Madden-Julian Oscillation:
Recent Evolution, Current Status and Predictions

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
21 April 2025

Overview

- The MJO remained weak during mid-April.

- RMM-based forecasts differ between the GEFS and ECMWF ensemble means. Many of the GEFS ensemble members depict a strengthening MJO propagating east over the Western Hemisphere during the next two weeks and shifting back to the Indian Ocean by mid-May. However, the ECMWF model maintains a weak MJO into early May.

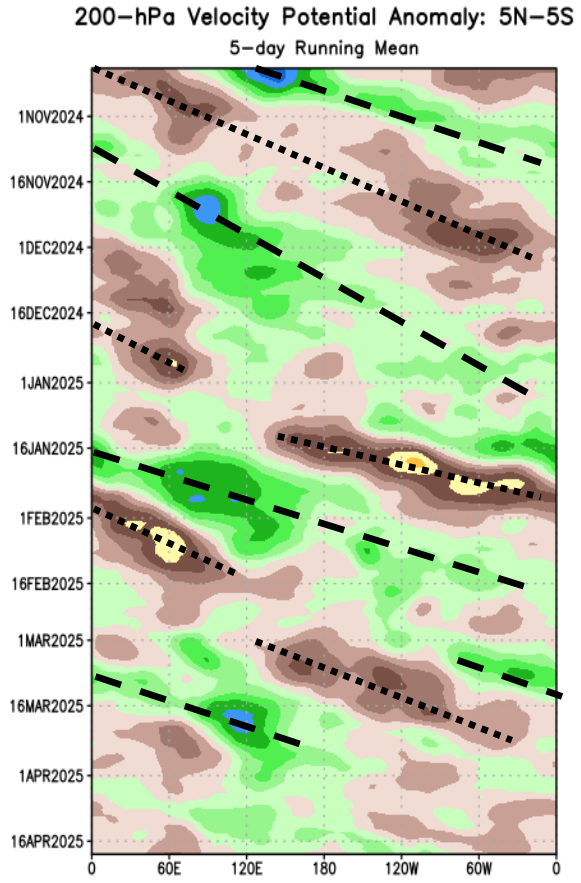
- If the MJO gains amplitude and propagates eastward over the Western Hemisphere during the next two weeks, then the large-scale environment would become more favorable for an early season tropical cyclone in the East Pacific.

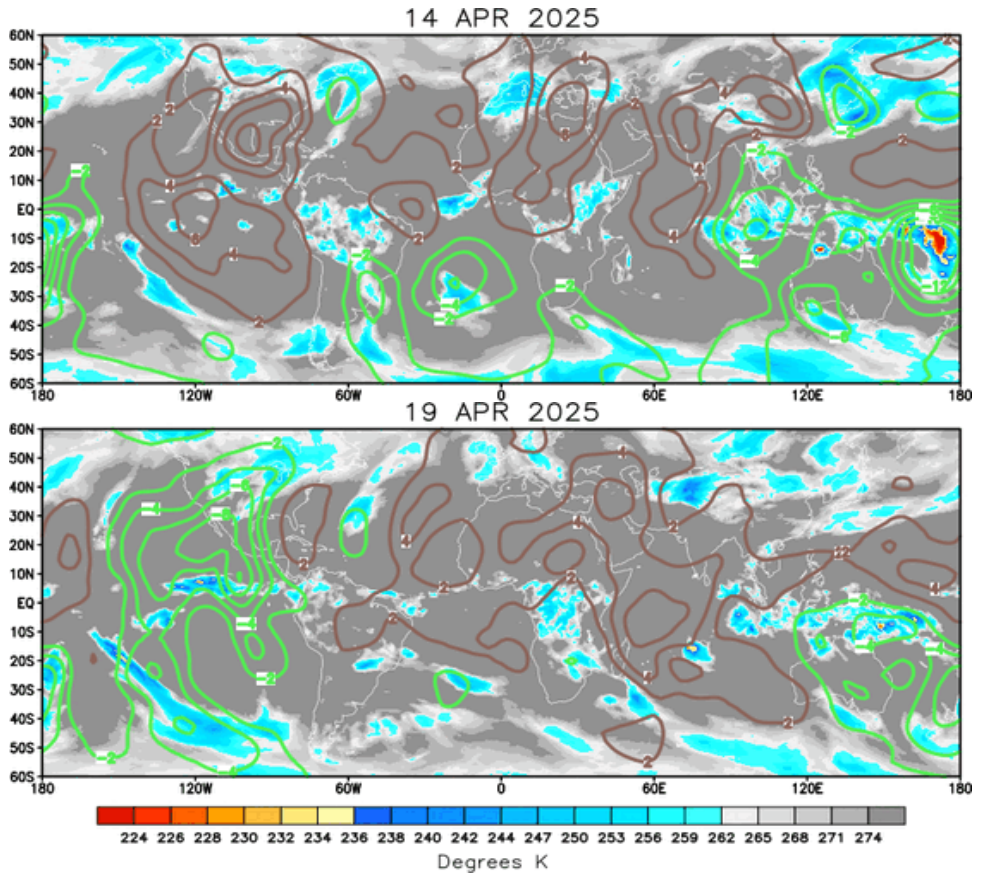
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

