

Earth Sciences  
Department



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

# Forecast Briefing

## October 2025

Climate Services Team (CST)

Earth System Services (ESS)

Barcelona Supercomputing Center (BSC)

Tuesday 28<sup>th</sup> Oct 2025

# Outline

- I. Recent state of the climate
- II. Seasonal forecasts
- III. Intra-seasonal forecasts
- IV. Discussion

# I. Recent state of the climate

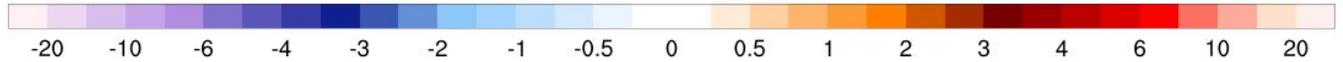
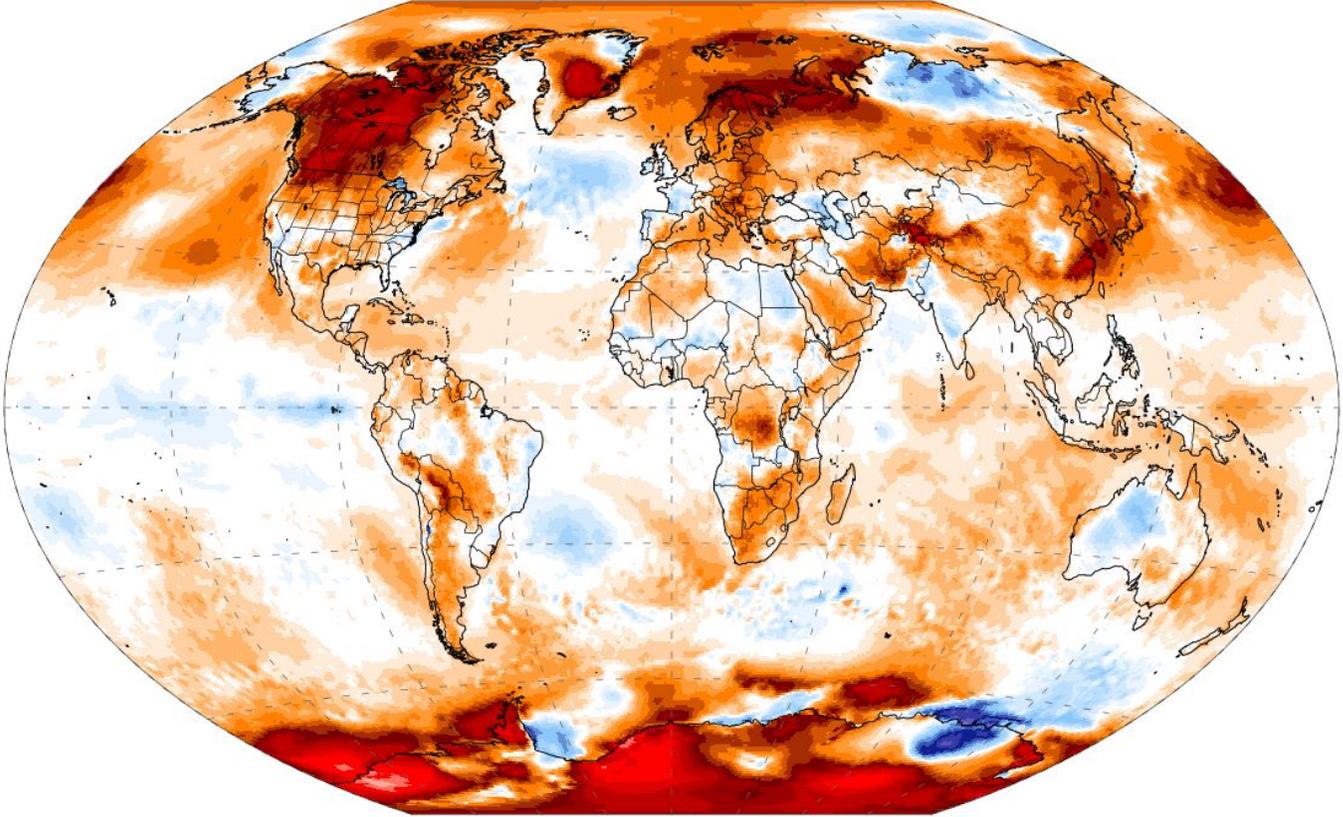
# I. Recent state of the climate

## Temperature

- September's signal had large positive anomalies in parts of northern North America, Greenland, Antartida, Scandinavia and eastern Asia.
- There are some regions where the anomalies have been higher for September than for JAS such as some parts of northern North America the USA, Greenland and Scandinavia

2m Temperature Anomaly (°C)  
September 2025 - 1991-2020

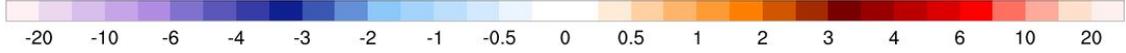
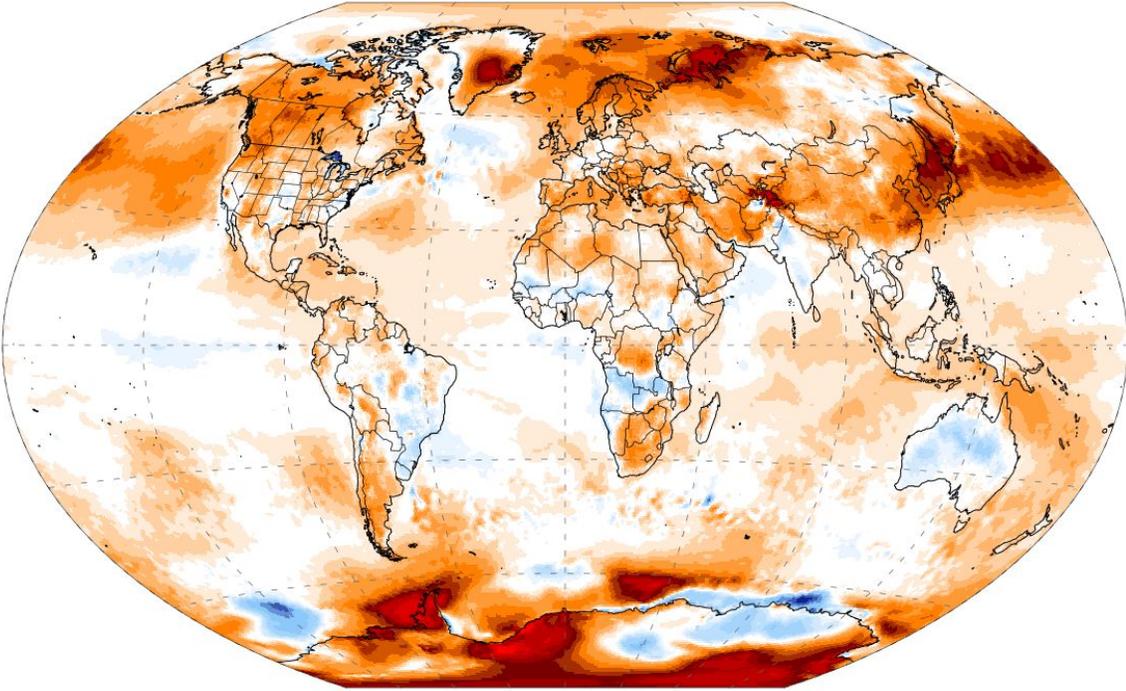
ECMWF ERA5 (0.5x0.5 deg)



ClimateReanalyzer.org | Climate Change Institute | University of Maine

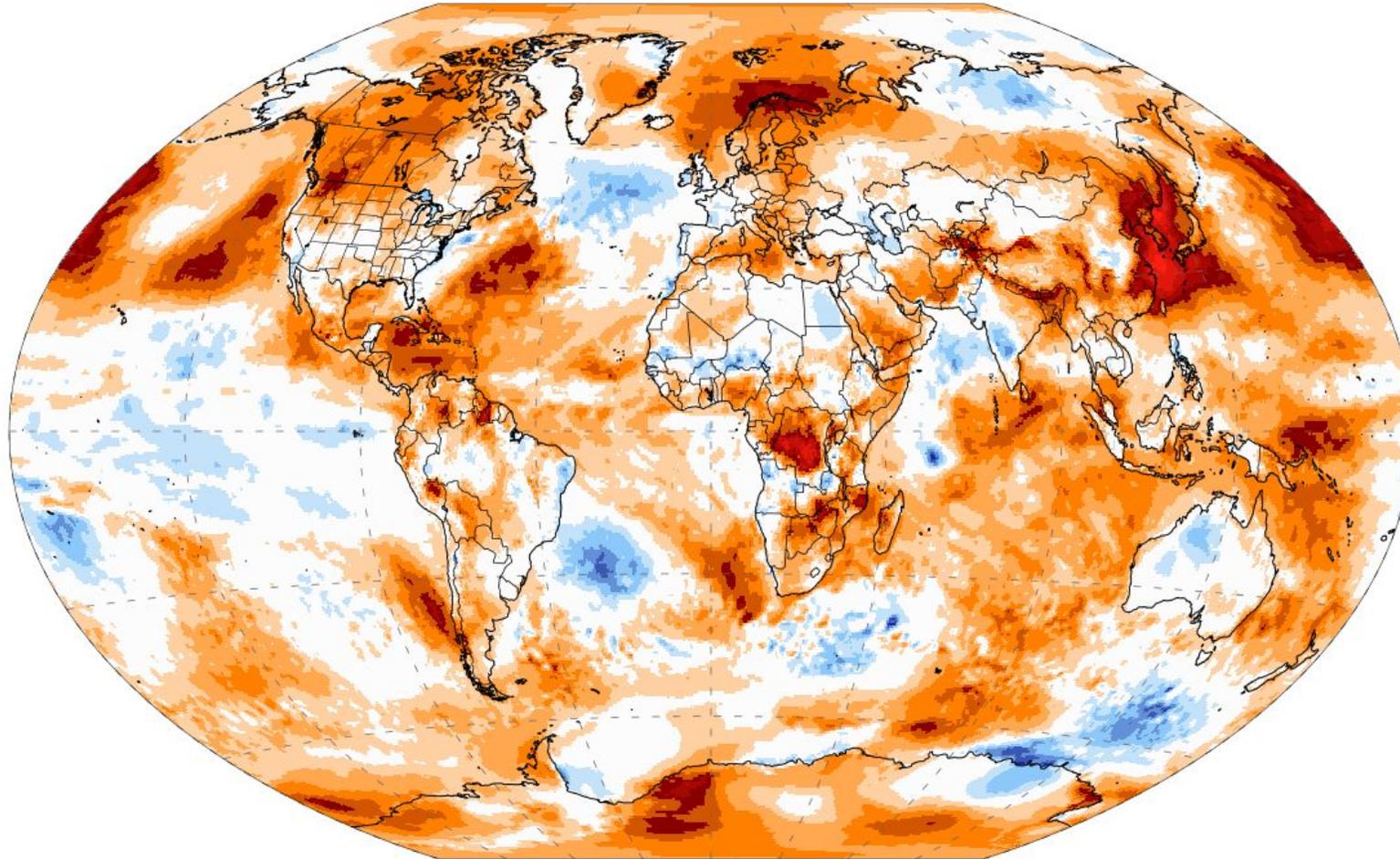
2m Temperature Anomaly (°C)  
JAS 2025 - 1991-2020

ECMWF ERA5 (0.5x0.5 deg)

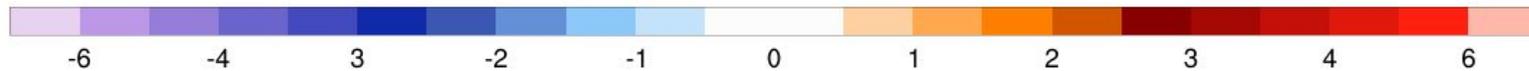


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Source: [https://climatoreanalyzer.org/research\\_tools/monthly\\_maps/](https://climatoreanalyzer.org/research_tools/monthly_maps/)



- The standardized anomaly gives a measure of how large an anomaly is compared to the climatological (i.e. typical) variability. It is measured in number of  $\sigma$  (i.e. number of standard deviations)
- From the aforementioned anomalies only the one in Scandinavia and eastern Asia hold

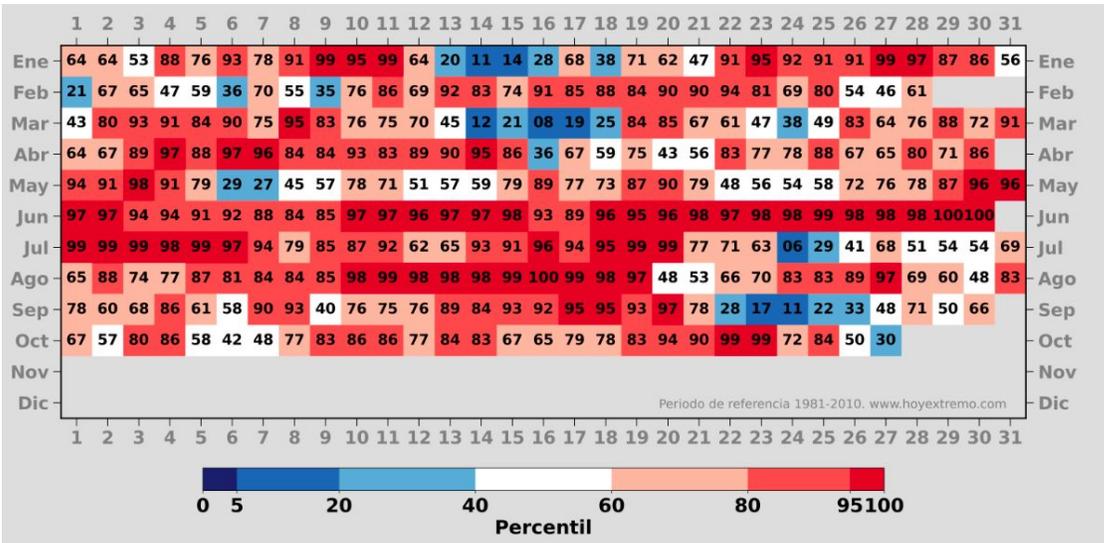
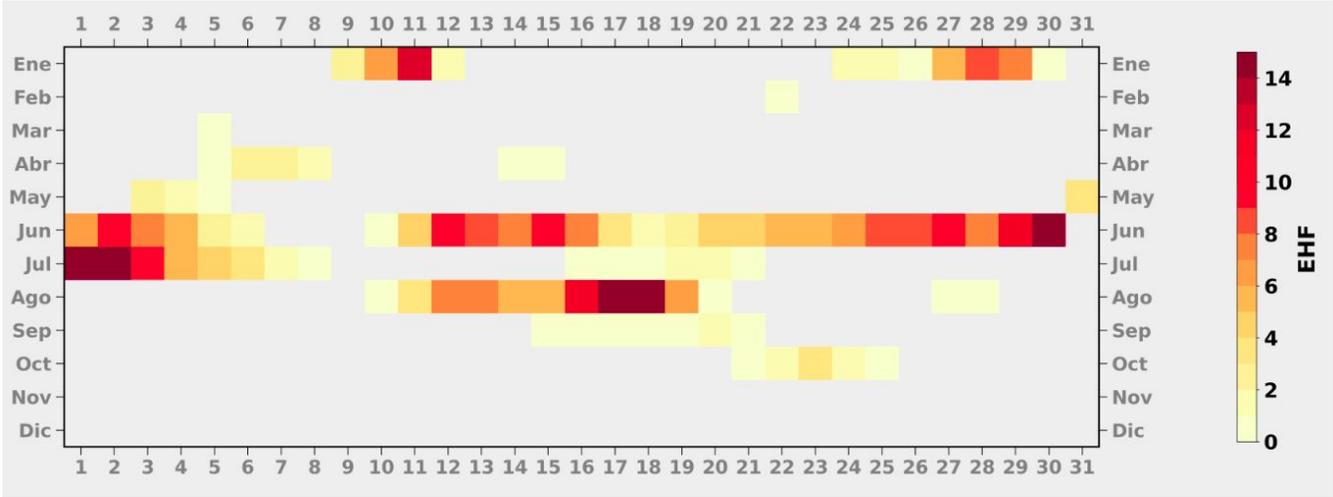
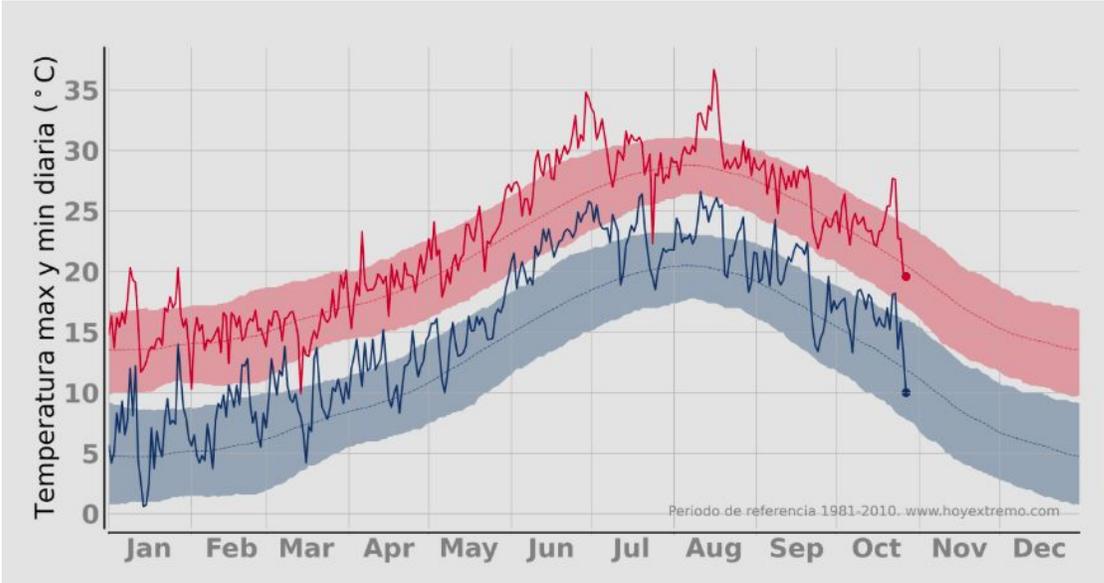


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# I. Recent state of the climate

## Barcelona



➤ **Excess Heat Factor (EHF):** Temperature-based index that allows to monitor the extension, duration and intensity of a heat wave.

$$EHI_{sig} = (T_i + T_{i+1} + T_{i+2})/3 - T_{95}$$

$$EHI_{accl} = (T_i + T_{i+1} + T_{i+2})/3 - (T_{i-1} + \dots + T_{i-30})/30$$

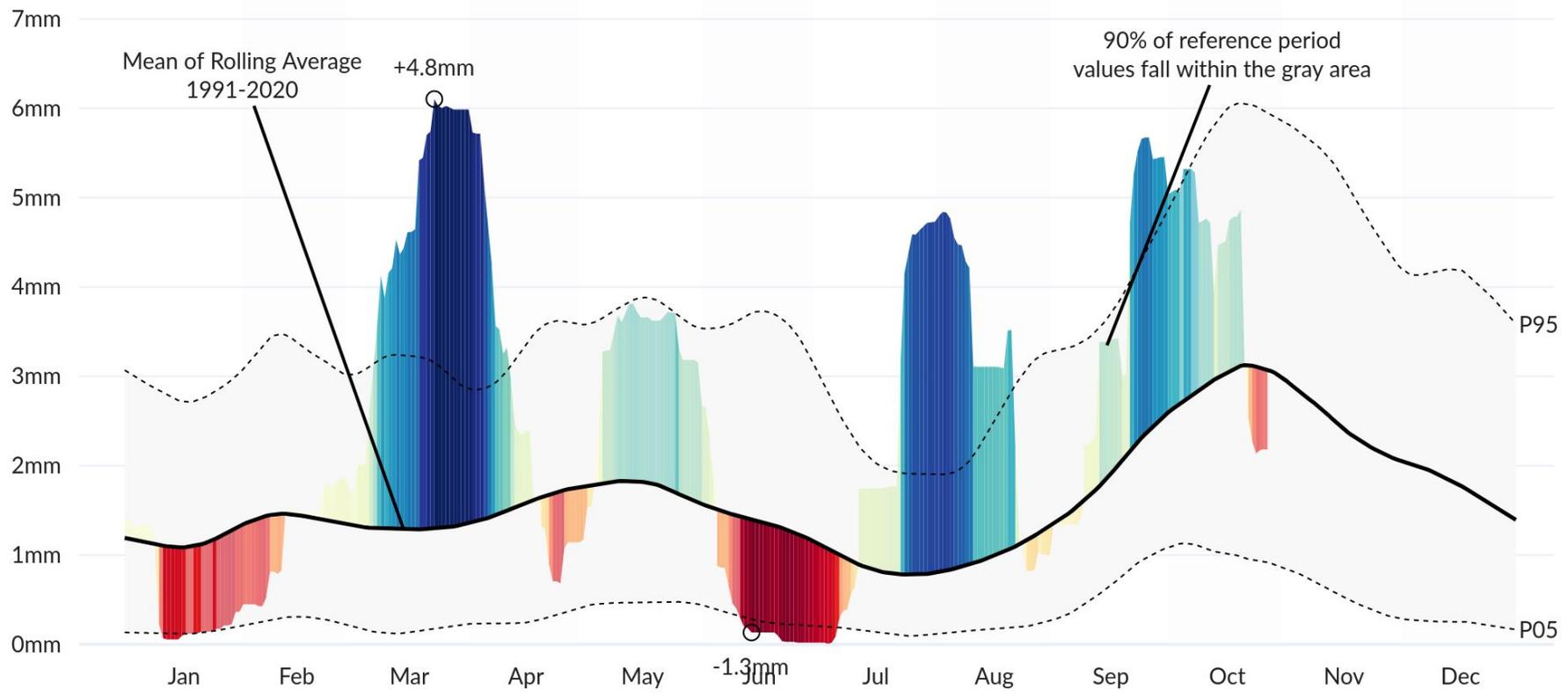
$$EHF = EHI_{sig} \times \max(1, EHI_{accl})$$

Source: [https://hoyextremo.com/city\\_pages/barcelona/#summary](https://hoyextremo.com/city_pages/barcelona/#summary)

# I. Recent state of the climate

## Barcelona

### Precipitation in Barcelona, Spain 2025 30-day Rolling Average compared to historical values (1991-2020)



lat: 41.38258, lon: 2.177073 (last date included: 27 Oct 2025)

Data: open-meteo.com, OSM, License: CC by-sa-nc 4.0 Graph: Jan Kühn, <https://yotka.org>

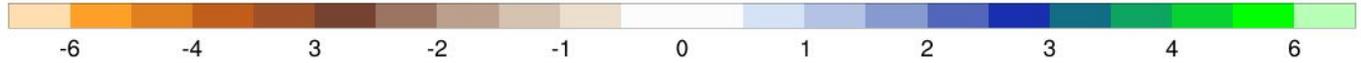
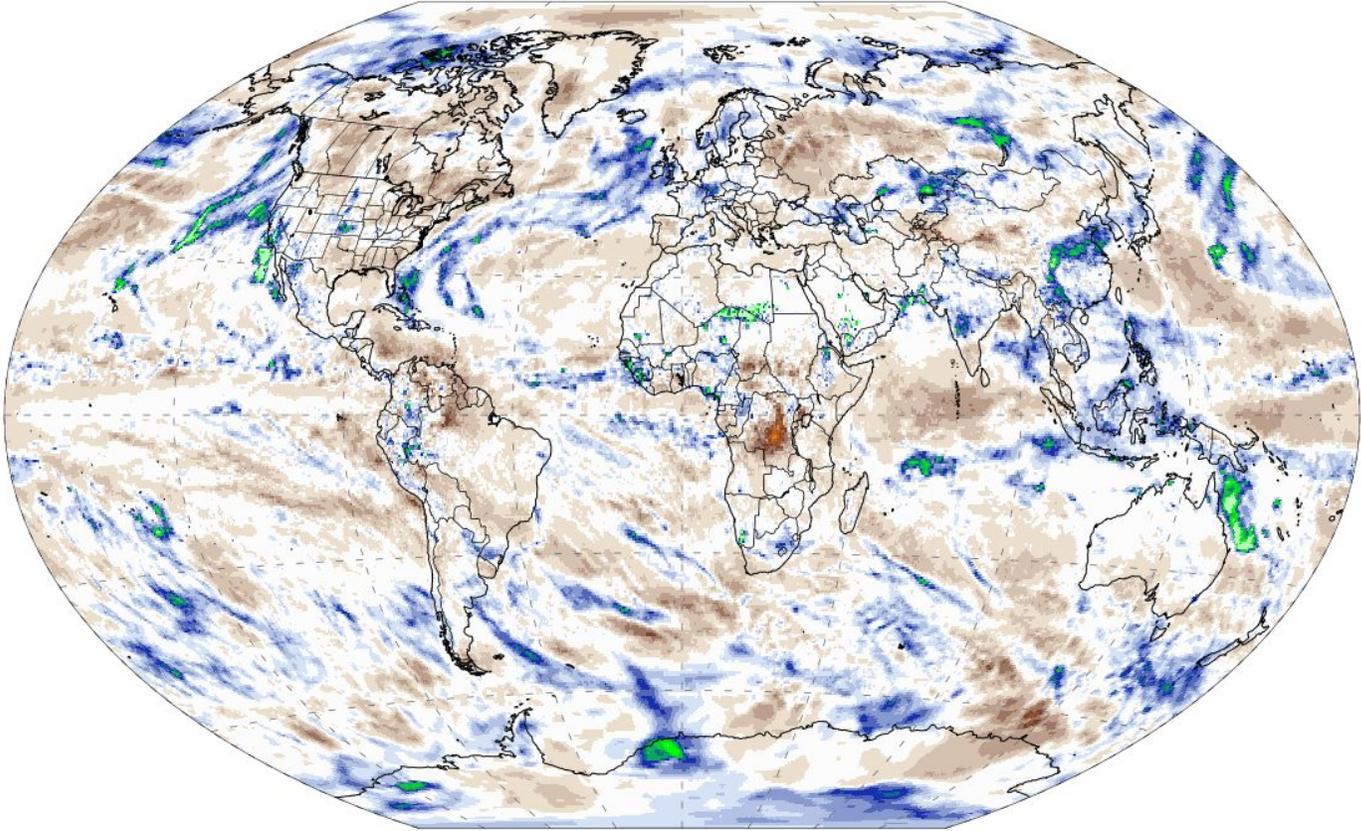
# I. Recent state of the climate

## Precipitation

- High precipitation over some points of the East Asia, Oceania, parts of the ITCZ (Indic ocean, Indonesia, Guyanas), and some blobs over the Sahara.
- Dryness over some parts of central Africa, South America, Central Eurasia.

Acc. Precipitation Standard Anomaly ( $\sigma$ )  
September 2025 - 1991-2020

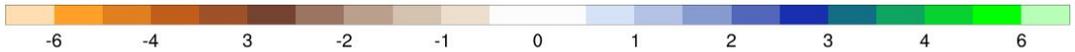
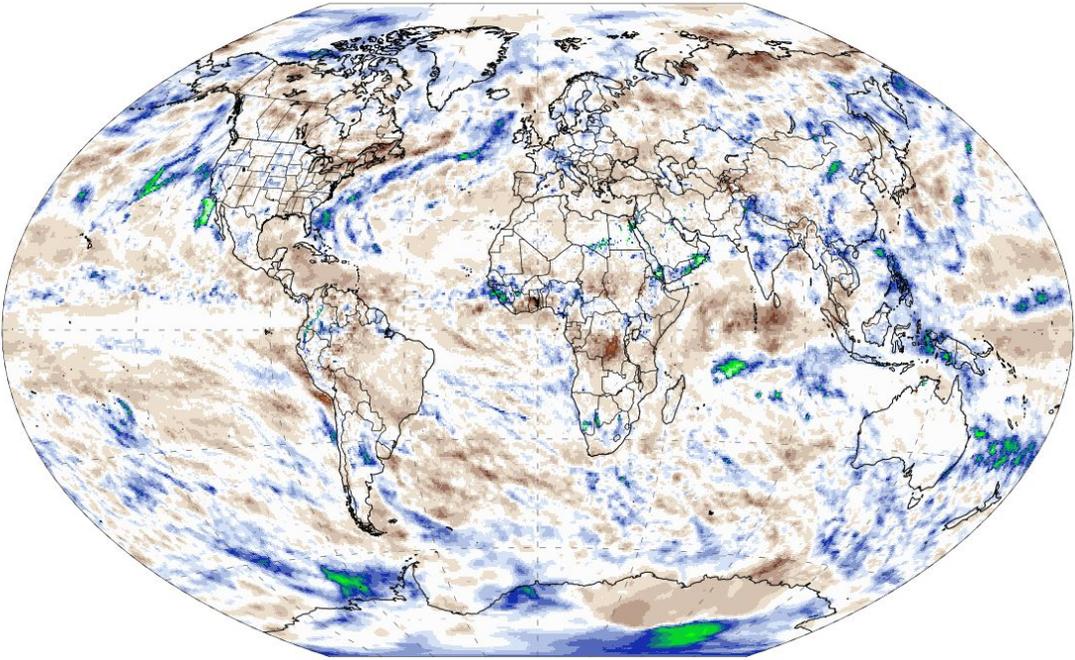
ECMWF ERA5 (0.5x0.5 deg)



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Acc. Precipitation Standard Anomaly ( $\sigma$ )  
JAS 2025 - 1991-2020

ECMWF ERA5 (0.5x0.5 deg)



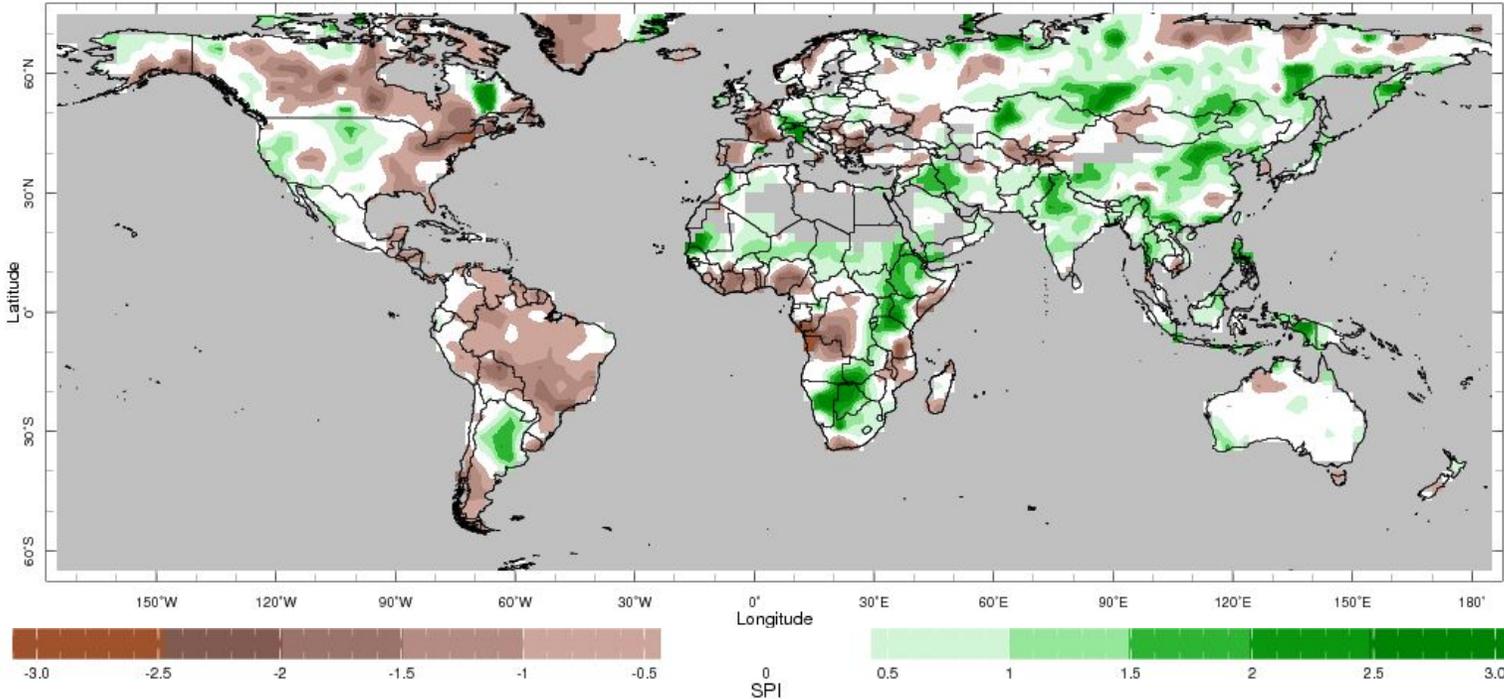
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# I. Recent state of the climate

## Standardized Precipitation index (SPI)

### SPI-3

Jul-Sep 2025



**Grey** = Regions with an annual average precipitation of less than 0.2 mm/day have been "masked" from the plot.

**Other information:** 2.5° lat/lon grid, 1979-present climatological base period

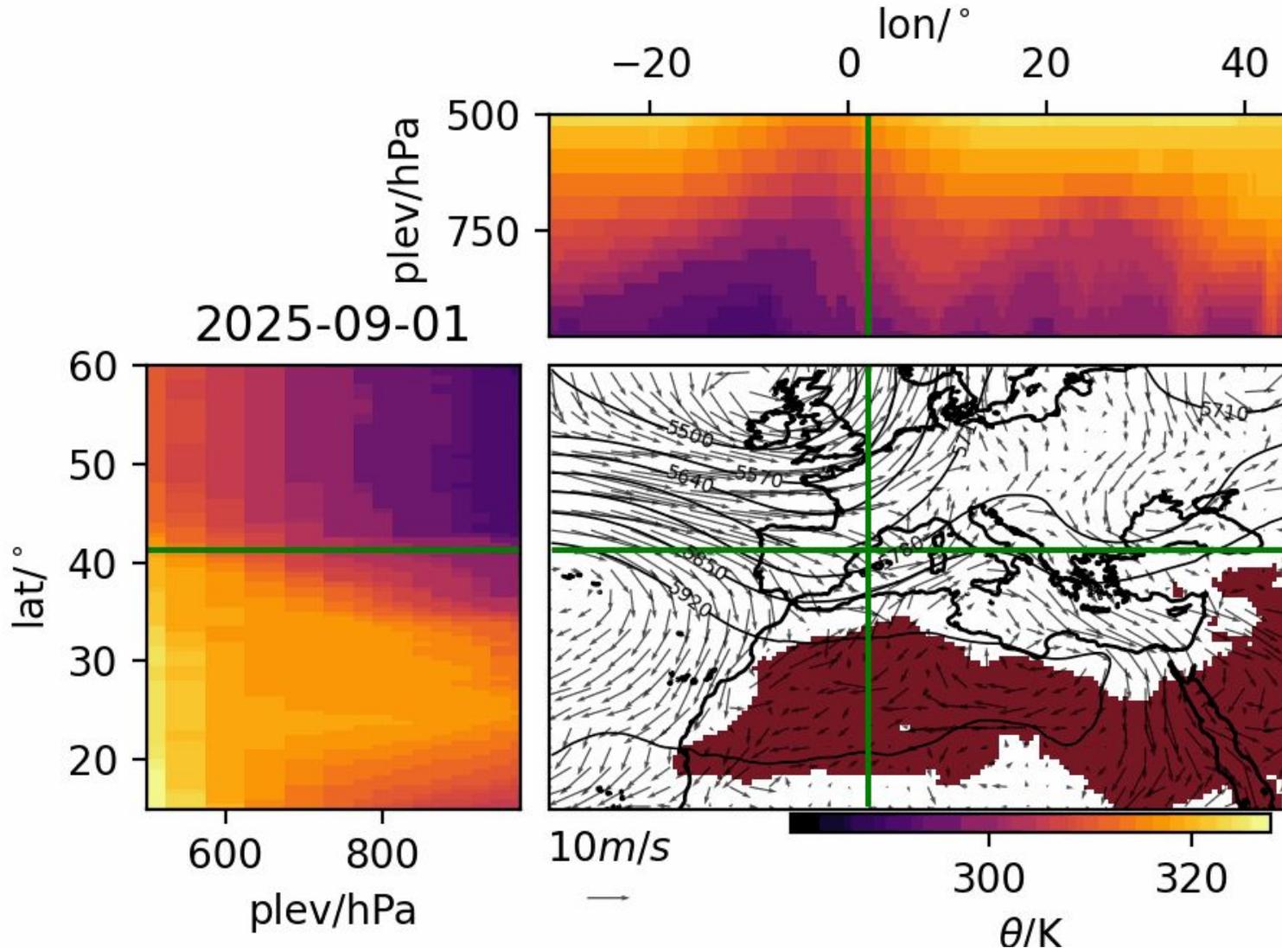
### ➤ SPI

The Standardized Precipitation Index (SPI; McKee 1993) is the number of standard deviations that observed cumulative precipitation (over x number of months) deviates from the climatological average.

