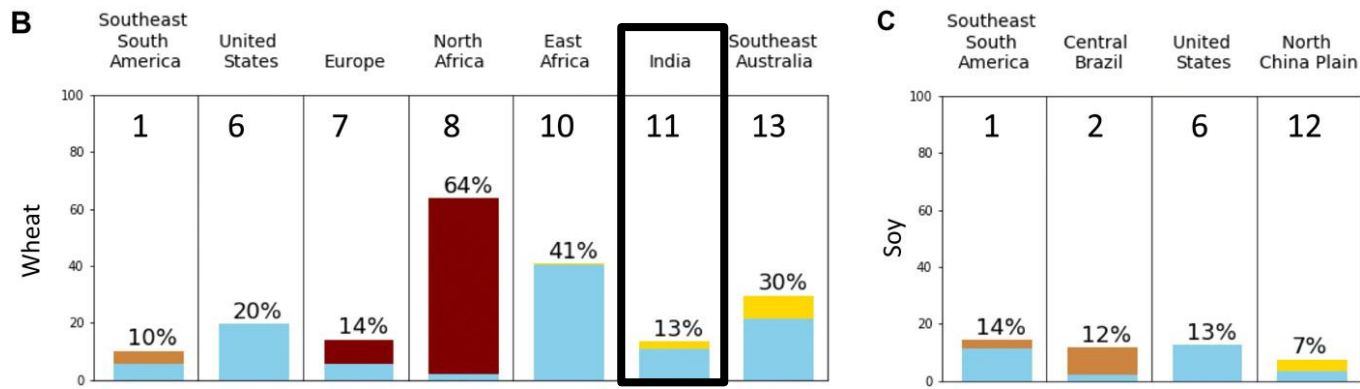
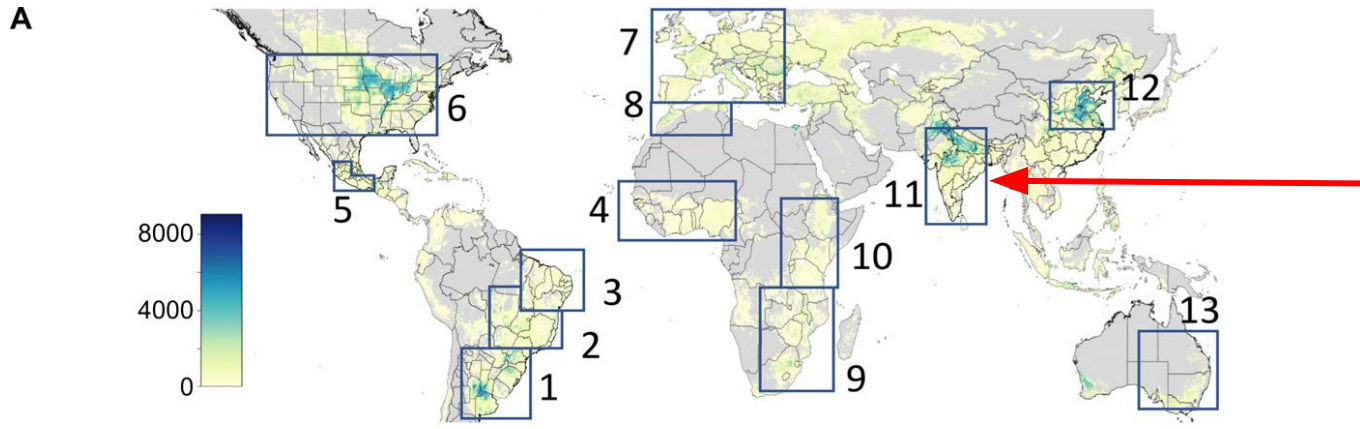


- During the development of El Niño, in boreal summer, shifts in atmospheric pressure centres lead to high pressure and subsidence over the central Indian ocean, inhibiting the summer monsoon. (Although ENSO it's not the only source of the monsoon's seasonal variance).
- The SW monsoon provides up to 80% of India's annual rainfall, supporting agriculture, water and energy resources.



# III. Tropical variability

## ENSO impacts: The Indian summer monsoon



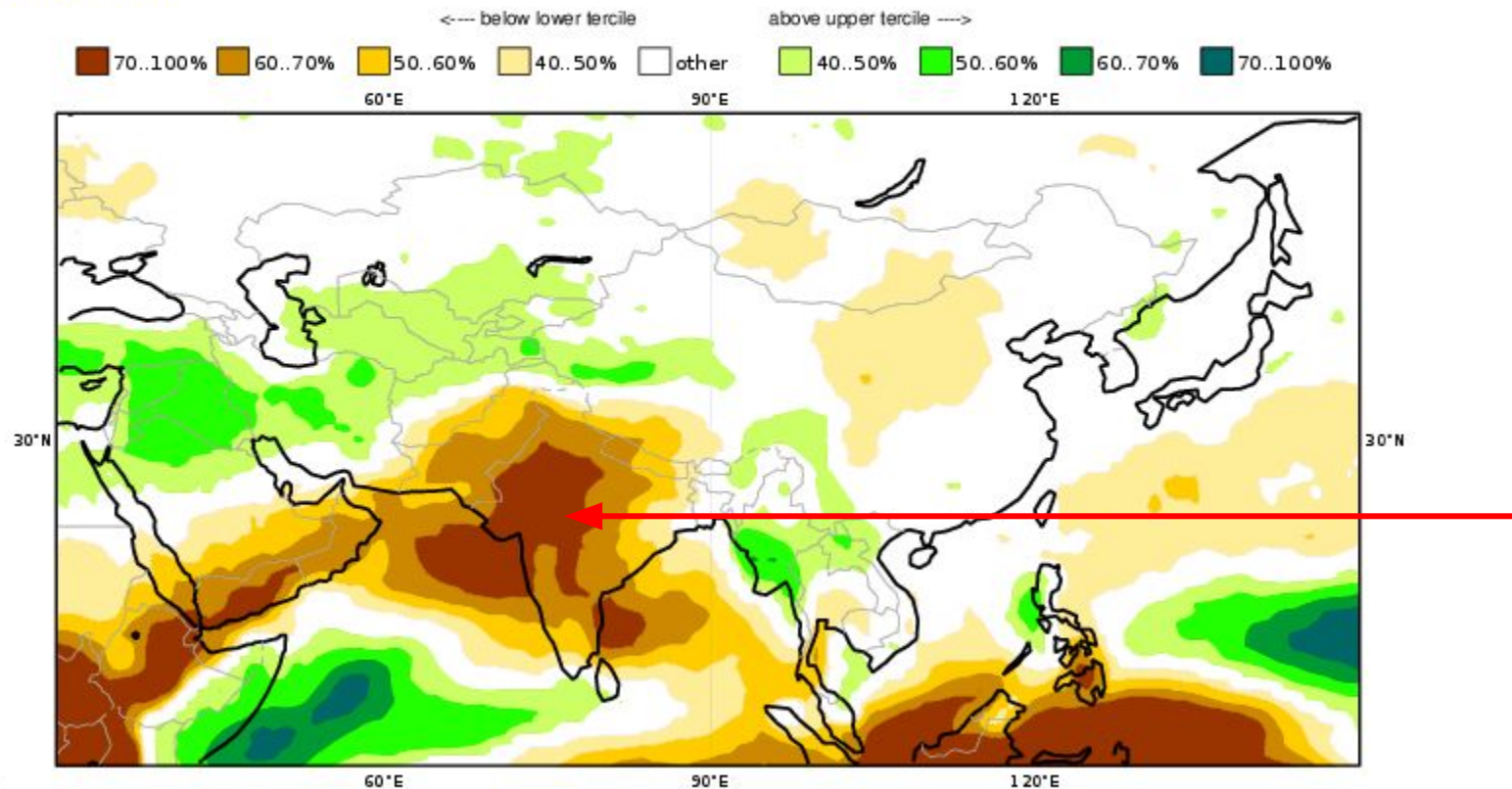
➤ The agriculture system in India is strongly modulated by ENSO (13% of wheat, 25% of maize production variability).

