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

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

Overview

- Since entering the Western Pacific last month, both RMM observations and upper-level velocity potential anomaly observations show the enhanced phase of the MJO remaining weak and lacking any coherent eastward propagating behavior.

- RMM forecasts feature a weak MJO signal that circumnavigates the RMM origin during the next two weeks. However, this appears to be tied to equatorial Kelvin Wave activity with the main MJO envelope remaining situated over the Western Pacific during the next two weeks based on objectively filtered upper-level velocity potential forecasts.

- These forecasts reveal the main MJO envelope slowly propagating eastward into the Western Hemisphere, with much of the enhanced divergence aloft being expressed south of the equator later in April.

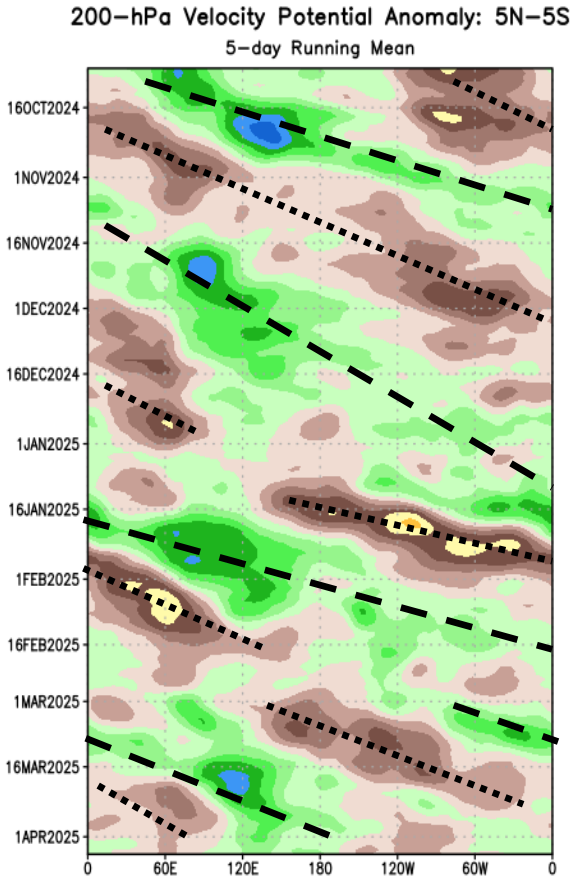
- Late April is typically the least active time of year for tropical cyclones globally. Based on climatology and dynamical model forecasts, tropical cyclone development is most likely to occur to the north of Australia and over the South Pacific, although chances are low.

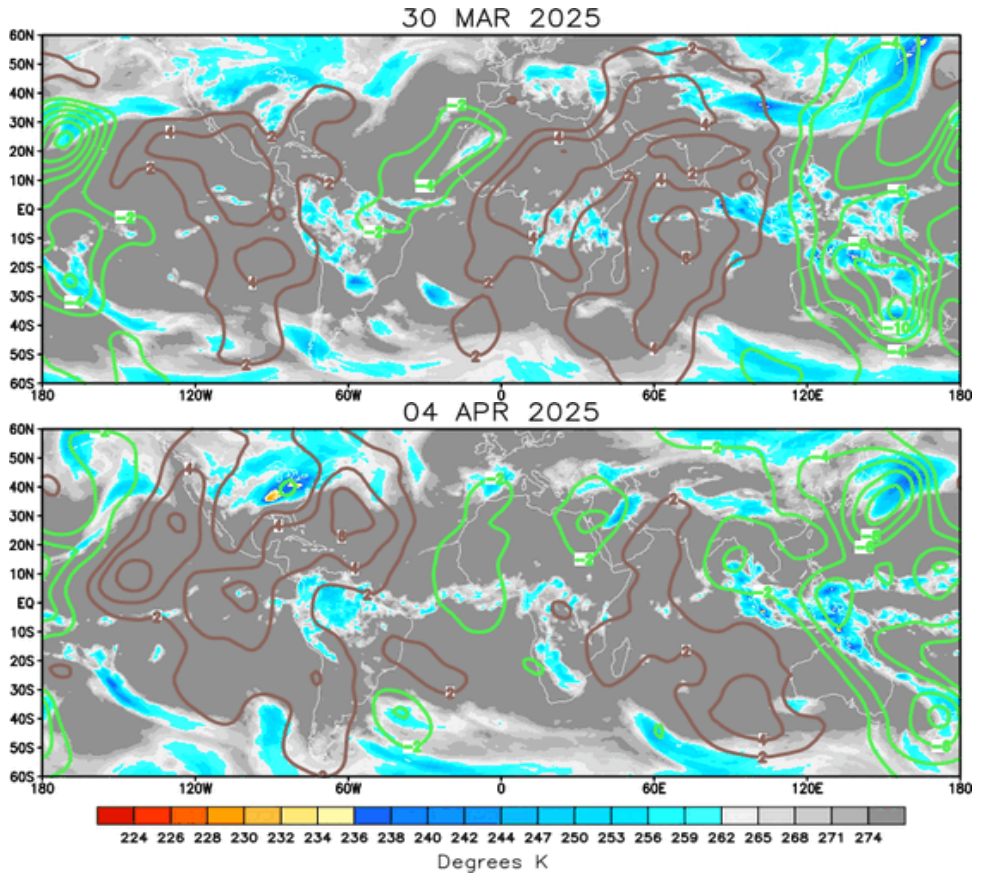
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