- SPI-x:  
Cumulative distribution over x-months.
- Shorter SPI values (SPI-1, SPI-3):  
Respond quickly to rainfall changes, useful for early warning systems.
- Longer SPI values (SPI-6, SPI-12, SPI-24):  
Reflect cumulative precipitation trends, useful for long-term water resource management.

# I. Recent state of the climate

## Saharan air masses

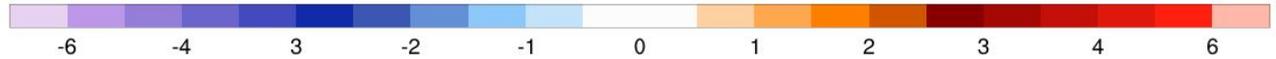
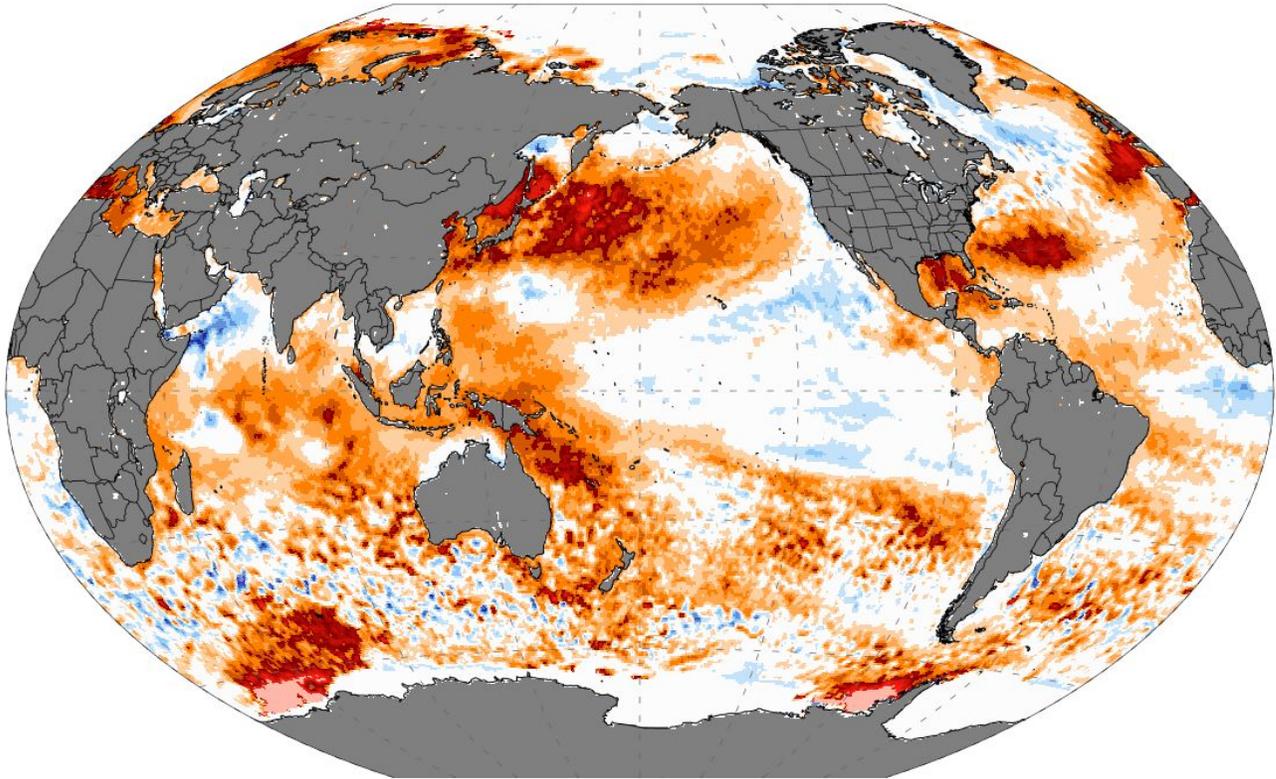


# I. Recent state of the climate

## Sea surface temperature (SST)

Sea Surface Temperature Standard Anomaly ( $\sigma$ )  
JJA 2025 - 1991-2020

ECMWF ERA5 (0.5x0.5 deg)

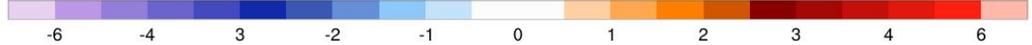
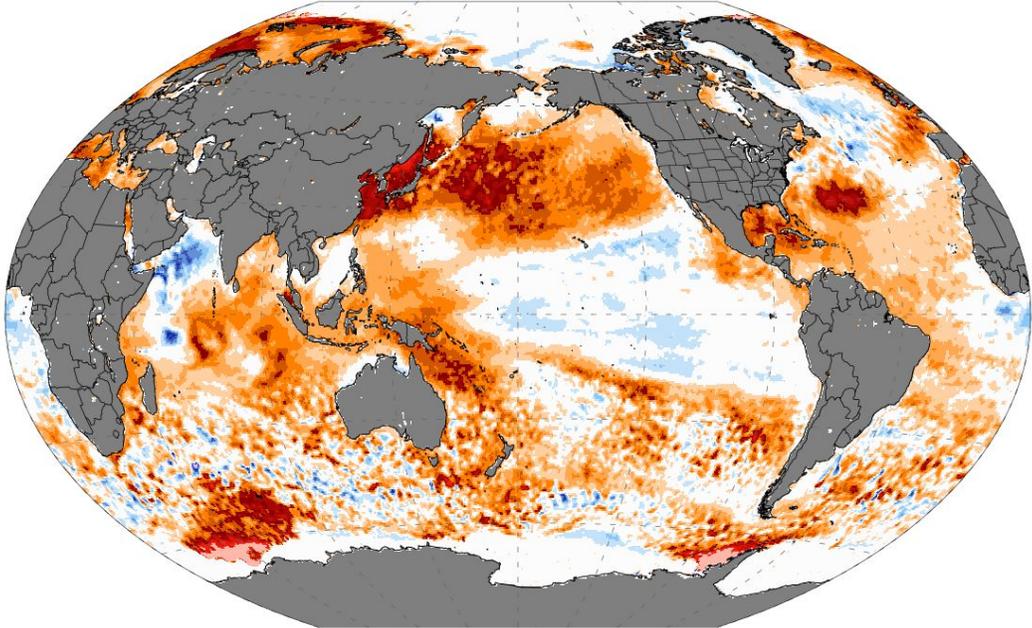


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- Very warm North Pacific (PDV-) and warm Indian Ocean.
- End of hurricane season in the Tropical Atlantic.

Sea Surface Temperature Standard Anomaly ( $\sigma$ )  
JAS 2025 - 1991-2020

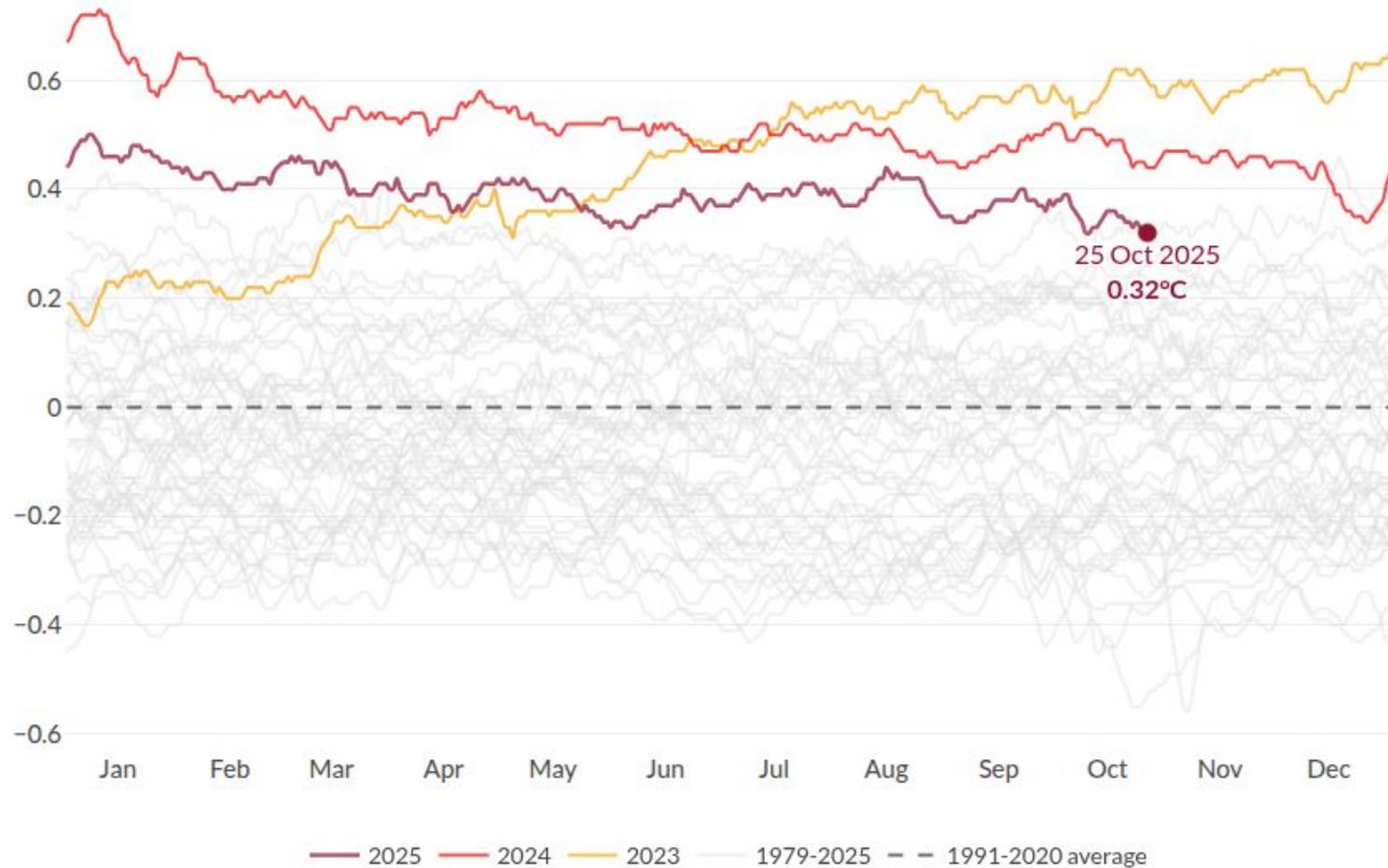
ECMWF ERA5 (0.5x0.5 deg)



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## Sea surface temperature anomaly (60°S-60°N)

Daily average • Baseline: 1991-2020 • Data: ERA5

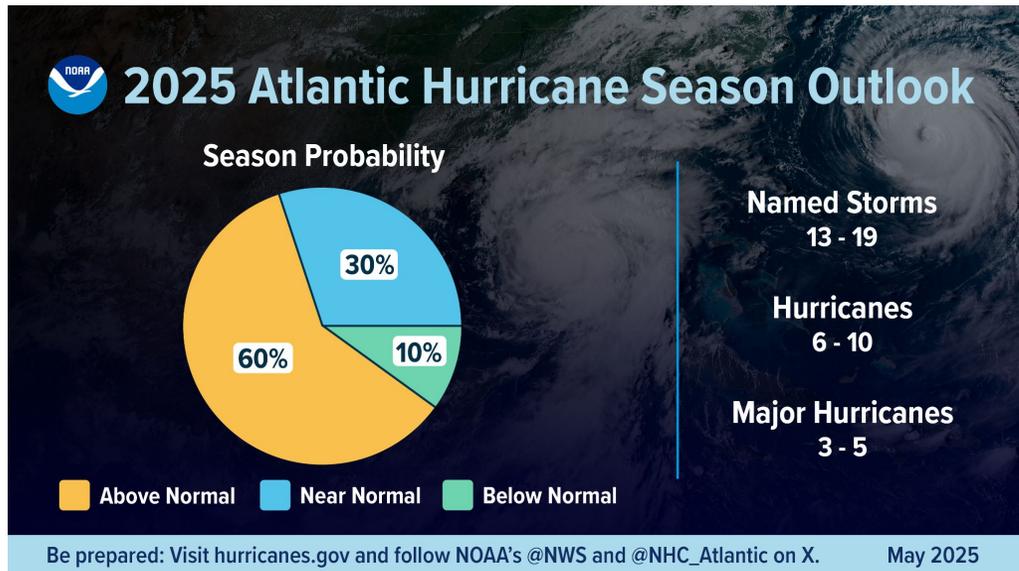


Credit: C3S/ECMWF

- Since mid-2023, SST anomalies have increased significantly compared to previous years, remaining above +0.4 °C throughout all seasons.
- SST appears now to be going back into its “normal” range.
- This 3-year enhancement could be partially explained by the combination of a strong El Niño in 2023 and the Hunga-Tonga volcanic eruption, which injected vast amounts of water vapour into the stratosphere.



# I. Recent state of the climate

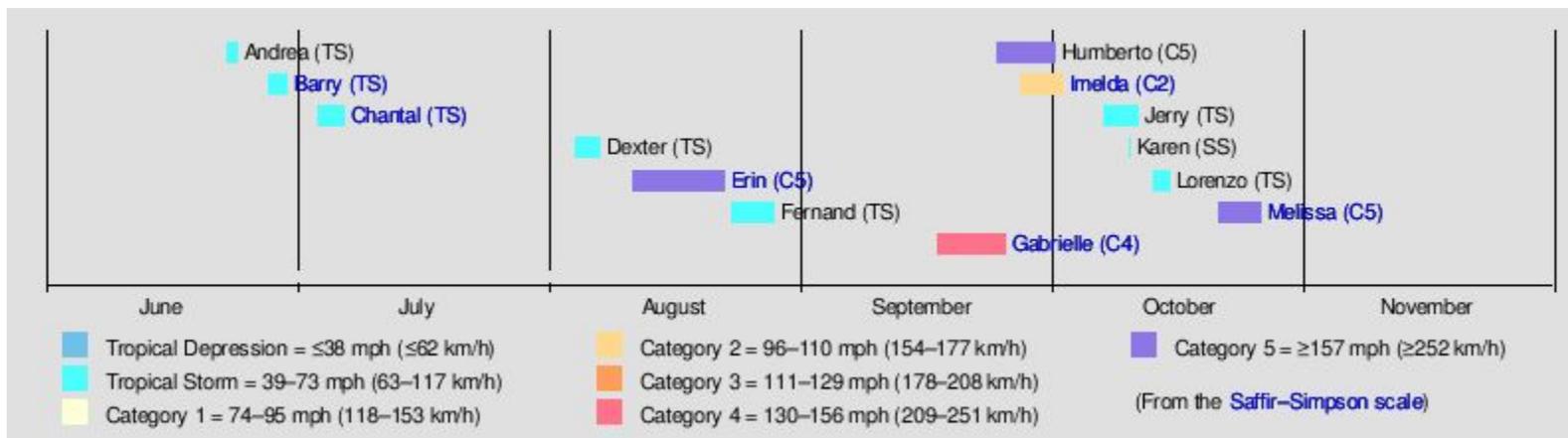


## The forecast

The hurricane season was expected to be “above normal”  
Why?

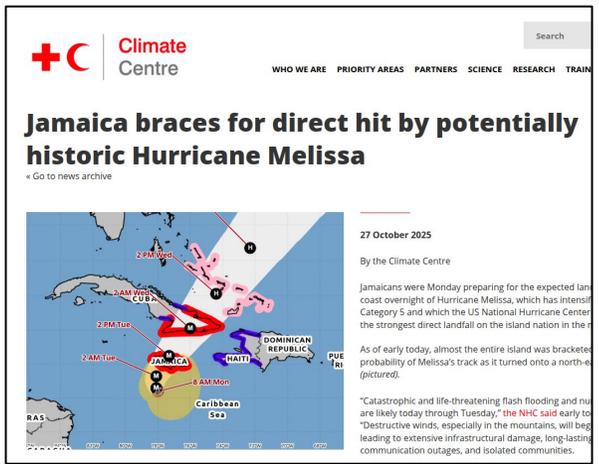
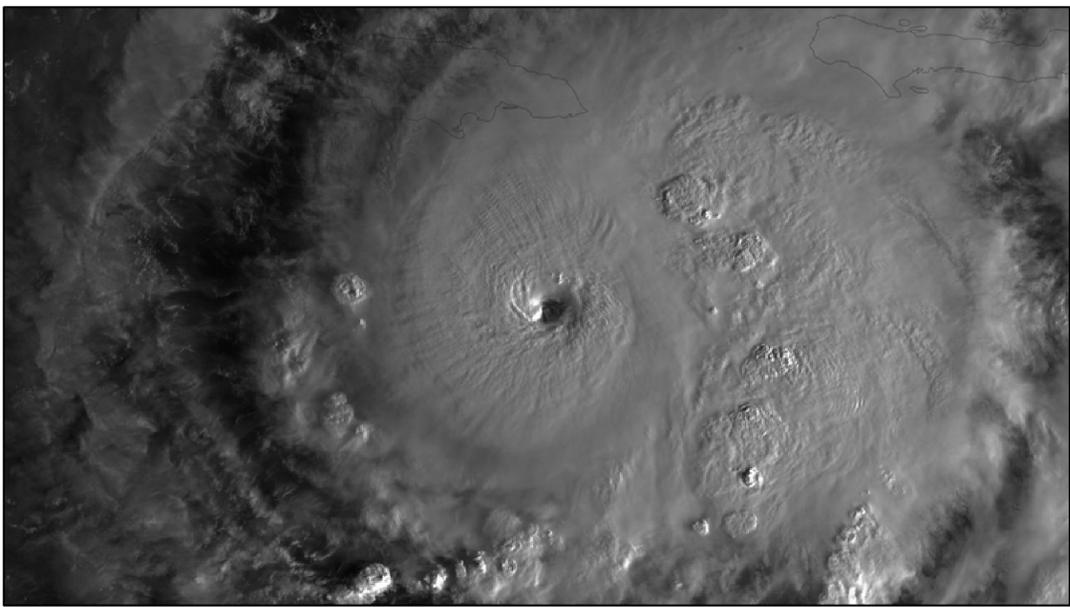
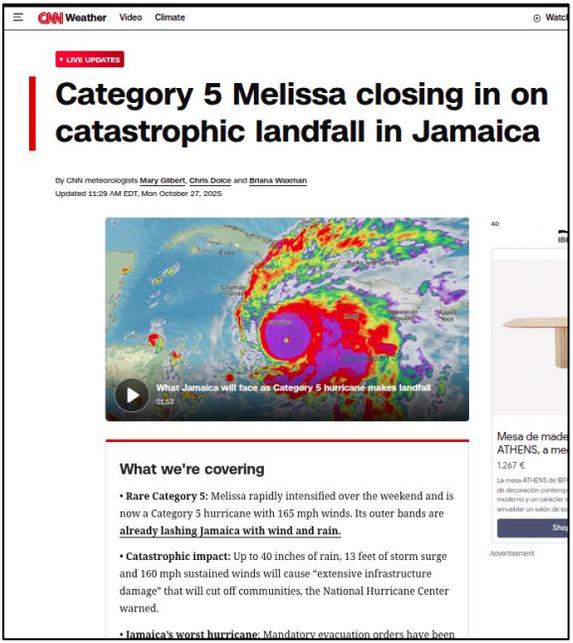
- ENSO-neutral conditions (Walker circulation is not weaker, strong easterlies across the Atlantic)
- Potential high activity of the West African Monsoon (Atmospheric instability and African jet stream -> development of tropical waves)

## The season so far



# I. Recent state of the climate

# Hurricane Melissa





# Key Messages for Hurricane Melissa

## Advisory 27: 11:00 PM EDT Mon Oct 27, 2025

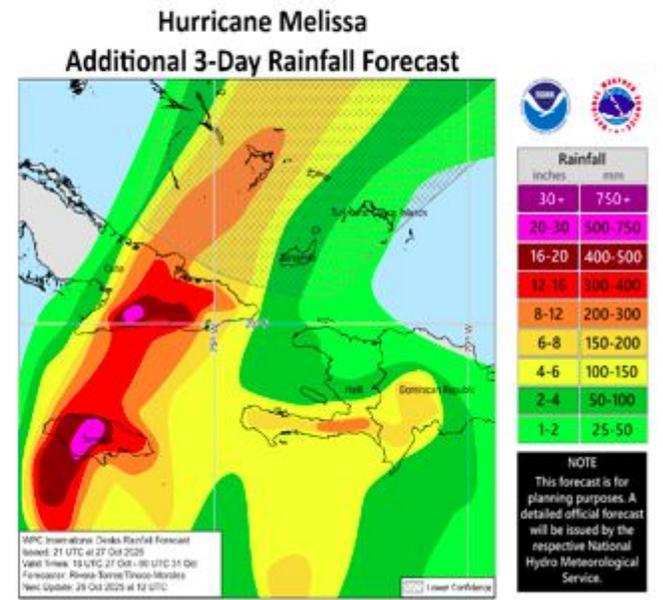
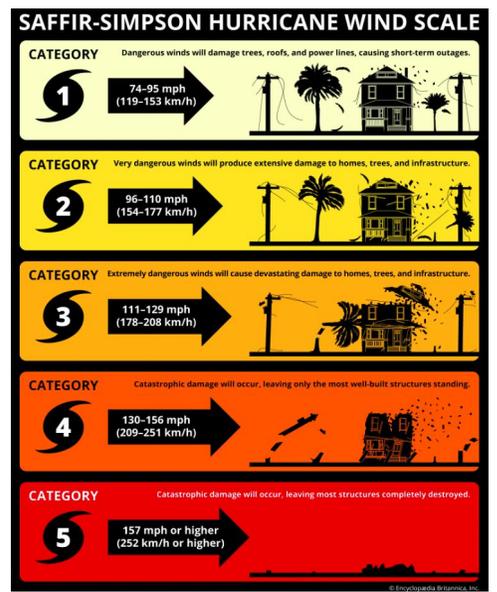
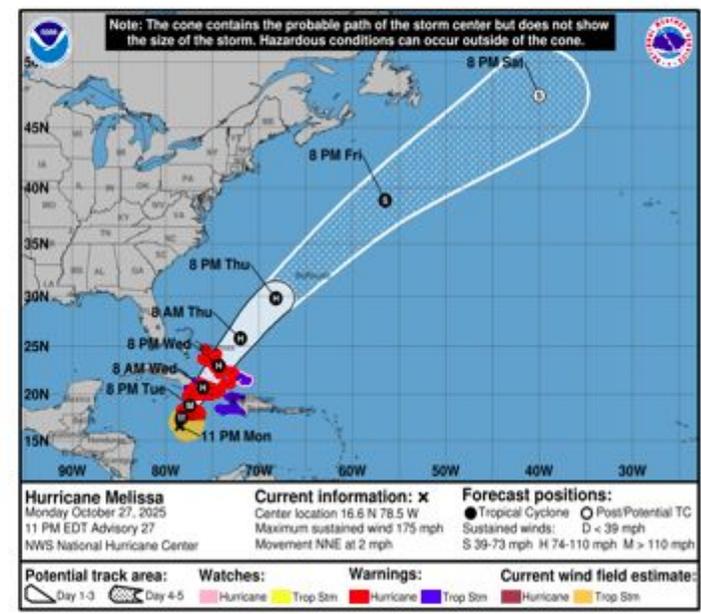
### I. Recent state of the climate

1. Jamaica: Remain in your safe shelter. Catastrophic flash flooding and numerous landslides are expected through Tuesday. The eyewall's destructive winds may cause total structural failure, particularly in higher elevations, leading to widespread infrastructural damage, prolonged power and communication outages, and isolated communities. Along the southern coast, life-threatening storm surge and damaging waves are anticipated through Tuesday. Failure to take immediate action may result in serious injury or significant loss of life.

2. Haiti and the Dominican Republic: Catastrophic flash flooding and landslides are expected across southwestern Haiti and southern portions of the Dominican Republic through midweek. In Haiti, extensive infrastructural damage and isolation of communities is likely. Tropical storm conditions are expected late Tuesday and Wednesday.

3. Eastern Cuba: Heavy rainfall with life-threatening flash flooding and landslides is expected to begin shortly. Life-threatening storm surge and damaging winds are expected late Tuesday and Tuesday night. Preparations should be rushed to completion.

4. Southeast and Central Bahamas and the Turks and Caicos: Hurricane conditions, life-threatening storm surge, and heavy rainfall are expected across portions of the southeast and central Bahamas on Wednesday. Residents should follow advice given by local officials and be sure to have preparations complete by Tuesday night. Tropical storm conditions, heavy rains, and a significant storm surge is expected in the Turks and Caicos Islands on Wednesday.



# I. Recent state of the climate

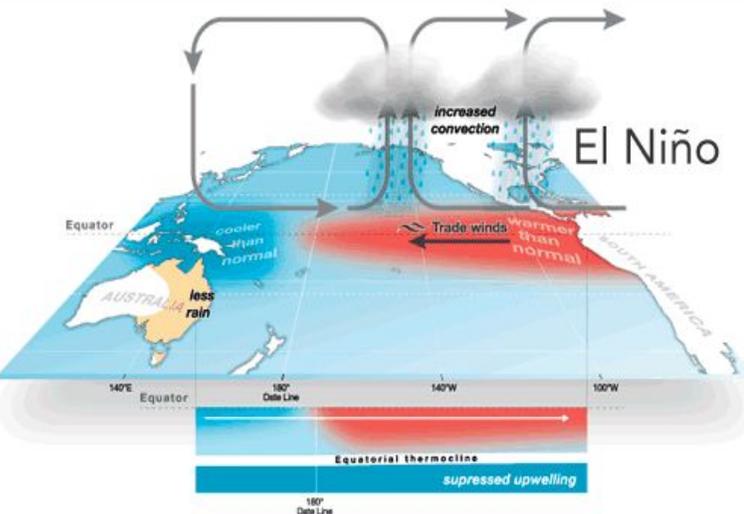
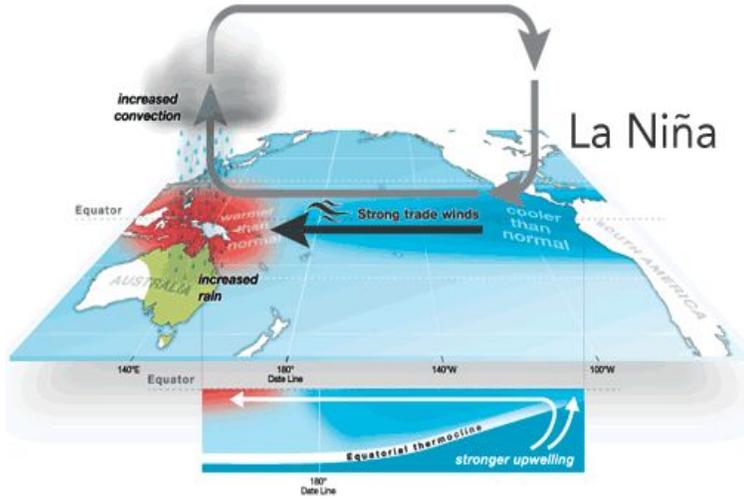
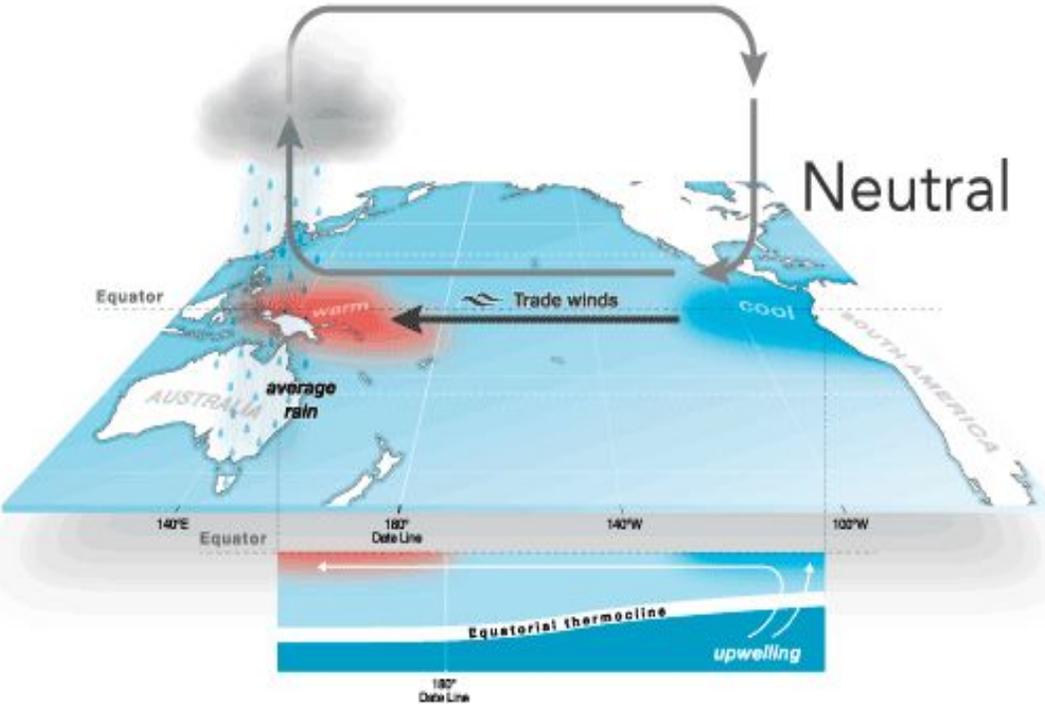
Could subseasonal forecasts capture the event?