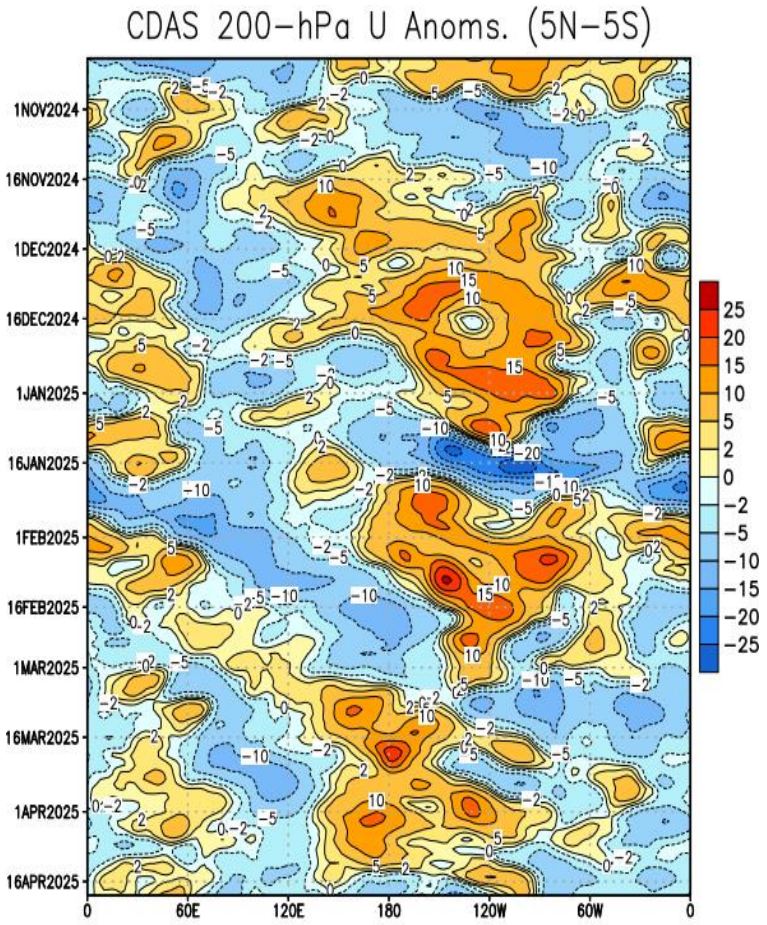


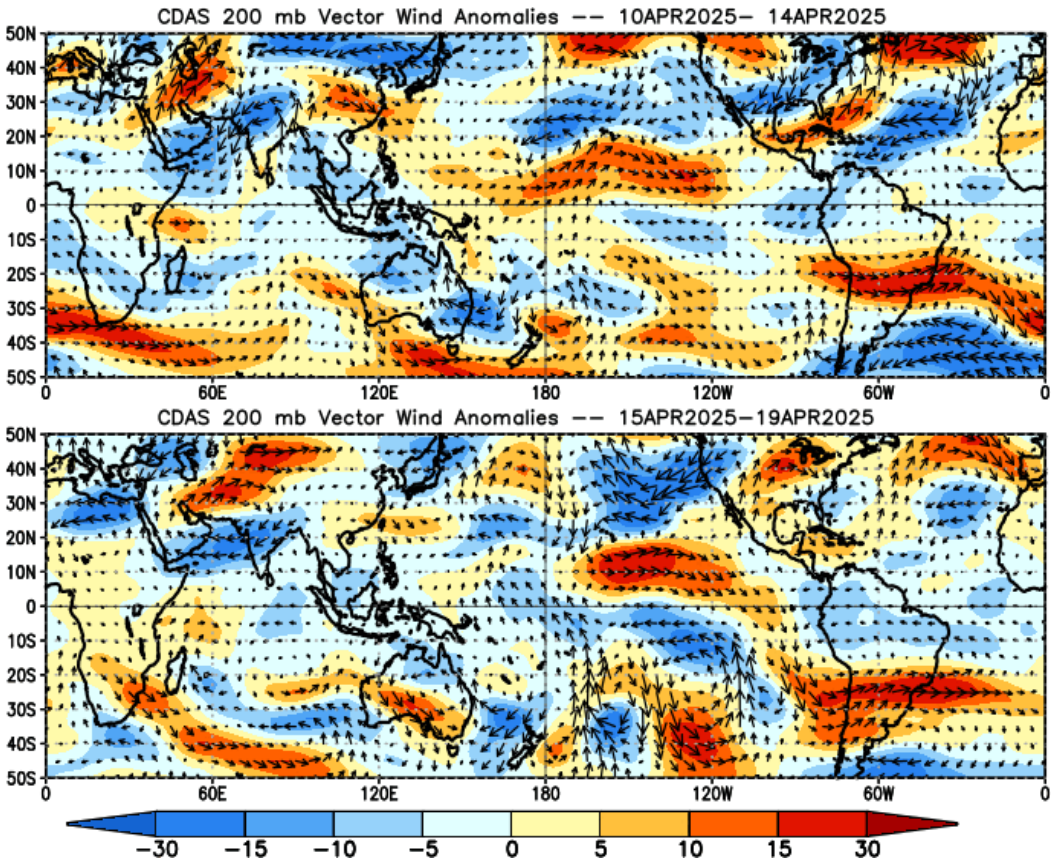


- The spatial pattern of 200-hPa velocity potential anomalies was incoherent during mid-April as the MJO remained weak.
- On April 19th, the areas of upper-level divergence located over the East Pacific seems to be related to a Kelvin wave.