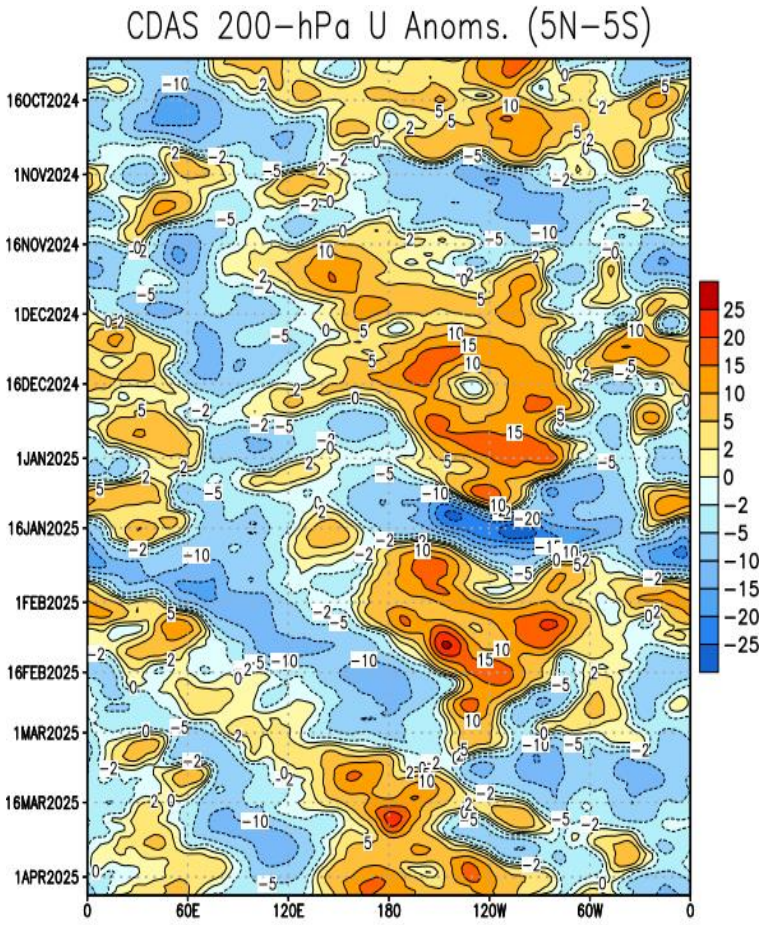


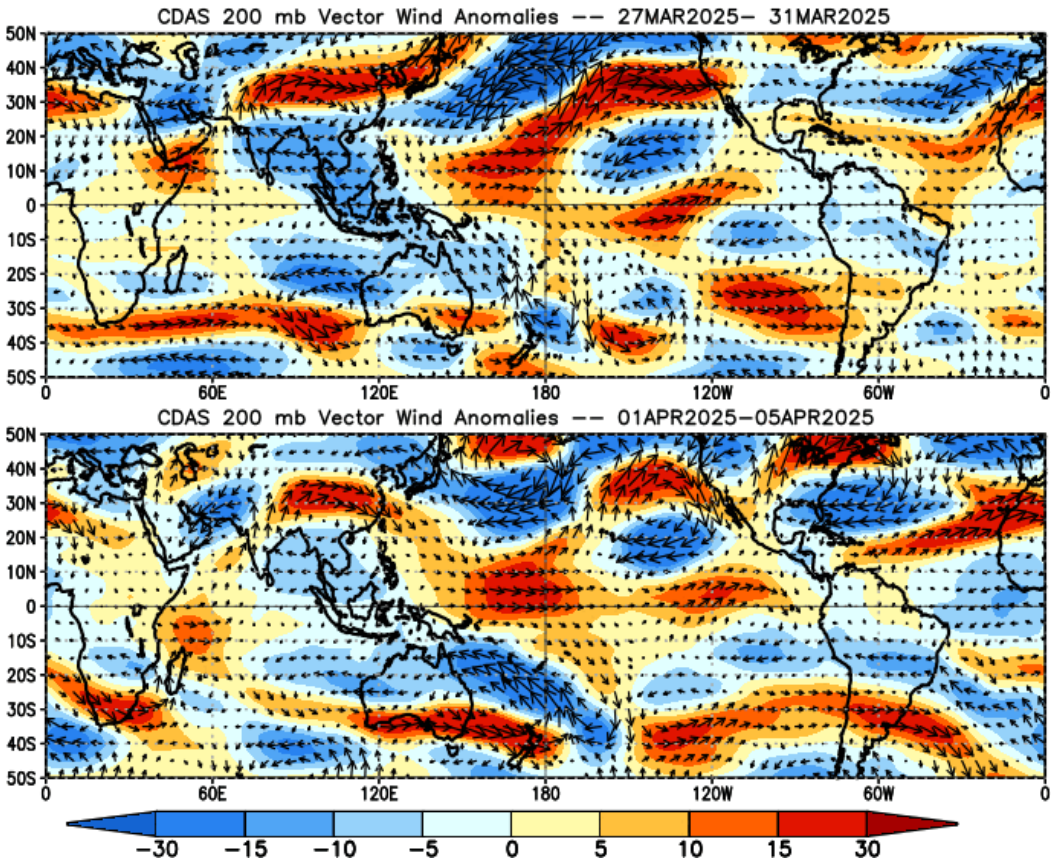


- From a velocity potential perspective, the MJO remains incoherent with a multiple wave pattern persisting from late March into early April.
- There is little eastward propagation of the enhanced convection and divergence aloft over the Maritime Continent and Western Pacific, with other modes of tropical variability playing a more predominant role than the MJO.