Local production variance associated with climate modes. Anderson et al., 2019 DOI: [10.1126/sciadv.aaw1976](https://doi.org/10.1126/sciadv.aaw1976)

### III. Tropical variability

## ENSO impacts: The Indian summer monsoon

C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC/BOM  
Prob(most likely category of precipitation) JAS 2026  
Nominal forecast start: 01/05/26  
Unweighted mean



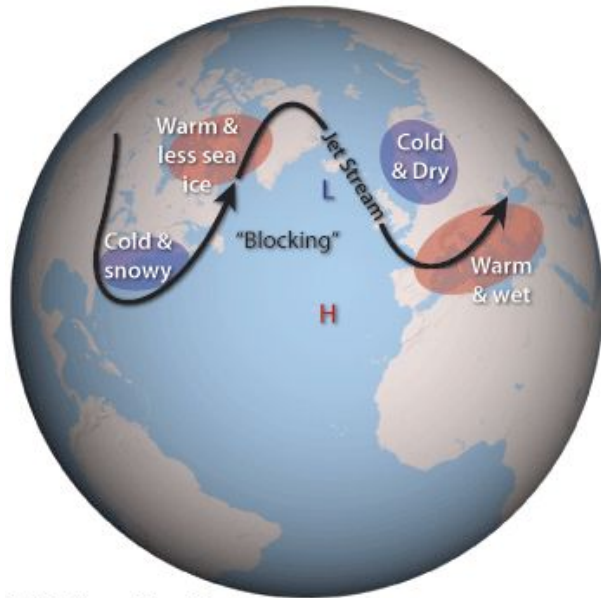
- 70% probability of **below normal precipitation** over India in the **JAS** season.
- The developing of El Niño will likely weaken the summer Indian monsoon, leading to strong impacts on the agriculture system.

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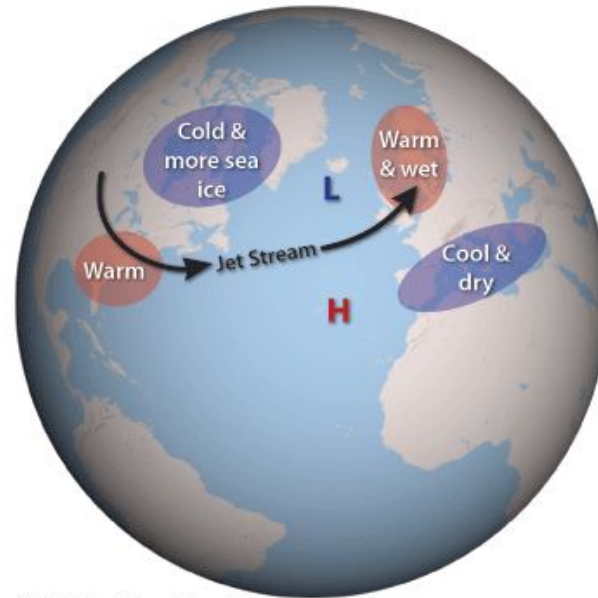
# IV. Extratropical variability

## North Atlantic Oscillation (NAO)

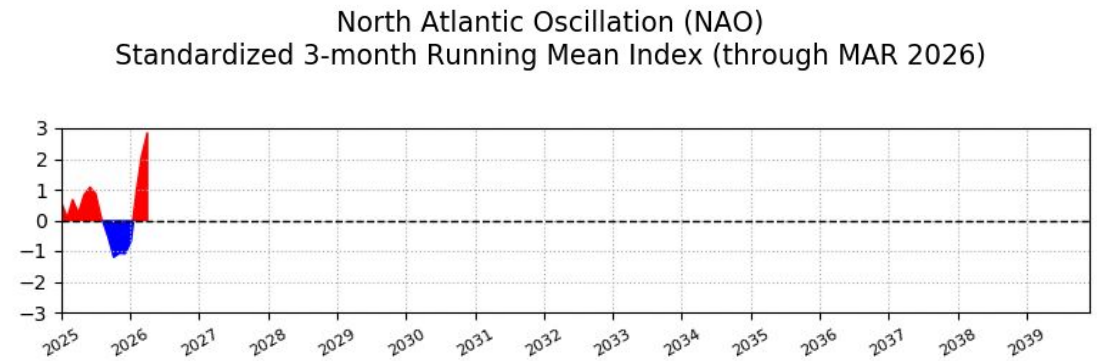
- The **North Atlantic Oscillation (NAO)** is the leading mode of large-scale atmospheric variability in the North Atlantic basin.