200-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

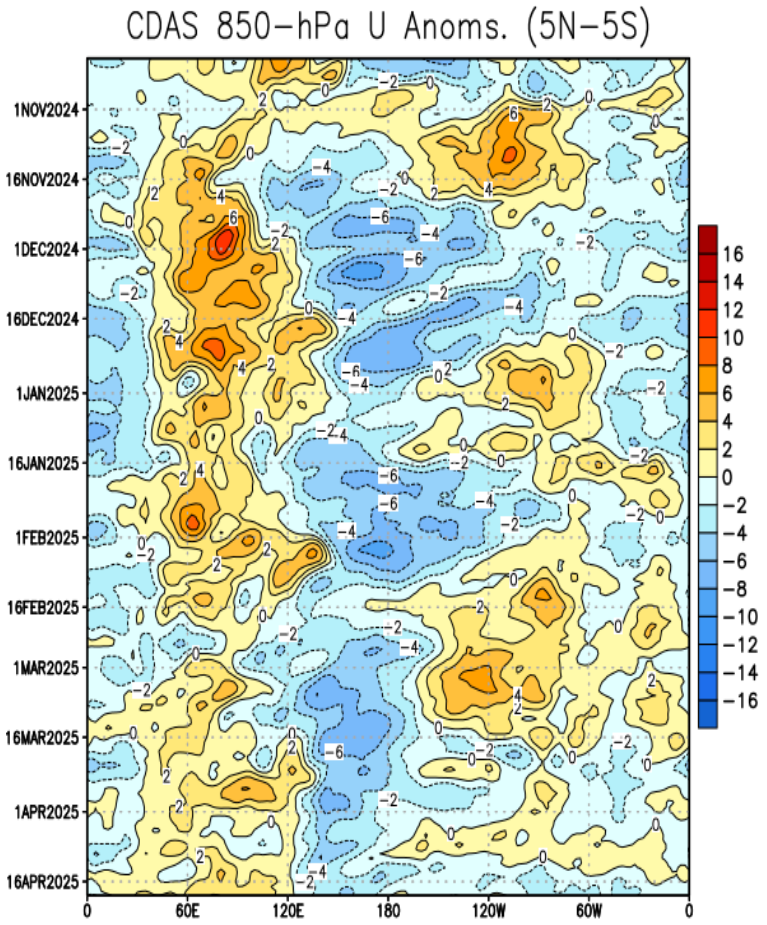


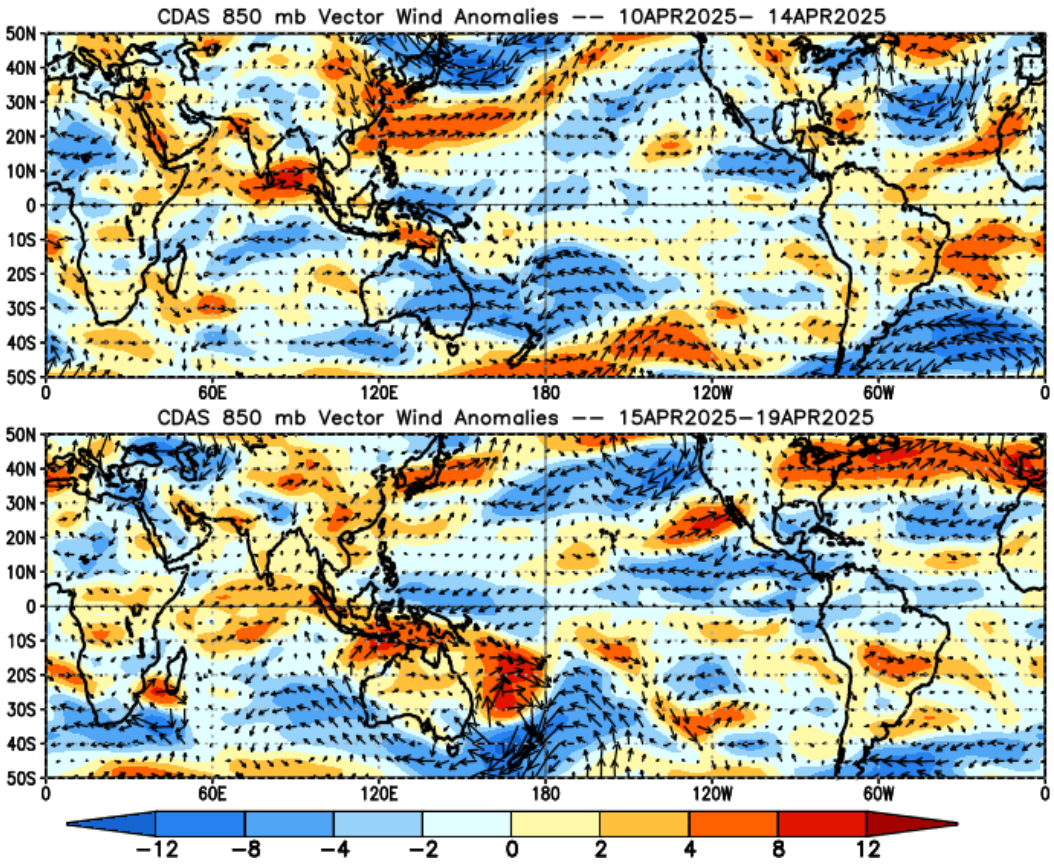


- Recently, the persistent area of anomalous upper-level westerlies across the equatorial central Pacific became easterlies which is another sign of the transition to ENSO-neutral conditions.
- To the north of the equator across the East Pacific, strong westerly anomalies persist.

850-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

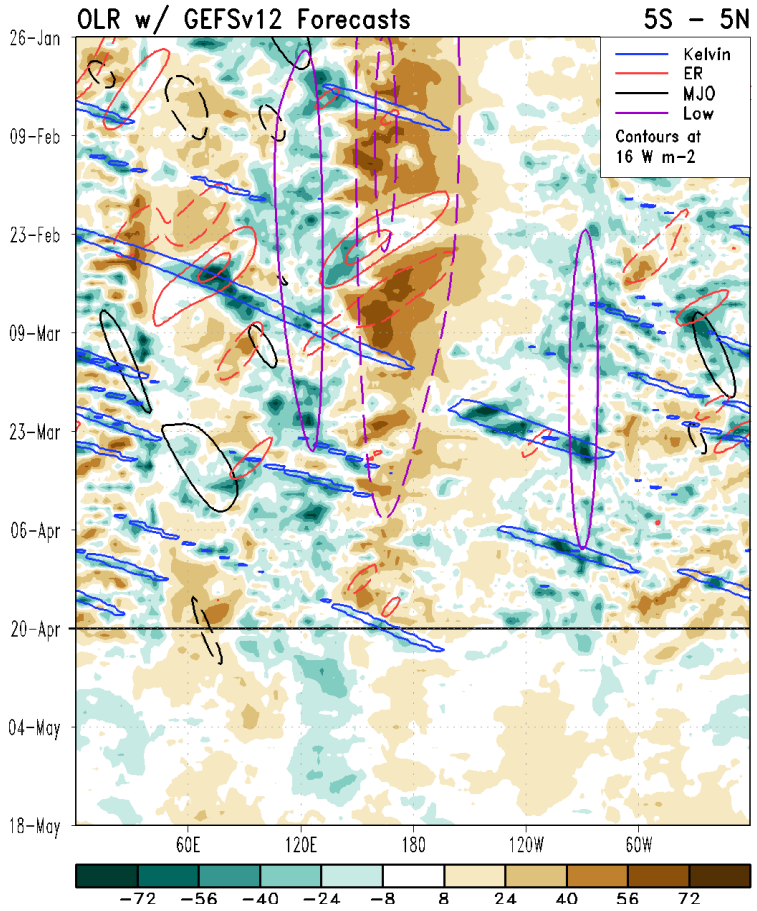


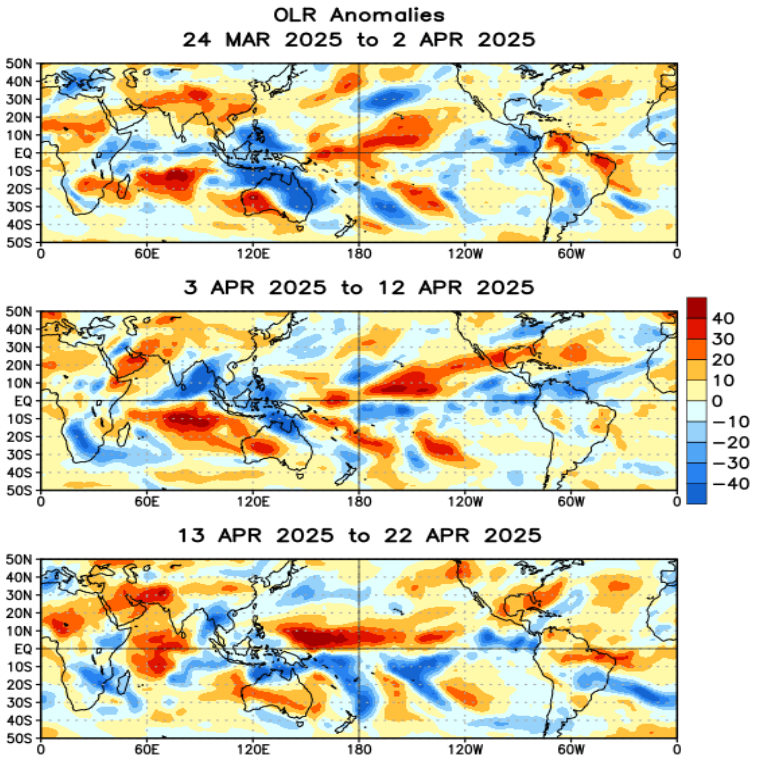


- The low-level wind pattern generally remains stationary due to little tropical forcing (MJO or ENSO), with extratropical activity dominating.
- Enhanced trades remain across the equatorial west Pacific but these continue to weaken.
- Following a brief period (April 10-14) of anomalous northerly low-level winds across the Great Plains, average or anomalous low-level southerlies have returned.