200-hPa Wind Anomalies

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

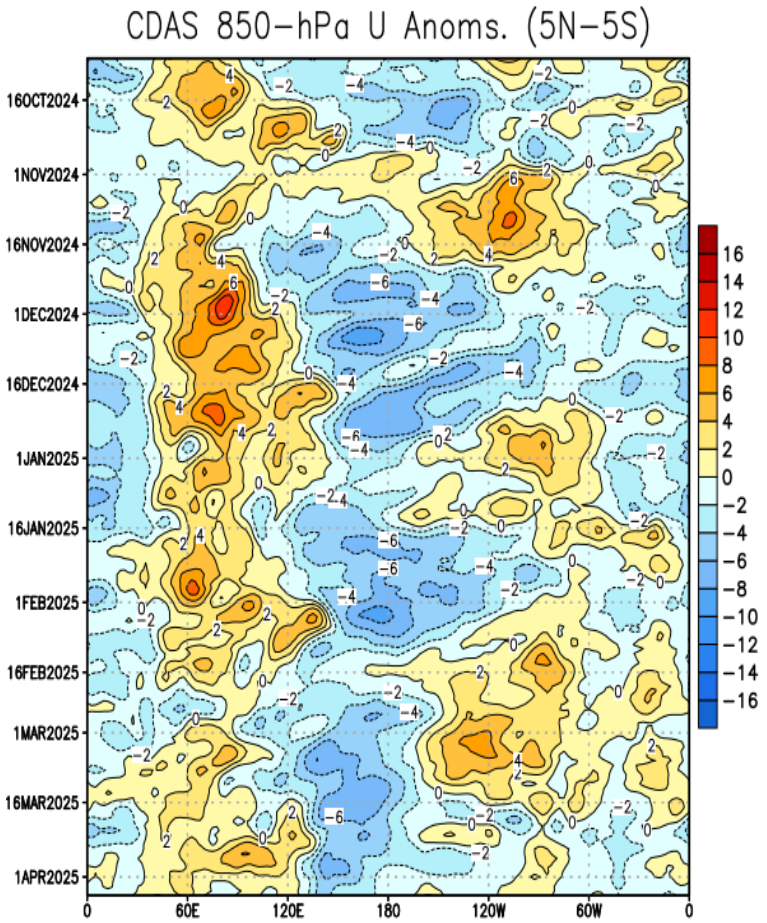


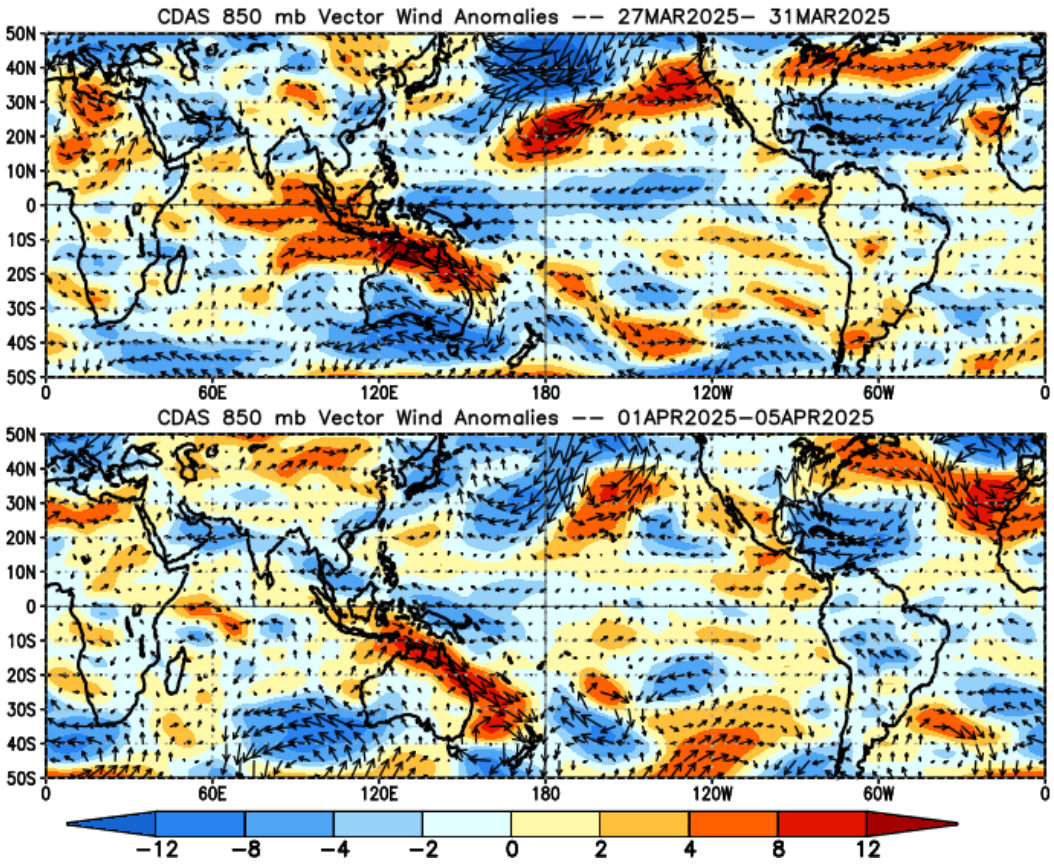


- The westerly phase of the MJO shifted eastward over the equatorial Pacific during March, with the advancing easterly phase stymied by strengthening upper-level westerlies along and to the west of the Date Line.
- Anomalous westerlies aloft have generally persisted since late 2024 over equatorial Africa and the western Indian Ocean
- A wave train is evident extending from the tropical Pacific through North America.