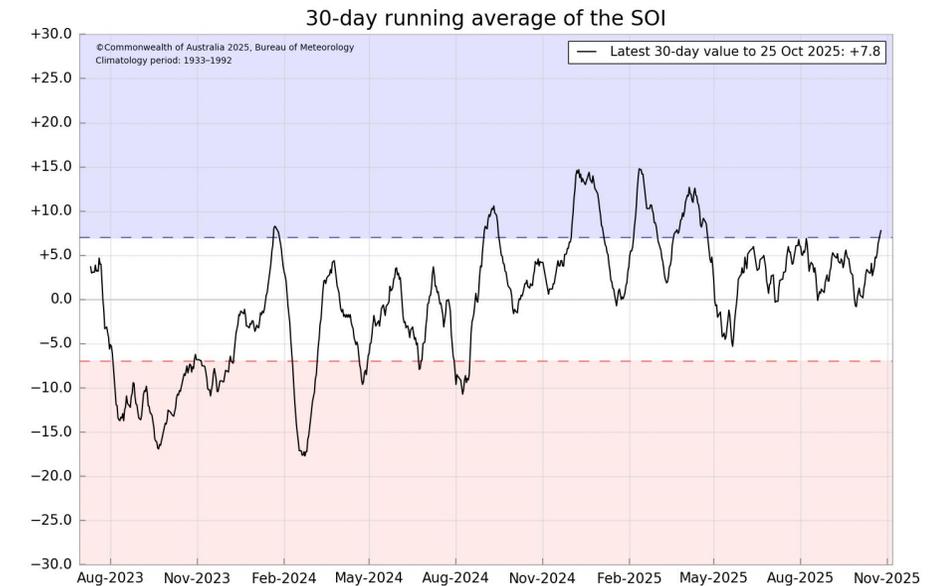
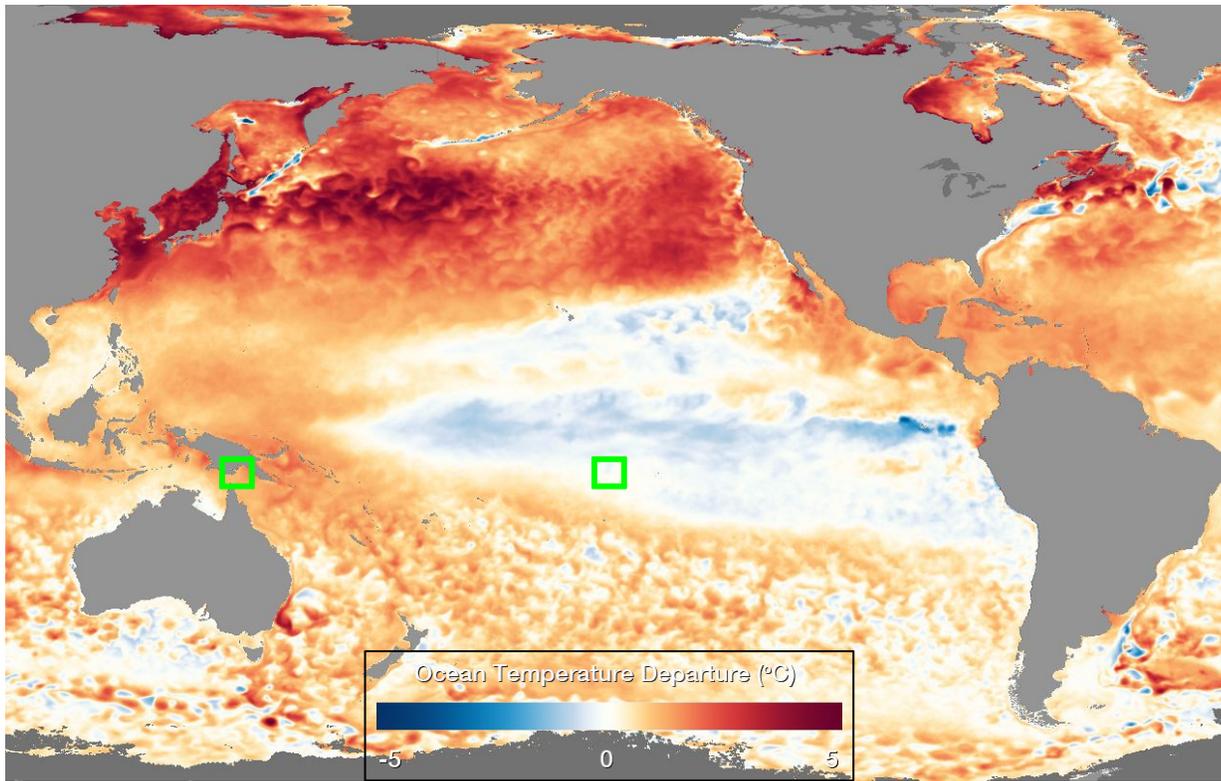
**Initialisation** - 23 October

# I. Recent state of the climate

# 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.





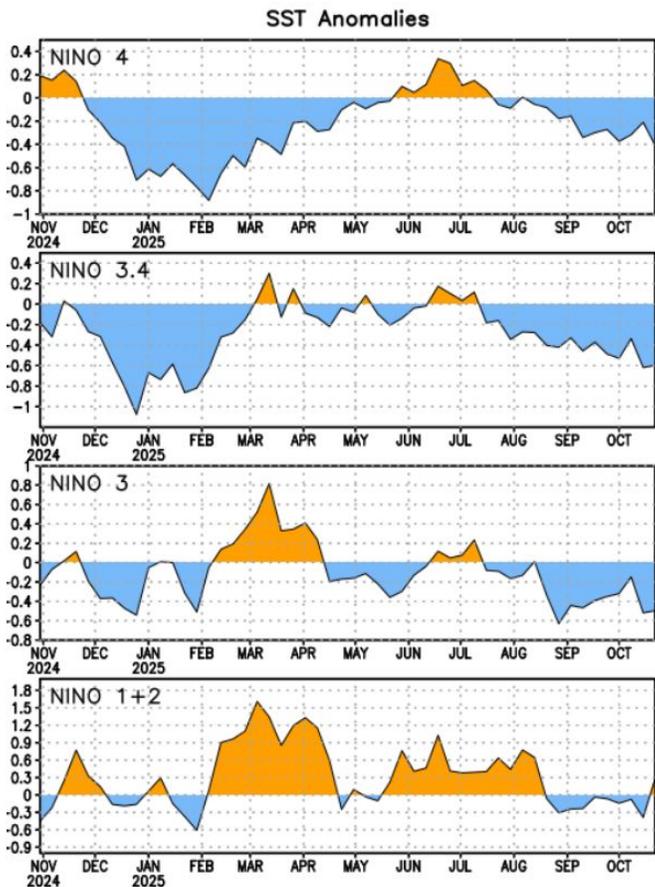
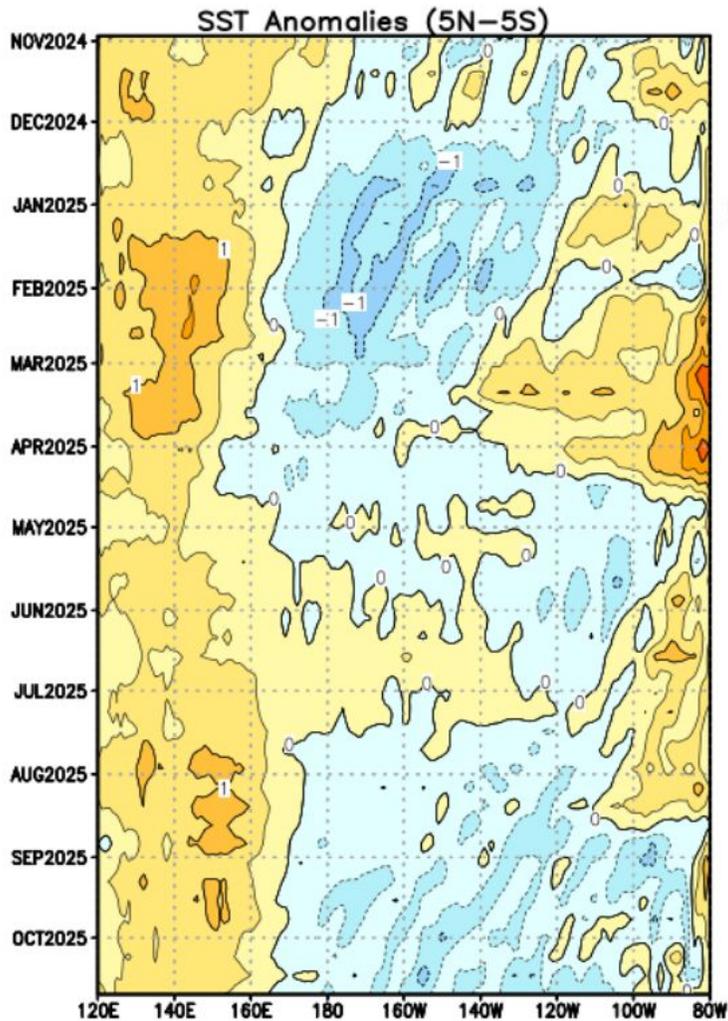
- ENSO status is traditionally diagnosed by looking at SST anomalies in the Niño 3.4 region, known as the **Oceanic Niño Index** (ONI), and the difference in mean sea level pressure between Darwin and Tahiti, known as the **Southern Oscillation Index** (SOI).
- ENSO alert system status: **La Niña Advisory**



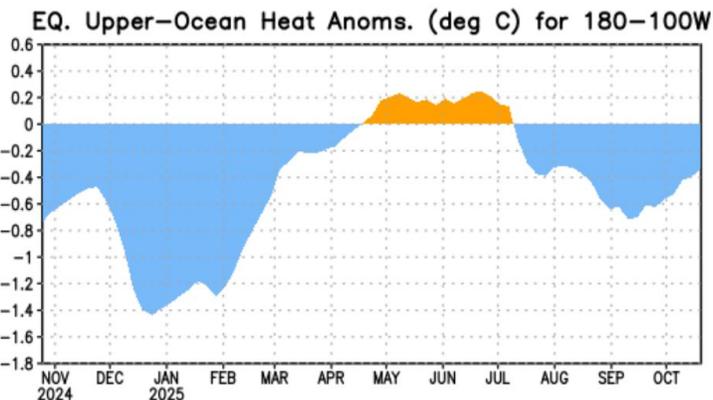
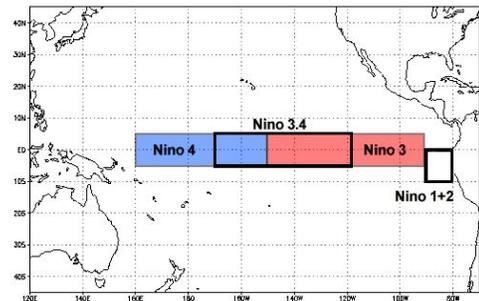
# I. Recent state of the climate

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

ENSO Alert System Status: **La Niña Advisory**  
 La Niña conditions are present.\*



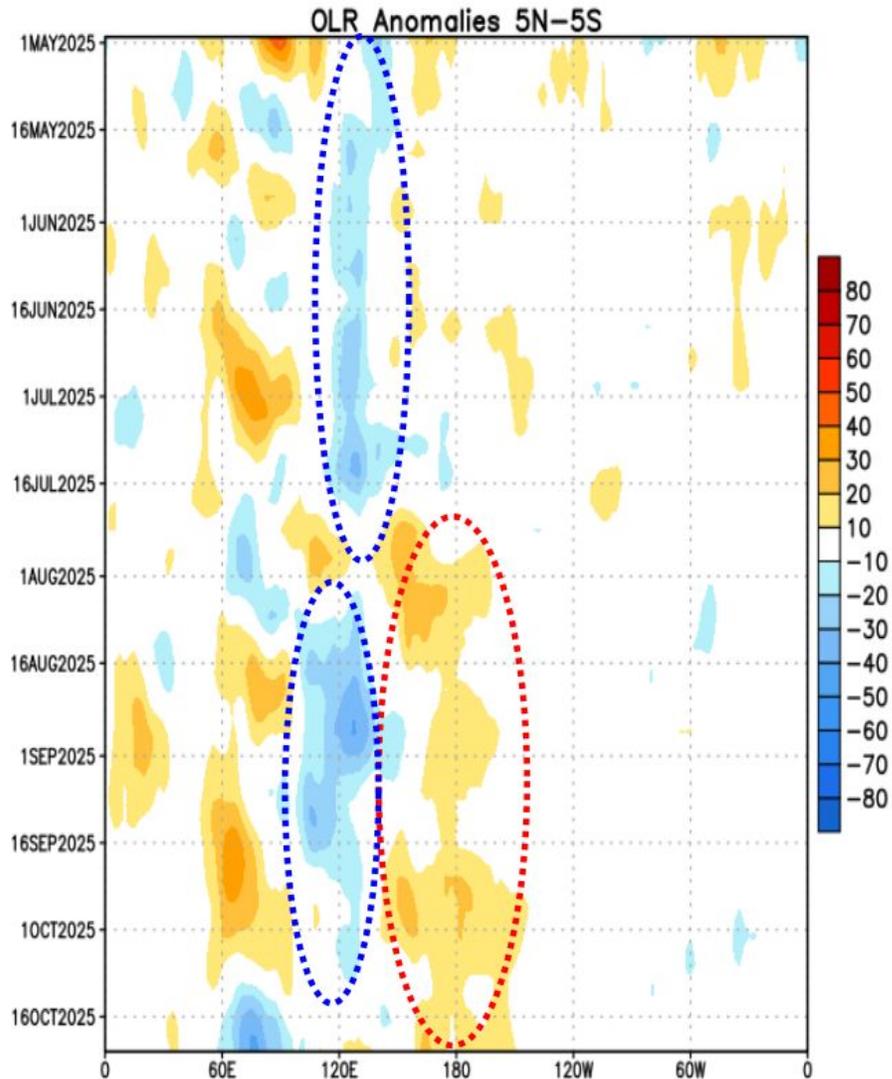
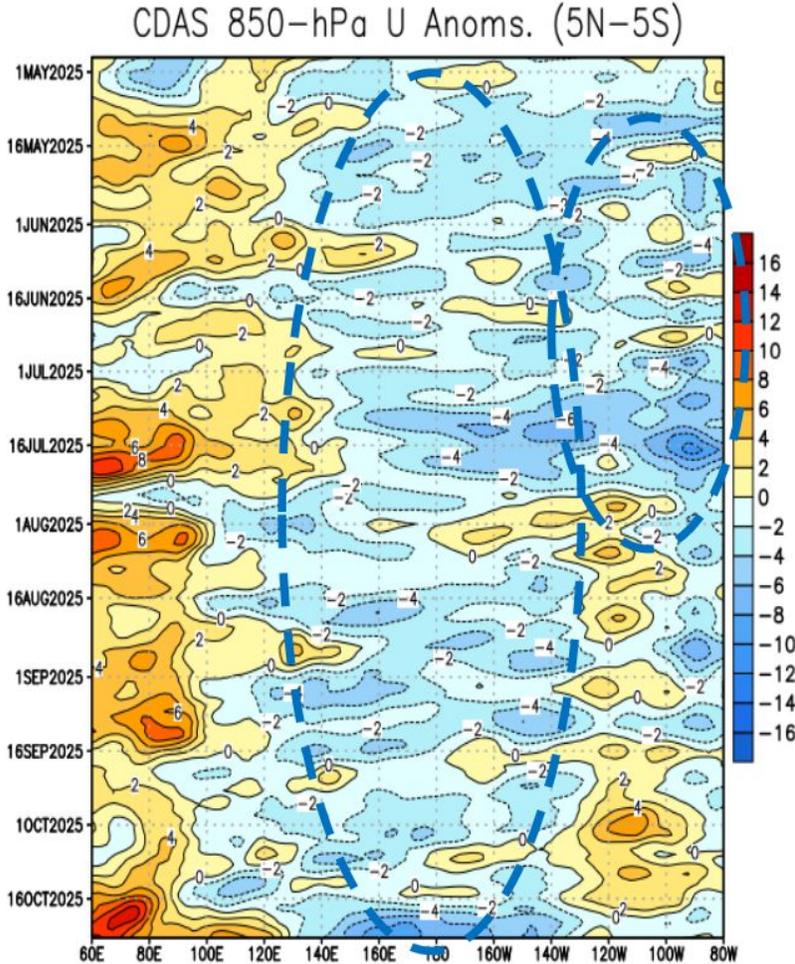
➤ Monitoring regions



➤ Ocean conditions evolving towards weak La Niña.

# I. Recent state of the climate

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

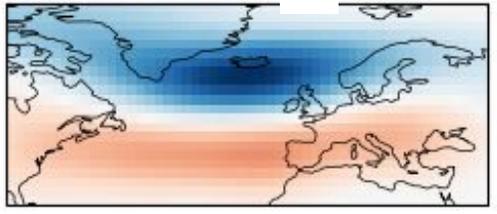


- Strong subsidence (positive OLR anomalies) over the Date Line and enhanced convection (negative OLR anomalies) over the Maritime Continent are consistent with a La Niña.
- Central Pacific dominated by easterly wind anomalies (blue color in left plot), also consistent with a La Niña.

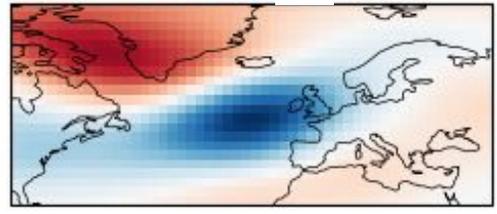
# I. Recent state of the climate

## Weather regimes

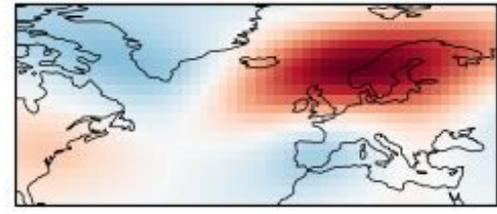
NAO +



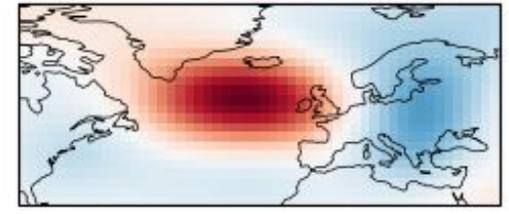
NAO -



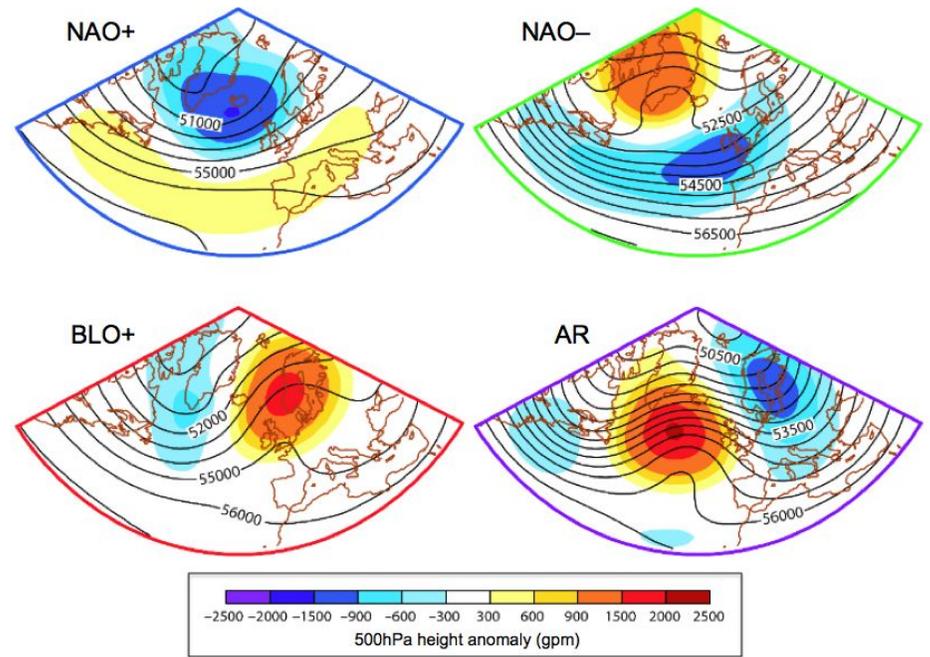
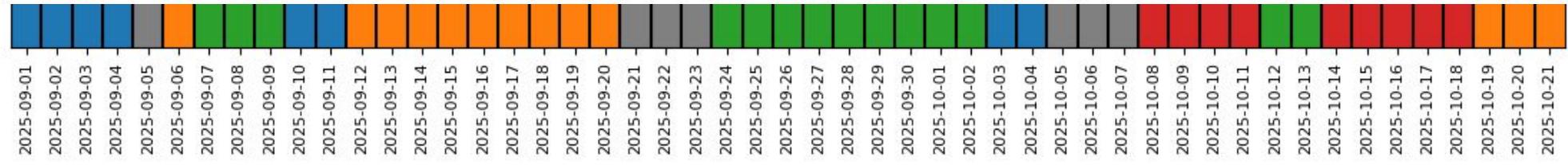
Block



ATR



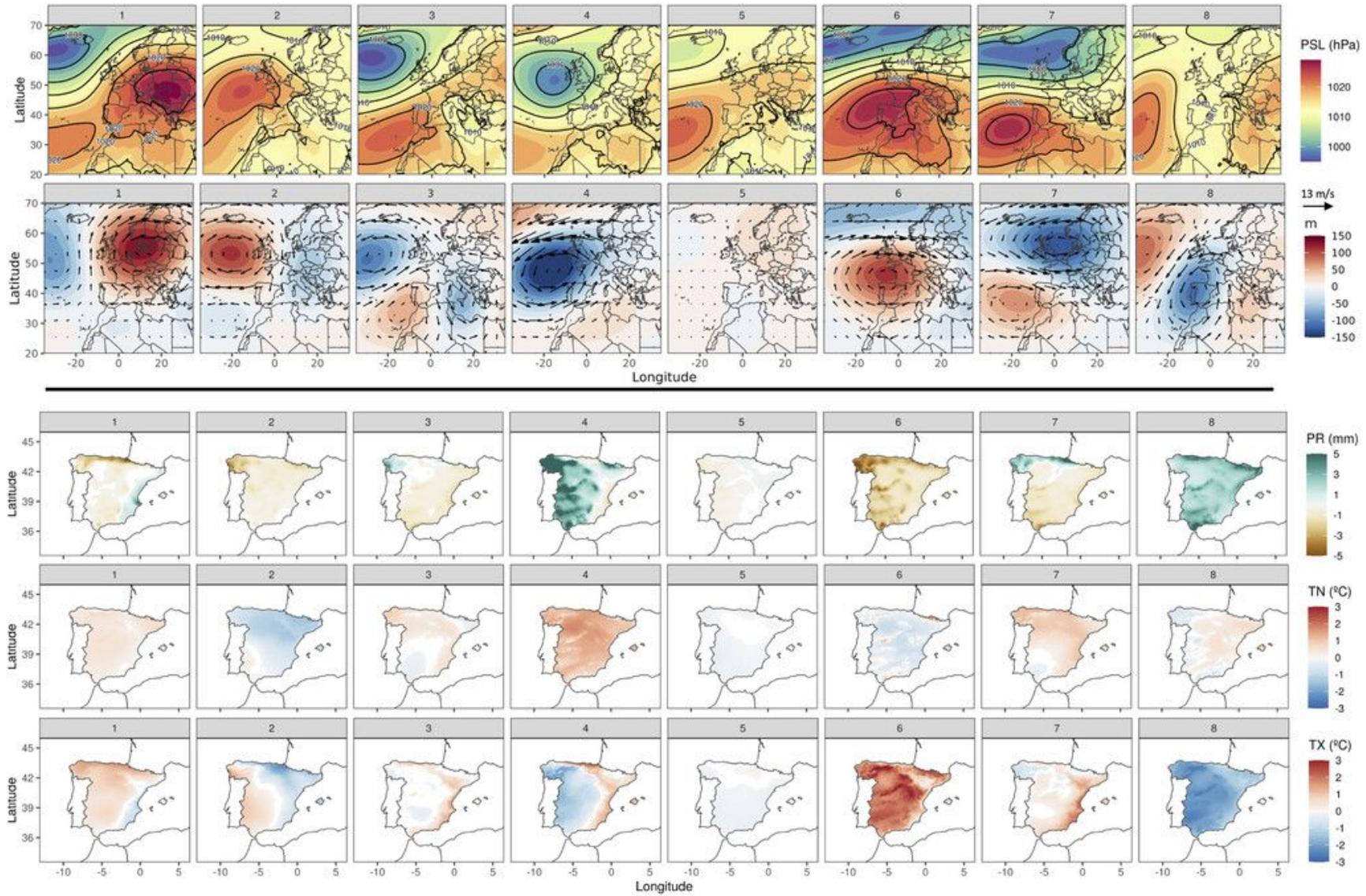
Timeline of Circulation Patterns



- **Blocking:** Onset through anticyclonic wave breakings over Europe in the upper troposphere (Michel et al., 2012). Two main precursors of Euro-Atlantic blocking events are a retrograding high-latitude planetary-scale wave and an enhanced baroclinic wavetrain across the North Atlantic (Michelangeli & Vautard, 1998)
- **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-:** (Generally weaker pressure differences) Spells of easterly winds bring cold dry and calm winters with fewer and weaker storms to northern Europe and eastern USA.
- **ATR:** NEurope: Drier and slightly milder due to being under the influence of ridging on the upstream side. SEurope: Can be wetter (particularly Iberia and western Med) due to enhanced storm tracks directed southward. Eastern Med may be less affected.

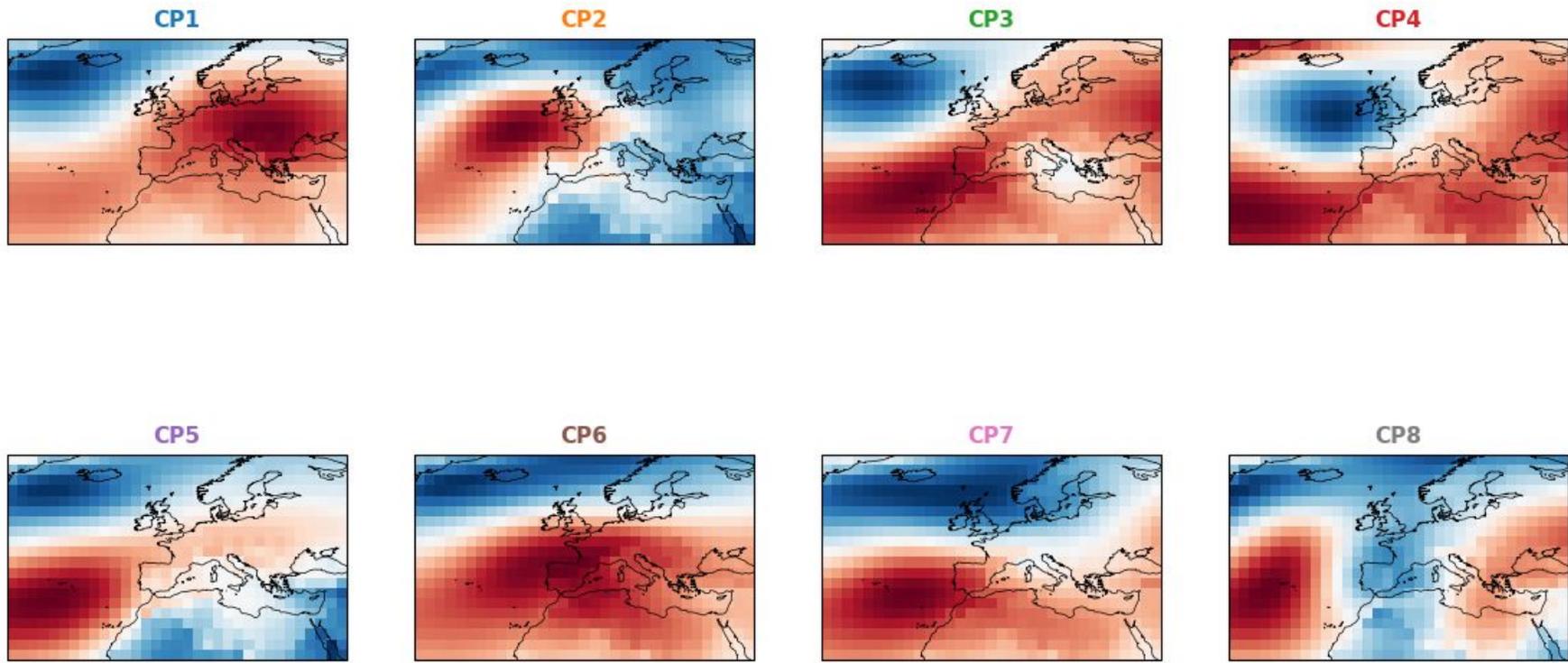
# I. Recent state of the climate

Mati's CPs

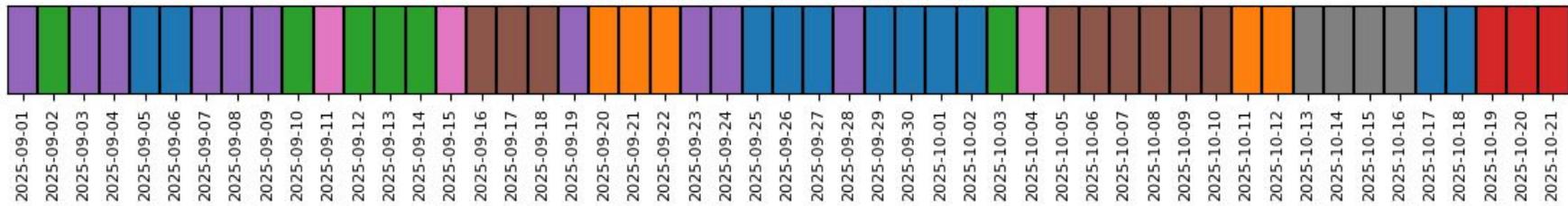


# I. Recent state of the climate

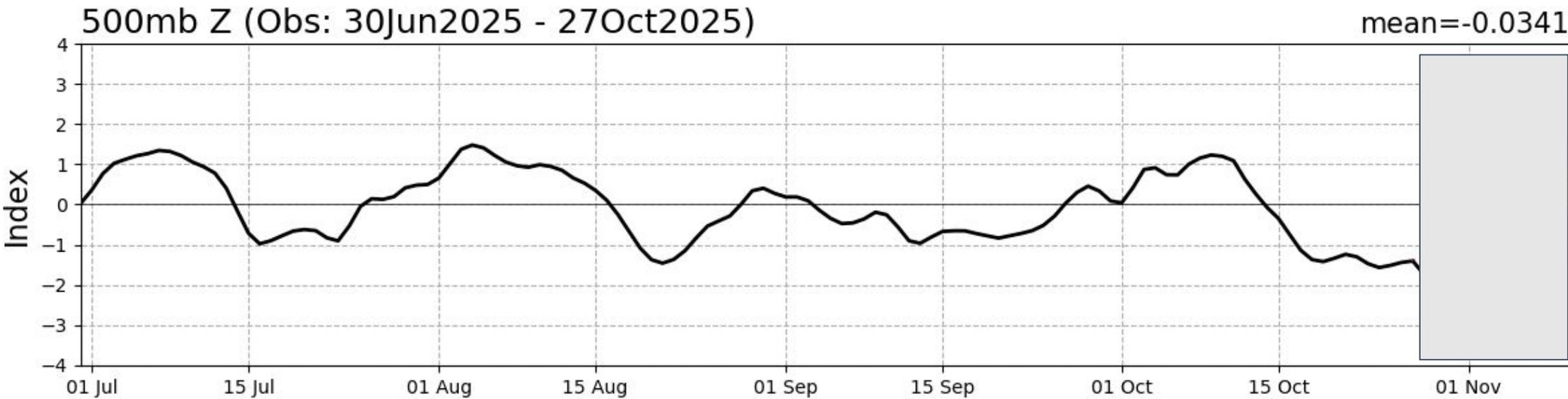
## Mati's CPs

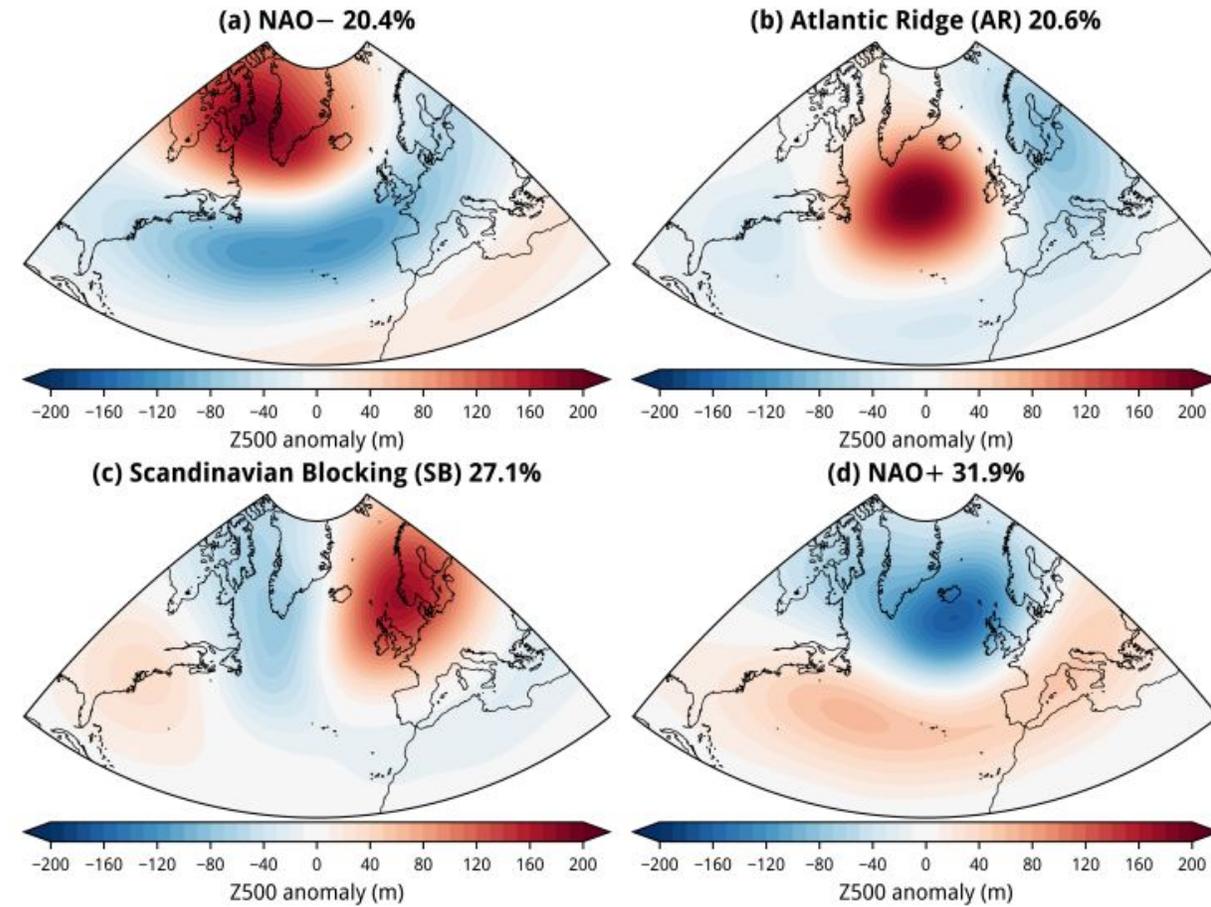
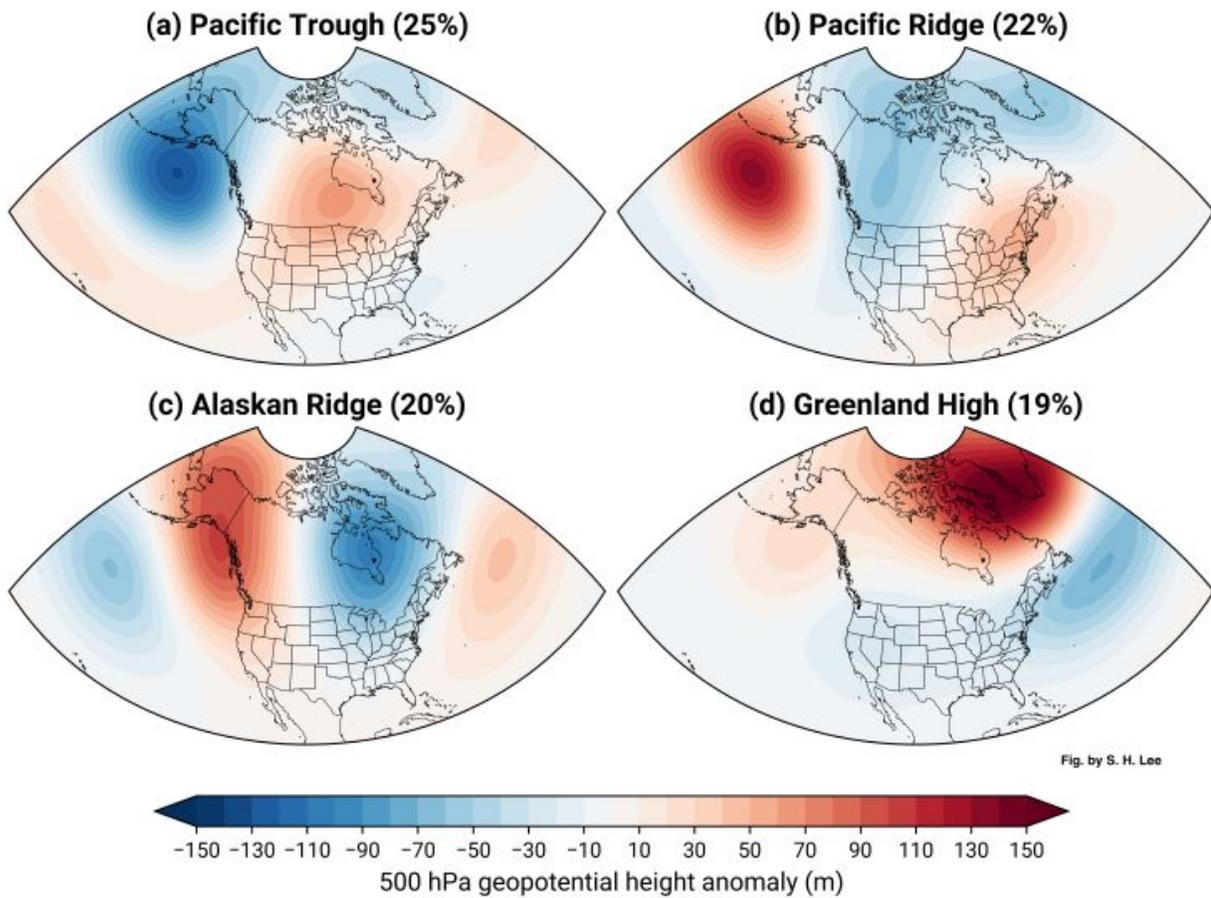