Outgoing Longwave Radiation (OLR) Anomalies

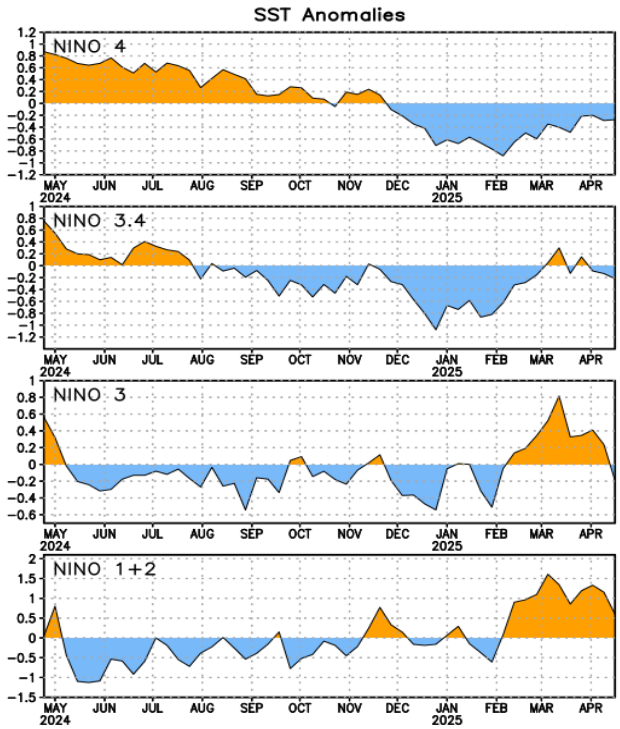
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

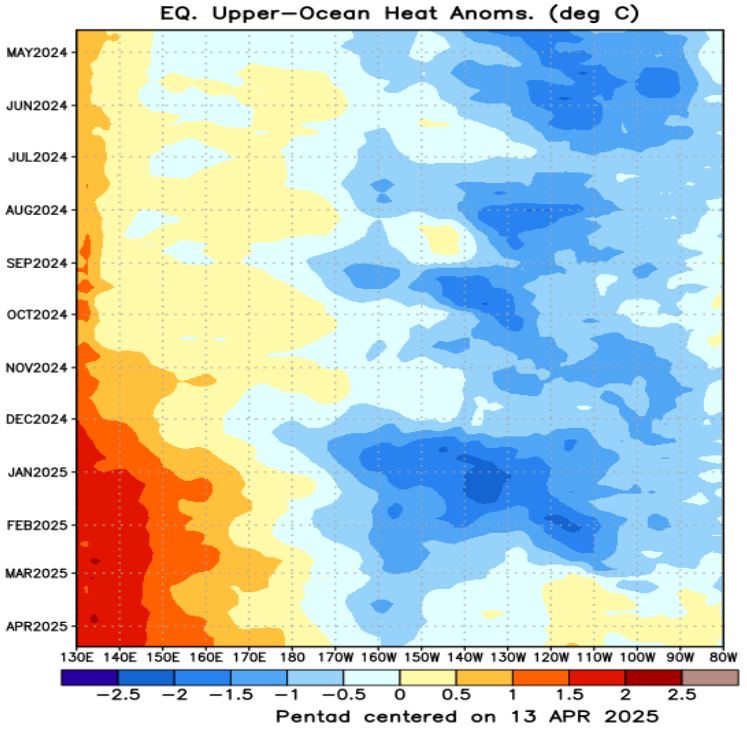




- From late March to mid-April, suppressed convection extends from the south-central Pacific through the southern U.S. which is consistent with a continued response from La Niña.
- In addition, enhanced convection persists over the Maritime Continent.
- There is little signal in the OLR forecasts from the GEFS beyond low-frequency features.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

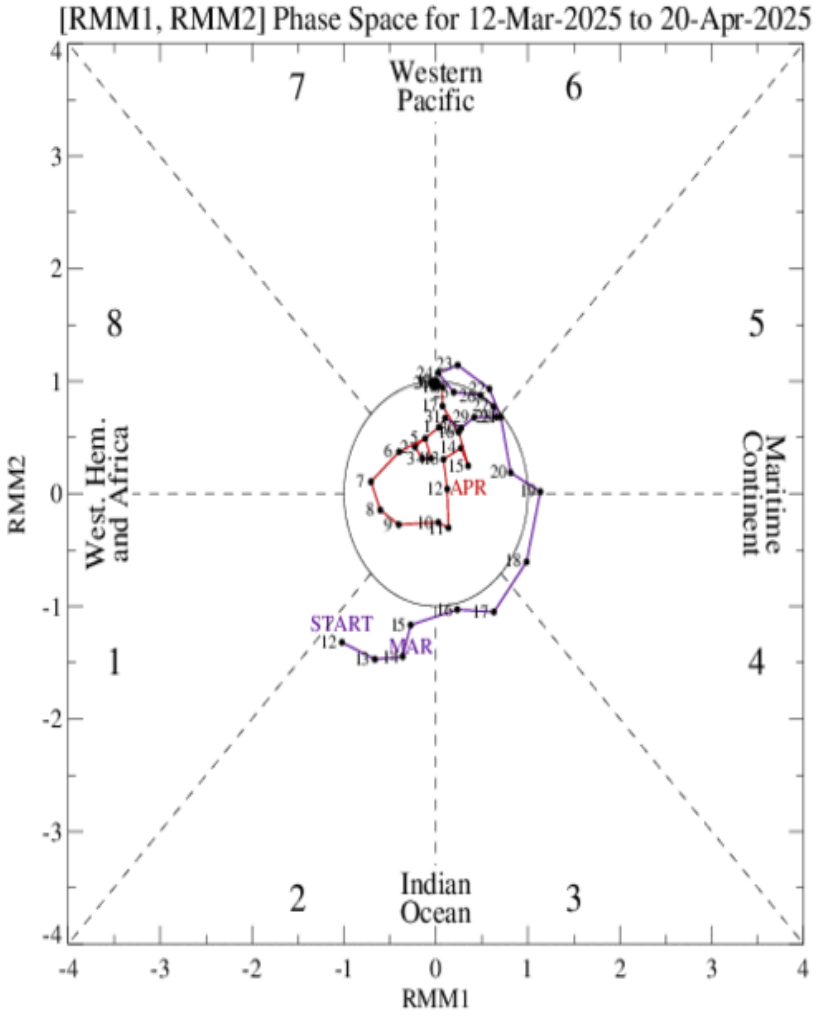




- SST anomalies in Niño 3.4 region remain variable and near zero, consistent with the transition to ENSO-neutral conditions.
- Subsurface negative temperature anomalies continue to weaken across the central and eastern Pacific, with positive anomalies emerging east of 120°W, along with strong positive SST anomalies in the NINO 3 and NINO 1+2 regions.
- Large subsurface positive temperature anomalies remain established west of the Date Line.