850-hPa Wind Anomalies

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

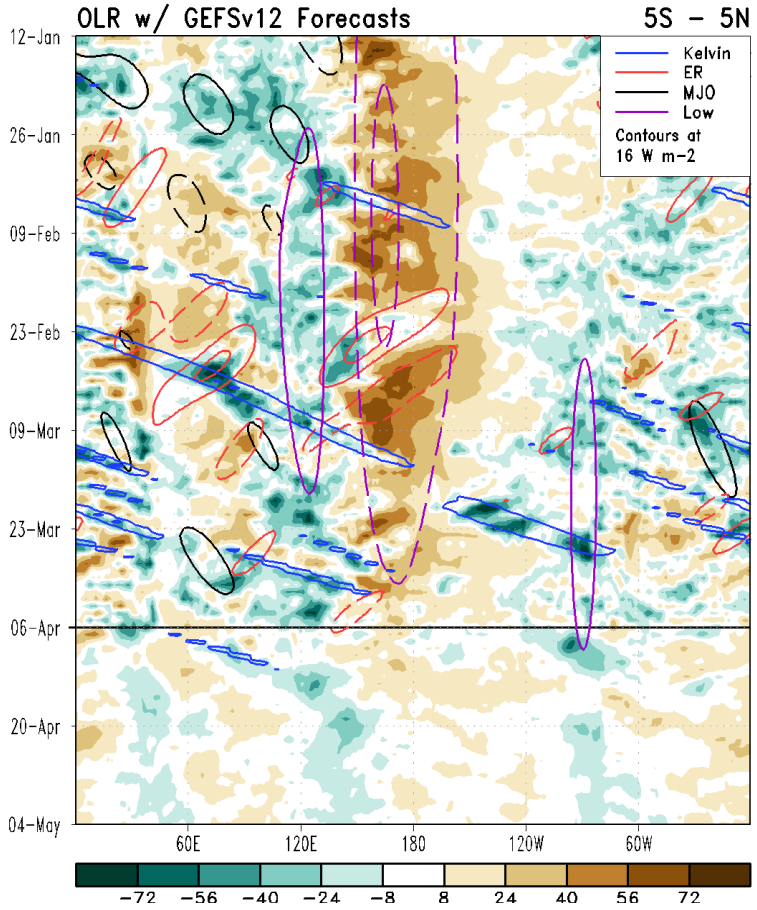


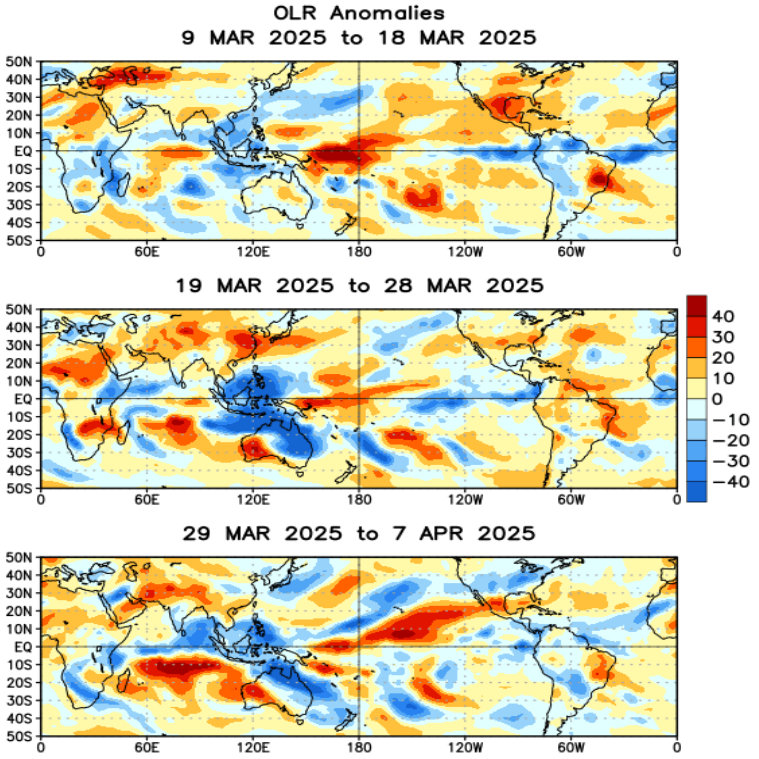


- The low-level zonal wind pattern is comparably more stationary than that of aloft, and indicative of disorganized MJO activity.
- While slightly weaker, enhanced trades remain entrenched along and to the west