NAO Negative Mode

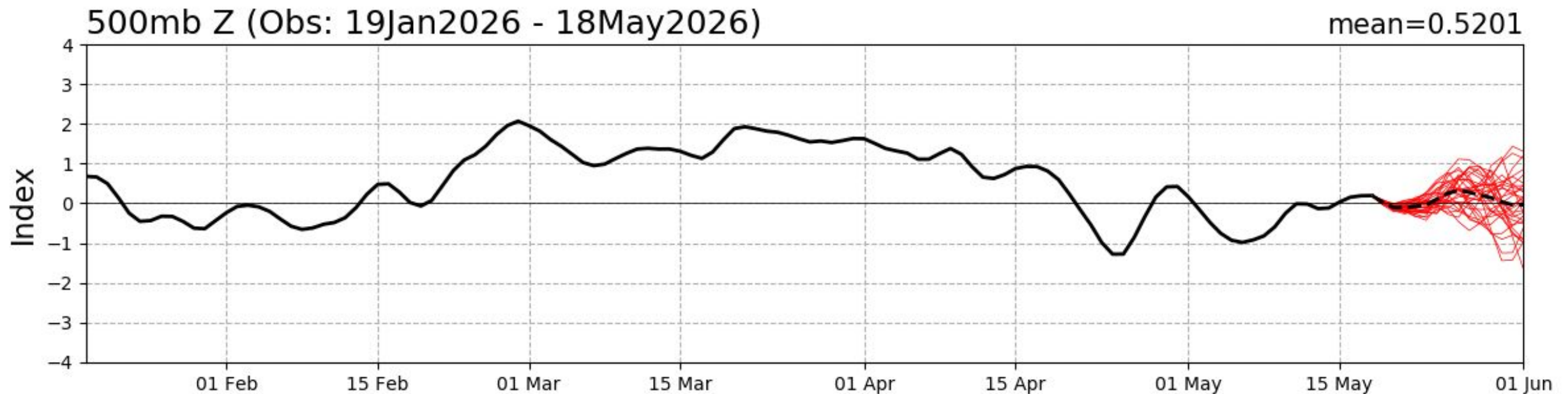


NAO Positive Mode



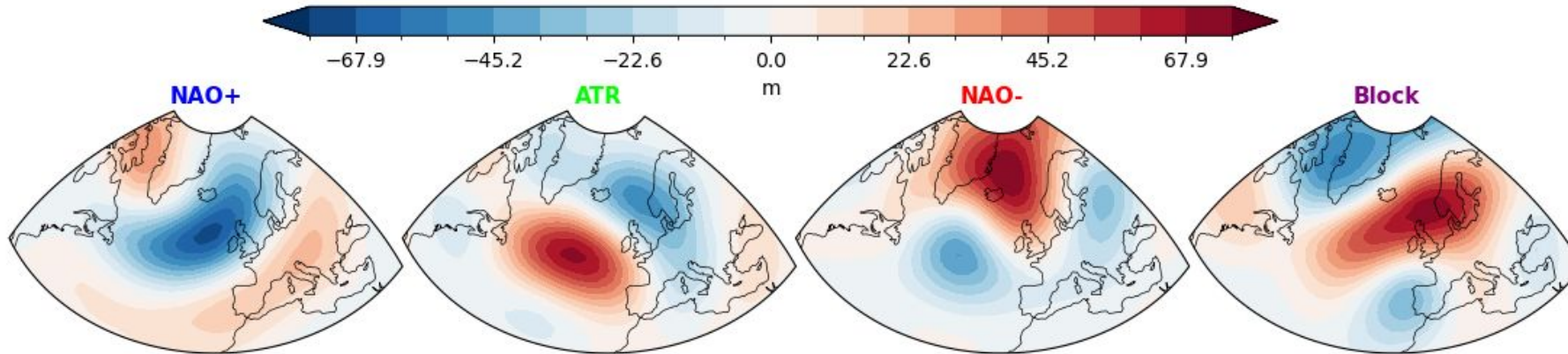
- Negative NAO in late April and early May followed by an inactive period which will continue according to the forecast.

## NAO Index: Observed & GEFS Forecasts



## IV. Extratropical variability

### Euro-Atlantic weather regimes

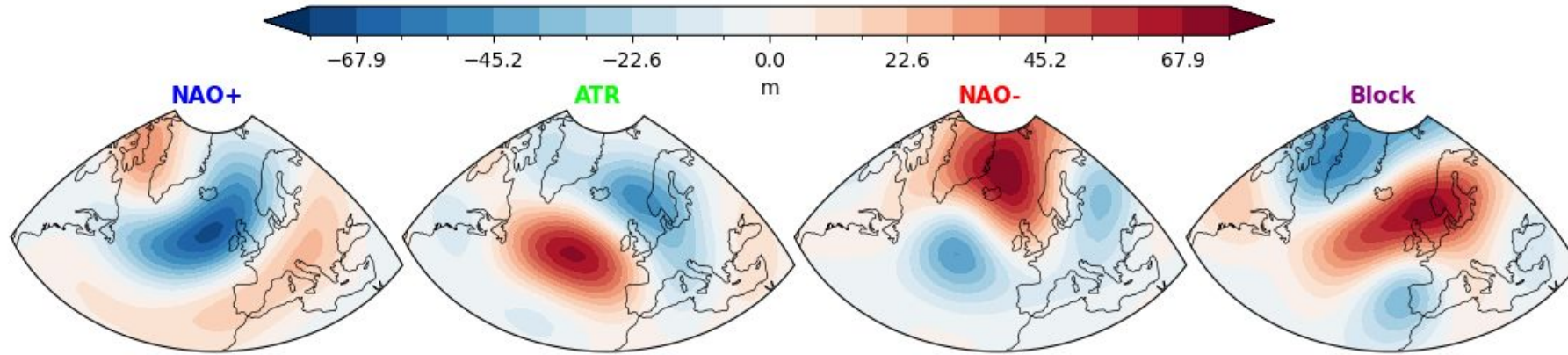


- Geopotential height anomaly composites at 500 hPa.
- 1980 - 2008 **MJJAS** (k-means clustering).
- In summer, the amplitude of the anomalies are weaker than for winter

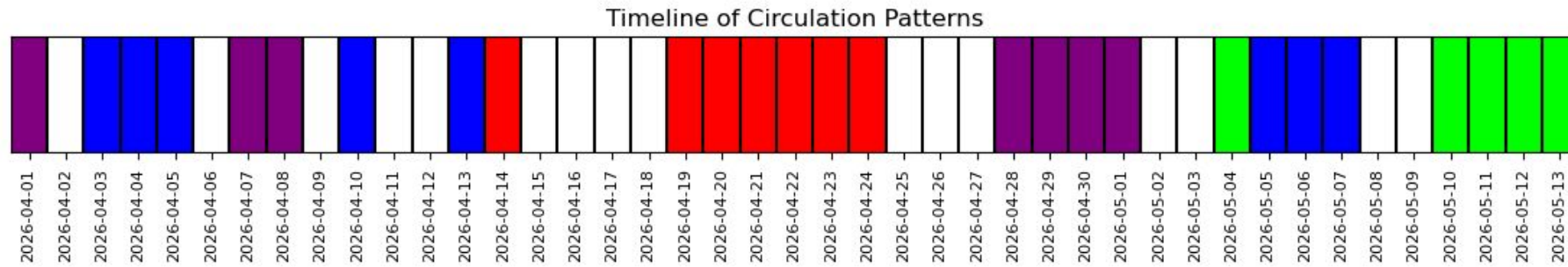
- **Blocking:** Cold and dry anomalies in Northern Europe, wet anomalies in Southwestern Europe. Onset through anticyclonic wave breaking over Europe in the upper troposphere (Michel et al., 2012).
- **NAO+:** Westerly winds predominate bringing mild, wet and stormy winter conditions to northern Europe and eastern USA while southern Europe is more likely to see cold, dry winter conditions.
- **NAO-:** Spells of easterly winds bring cold dry and calm winters with fewer and weaker storms to northern Europe and eastern USA.
- **ATR:** Northern Europe: Drier and slightly milder due to being under the influence of ridging on the upstream side. Southern Europe: Can be wetter (particularly Iberia and Western Mediterranean) due to enhanced storm tracks directed southward. Eastern Mediterranean may be less affected.