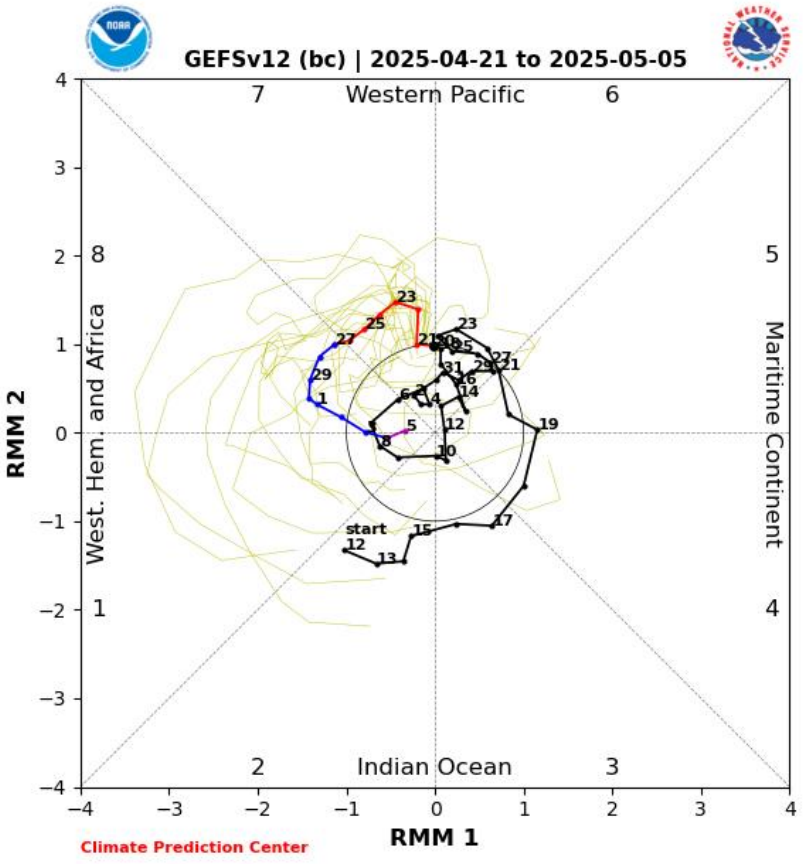
MJO Index: Recent Evolution

- The MJO signal is non-existent, with the RMM-based index meandering within the unit circle since late March.