of the Date Line, consistent with waning La Niña conditions.
- Any eastward shifting westerlies have been observed off the equator and to the north of Australia, where tropical cyclone development has prevailed during the past month.

Outgoing Longwave Radiation (OLR) Anomalies

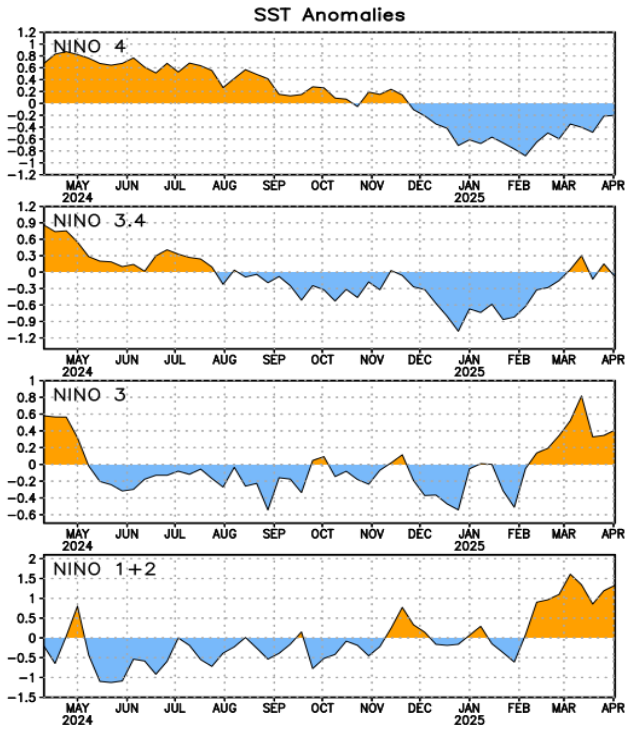
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