# IV. Extratropical variability

## Euro-Atlantic weather regimes

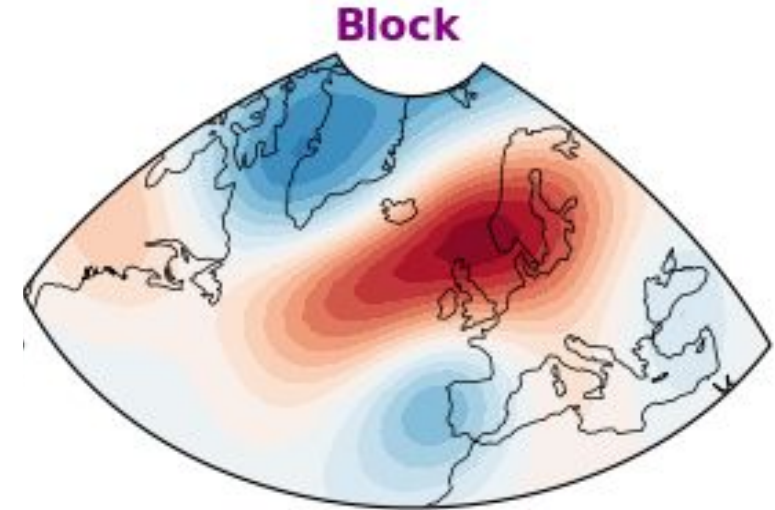
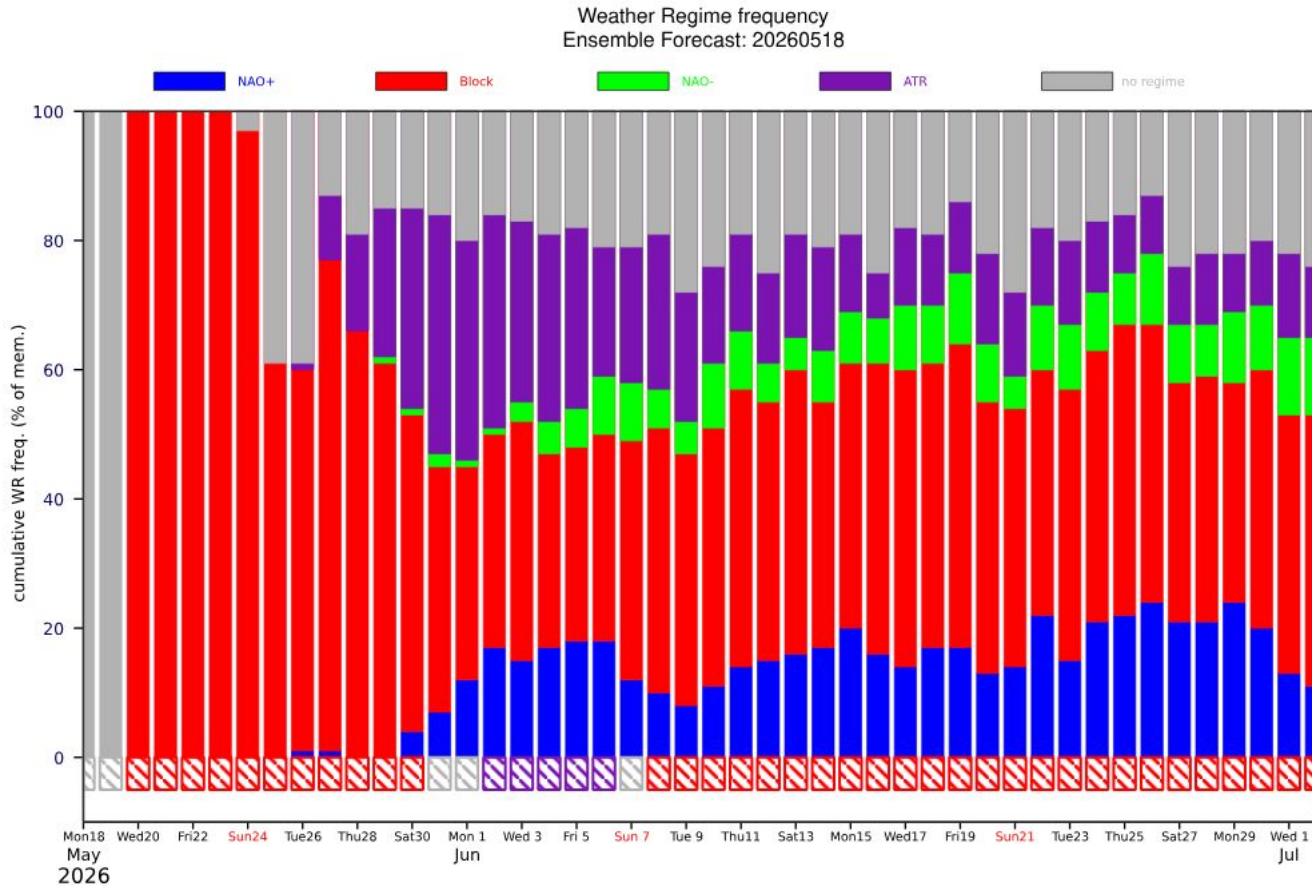


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# IV. Extratropical variability