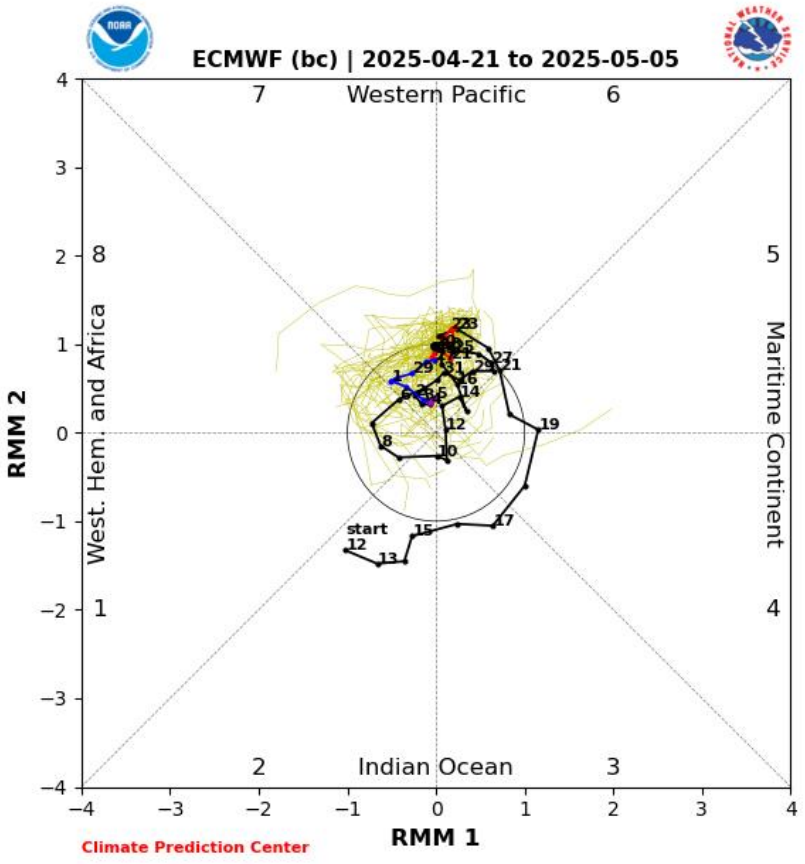


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

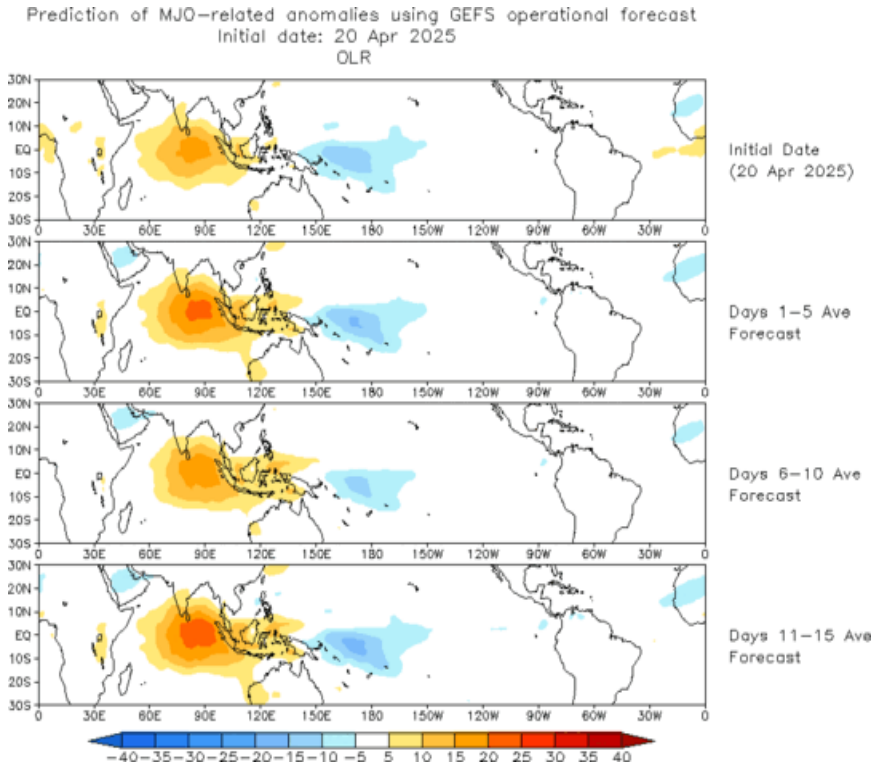


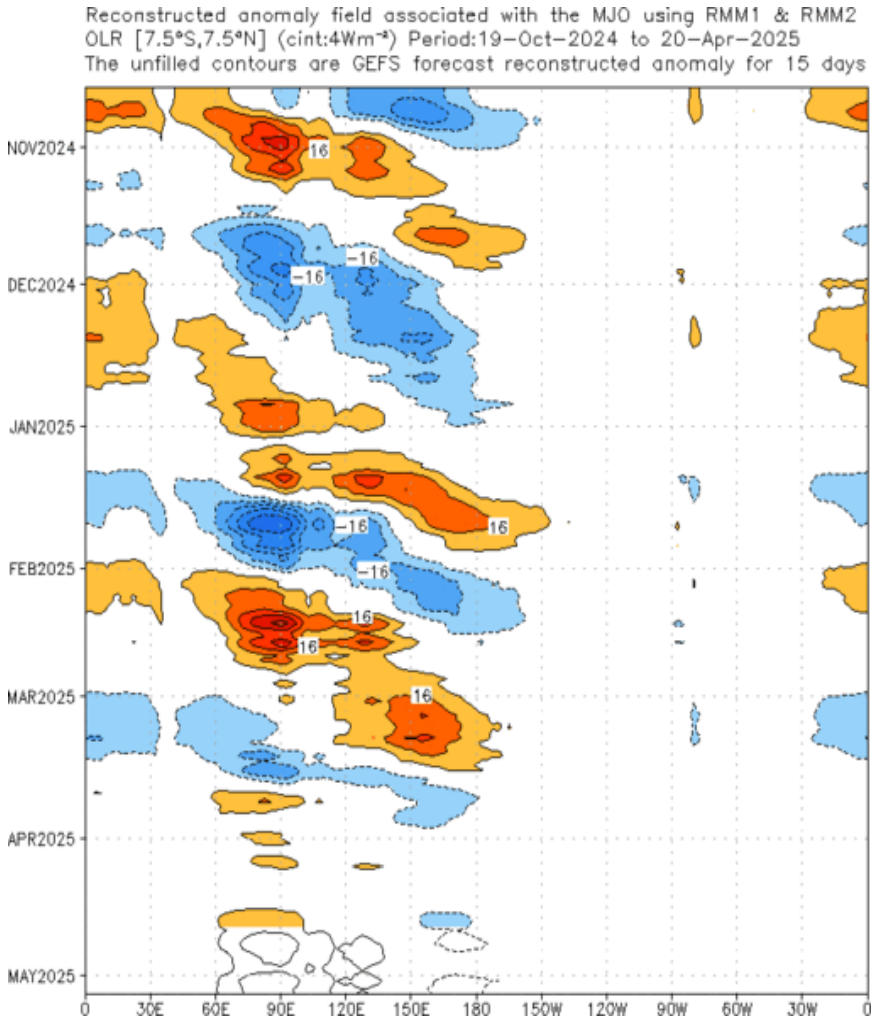
ECMWF Forecast

- Dynamical models diverge on the MJO evolution during late April and early May with the GEFS more bullish with a strengthening MJO as it is forecast to propagate eastward over the Western Hemisphere.

MJO: GEFS Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

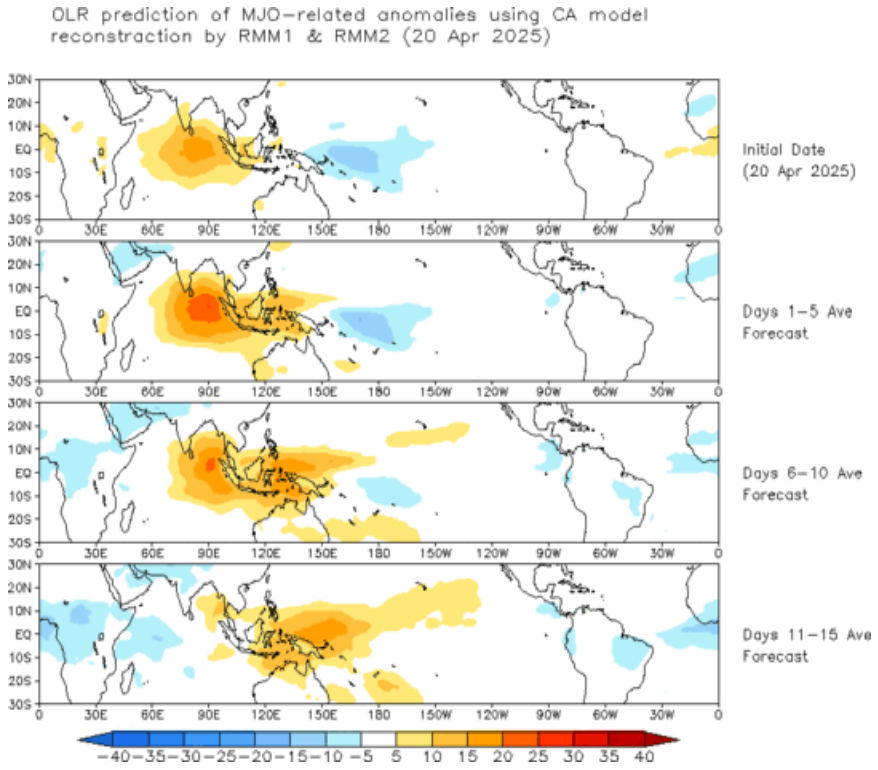


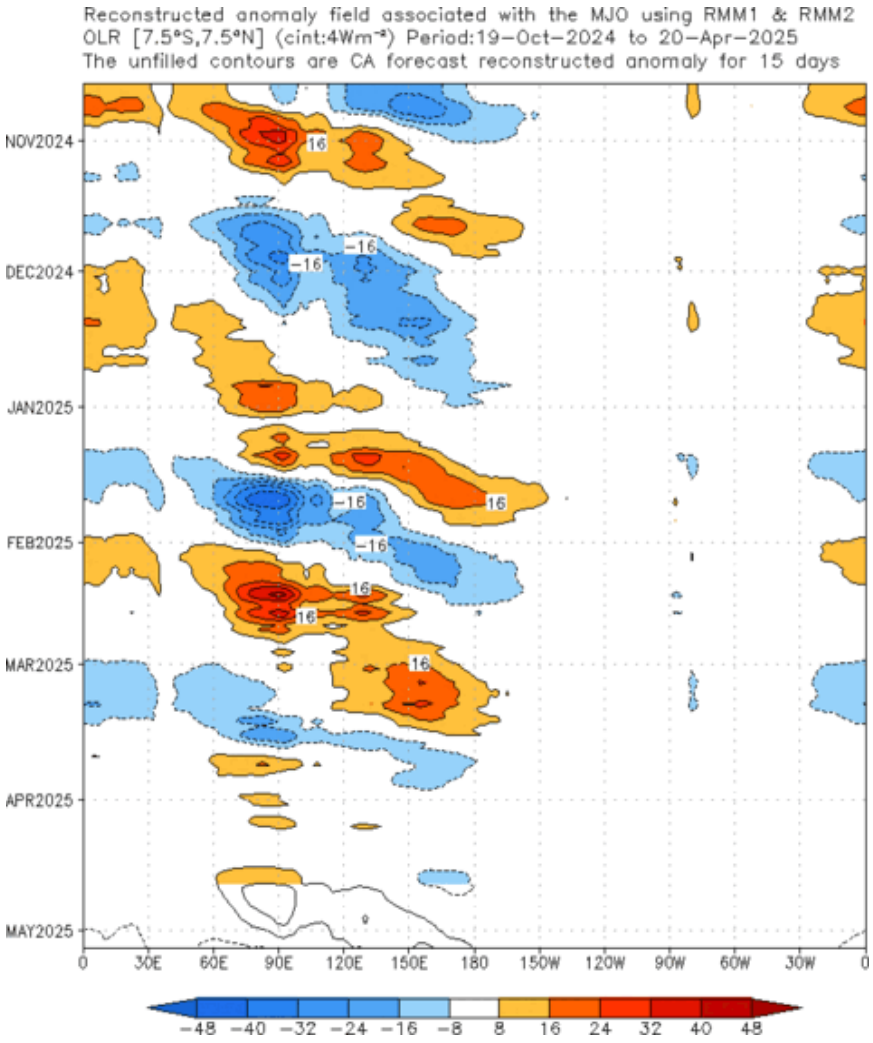


- Despite many GEFS ensemble members depicting a strengthening MJO, its forecast anomalies during the next two weeks are nearly stationary.
- Positive anomalies (suppressed convection) are forecast to persist across the Indian Ocean and Maritime Continent with negative anomalies (enhanced convection) across parts of the equatorial Pacific.