Timeline of Circulation Patterns



### NAO Index: Observed & GEFS Forecasts





Source: <https://simonleewx.com/north-atlantic-wintertime-weather-regimes/>

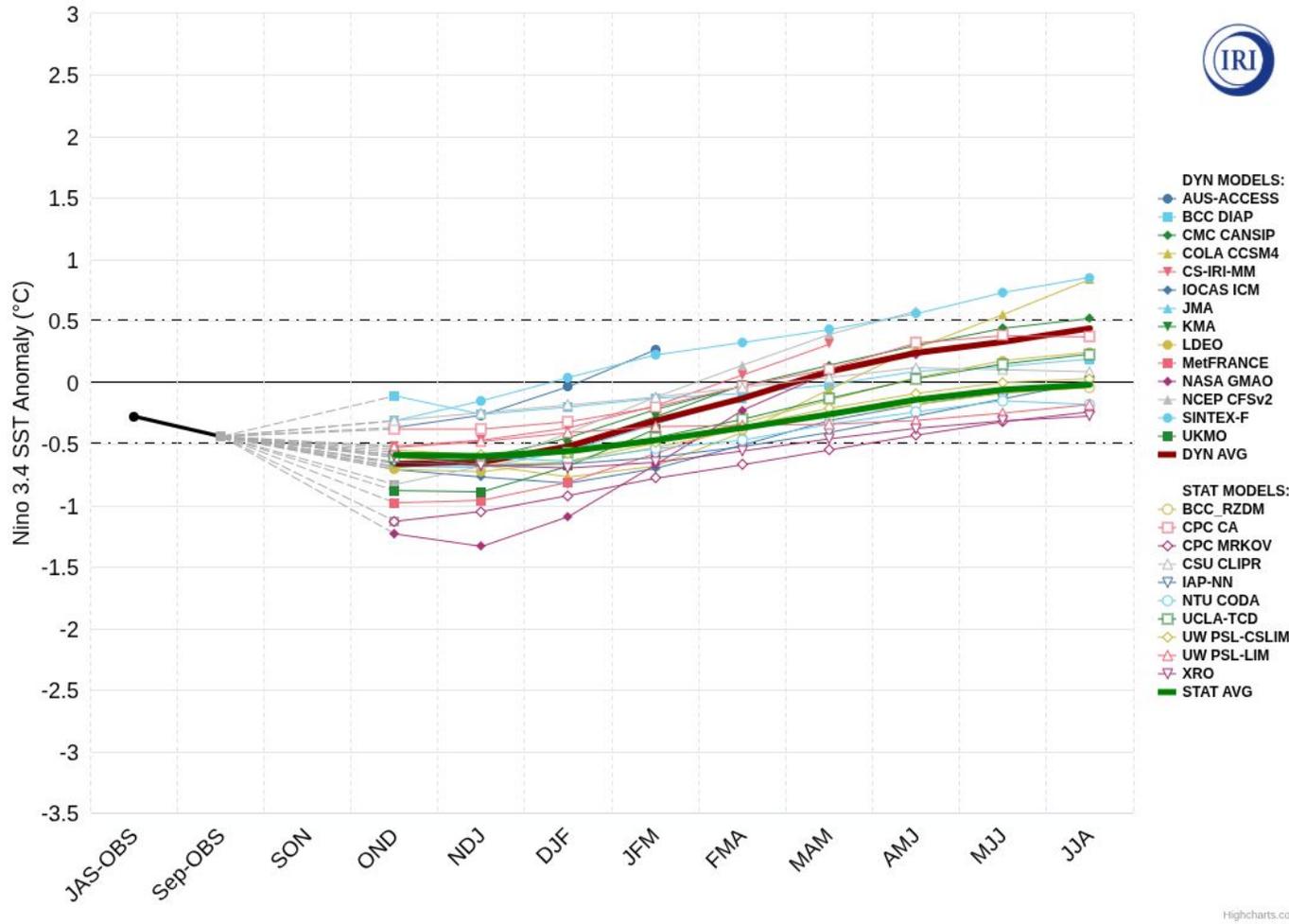
I. Recent state of the climate

II. Seasonal forecasts

# II. Seasonal forecasts

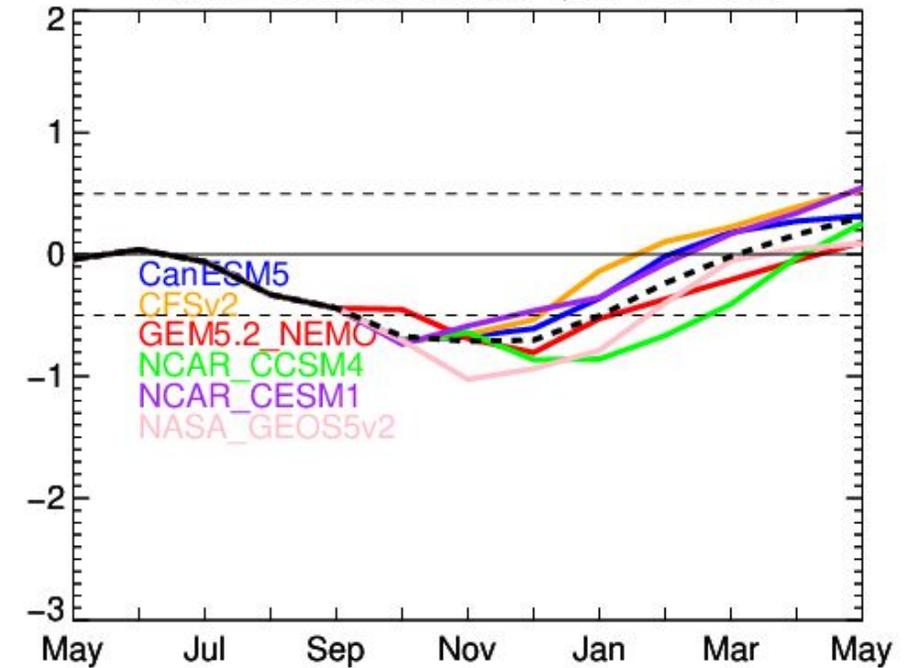
## ENSO forecasts

Model Predictions of ENSO from Oct 2025



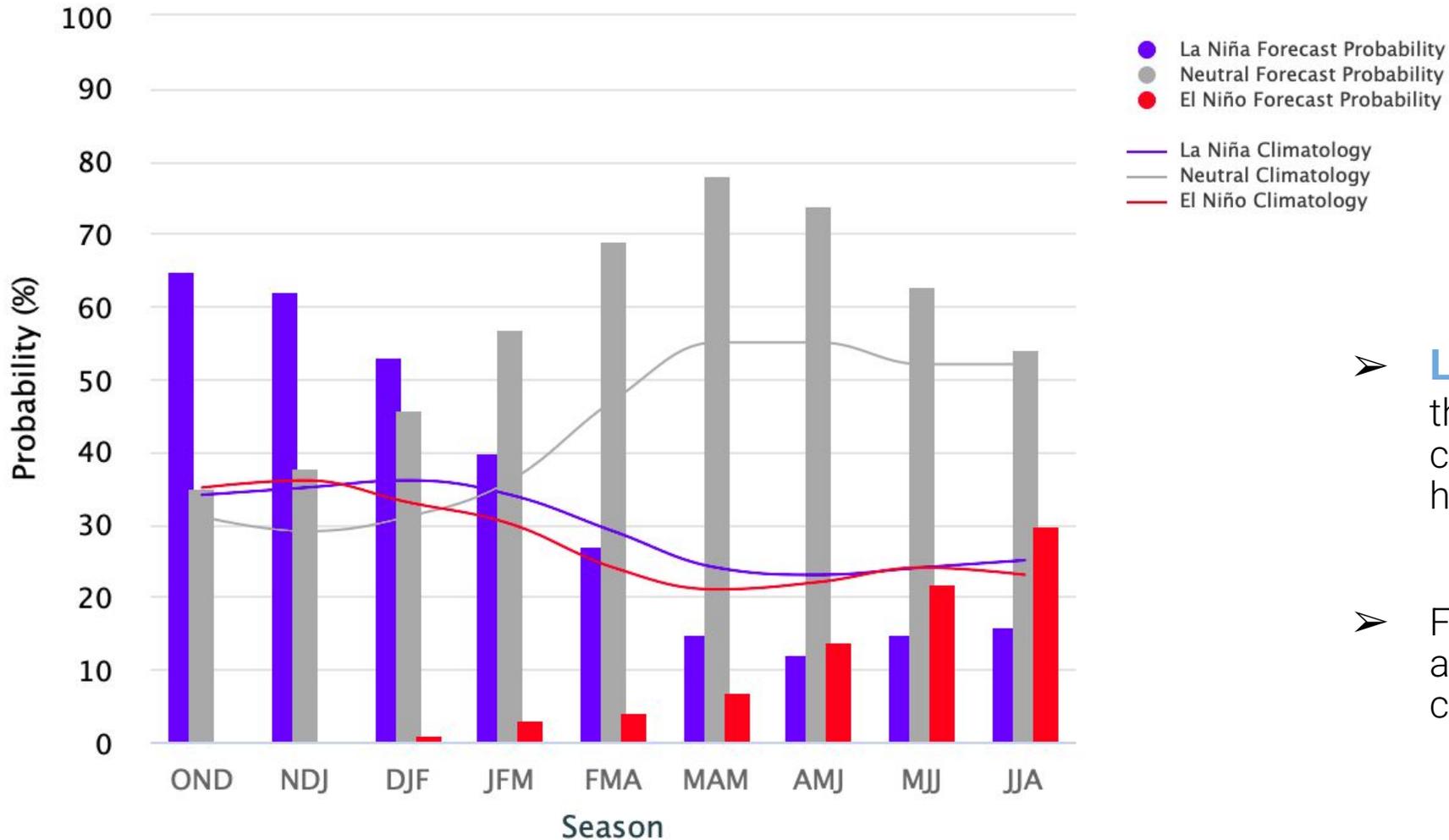
➤ Possible **weak La Niña** conditions in the coming months. Good agreement between dynamical and statistical models.

NMME scaled Nino3.4, IC=202510



## Mid-October 2025 IRI Model-Based Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly Neutral ENSO:  $-0.5\text{ }^{\circ}\text{C}$  to  $0.5\text{ }^{\circ}\text{C}$



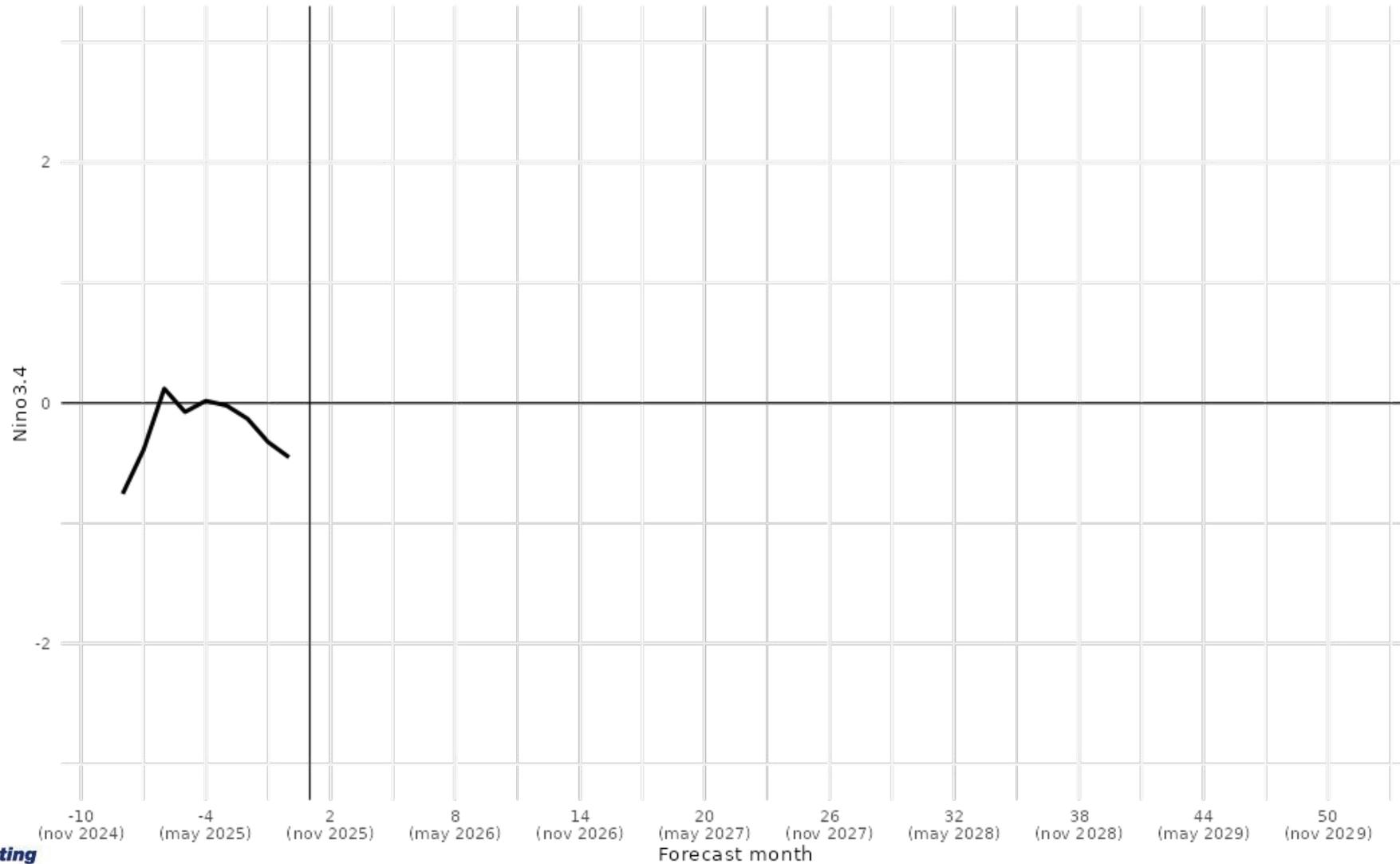
➤ **La Niña** conditions expected until the end of 2025. **Neutral** conditions expected for the first half of 2026.

➤ Forecast probability needs to be always compared against climatological probability.

# Seamless S2D forecast (Oct 2025)

Nino3.4 forecast issued in October 2025

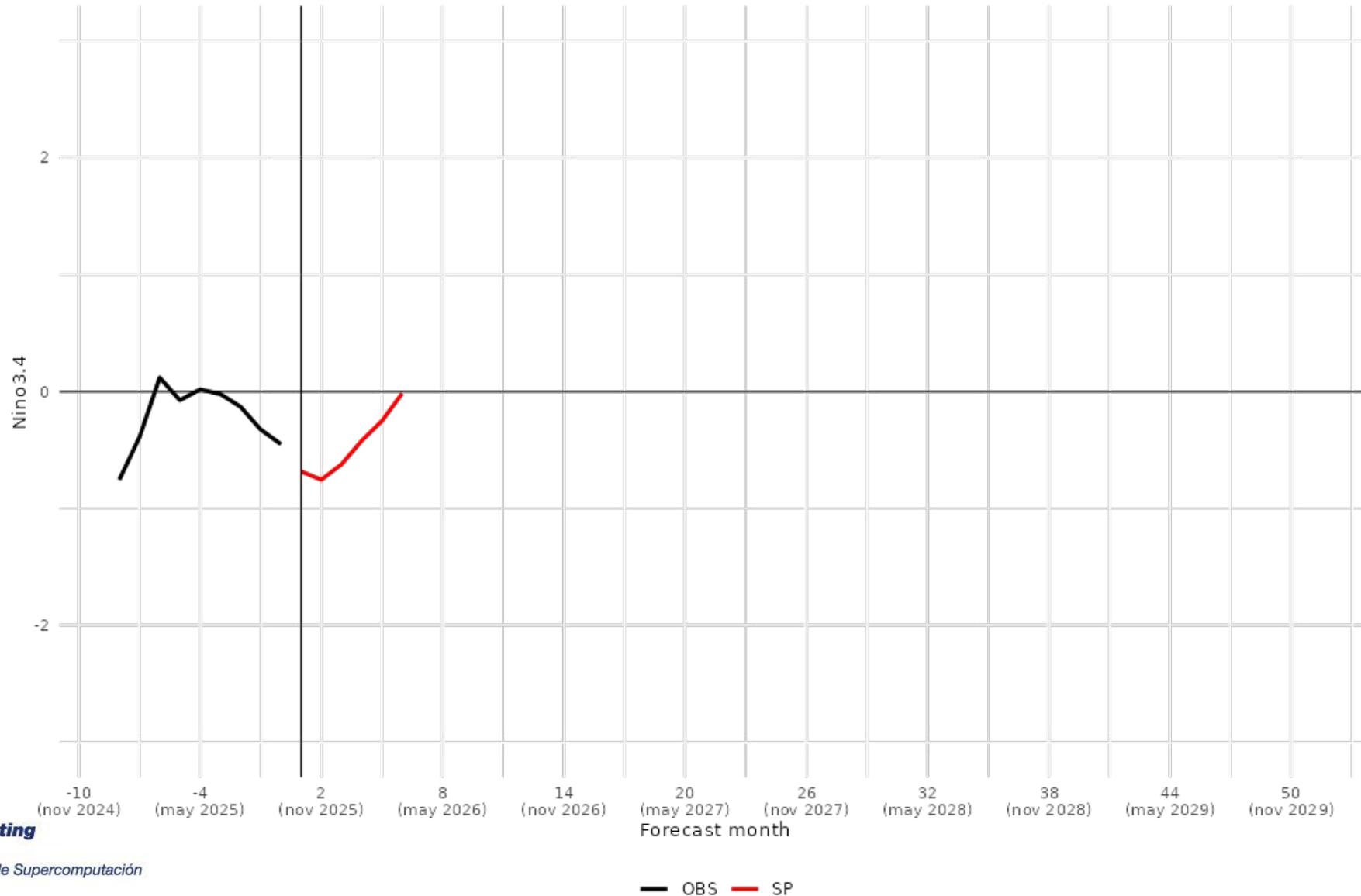
DP+HIST ensemble constrained with SP-based\_fmonths1-6\_Nino3.4



# Seamless S2D forecast (Oct 2025)

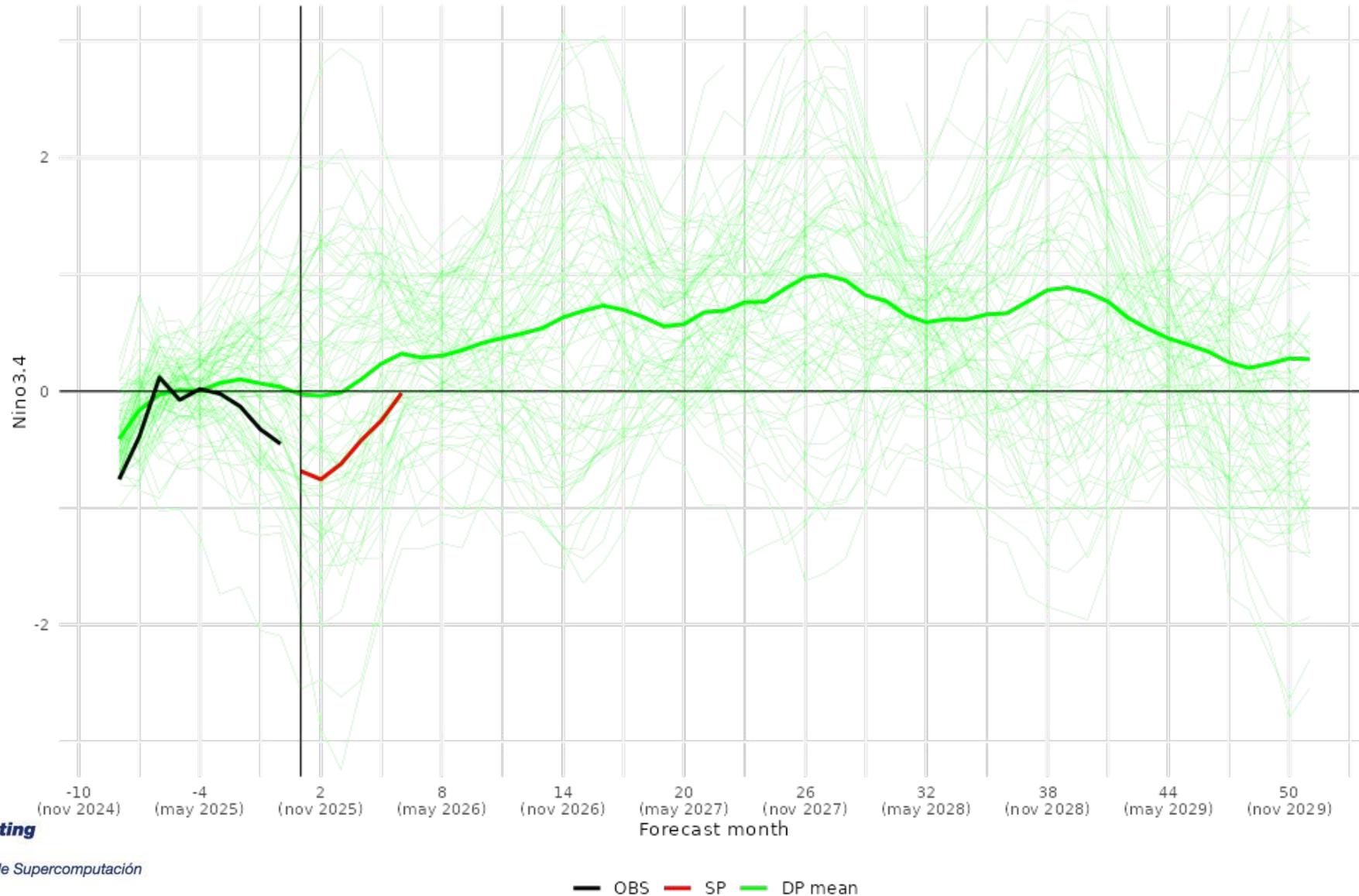
Nino3.4 forecast issued in October 2025

DP+HIST ensemble constrained with SP-based\_fmonths1-6\_Nino3.4



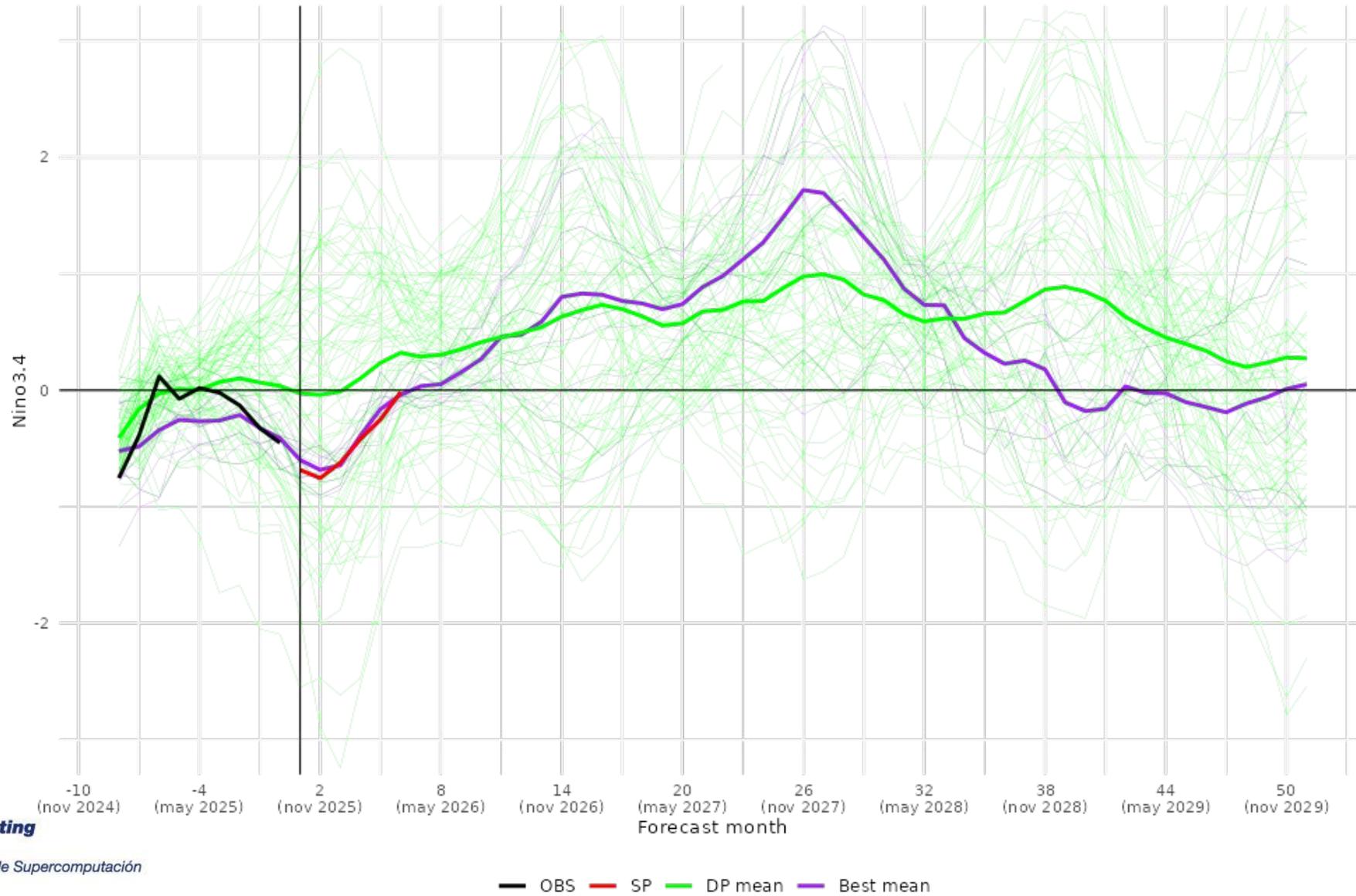
# Seamless S2D forecast (Oct 2025)

Nino3.4 forecast issued in October 2025  
DP+HIST ensemble constrained with SP-based\_fmonths1-6\_Nino3.4



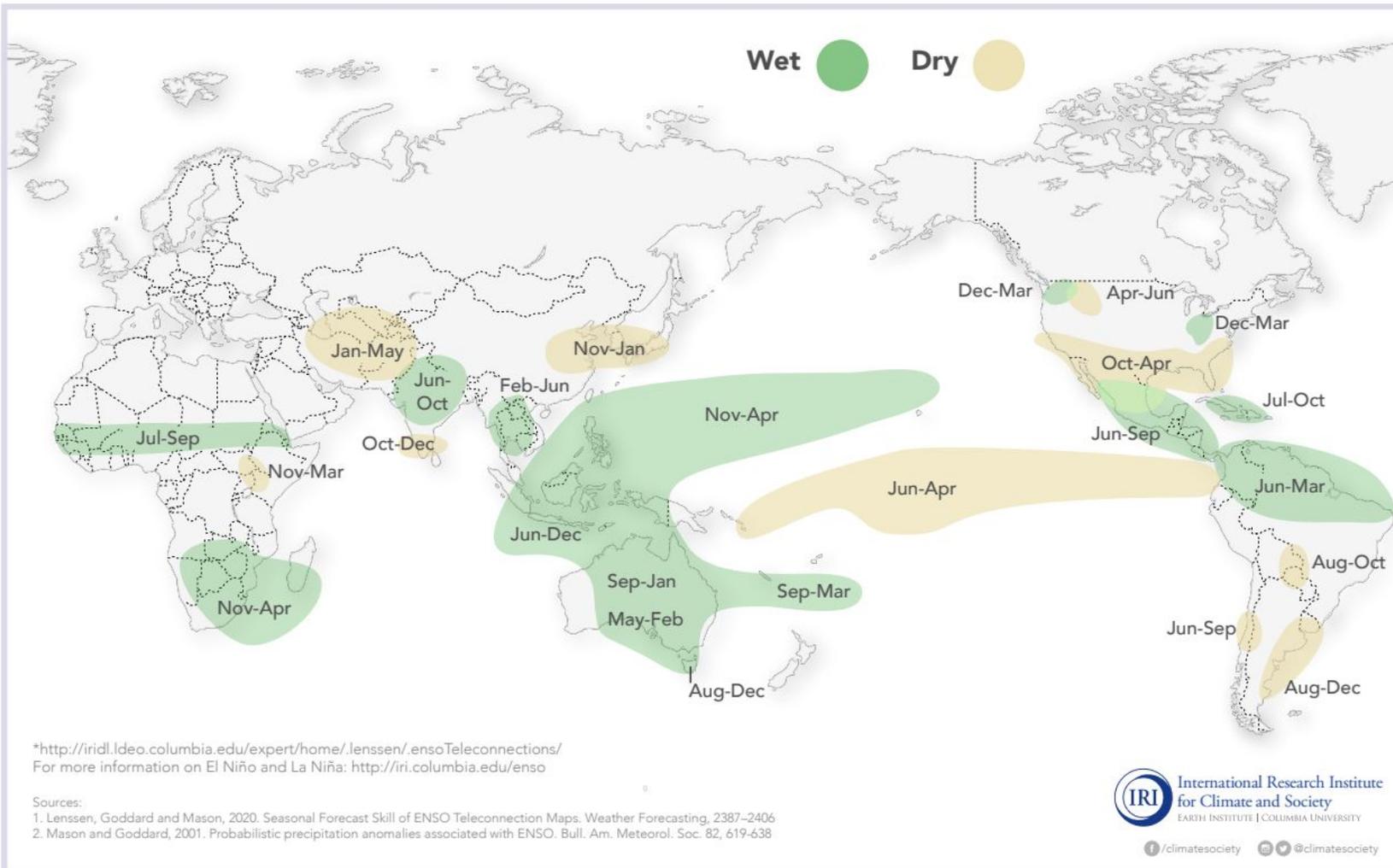
# Seamless S2D forecast (Oct 2025)

Nino3.4 forecast issued in October 2025  
DP+HIST ensemble constrained with SP-based\_fmonths1-6\_Nino3.4



# La Niña and Rainfall

La Niña 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.