## Euro-Atlantic weather regimes

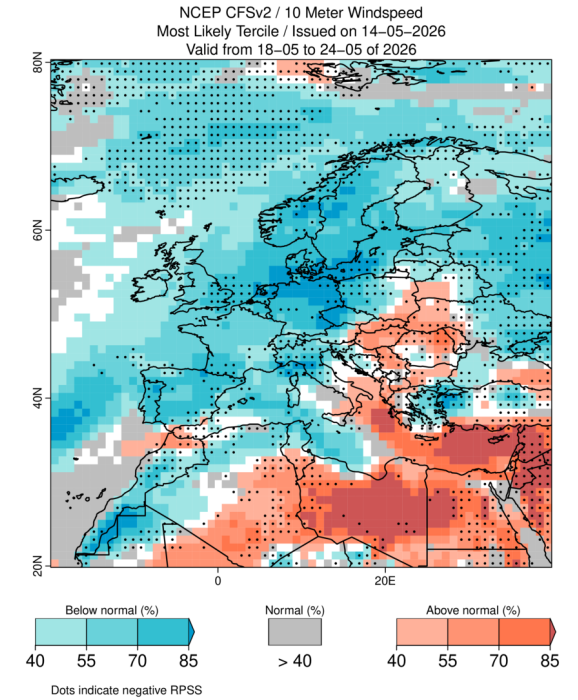
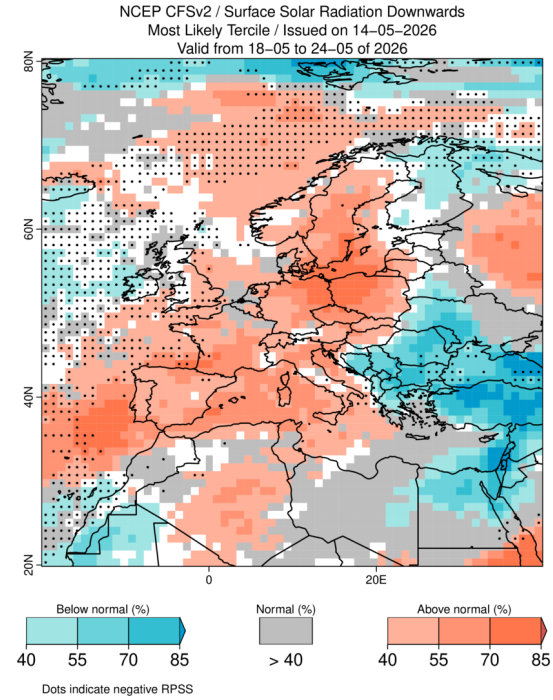
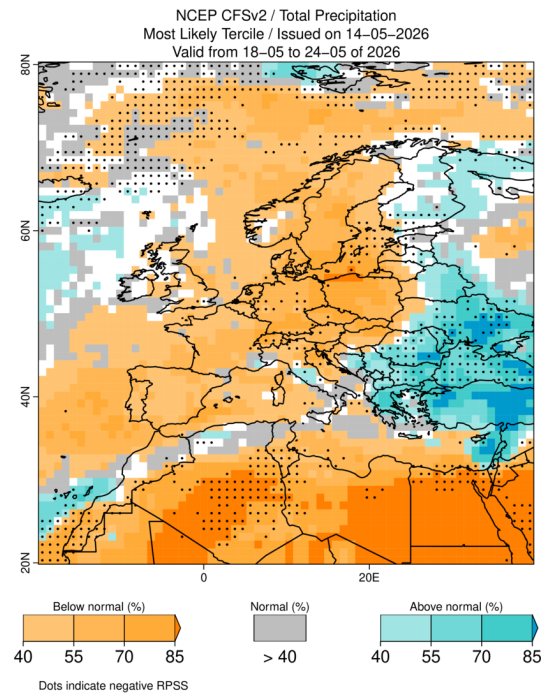
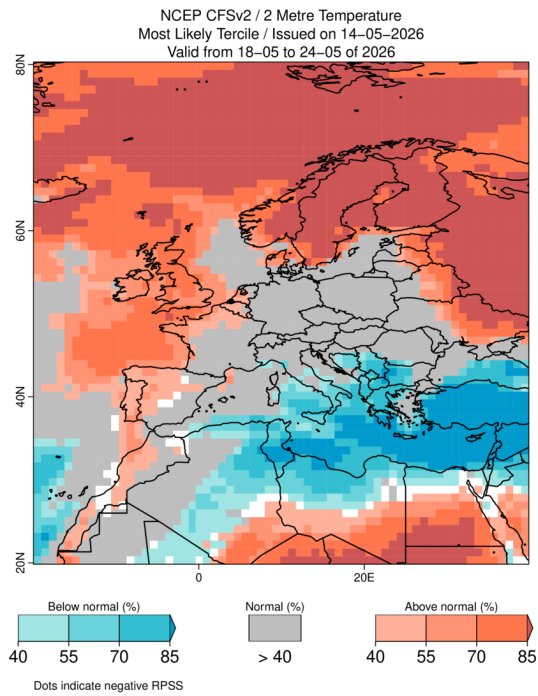


➤ ECMWF more in favour of Scandinavian Blocking.

# IV. Extratropical variability

Valid on 18 - 24 May [Init. 14 May]

Hindcast period: 1999 - 2016



Temperature



Precipitation



Solar radiation

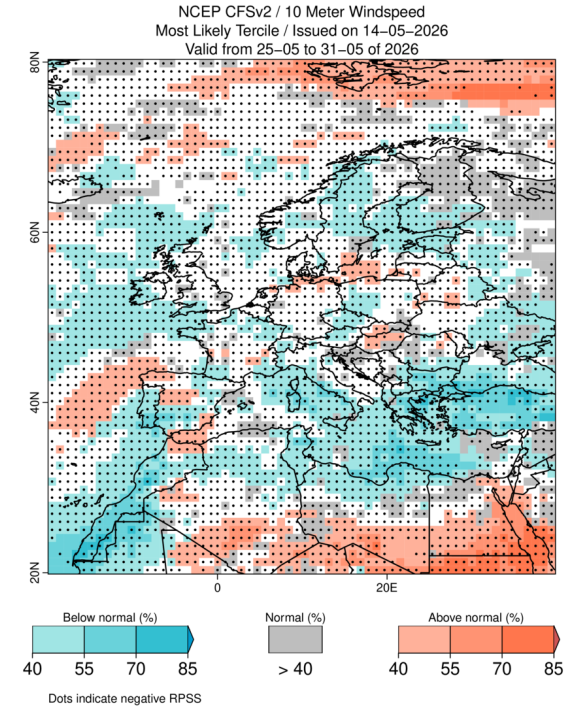
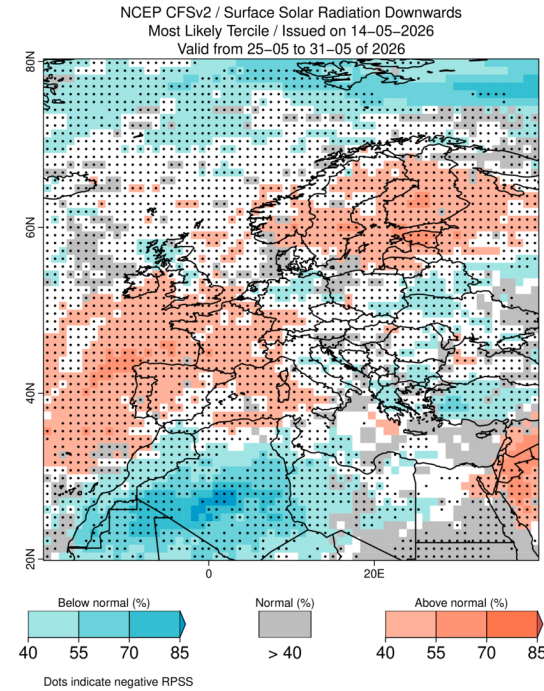
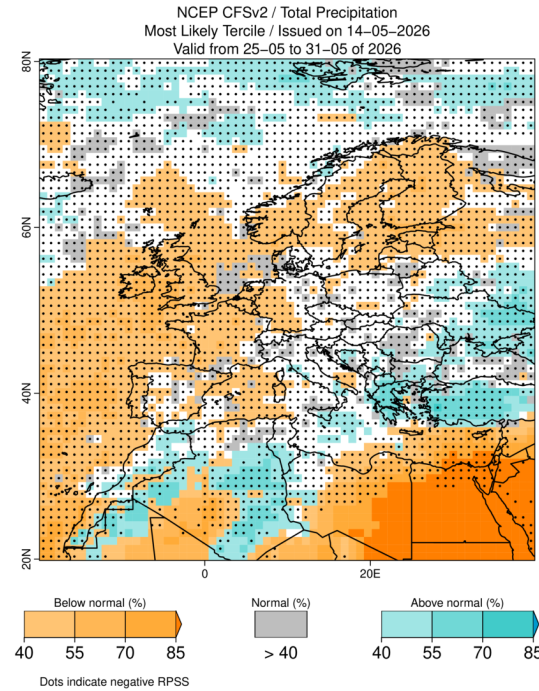
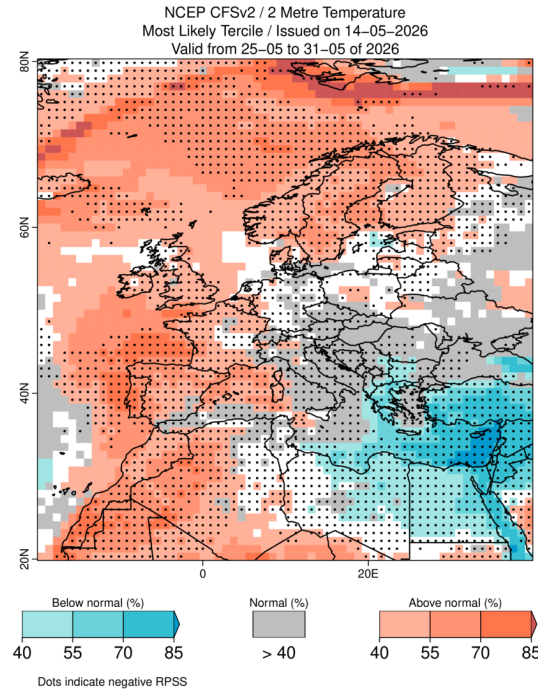