MJO: Constructed Analog Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

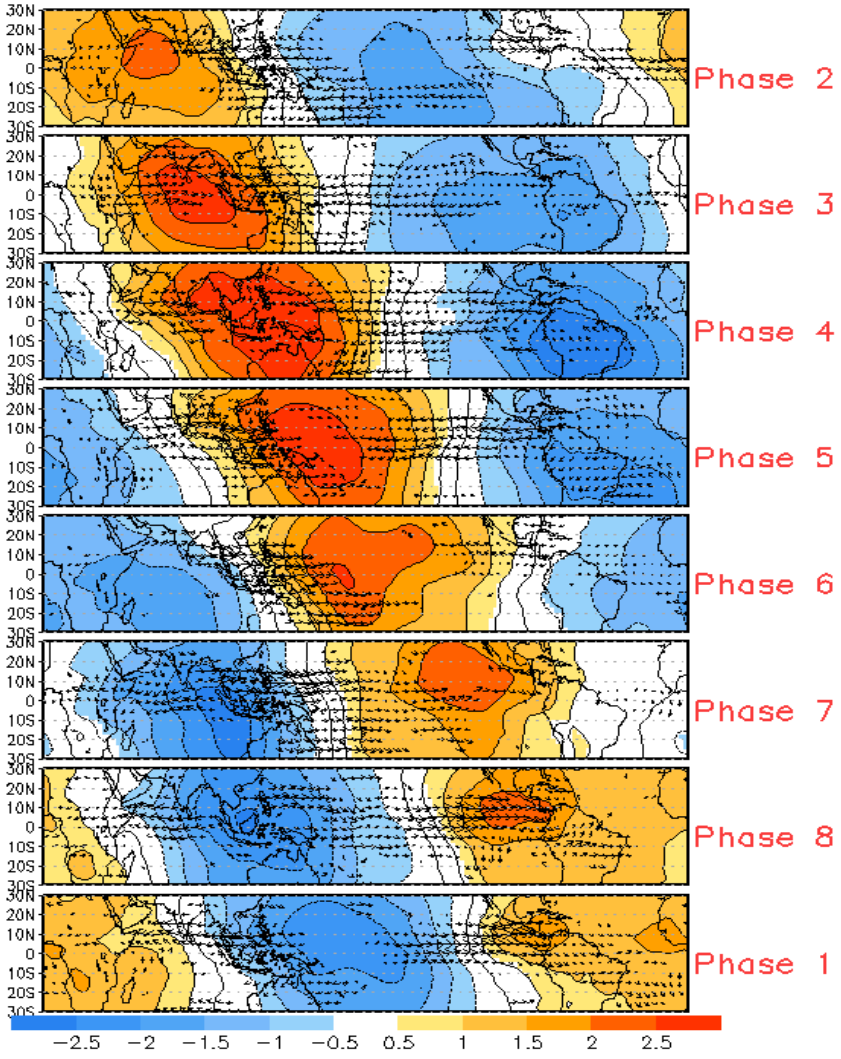




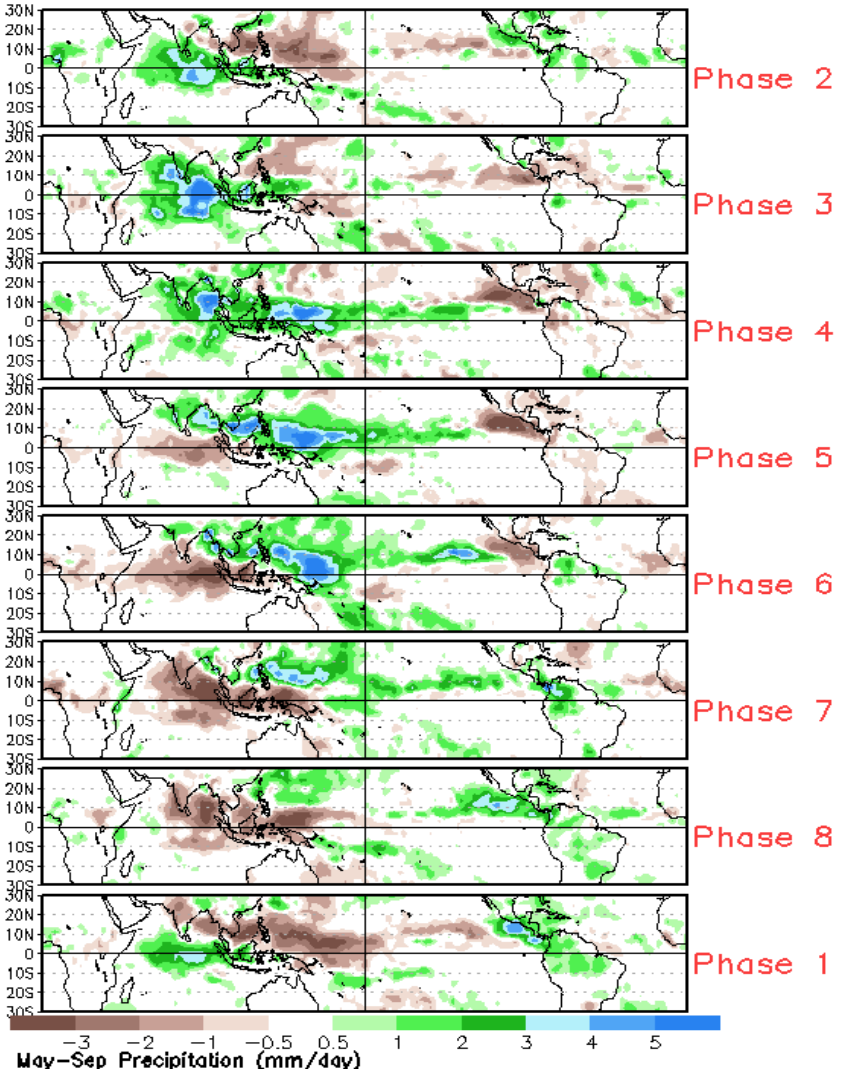
- The constructed analog forecast favors a suppressed convections shifting east from the Indian Ocean to the west-central Pacific.
- By week-2, enhanced convection is forecast to return to Africa and the western Indian Ocean.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