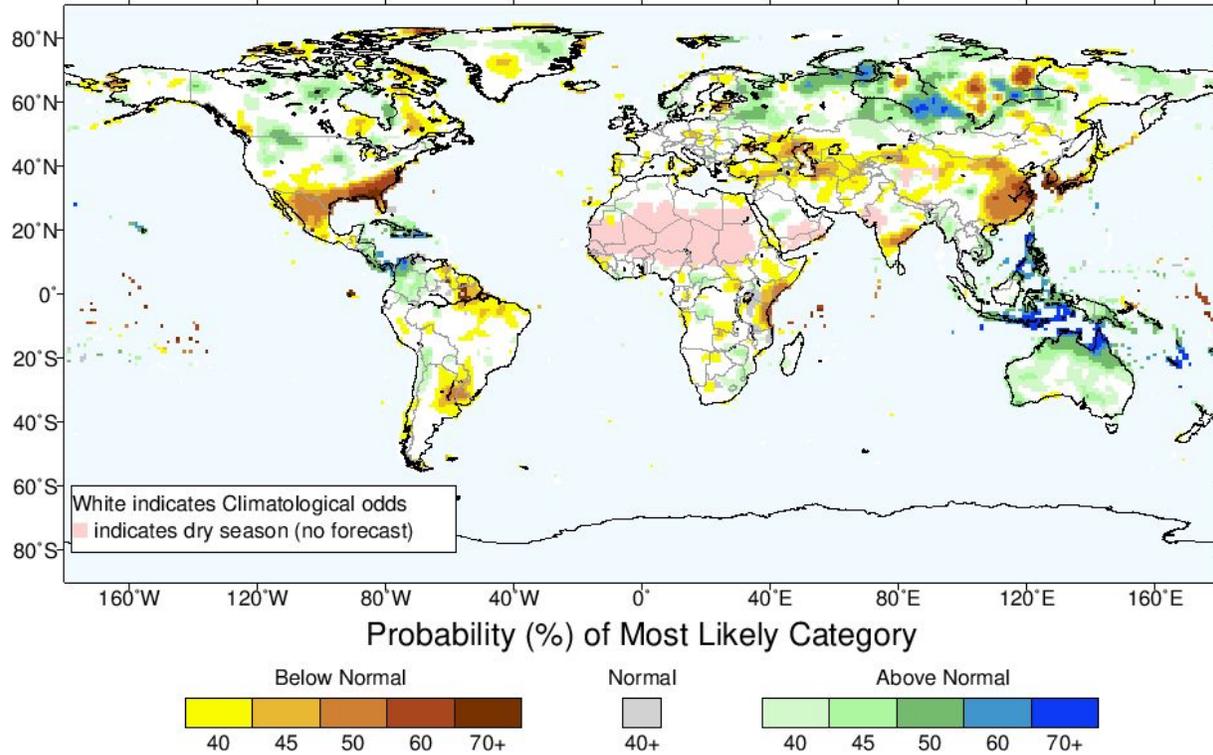


- Canonical **La Niña** impacts on rainfall patterns across the globe.
- For SON **drier** anomalies are expected in: Parts of South America, southern North America and central Asia
- **Wetter** anomalies are expected in: parts of Australia, northern South America, central South America, Southeast Asia, Philippines, Eastern Pacific

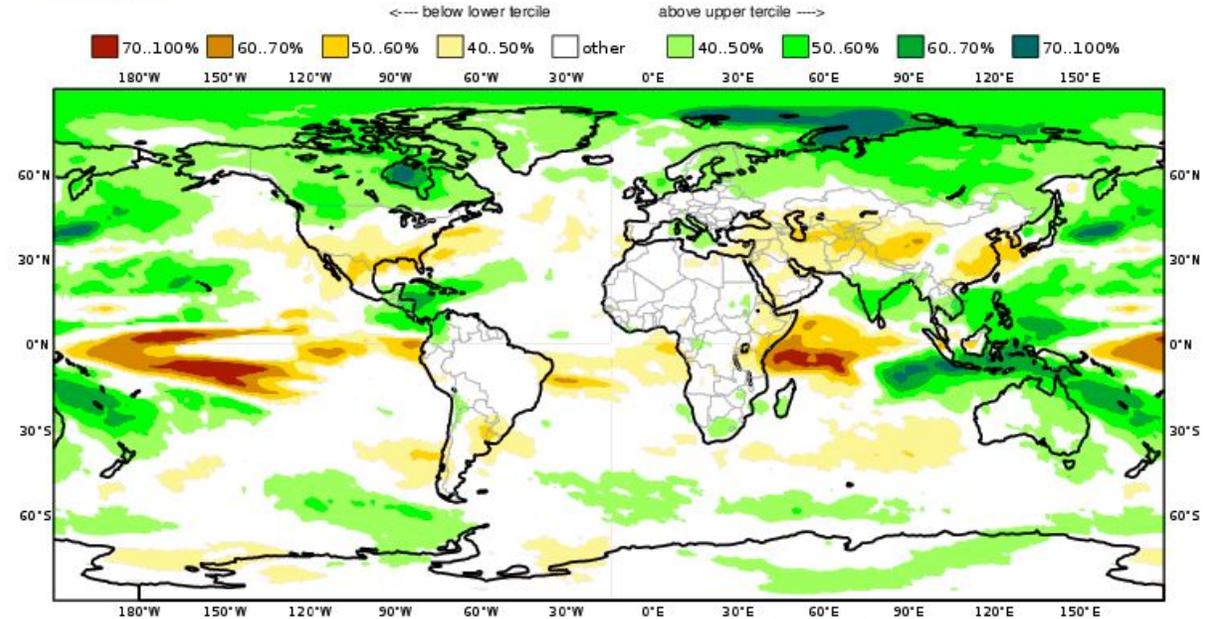
# II. Seasonal forecasts

## Precipitation

IRI Multi-Model Probability Forecast for Precipitation for November-December-January 2026, Issued October 2025

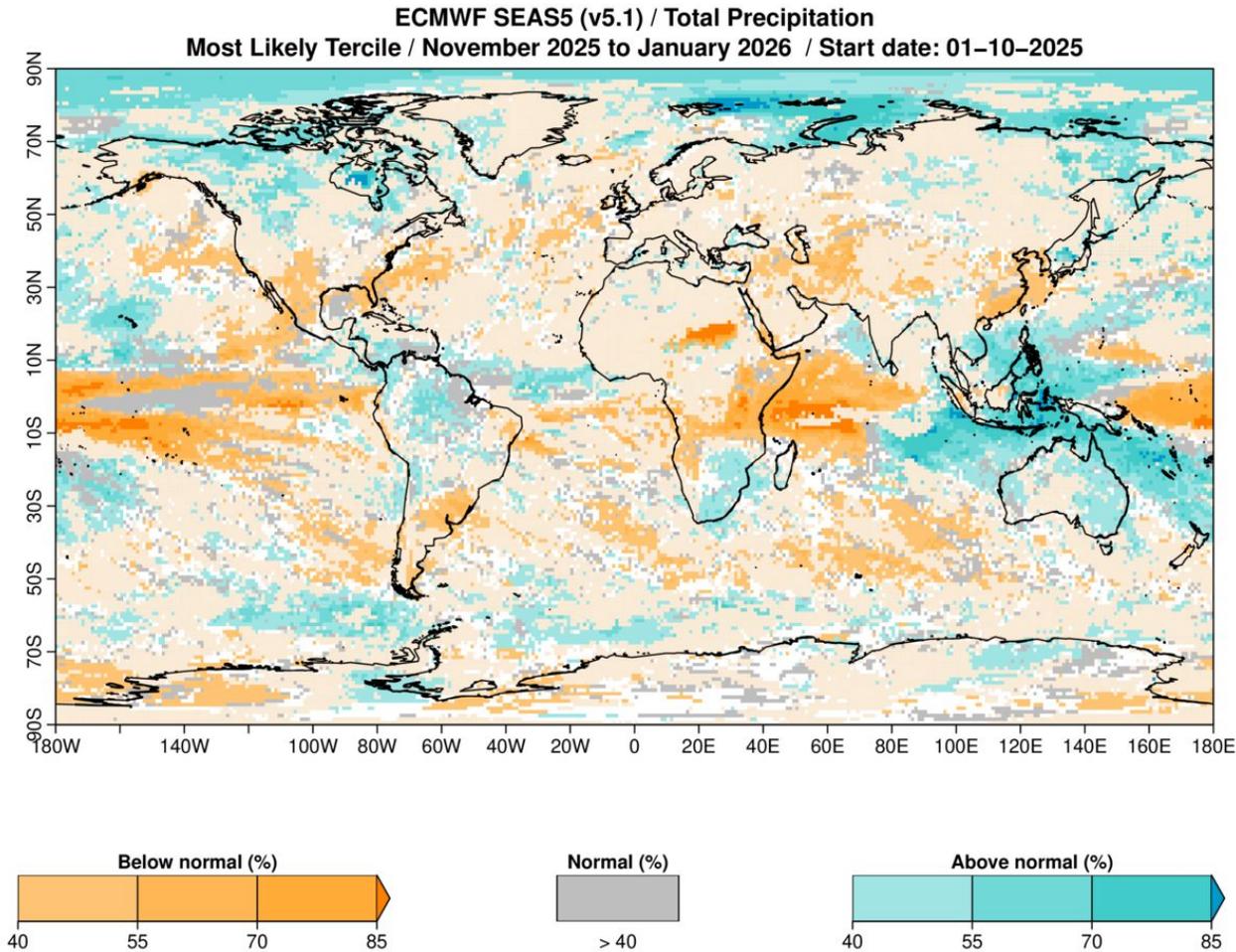


C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC/BOM  
 Prob(most likely category of precipitation)  
 NDJ 2025/26  
 Nominal forecast start: 01/10/25  
 Unweighted mean

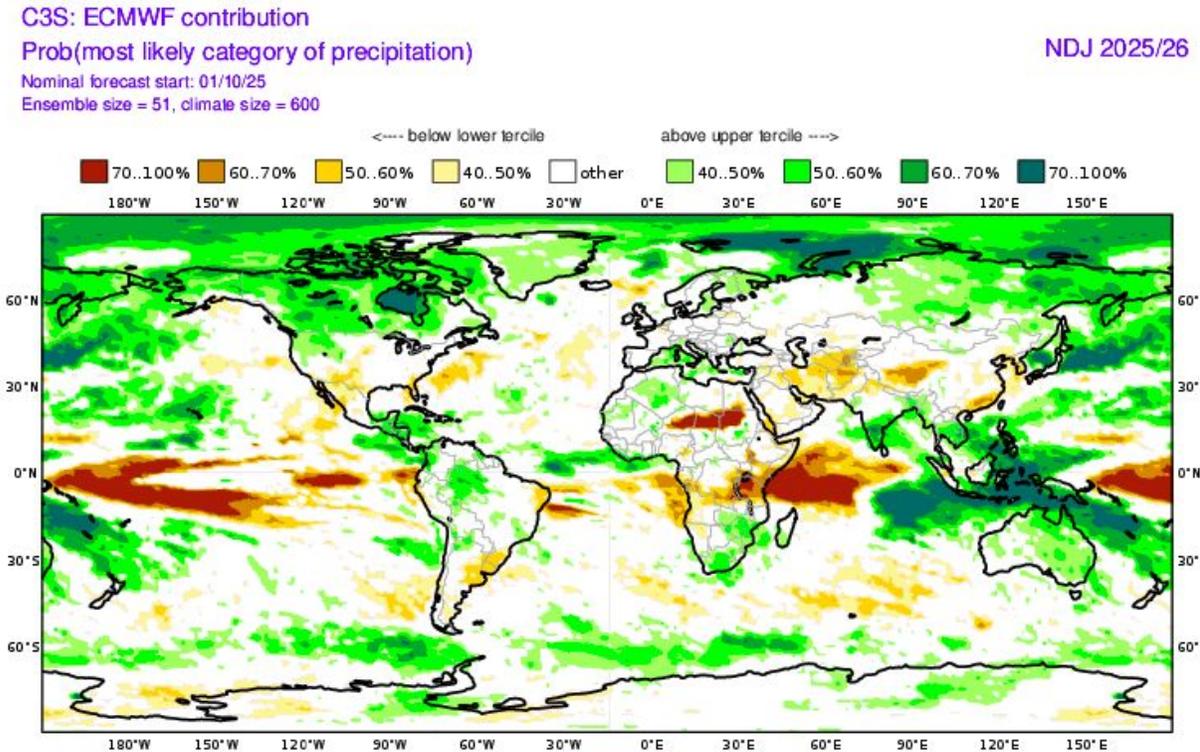


- Positive anomalies in southeastern Asia, Australia, parts of Northern Eurasia, central America and Caribbean islands Eastern
- Negative anomalies in southern North America, southern central Asia and many parts of China.

➤ Calibrated



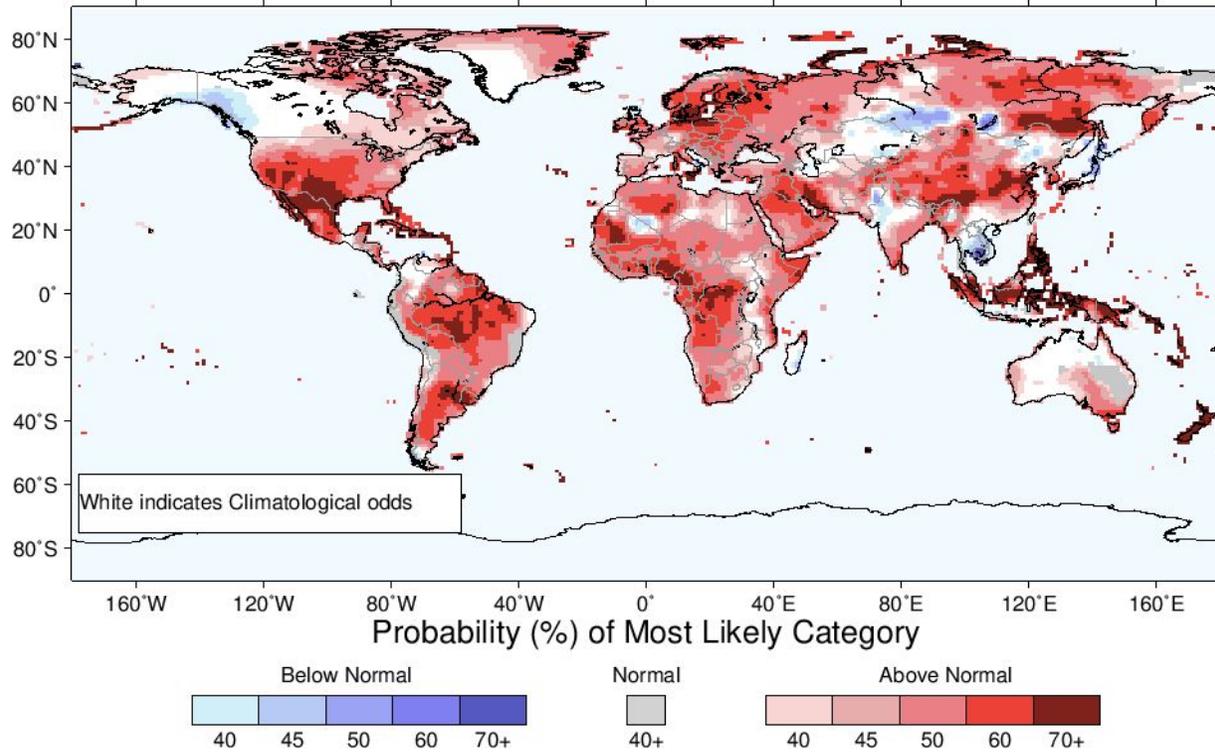
➤ Uncalibrated



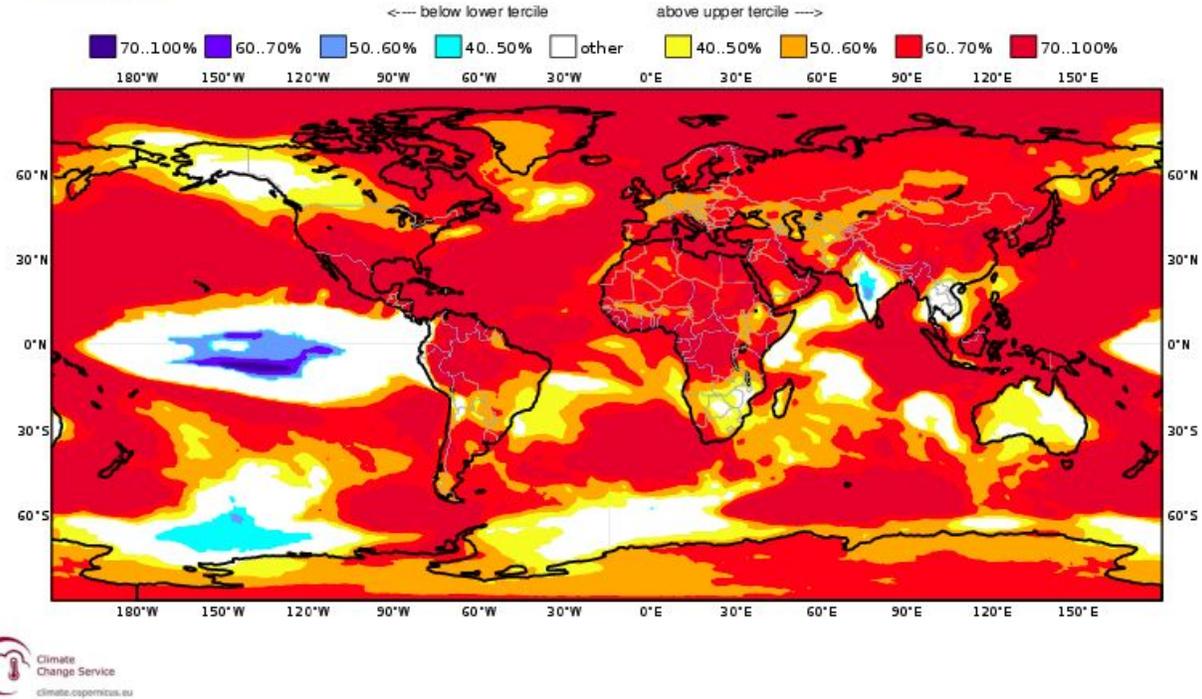
# II. Seasonal forecasts

## Temperature

IRI Multi-Model Probability Forecast for Temperature for November-December-January 2026, Issued October 2025

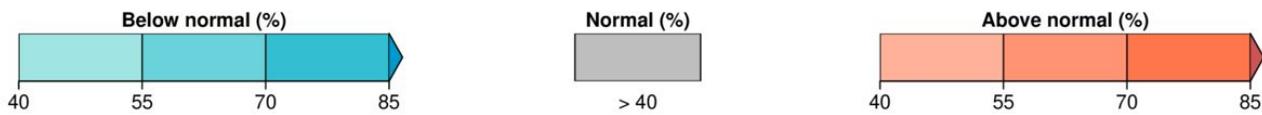
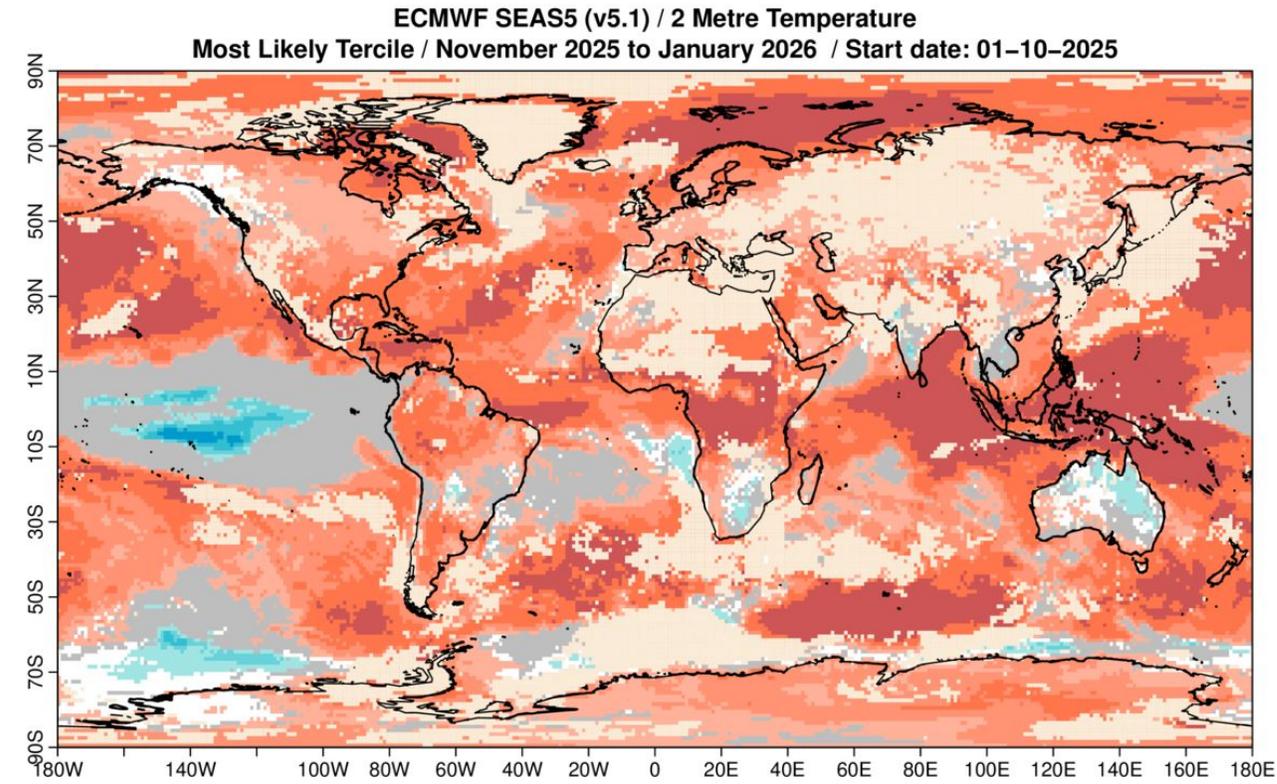


C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC/BOM  
 Prob(most likely category of 2m temperature)  
 NDJ 2025/26  
 Nominal forecast start: 01/10/25  
 Unweighted mean



- Typical global warming signal.
- Parts of South Pacific, Tropical Pacific and with cooler anomalies. Parts of Australia, India and eastern North America with less warm signals.

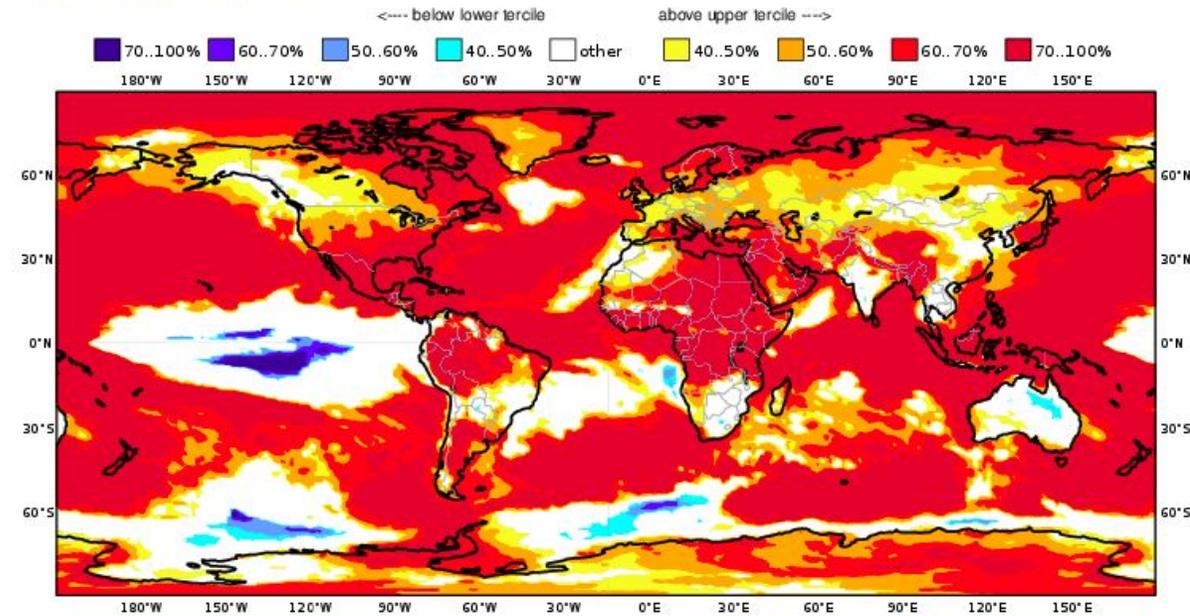
➤ Calibrated



➤ Uncalibrated

C3S: ECMWF contribution  
Prob(most likely category of 2m temperature)  
Nominal forecast start: 01/10/25  
Ensemble size = 51, climate size = 600

NDJ 2025/26

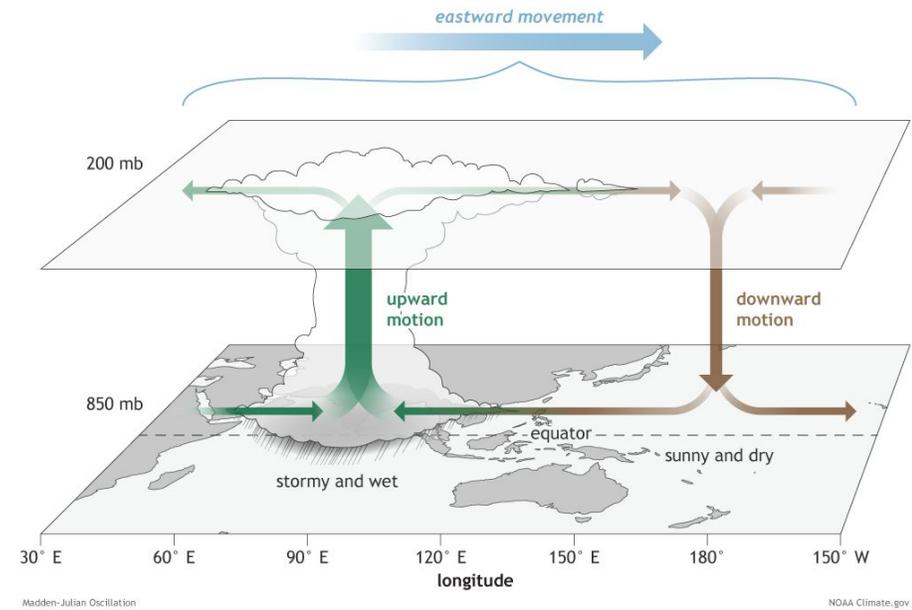
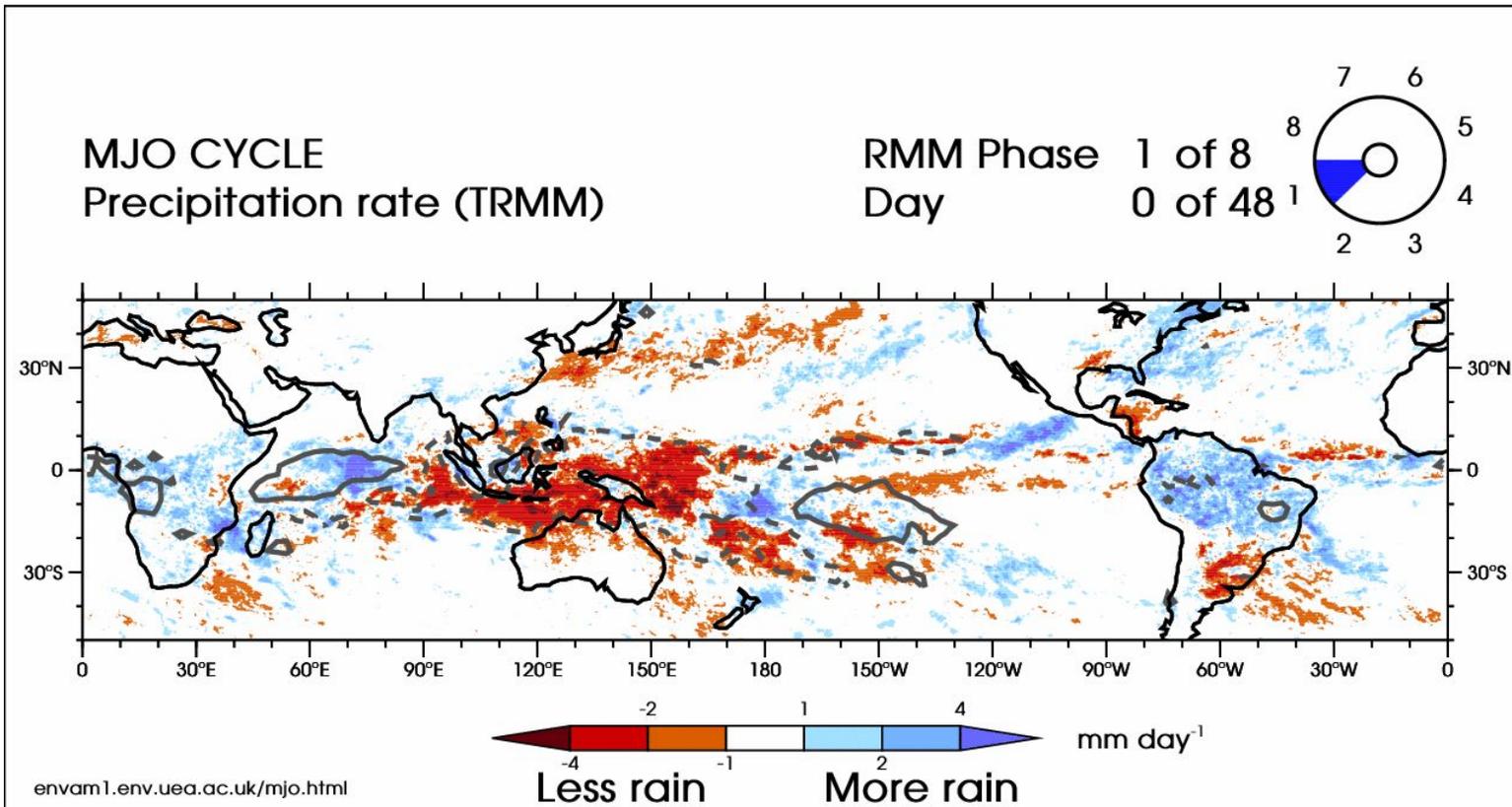


- I. Recent state of the climate
- II. Seasonal forecasts
- III. Intra-seasonal forecasts

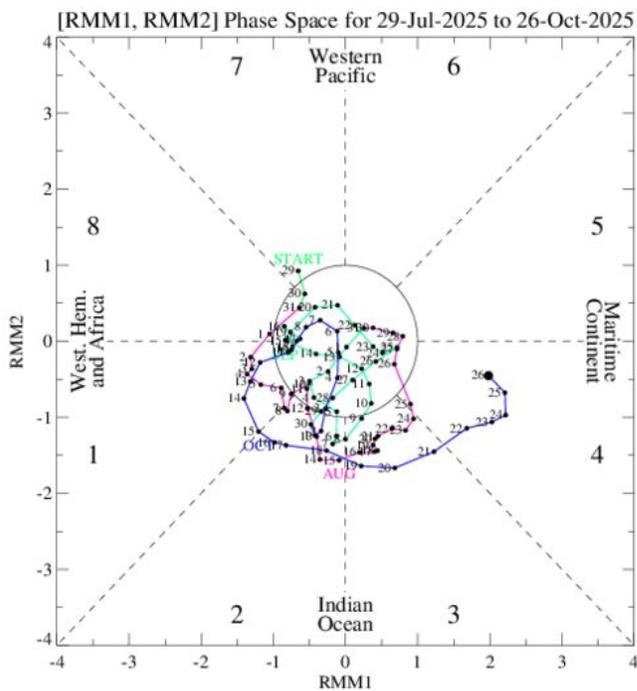
### III. Intra-seasonal forecasts

## Madden-Julian Oscillation (MJO)

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



- RMM phase diagram for the latest 90 days



### ➤ RMM index

RMM = Real-time Multivariate MJO Index

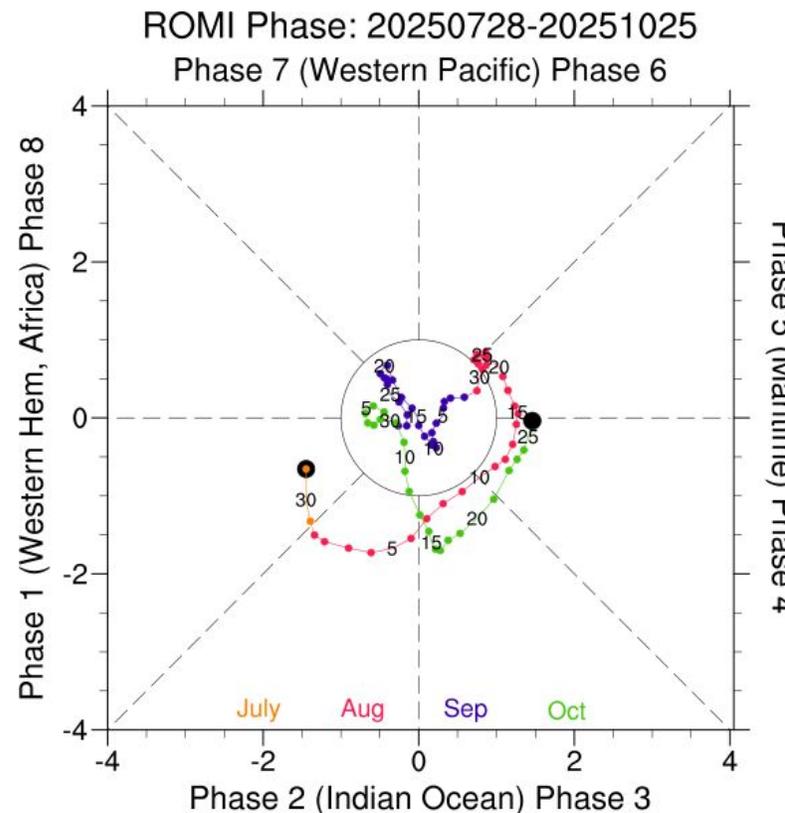
Developed by Matthew Wheeler and Harry Hendon (2004).