Surface wind

# IV. Extratropical variability

## Valid on 25 - 31 May [Init. 14 May]

Hindcast period: 1999 - 2016



Temperature



Precipitation



Solar radiation

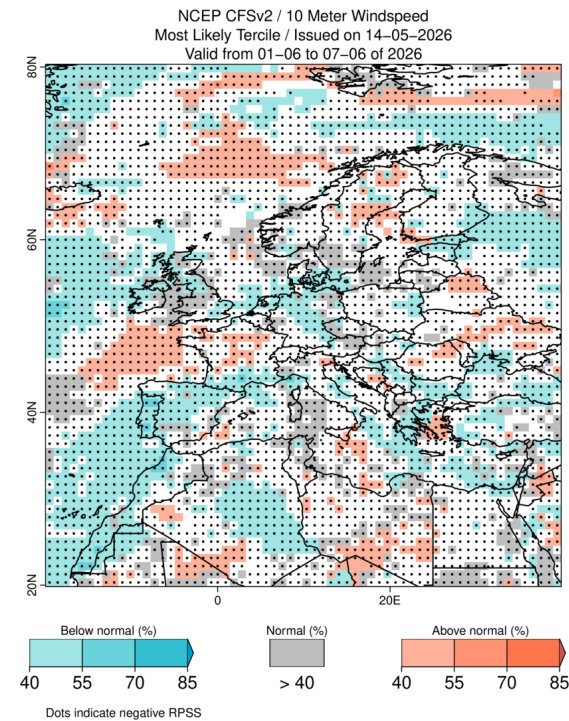
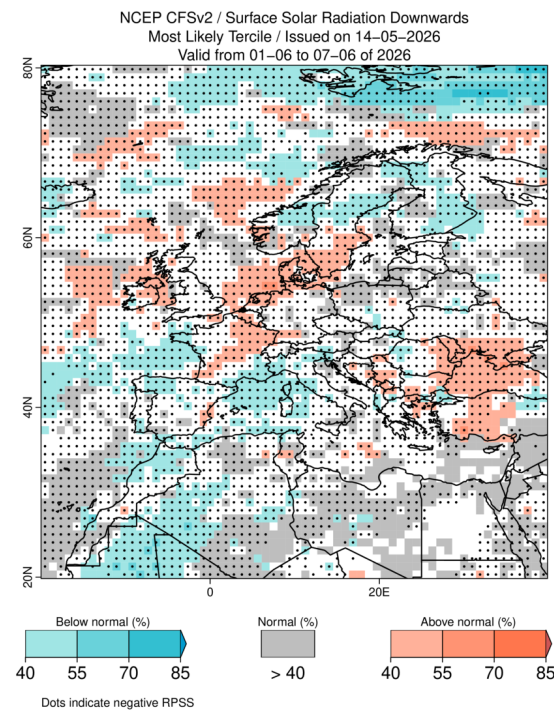
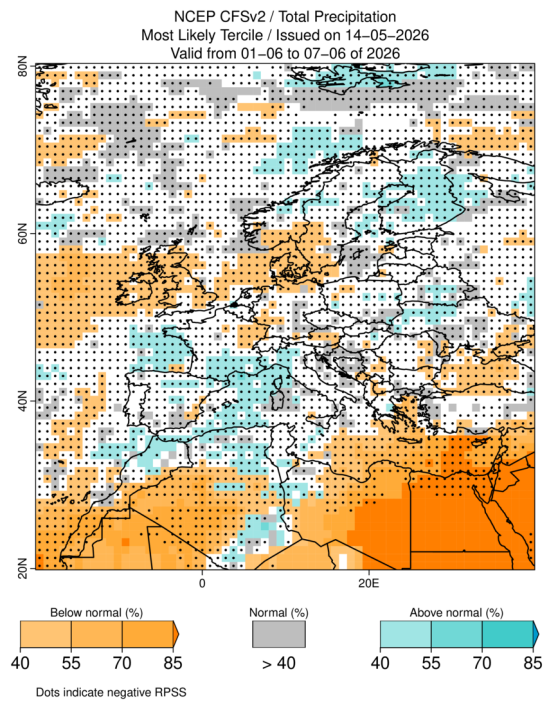
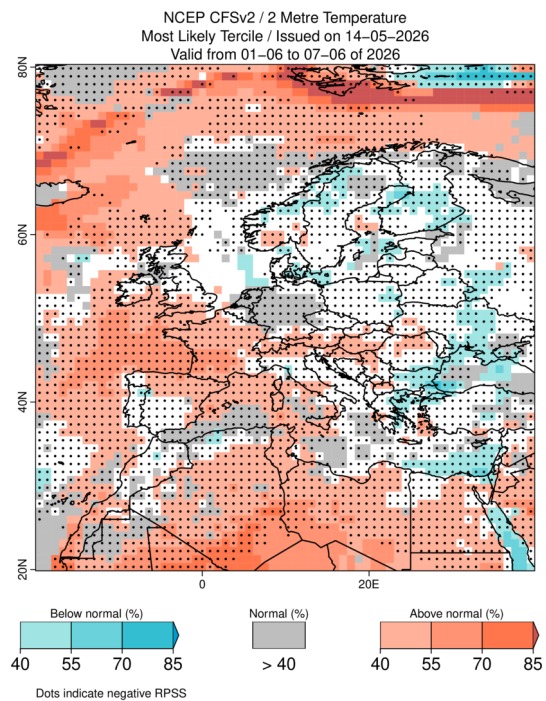