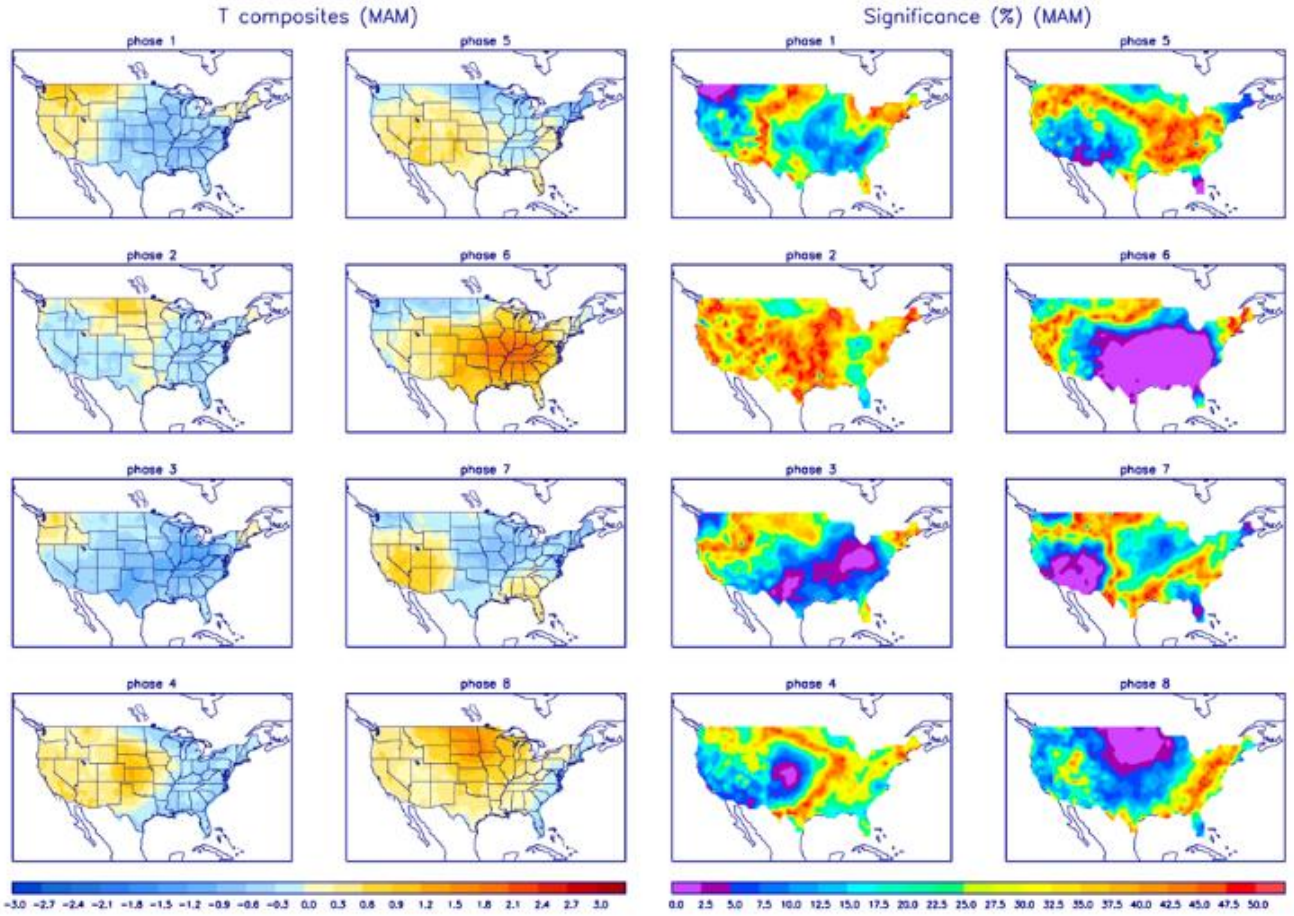
Precipitation Anomalies



MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show temperature anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Blue (red) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.

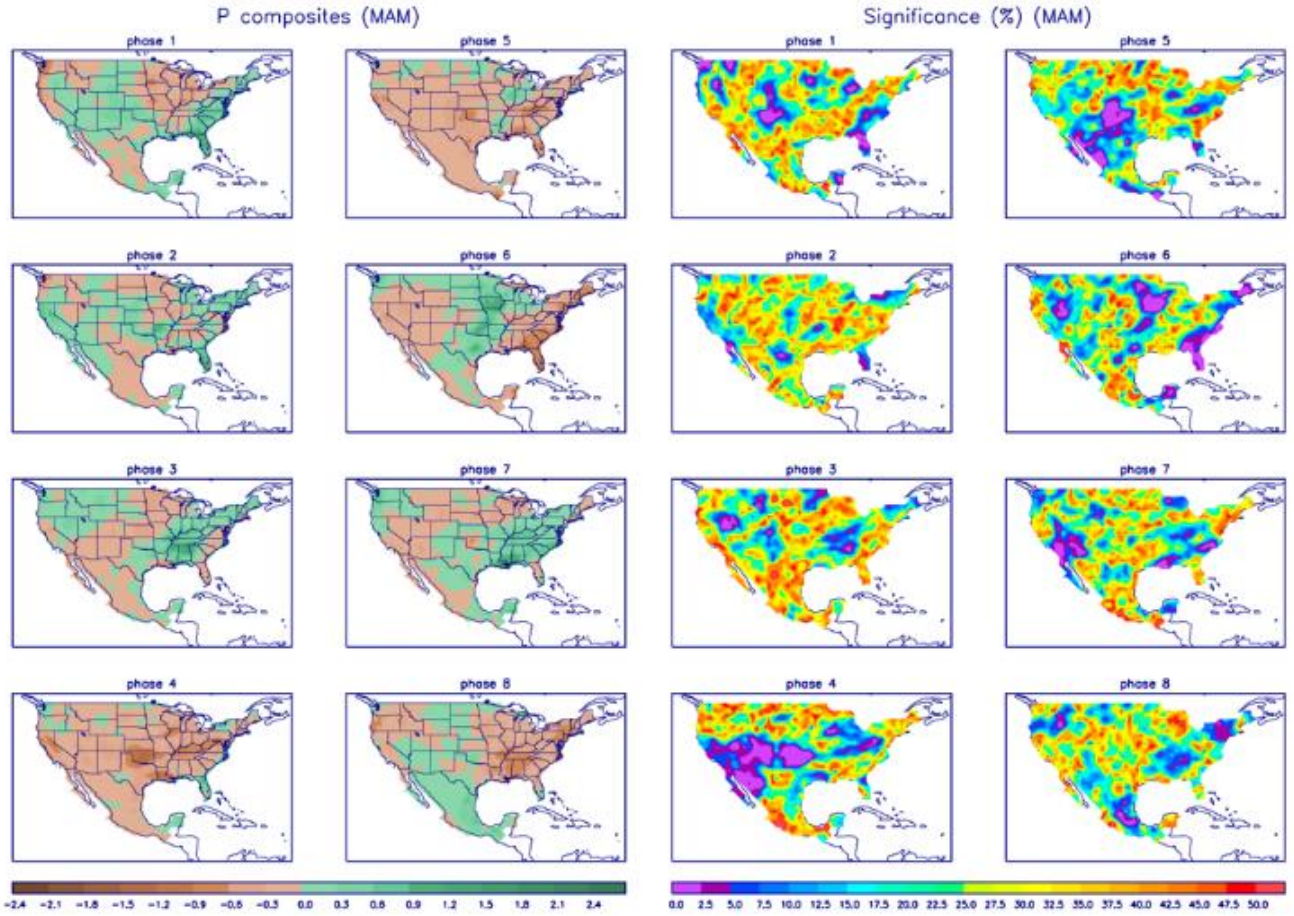


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - Precipitation

Left hand side plots show precipitation anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Brown (green) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.



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