A multivariate index that combines:

- **Outgoing Longwave Radiation** (a proxy for convection/cloudiness)
- **Zonal winds at 850 hPa** (low-level winds)
- **Zonal winds at 200 hPa** (upper-level winds)

Projects these variables onto two principal components (RMM1 and RMM2) to define the MJO's location and intensity in an 8-phase diagram.

- ROMI phase diagram for the latest 90 days



### ➤ ROMI index

ROMI = Real-time OLR MJO Index

Developed as a simpler alternative to RMM.

**Based only on OLR data.**

Uses empirical orthogonal function (EOF) analysis of OLR to define MJO phases.

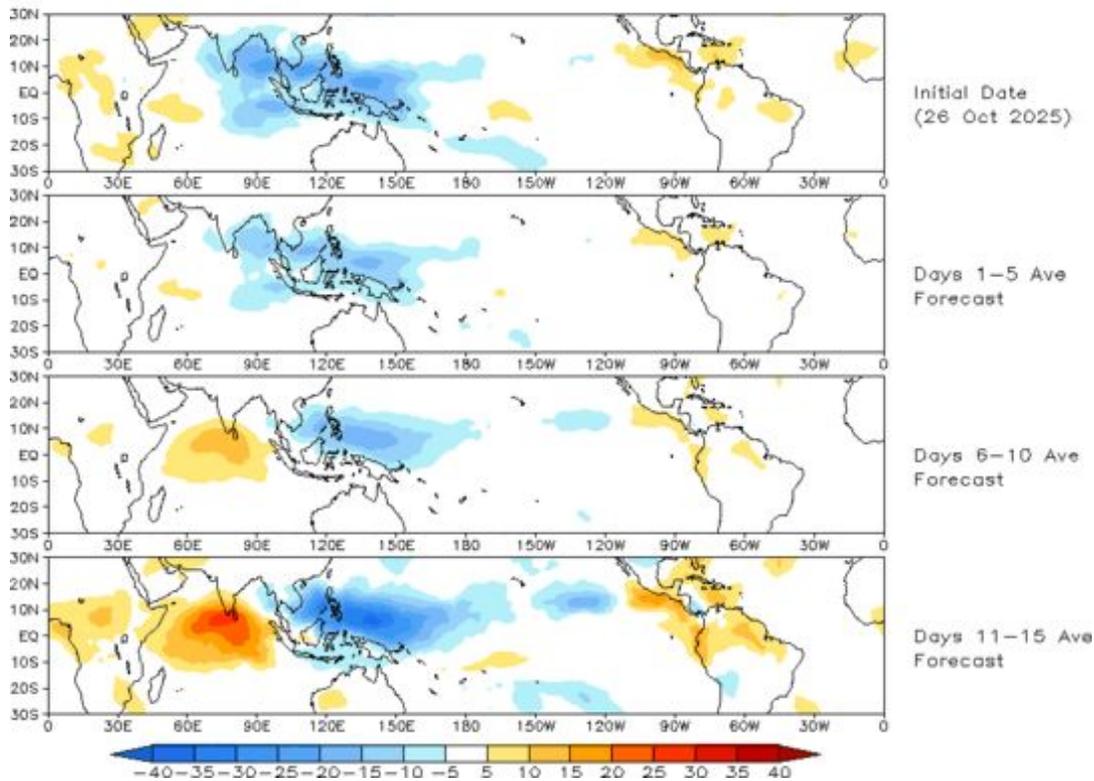
- During September the MJO was mostly inactive, but it has intensified progressively during October.

# III. Intra-seasonal forecasts

## MJO forecasts

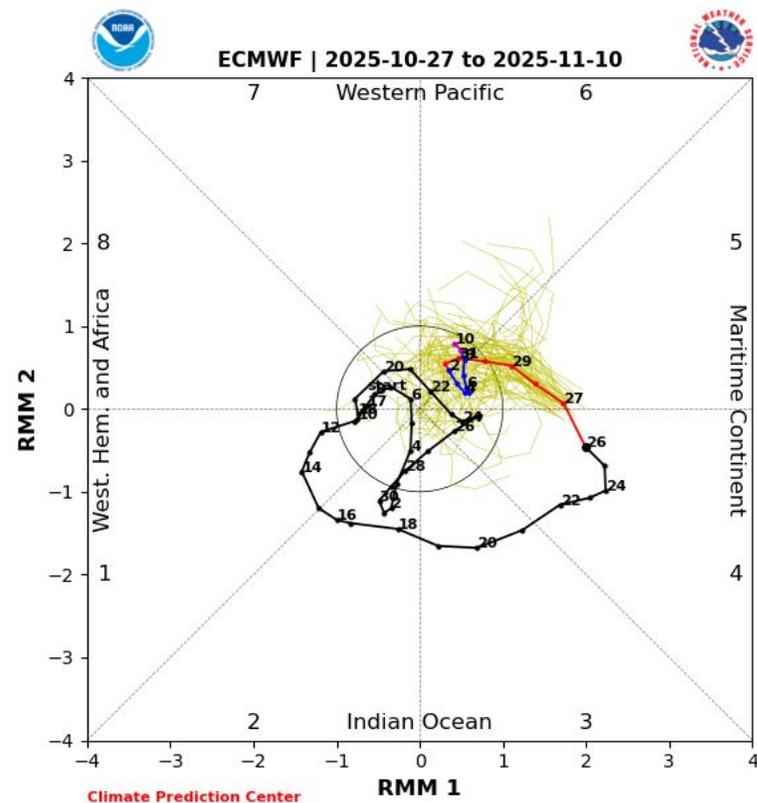
- OLR anomalies [W/m<sup>2</sup>] (ensemble mean GEFS)

Prediction of MJO-related anomalies using GEFS operational forecast  
Initial date: 26 Oct 2025  
OLR



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

- Evolution of last 40 days of observations + ensemble forecast

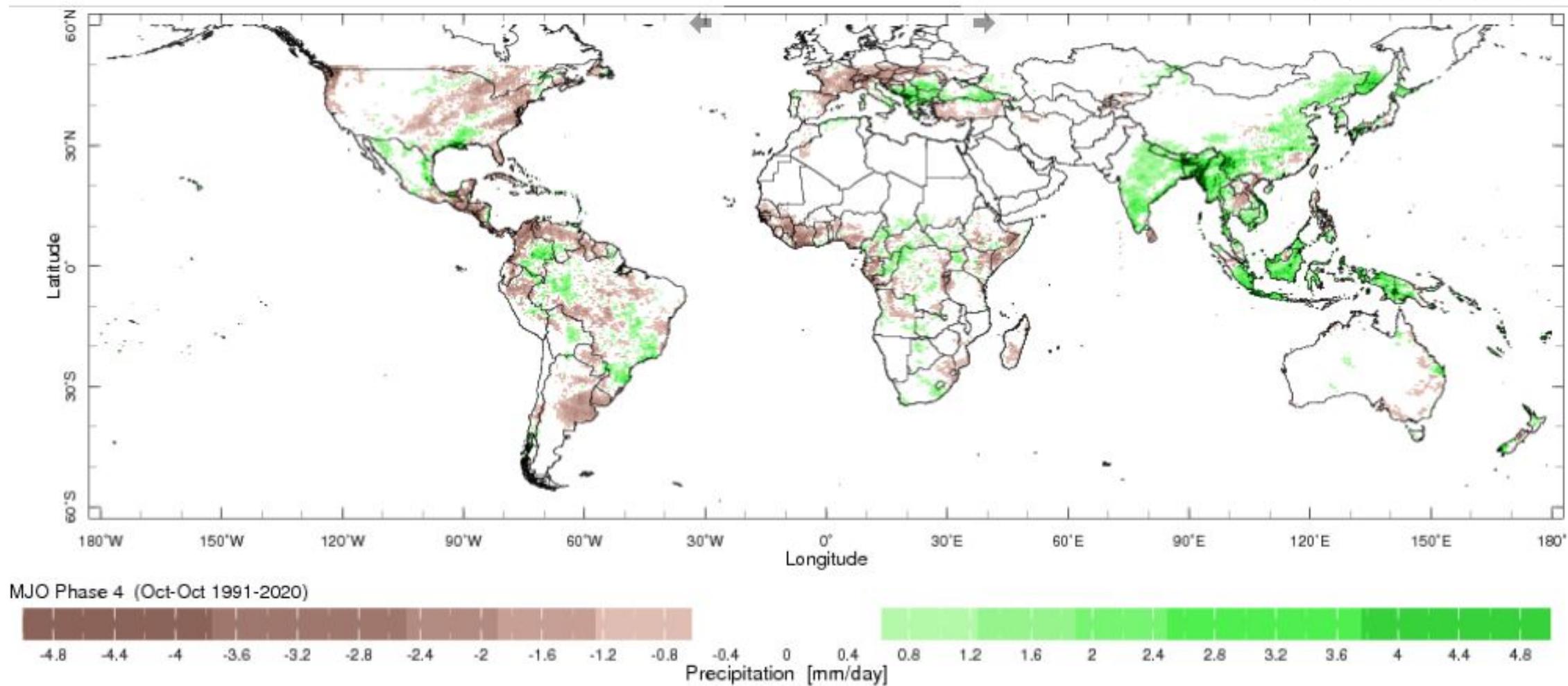


Mean forecasts: 1-7 day, 8-14 day, >= 15 days

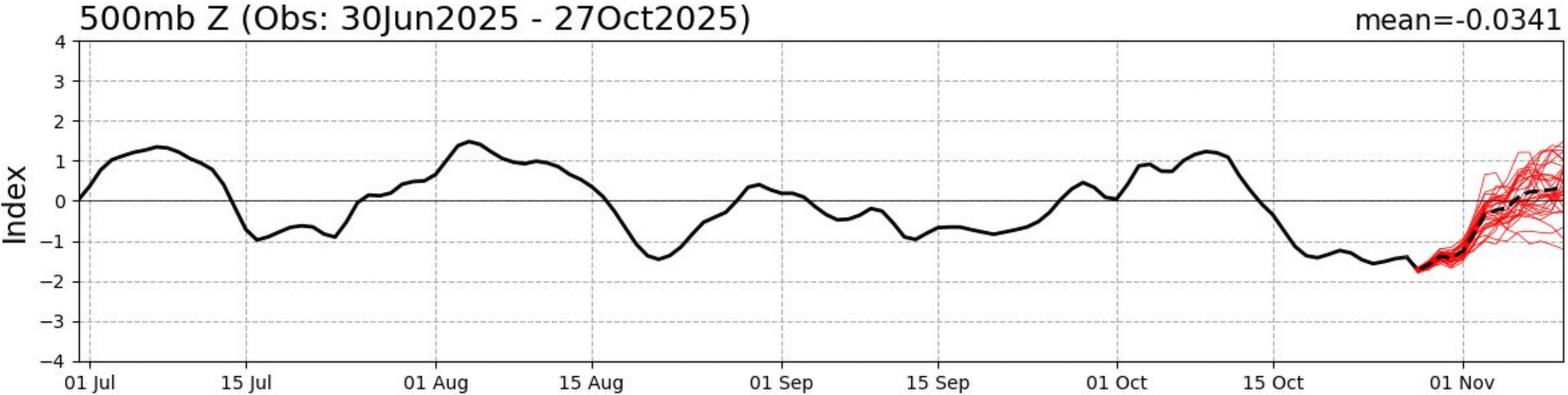
- MJO is expected to transition towards the Indian Ocean.

➤ Precipitation composite during MJO Phase 4 in October

Composite = average pattern

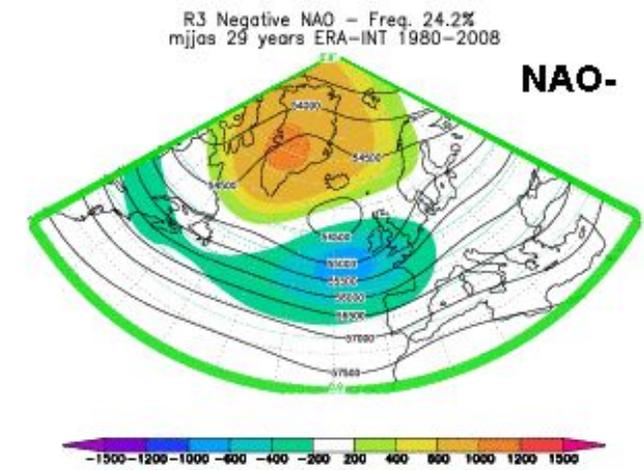
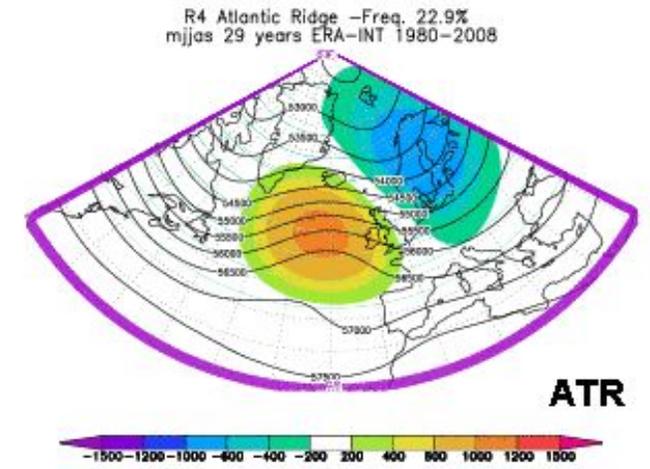
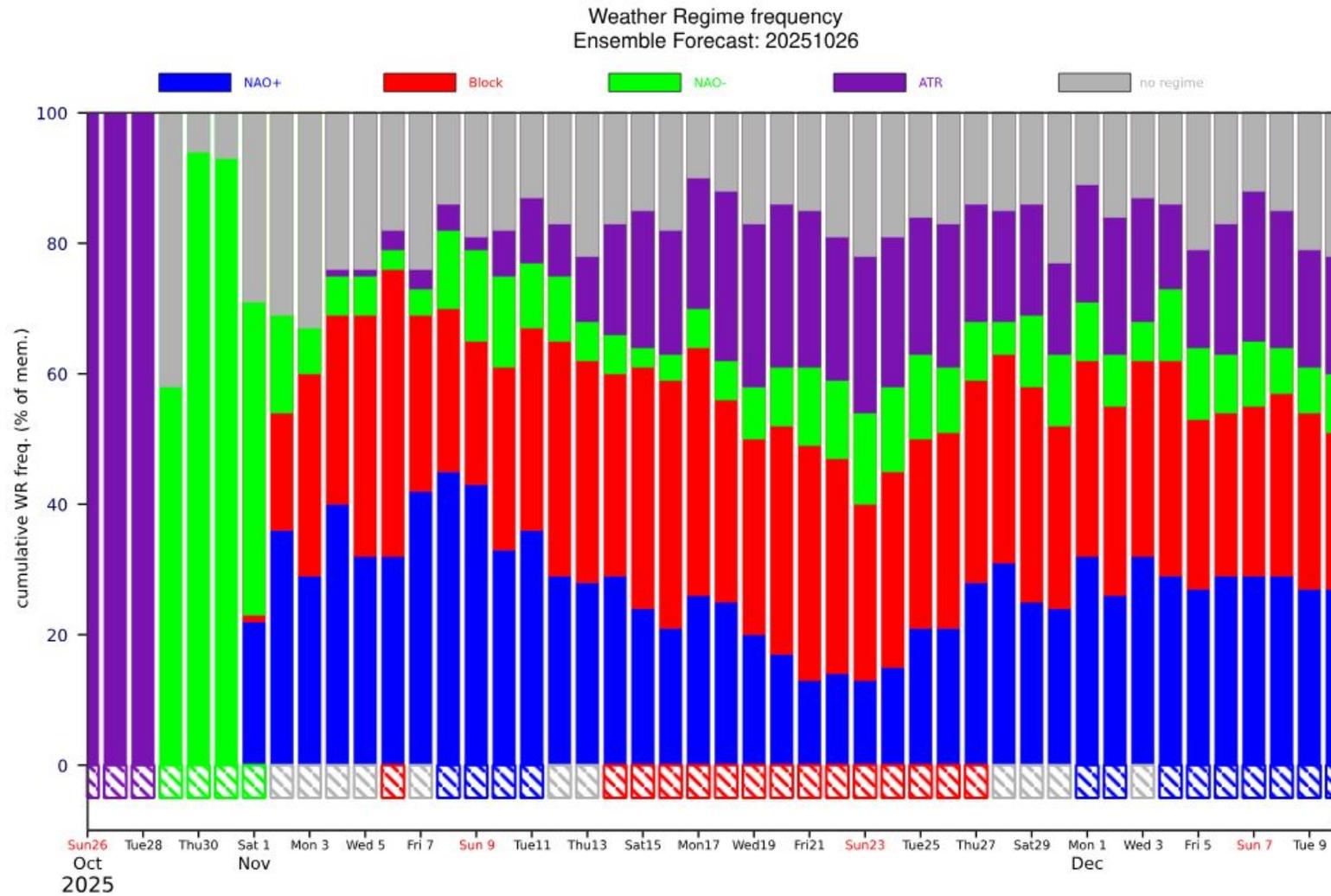


### NAO Index: Observed & GEFS Forecasts



# III. Intra-seasonal forecasts

## Weather regimes



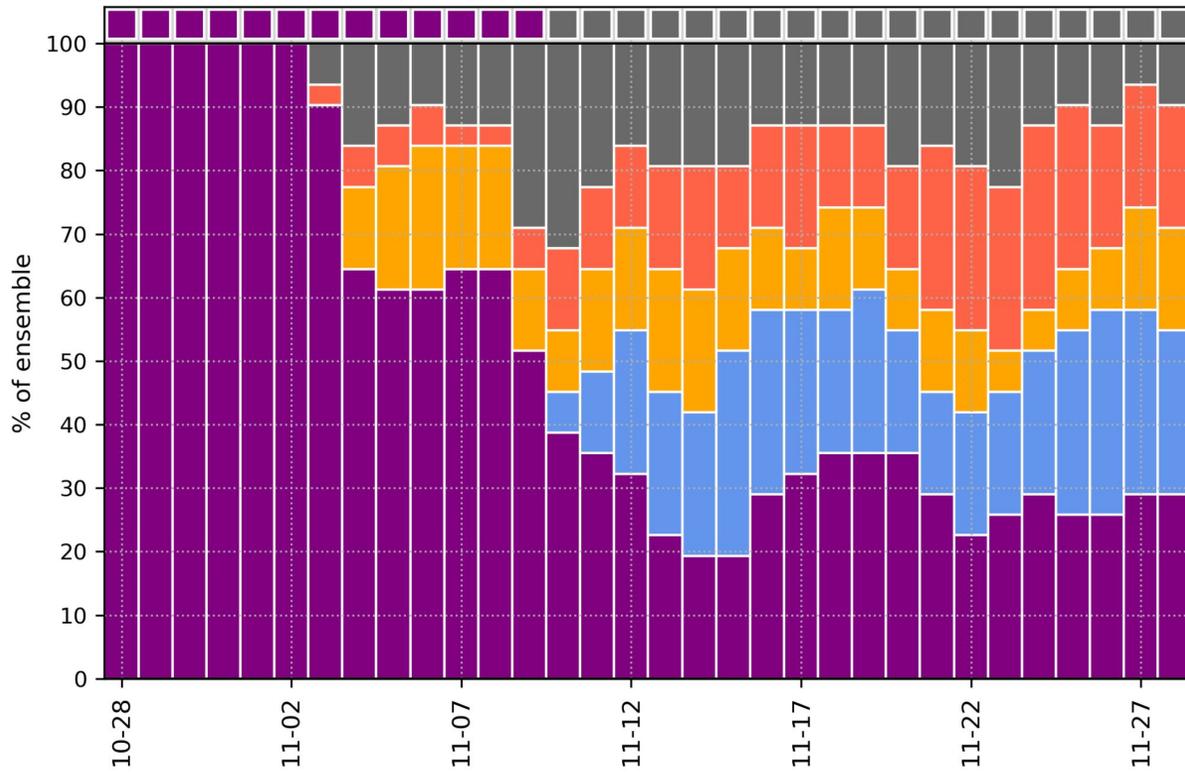
# North American Weather Regimes

simonleewx.com

Plot generated 1400Z 2025-10-27

GEFS: 2025-10-26 00Z

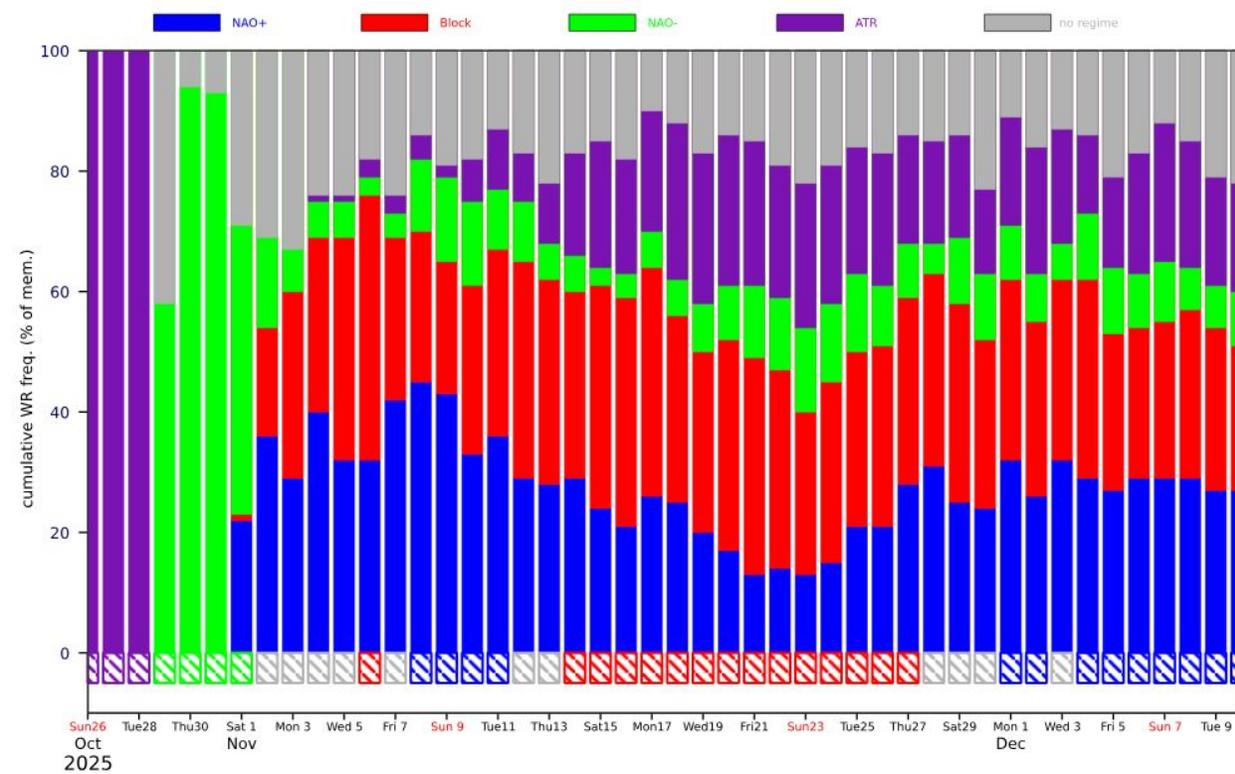
PT PR AKR GH NO



PT = Pacific Trough, PR = Pacific Ridge, AKR = Alaskan Ridge, GH = Greenland High, NO = No Regime

# Weather Regime frequency

Ensemble Forecast: 20251026



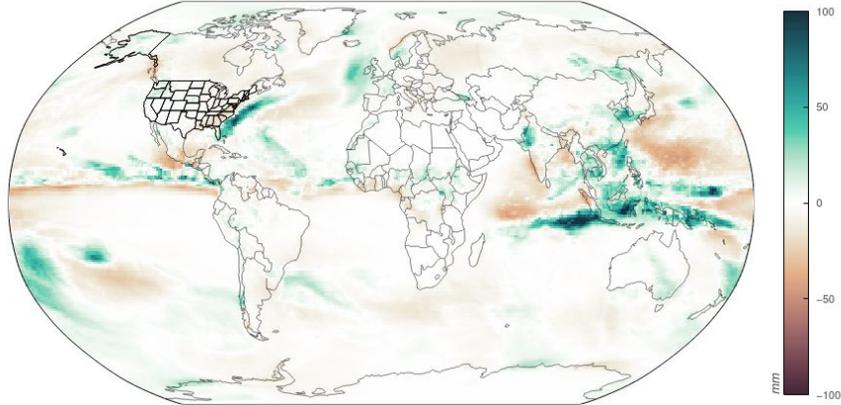
➤ Increased likelihood of GH (in Europe NAO+, Messori et al., 2023) as expected in the North American regimes.

# III. Intra-seasonal forecasts

## Precipitation

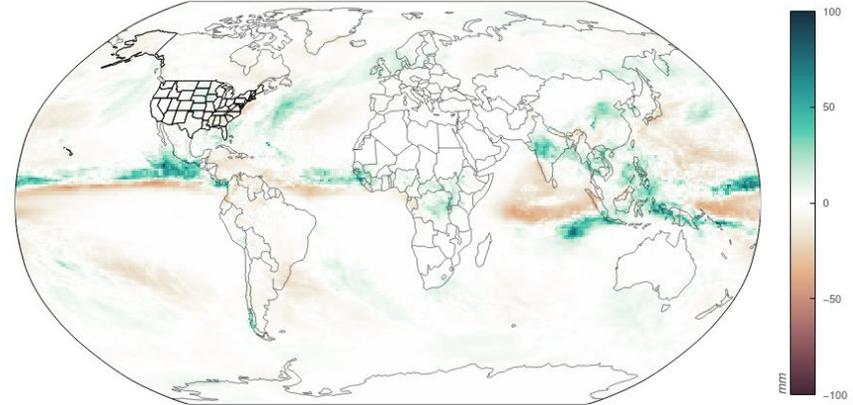
Week 1

SubC Total Precipitation Anomalies (mm) for Forecast Date: 20250904



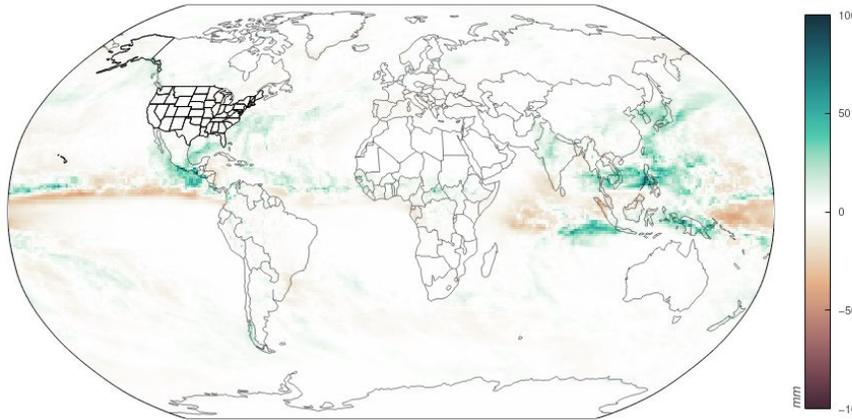
Week 2

SubC Total Precipitation Anomalies (mm) for Forecast Date: 20250904



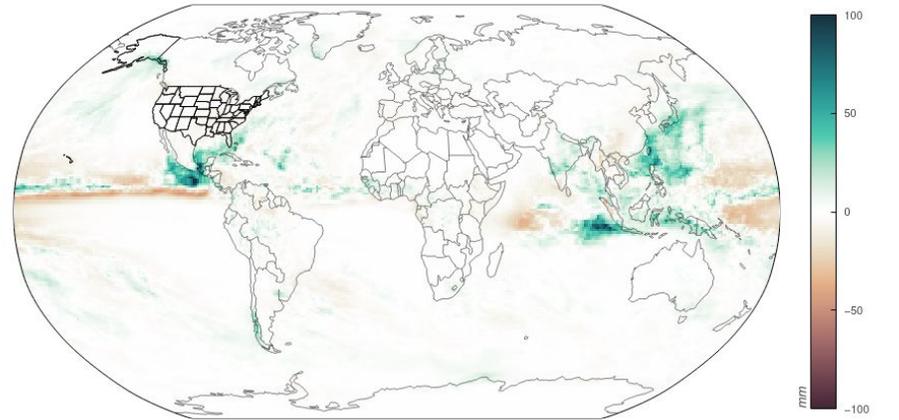
Week 3

SubC Total Precipitation Anomalies (mm) for Forecast Date: 20250904



Week 4

SubC Total Precipitation Anomalies (mm) for Forecast Date: 20250904

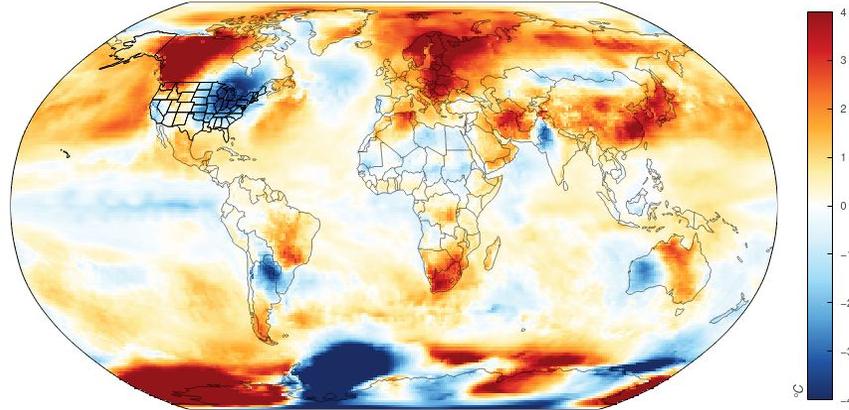


# III. Intra-seasonal forecasts

## Temperature

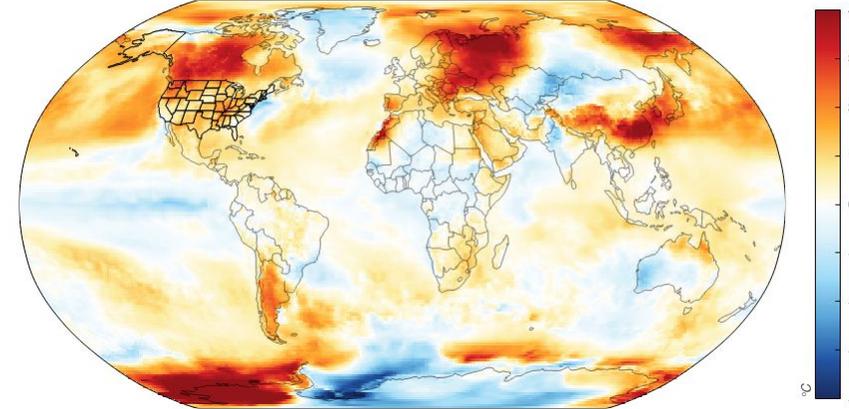
Week 1

SubC 2m Temperature Anomalies (°C) for Forecast Date: 20250904



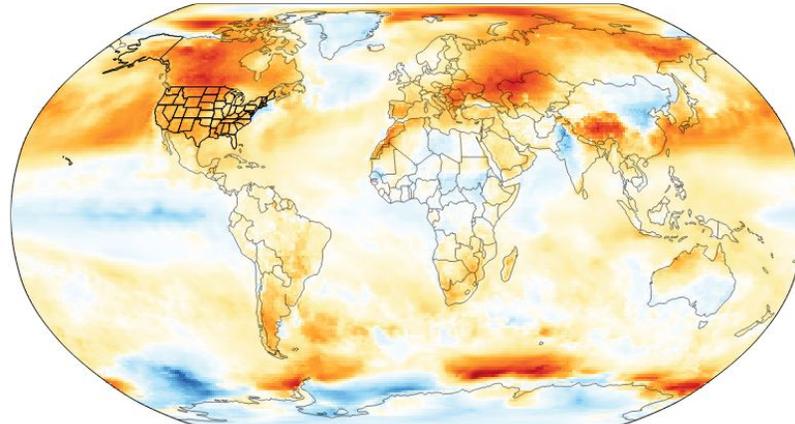
Week 2

SubC 2m Temperature Anomalies (°C) for Forecast Date: 20250904



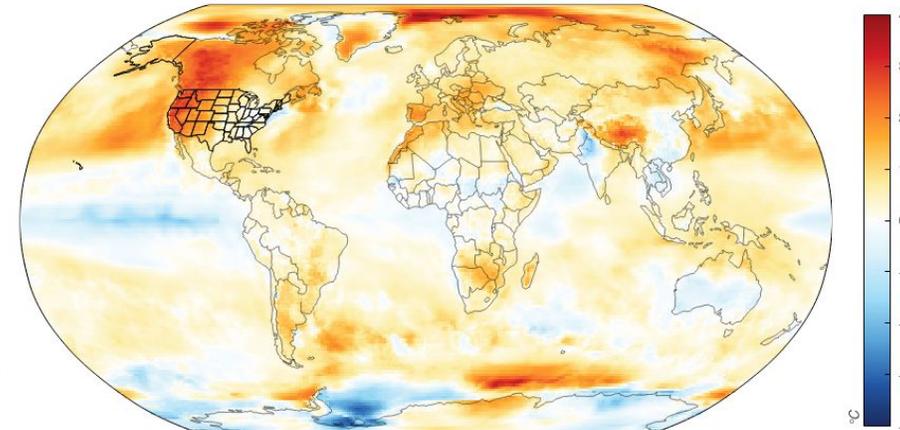
Week 3

SubC 2m Temperature Anomalies (°C) for Forecast Date: 20250904



Week 4

SubC 2m Temperature Anomalies (°C) for Forecast Date: 20250904



- I. Recent state of the climate
- II. Seasonal forecasts
- III. Intra-seasonal forecasts
- IV. Discussion

# Summary

## Recent state of the climate

- Persistent observed **dry** anomalies in most of the Americas, the Guinean coast, Congo, central Asia, parts of Australia, most of Europe, Southeast Asia, eastern China, Madagascar, eastern Siberia, parts of India and Australia.
- Both record wet (Iberian peninsula, south of France, parts of Italy) and **dry** in central-north Europe (North of Germany, Alps, etc.).
- Persistent weak **la Niña** with **warm** anomalies in the Niño 1+2 region (**Coastal El niño**).
- Sudden stratospheric warming (likely final event) starting around the 12th of March with likelihood of **mild** conditions over europe in the upcoming weeks.
- During February MJO avoided phase 8 due to strong subsidence in the CP. It became active at the beginning of March (phases 1 and 2) and has since then become inactive.