Surface wind

# IV. Extratropical variability

Valid on 1 - 7 June [Init. 14 May]

Hindcast period: 1999 - 2016



Temperature



Precipitation



Solar radiation

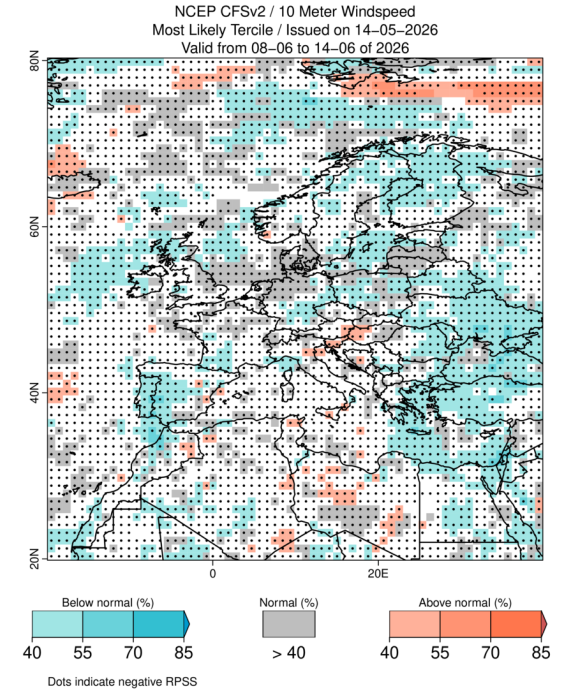
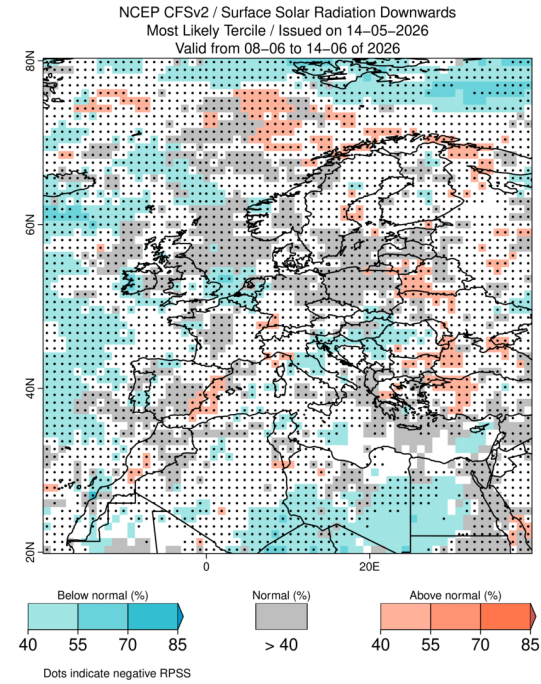
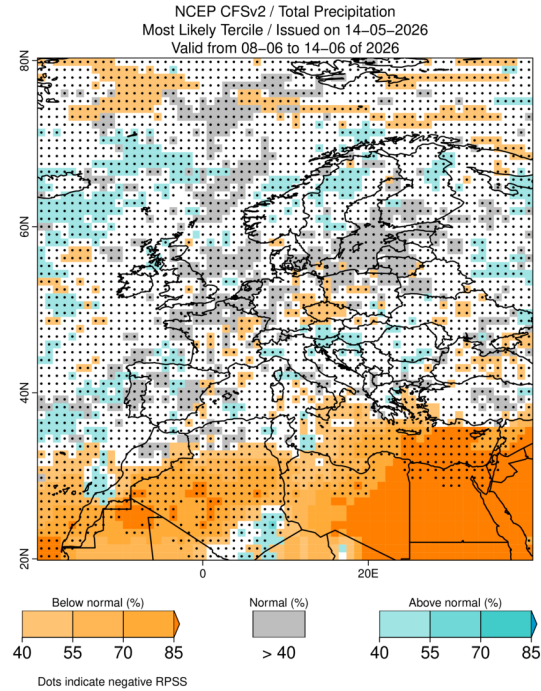
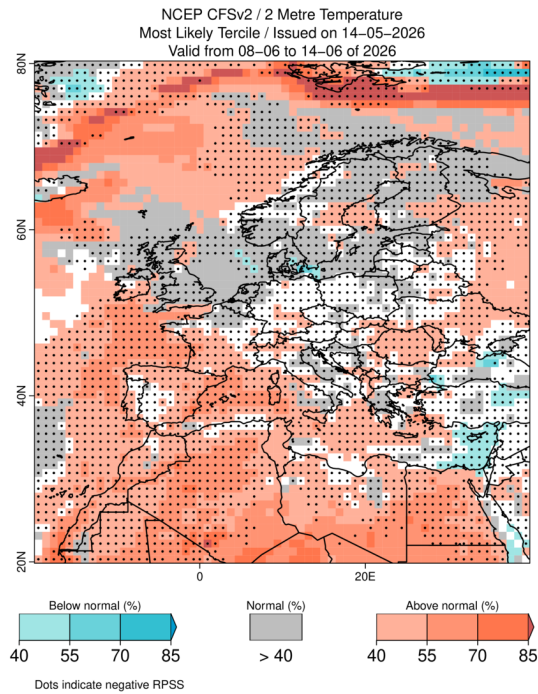


Surface wind

# IV. Extratropical variability

## Valid on 8 - 14 June [Init. 14 May]

Hindcast period: 1999 - 2016



Temperature



Precipitation



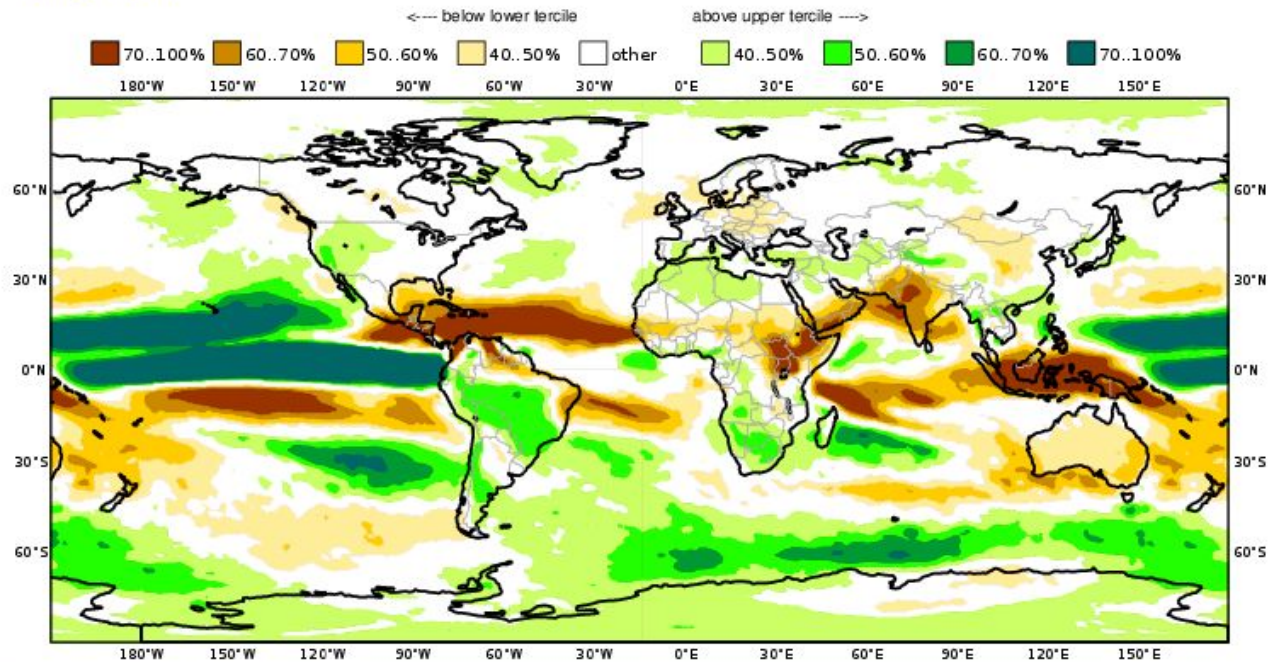
Solar radiation



Surface wind

- I. European state of the climate report 2025
- II. Recent state of the climate
- III. Tropical variability
- IV. Extratropical variability
- V. Seasonal forecasts

C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC/BOM  
 Prob(most likely category of precipitation) JJA 2026  
 Nominal forecast start: 01/05/26  
 Unweighted mean

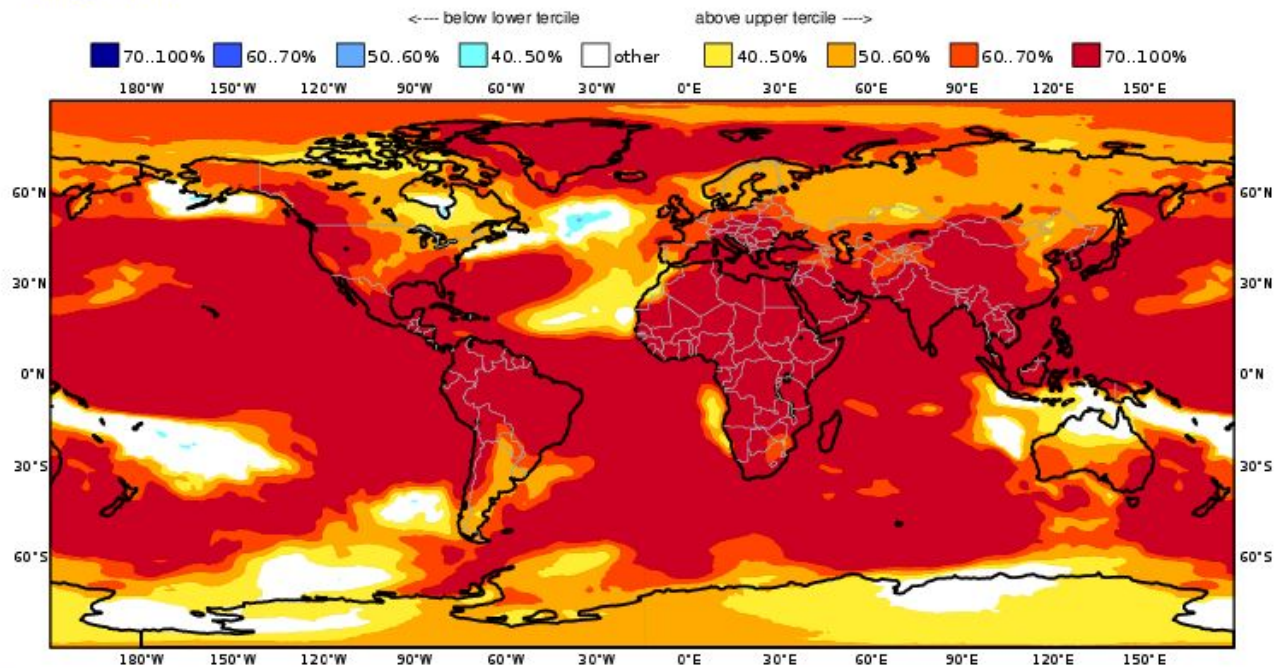


- **Positive** Most of South America (except NE), South/North Africa, West US, Southern Europe...
- **Negative** Indonesia, Australia, Central America, East/Horn of Africa, India, consistent with the development

# V. Seasonal forecasts

## Temperature

C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC/BOM  
Prob(most likely category of 2m temperature) JJA 2026  
Nominal forecast start: 01/05/26  
Unweighted mean



- Typical global warming signal.
- Parts of North Atlantic, North Australia and Pacific with average/cooler anomalies.

## Summary

- Europe is the world's fastest-warming continent, driven by Arctic albedo loss and more frequent heatwaves.
- April was unusually warm across Europe and the eastern Pacific near the US west coast. Europe was drier than normal, while Canada, Brazil, and parts of Asia experienced flooding.
- The MJO has remained weak and is expected to transition to phase 8 over the coming days.
- The equatorial Pacific is transitioning towards El Niño, with rising ocean heat content confirming the trend.
- C3S multi-system forecasts project a strong El Niño peaking near +2.5°C in October 2026 (watch old climatology). El Niño could weaken the Indian summer monsoon, increasing risks of lower rainfall and crop failures in India.
- In Europe, Scandinavian blocking is the dominant forecast regime for the next few days, though it differs from subseasonal week 1–2 forecasts indicating reduced rainfall and wind.
- For June–August, the C3S seasonal forecast indicates generally warmer-than-normal conditions across Europe, alongside precipitation patterns consistent with developing El Niño conditions.

# Forecast Briefing

## May 2026

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