# Summary

## Seasonal forecasts

- High likelihood of return to neutral conditions during MAM 2025.
- Apart from southern Africa, anomalies in precipitation could be consistent with a [La Niña](#).
- Typical **global warming signal** in seasonal temperature forecasts. Parts of North Atlantic, Southern sea, Indochinese peninsula with [cooler](#) anomalies. And northern North America, southern South America, India and southern Africa with less warm signals.

# Summary

## Intraseasonal forecasts

- High likelihood of inactive MJO for the forthcoming weeks.
- Increased likelihood of **mild** conditions over europe in the upcoming weeks, in-line with SSW impacts and ECMWF forecast.
  - Increased likelihood of GH in the US.

# Discussion

- What lead to the anomalous rainfall in the Iberian peninsula?
- What impacts will the final stratospheric warming have?
- Inconsistencies between ENSO forecasts and seasonal predictions.

Earth Sciences  
Department



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

# Forecast Briefing

## October 2025

Climate Services Team (CST)

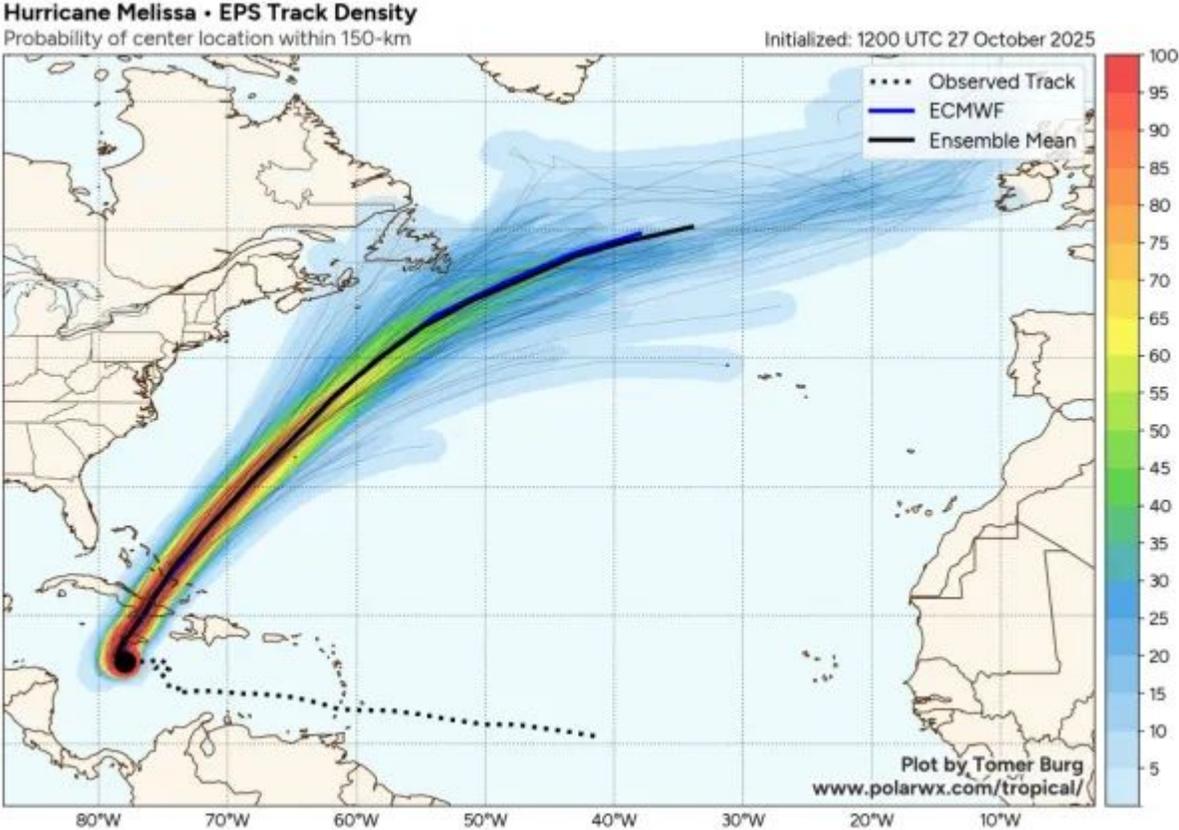
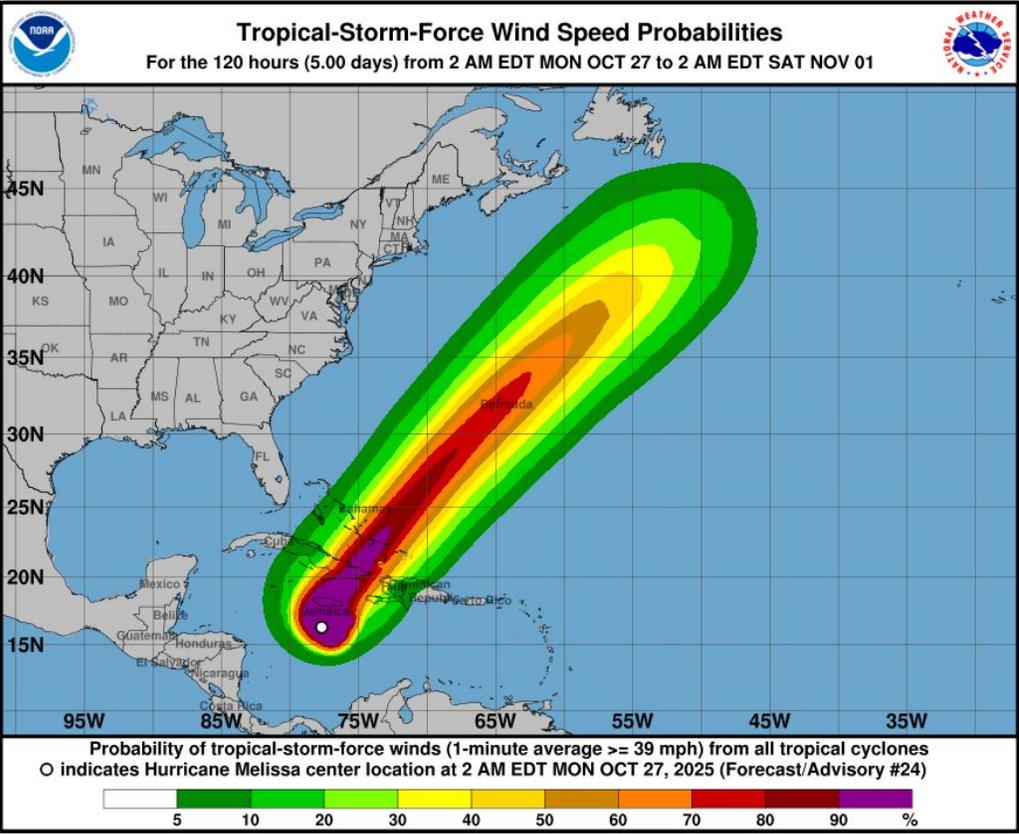
Earth System Services (ESS)

Barcelona Supercomputing Center (BSC)

Tuesday 28<sup>th</sup> Oct 2025

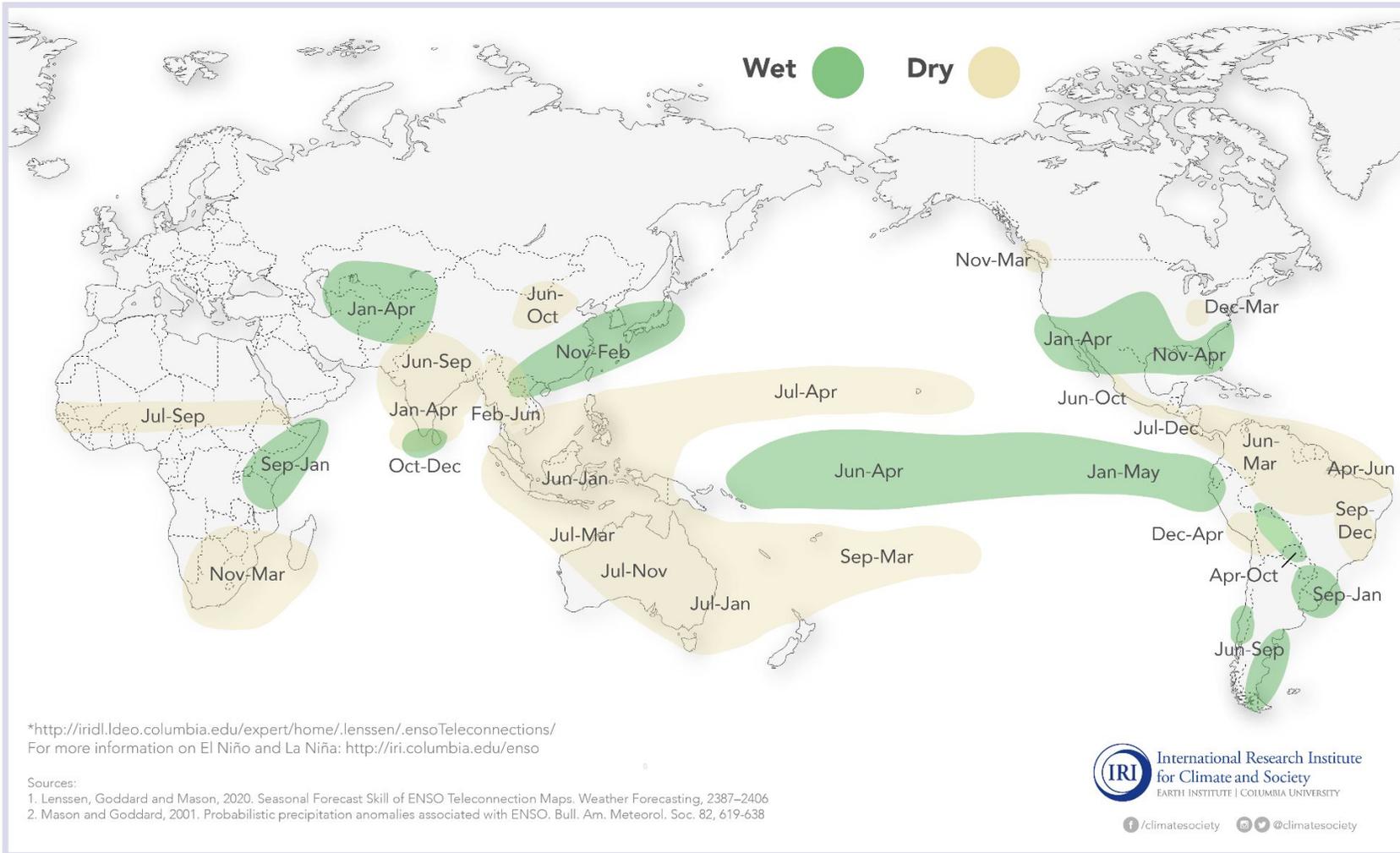
# I. Recent state of the climate

# Hurricane Melissa



# 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.



- Canonical **El Niño** impacts on rainfall patterns across the globe.
- For \*\*\* **drier** anomalies are expected in:
- **Wetter** anomalies are expected in:

# I. Recent state of the climate



## EUROPEAN STATE OF THE CLIMATE

### KEY EVENTS

Select an icon to find out more about specific events that characterised Europe in 2024

- Coldwave / snow
- Drought
- Flood
- Heatwave
- Marine Heatwave
- Storm
- Windstorm
- Wildfire
- Climate resilience initiatives

View as

MAP

TIMELINE



### Average daily surface air temperature for Europe

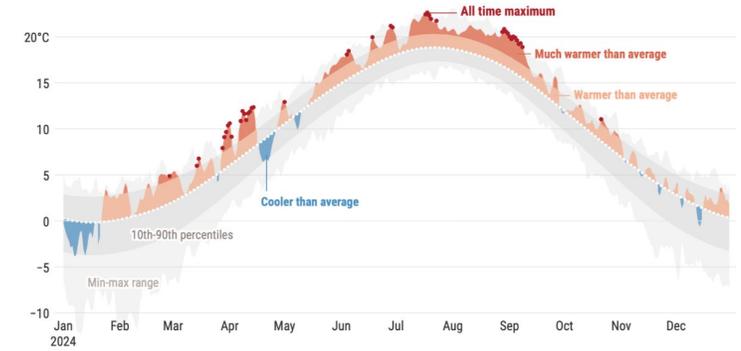


Figure 3.2. Average daily surface air temperature (°C) for European (as defined by C3S) land for 2024, showing warmer-than-average (orange shading), much-warmer-than-average (red shading) and all-time maximum (red dots) temperatures, and cooler-than-average (blue shading) temperatures, alongside the 10th and 90th percentiles (outside of which temperatures are considered to be much below/much above average) (grey shading) of the daily surface air temperature for 1991–2020 and the average (median, dashed line). Data: E-OBS. Credit: C3S/ECMWF/KNMI.

### Anomalies and extremes in monthly precipitation in 2024

Data: ERA5 (1979–2024) • Reference period: 1991–2020 • Credit: C3S/ECMWF

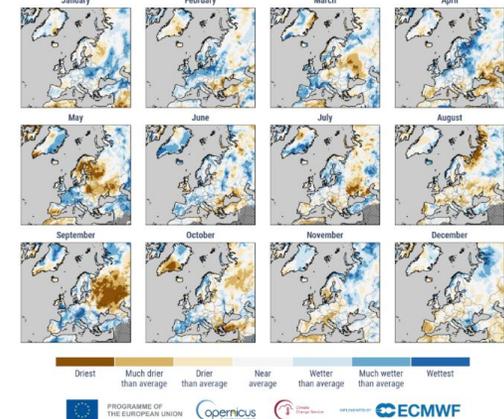
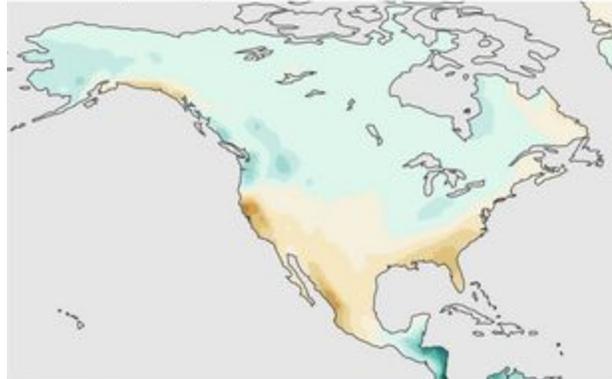


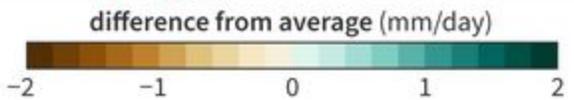
Figure 7.2a. Anomalies and extremes in monthly precipitation in 2024. The extreme categories ('wettest' and 'driest') are based on rankings for 1979–2024. The other categories describe how precipitation compares to the distribution during the 1991–2020 reference period. 'Much wetter/drier than average' - wetter/drier than 90% of precipitation values. 'Wetter/drier than average' - than 66% of precipitation values. 'Near average' - within the middle 33%. Data: ERA5. Credit: C3S/ECMWF.

# Winter 2024-25 precipitation forecast and verification

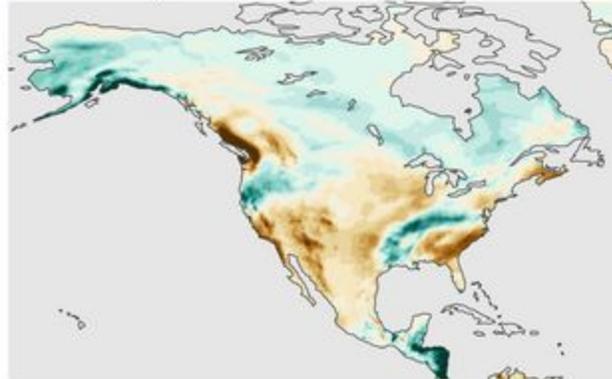
Forecast (NMME)



DJF 2024-25  
Base period 1991-2020

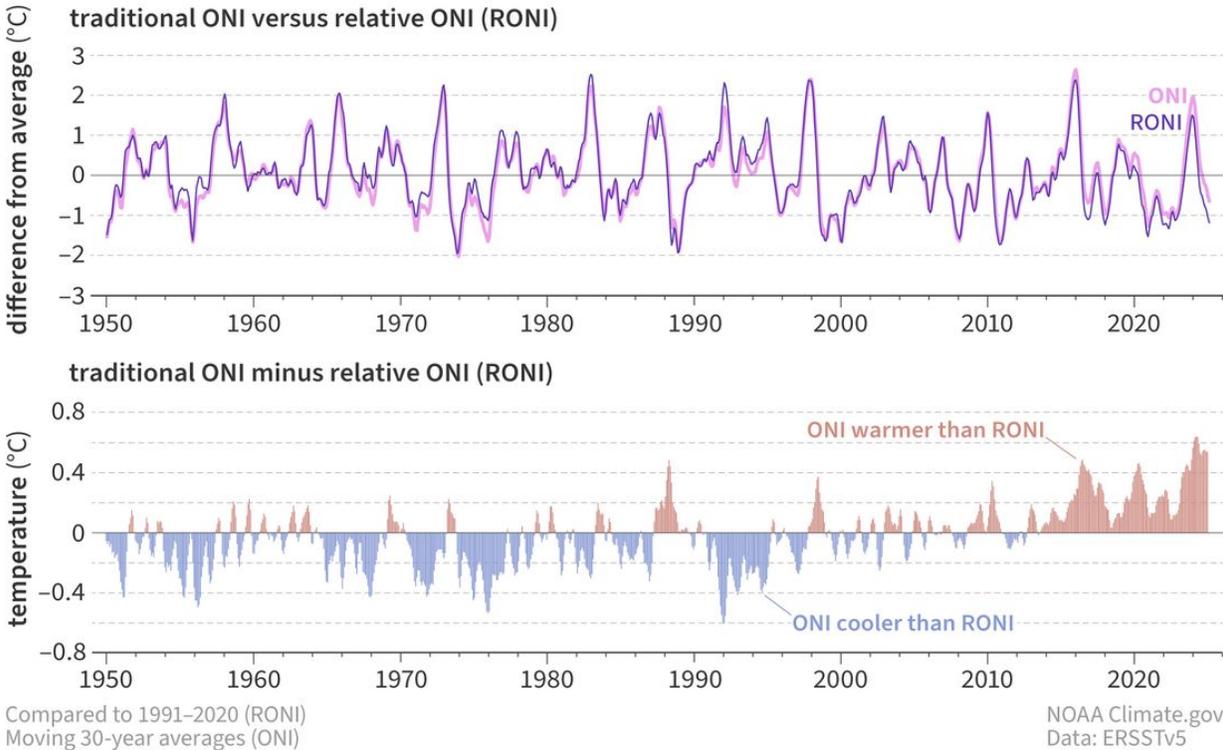


Verification (ERA5 Reanalysis)



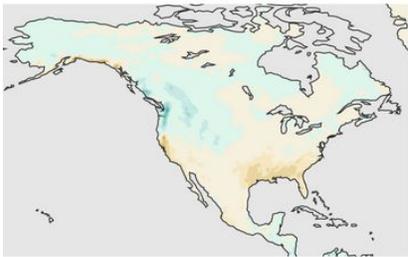
NOAA Climate.gov  
Data: NMME, ERA5 Reanalysis

# Traditional ENSO-monitoring index has been higher than relative index in recent years

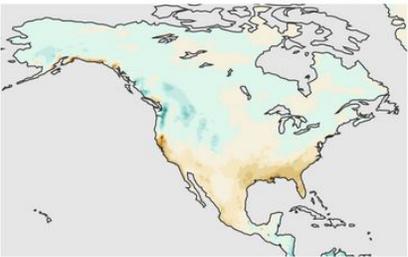


# Expected La Niña influence on the winter 2024-25 precipitation

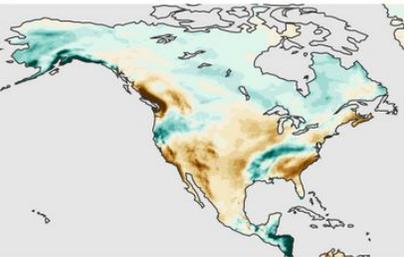
Pattern expected based on Niño-3.4 index (ONI)



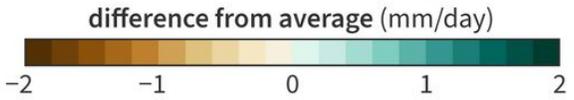
Pattern expected based on relative Niño-3.4 index (RONI)



Observed pattern (ERA5 Reanalysis)

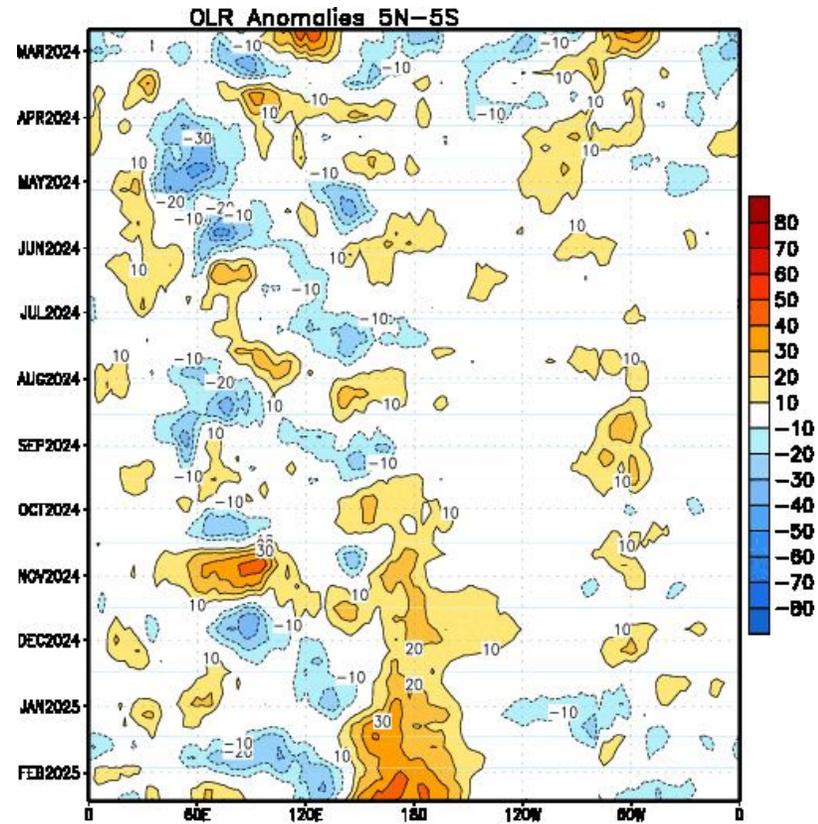
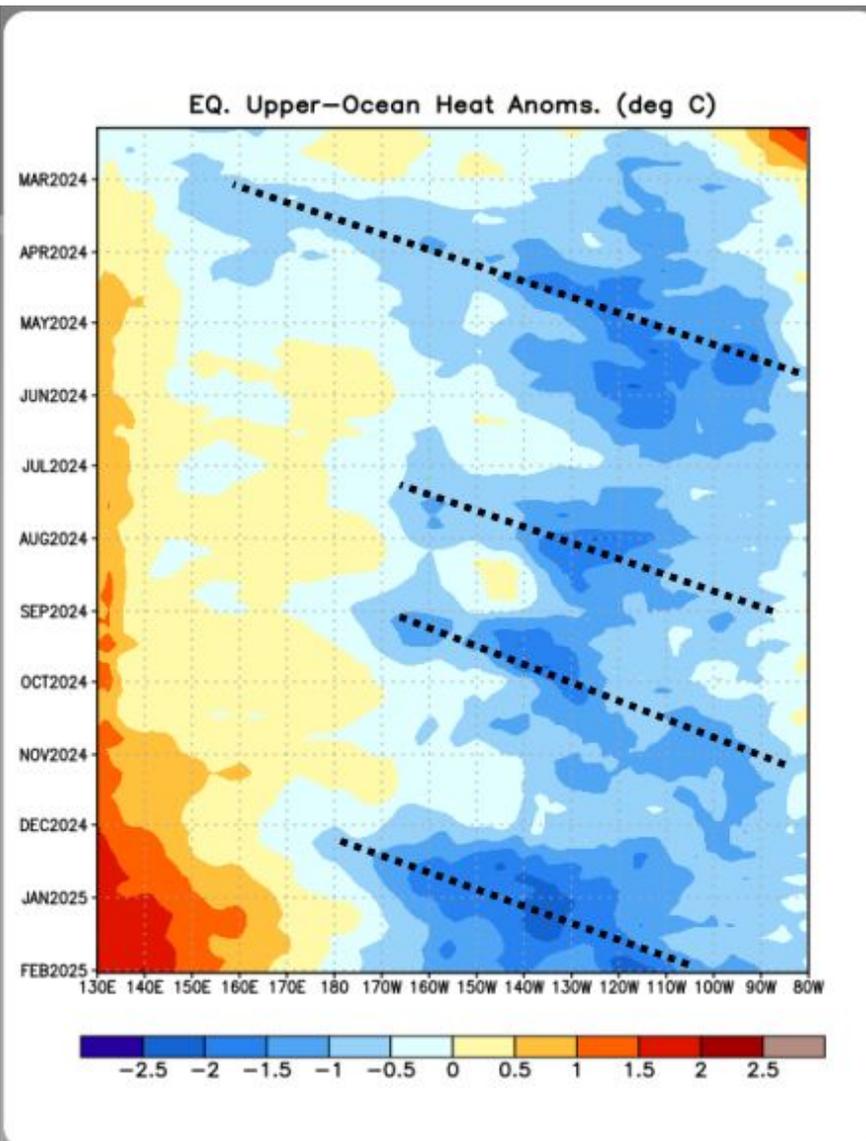


DJF 2024-25  
Base period 1991-2020



NOAA Climate.gov  
Data: ERA5 Reanalysis, ERSSTv5

- ONI has been consistently higher than RONI during the past 15 years (climate change signal).
- The observed anomaly pattern is much stronger than the one forecasted by NMME.



Data updated through 14 FEB 2025

CLIMATE PREDICTION CENTER/NCEP

Drier-than-average conditions (orange/red shading)

Wetter-than-average conditions (blue shading)

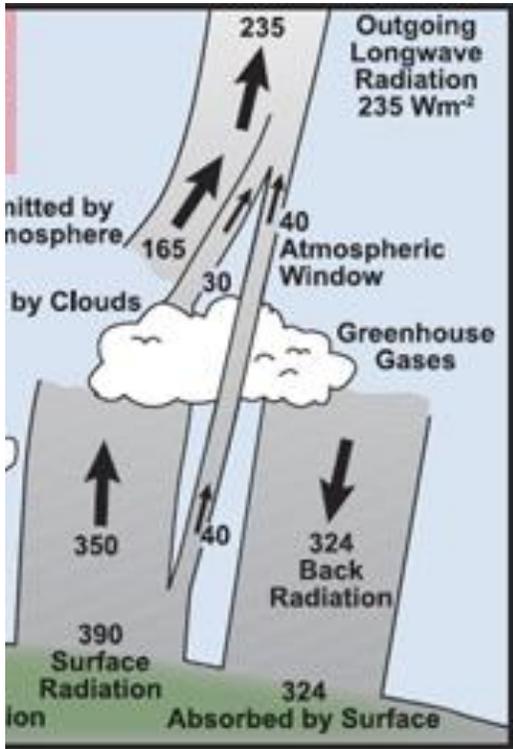
- Since mid-September 2024, positive OLR anomalies (suppressed convection/ rainfall) have persisted near the Date Line.
- Since early December 2024, negative OLR anomalies (enhanced convection/ rainfall) have emerged over Indonesia.

➤ Negative OLR anomalies:

**Enhanced convection =**

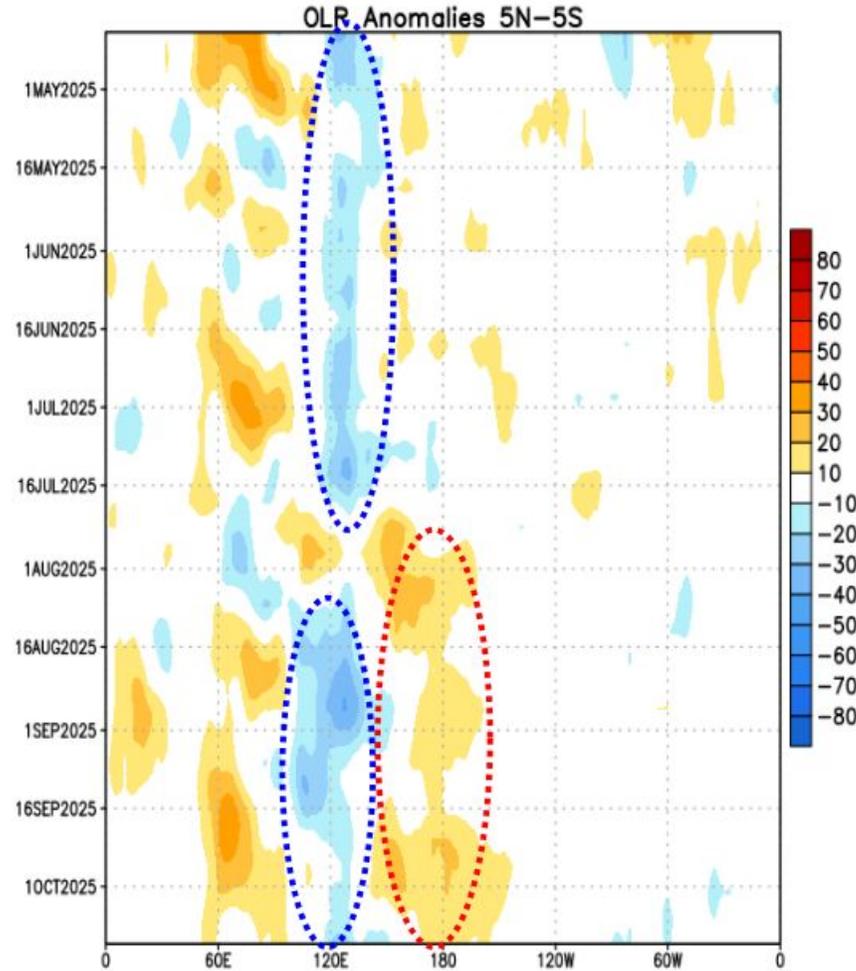
High and deep clouds =

Their top is cold and emits less emission of longwave radiation back to space.



➤ Positive OLR anomalies:

**Suppressed convection** over the central Pacific is associated with **La Niña**.



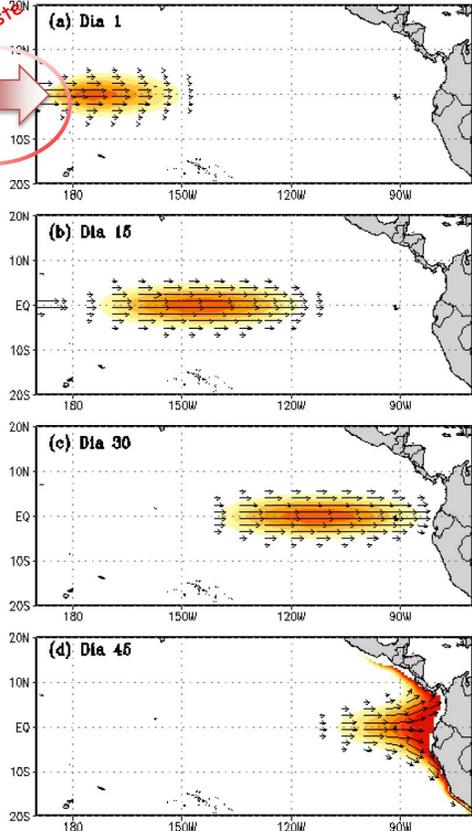
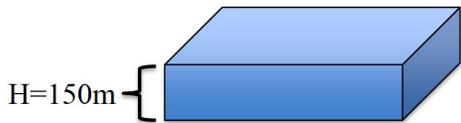
**Subsidence** (orange/red shading)  
Enhanced convection (blue shading)

# ¿Cómo se forma una onda Kelvin cálida?

Anomalia de viento del oeste  $\tau_x$

Simulación numérica de la propagación de una onda Kelvin Ecuatorial forzada por un pulso de viento del oeste ecuatorial centrado en 170°E durante 30 días con un pico máximo en el día 15.

Océano de profundidad H

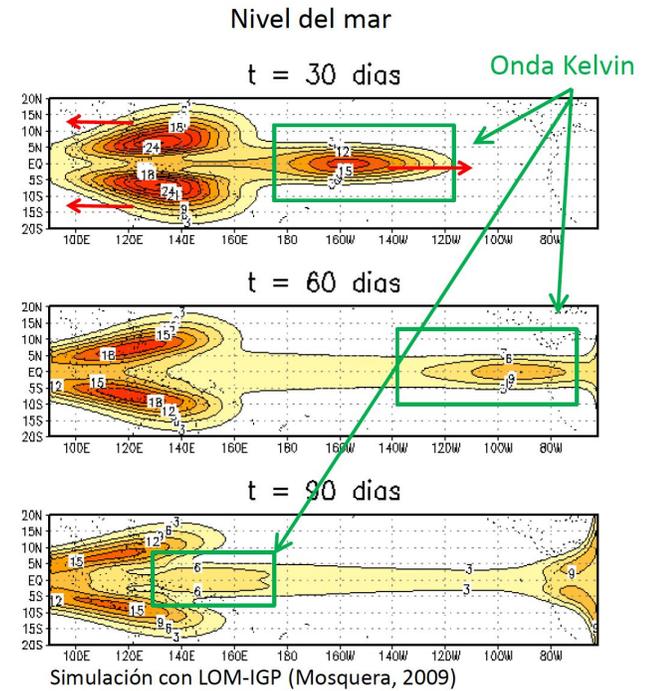
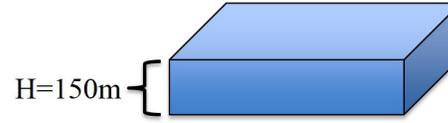


Mosquera (2014)

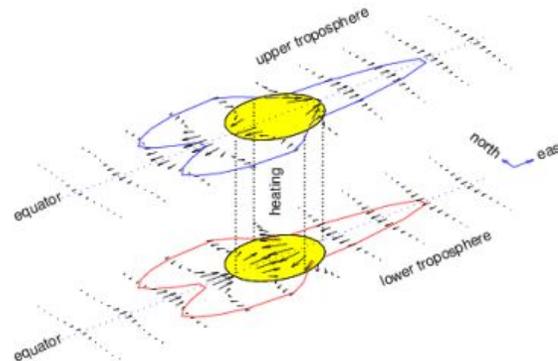
# ¿Cómo se forma una onda Kelvin cálida?

Como consecuencia de la reflexión de la onda Rossby en la frontera occidental

Océano de profundidad H

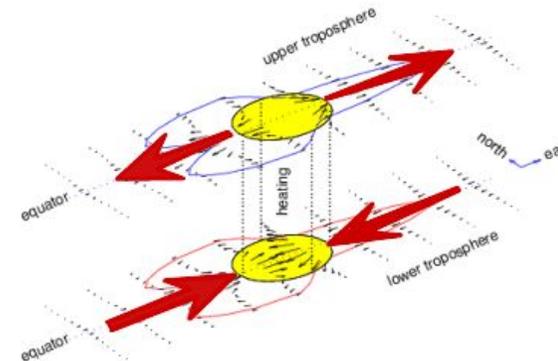


Two-Layer Model of Equatorial Heating

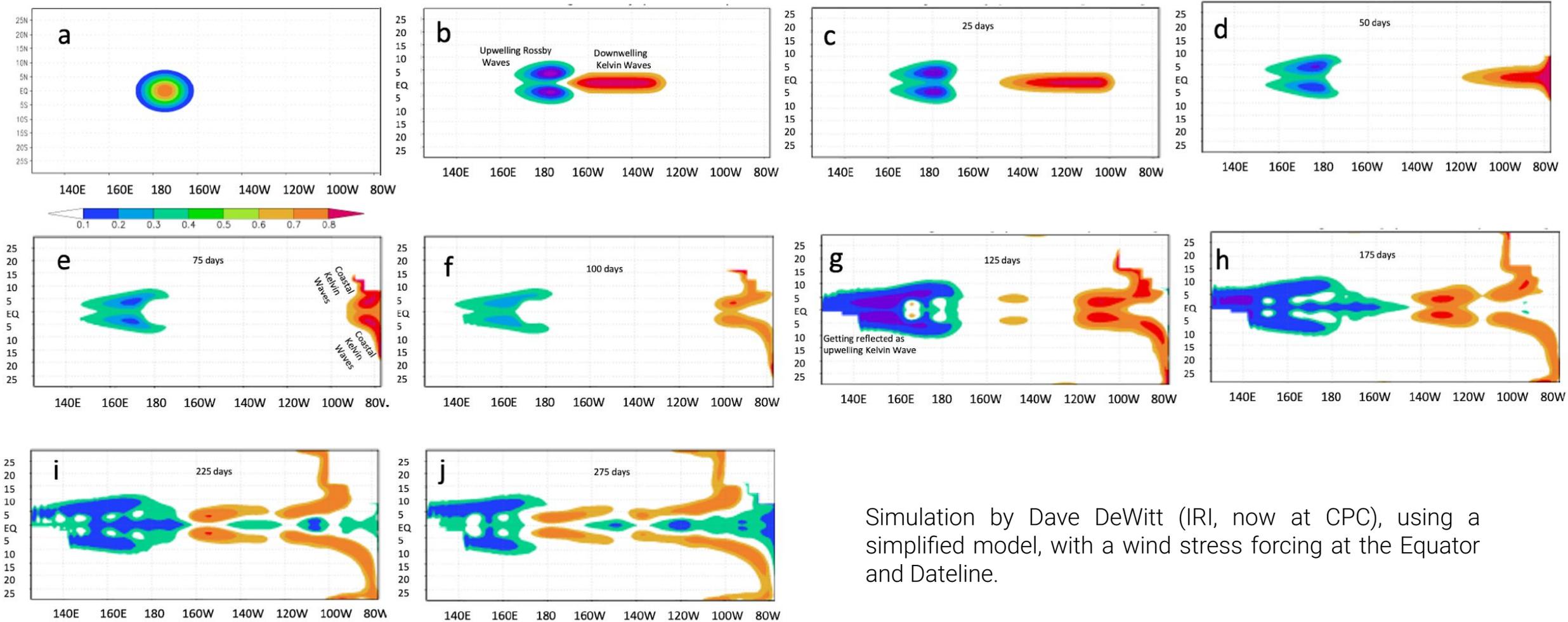


Gill, 1980: Q

Two-Layer Model of Equatorial Heating

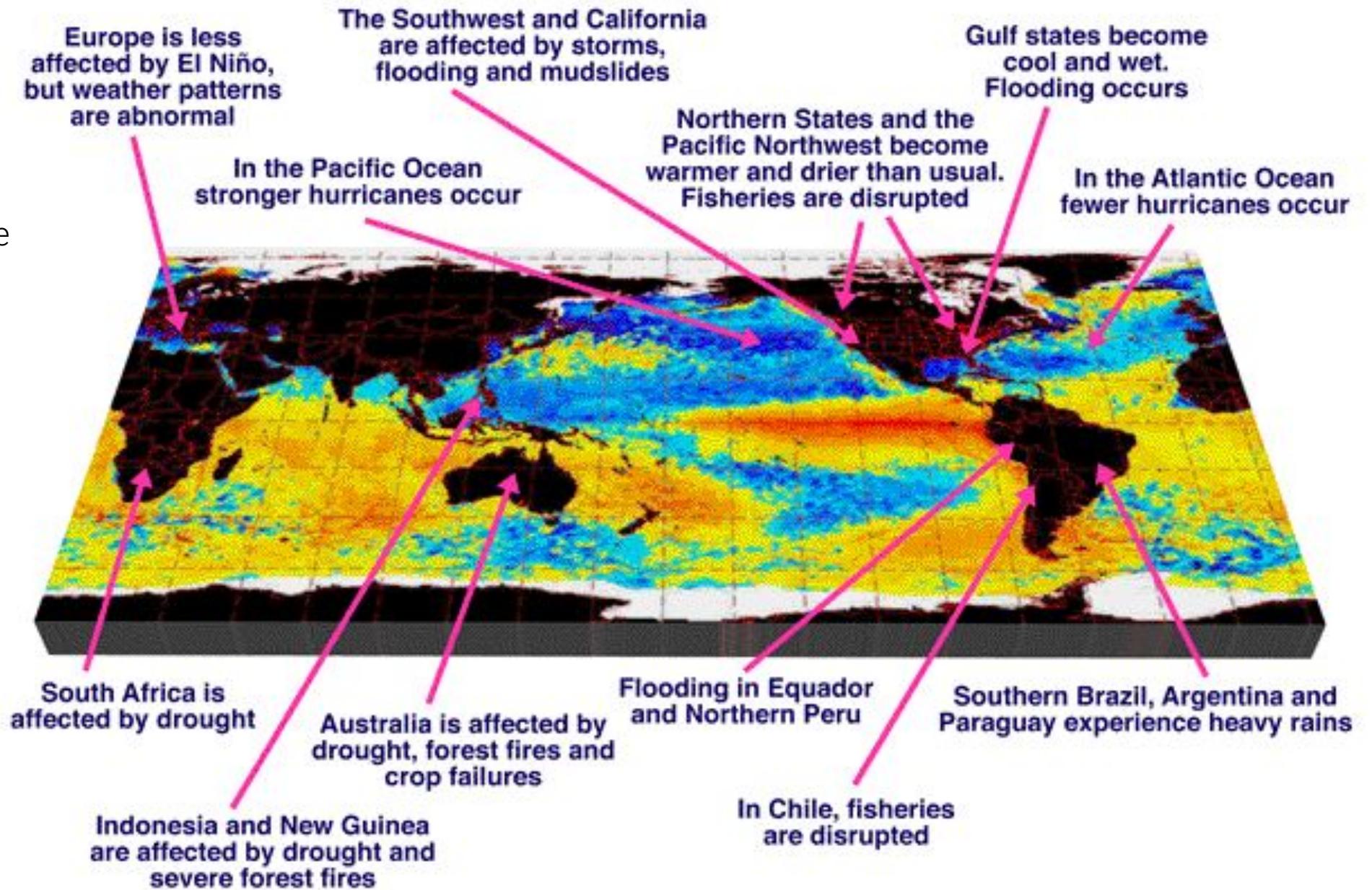


Gill, 1980: QJRMS



Simulation by Dave DeWitt (IRI, now at CPC), using a simplified model, with a wind stress forcing at the Equator and Dateline.

➤ Canonical El Niño impacts across the globe.

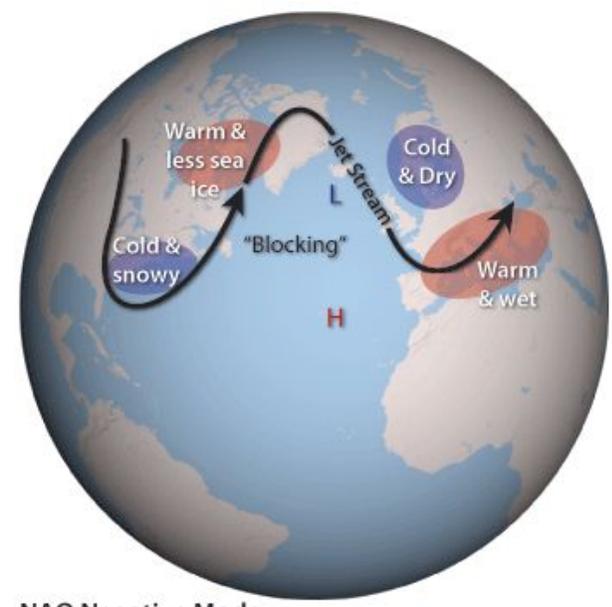
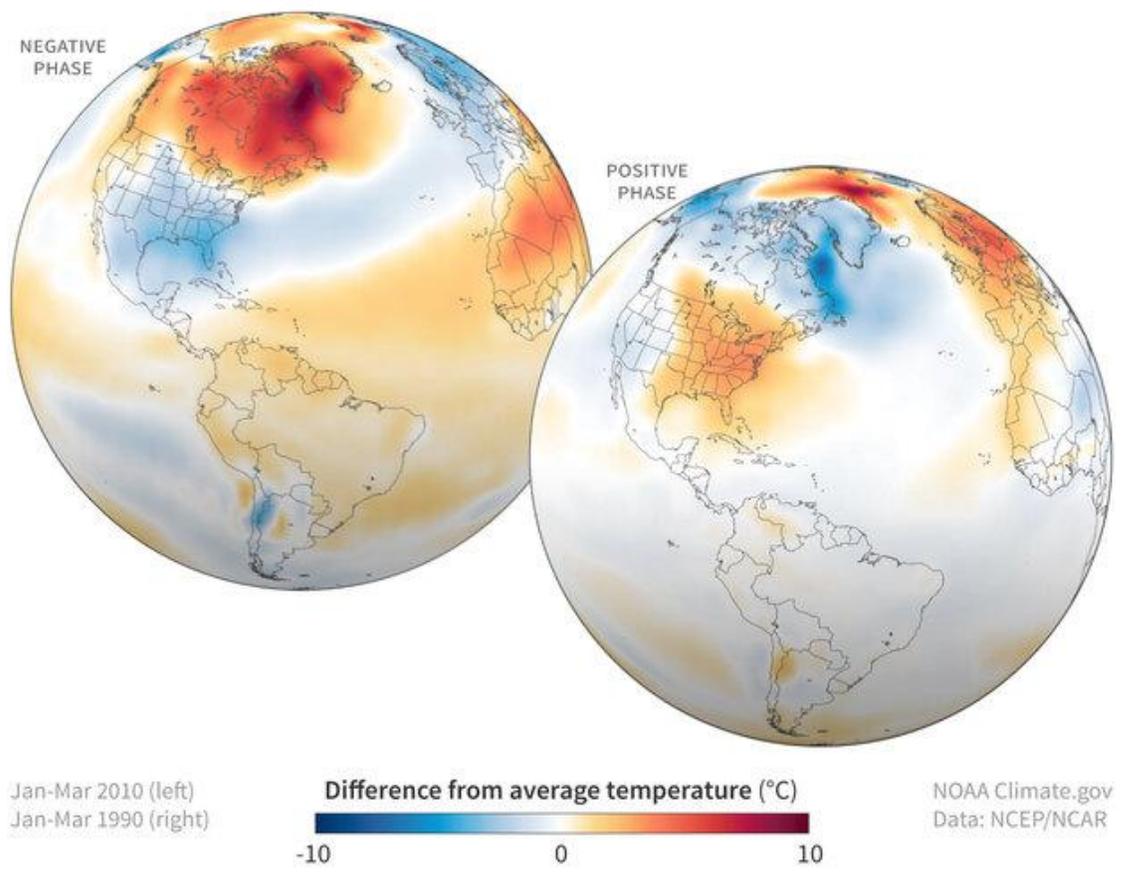


# I. Recent state of the climate

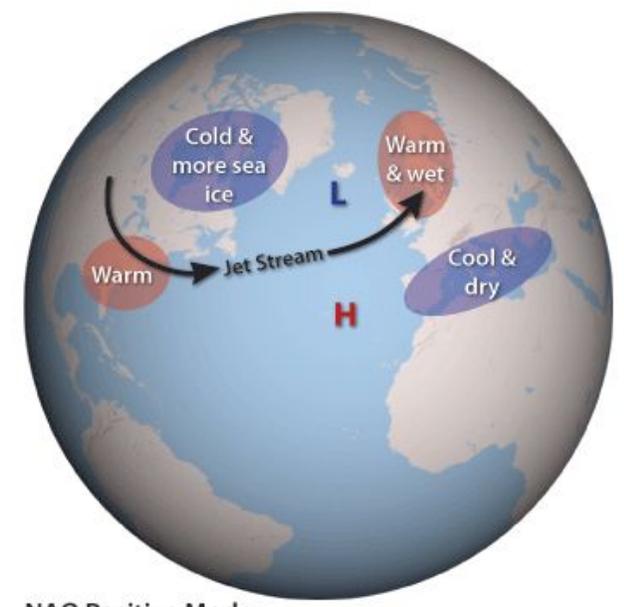
## North Atlantic Oscillation (NAO)

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

### NAO TEMPERATURE PATTERNS

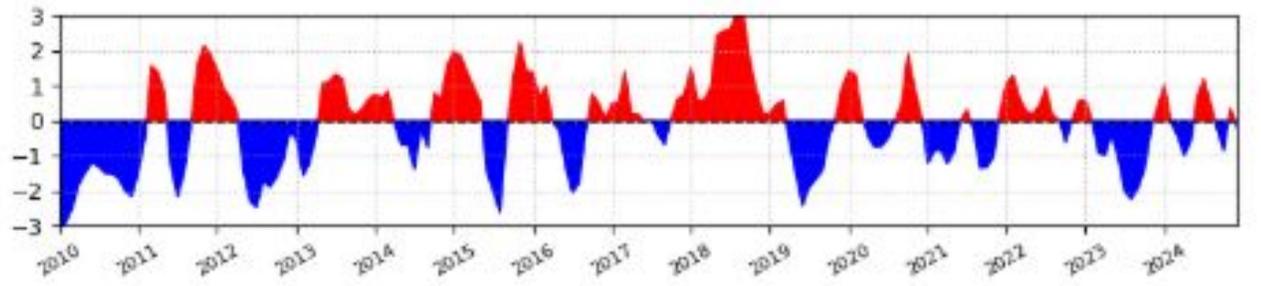


NAO Negative Mode



NAO Positive Mode

**NAO index:** Standardized 3-month Running Mean Index (through Jan 2025)



Source: [https://www.cpc.ncep.noaa.gov/data/teledoc/nao\\_ts.shtml](https://www.cpc.ncep.noaa.gov/data/teledoc/nao_ts.shtml)

# Summary of teleconnections

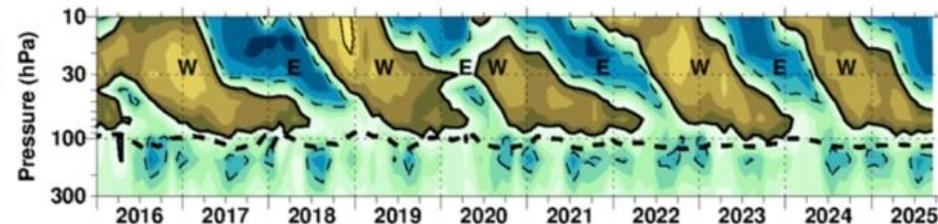
## • Positive NAO

- La Niña conditions  
→ Increases the likelihood of westerly winds in late winter
- MJO (sub-seasonal, early-mid November)

## • Negative NAO

- La Niña conditions  
→ Decreases the likelihood of westerly winds in early winter
- Quasi-biennial Oscillation (QBO) in easterly phase  
→ Increased chance of a weaker stratospheric polar vortex  
→ Increases the likelihood of sudden stratospheric warmings

## QBO Observations

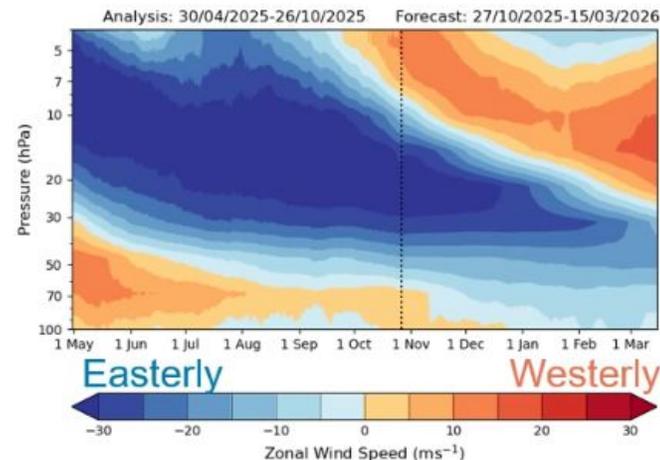


Paul A. Newman, Larry Coy, Leslie R. Lait (NASA/GSFC) Thu Oct 2 16:20:52 2025

[https://acd-ext.gsfc.nasa.gov/Data\\_services/met/qbo/qbo.html#uwind](https://acd-ext.gsfc.nasa.gov/Data_services/met/qbo/qbo.html#uwind)

## QBO Predictions

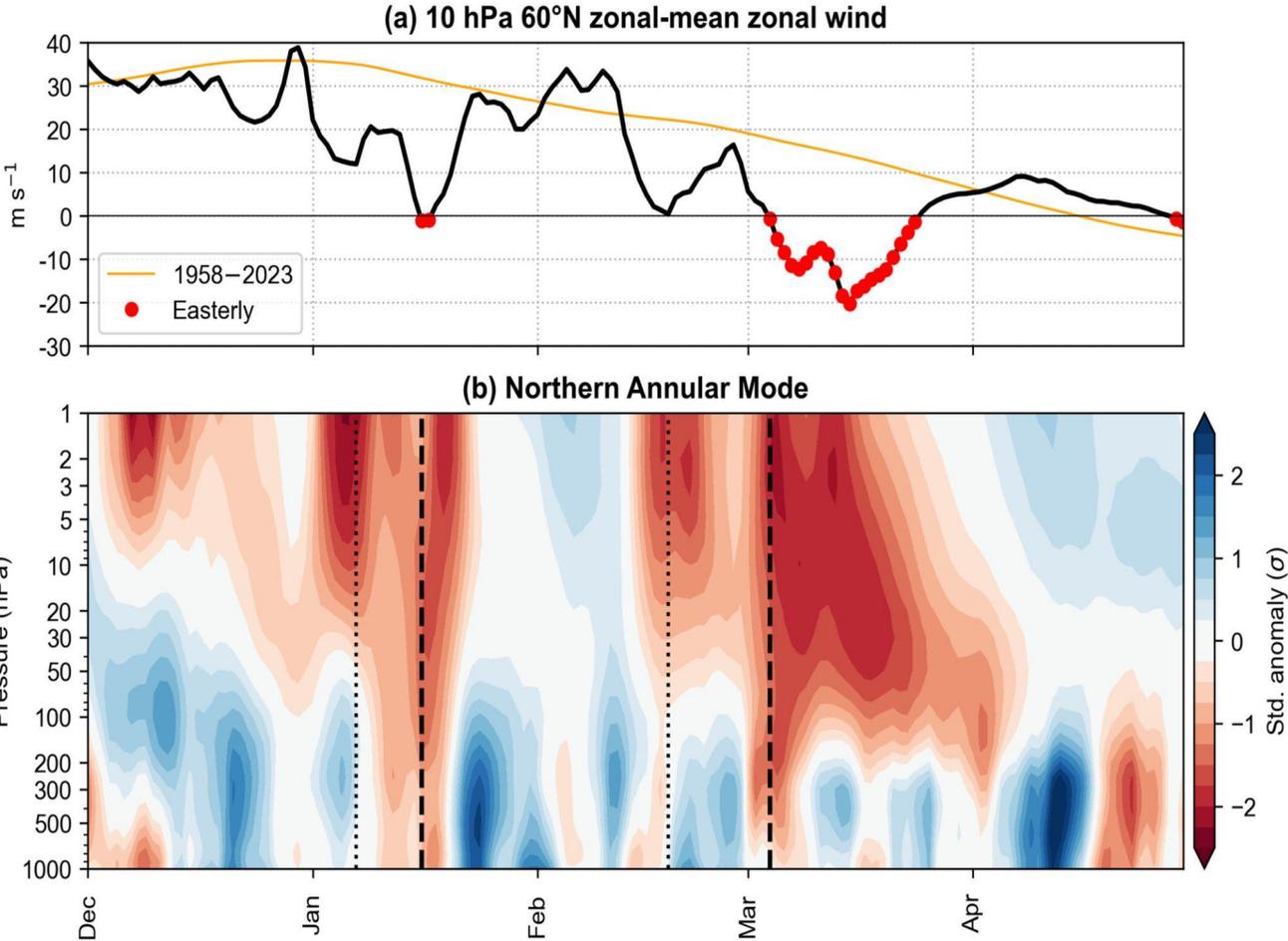
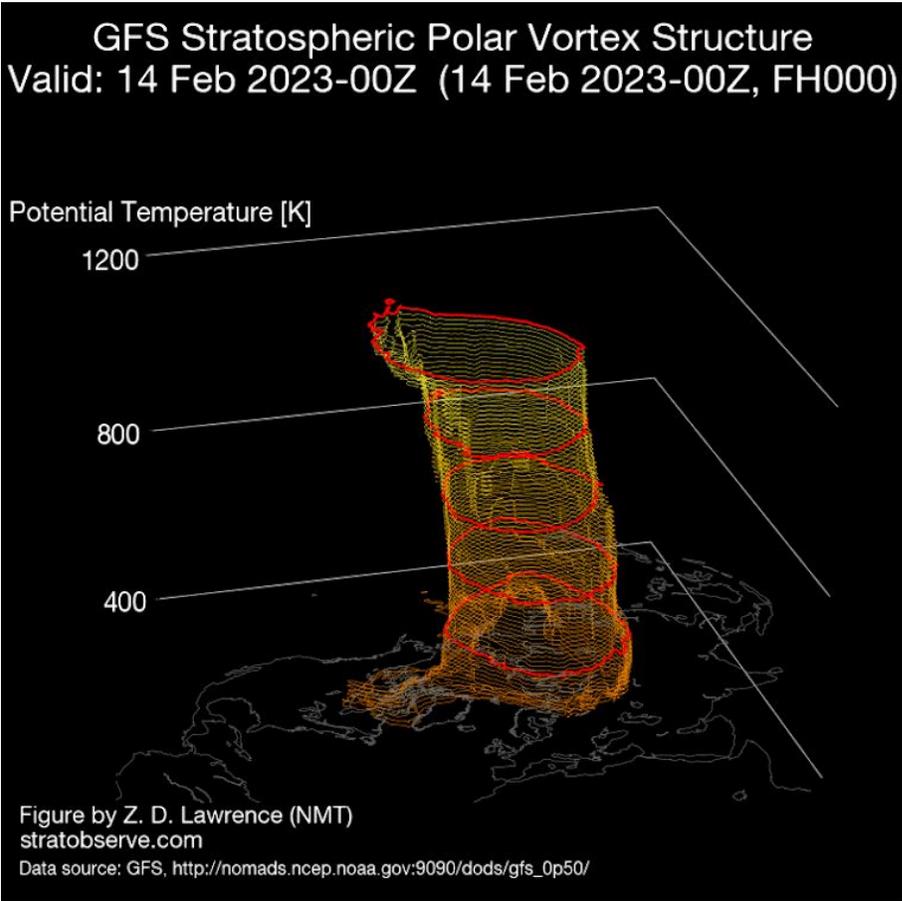
Zonal Mean Zonal Wind Speed At Equator



# I. Recent state of the climate

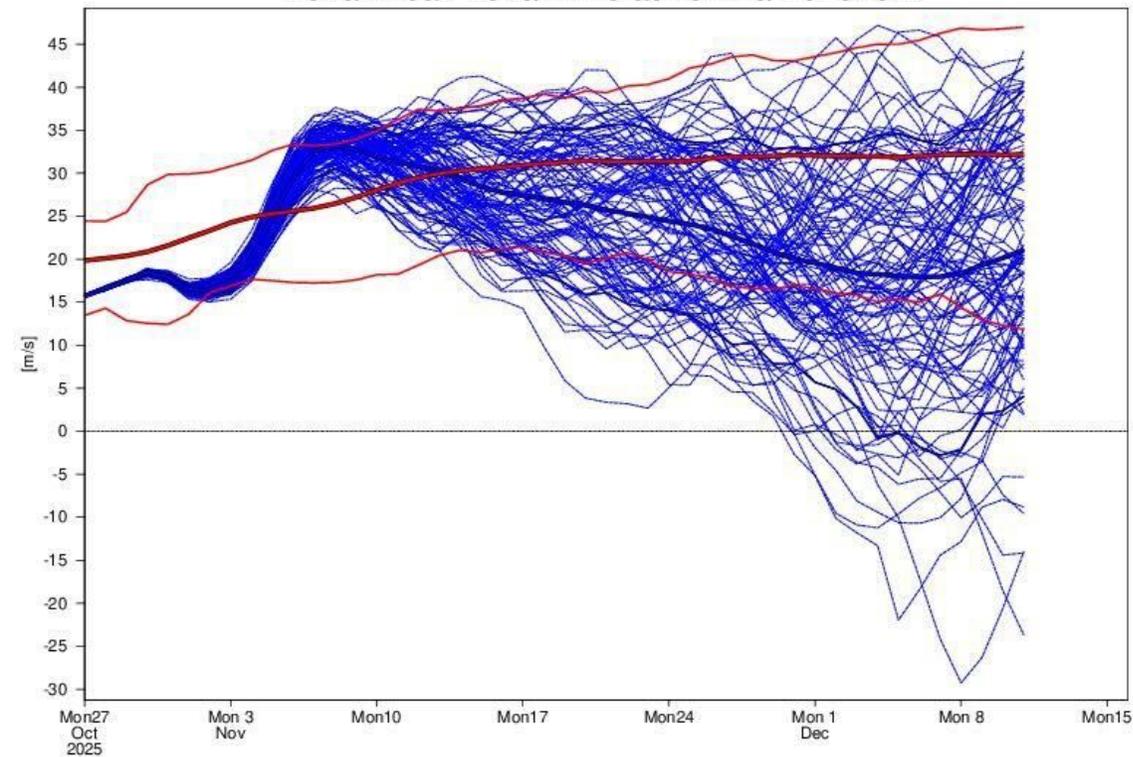
## Sudden stratospheric warmings (SSWs)

➤ A sudden stratospheric warming can reach the surface and drive very cold anomalies in northern Europe.



# I. Stratosphere (N. Hemisphere)

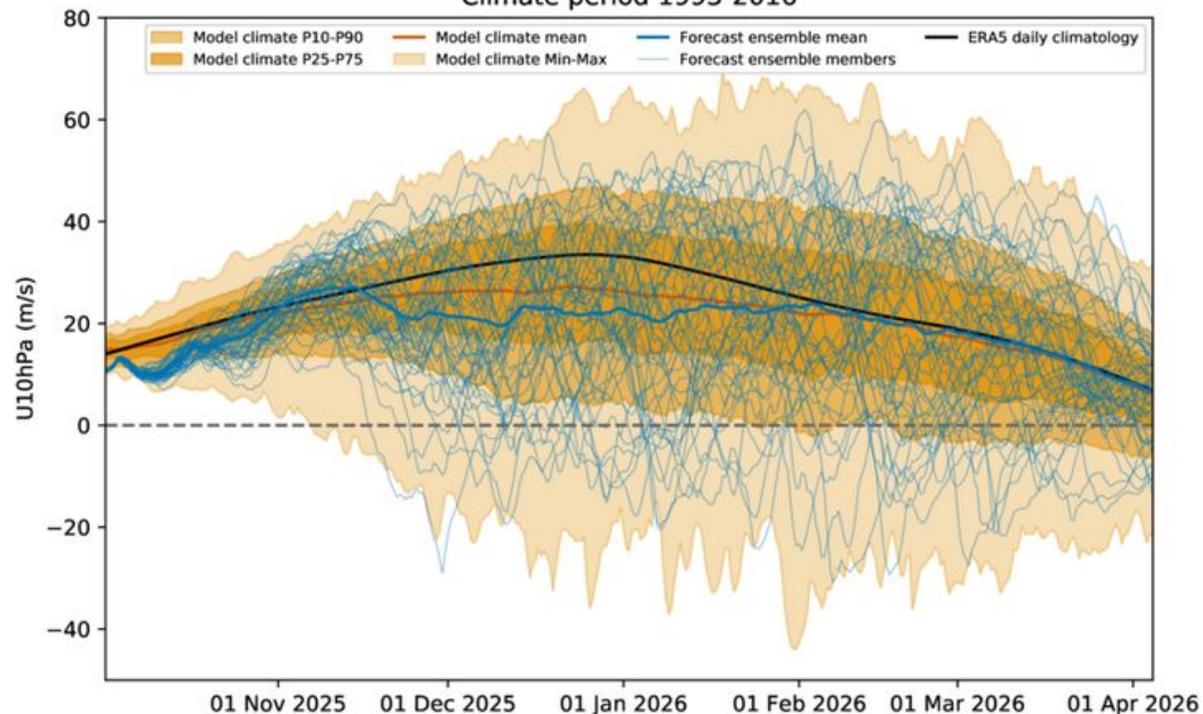
Zonal mean zonal wind at 10 hPa 20251027



Seasonal (source Copernicus)

Sub-seasonal (source ECMWF)

Zonal mean U10hPa at 60N  
C3S: ECMWF contribution from 1 Oct 2025  
Climate period 1993-2016



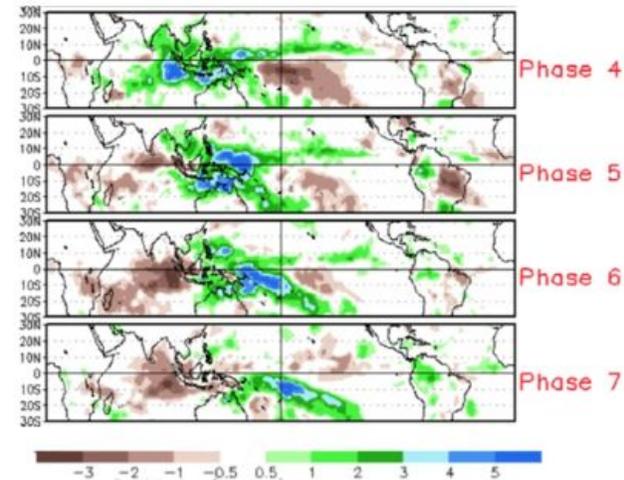
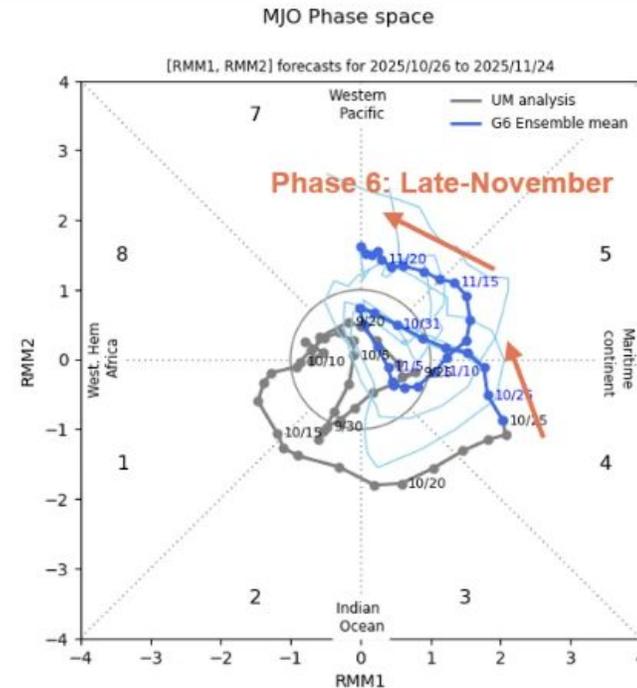
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