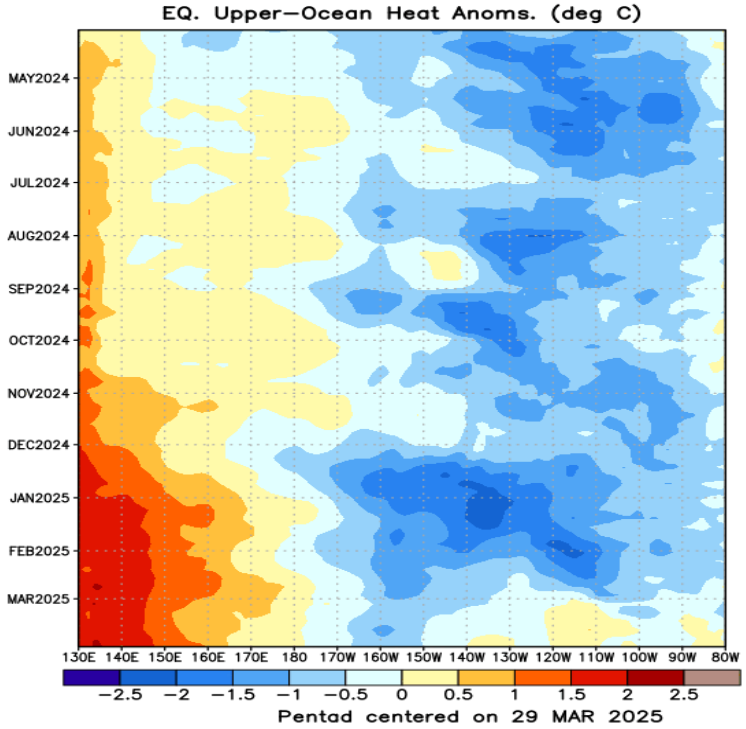




- La Niña driven suppressed convection continues across the equatorial Central Pacific, but has become more focused north of the equator in the western Hemisphere.
- A north to south convective dipole emerged across the Indian Ocean, with enhanced convection generally persisting across the Maritime Continent.
- OLR forecasts from the GEFS reveals little to no eastward shifting convective features and reflects a wave-3 pattern persisting along the equator through the end of April.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

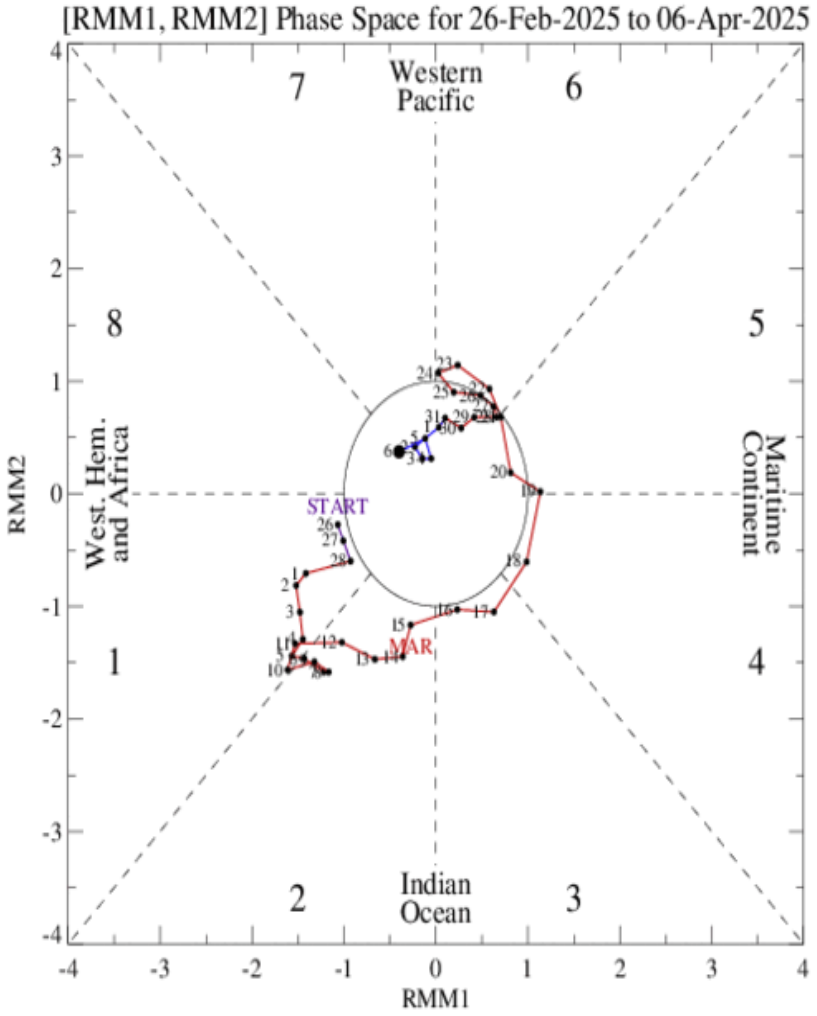




- SST anomalies in Niño 3.4 region remain variable and near zero.
- The strongest negative anomalies at the surface and subsurface remain confined from approximately 170W to 150W, and continue to weaken.
- The strongest positive anomalies remain in the Niño 3 and Niño 1+2 regions, but tepid subsurface anomalies suggests that this warm water is shallow.

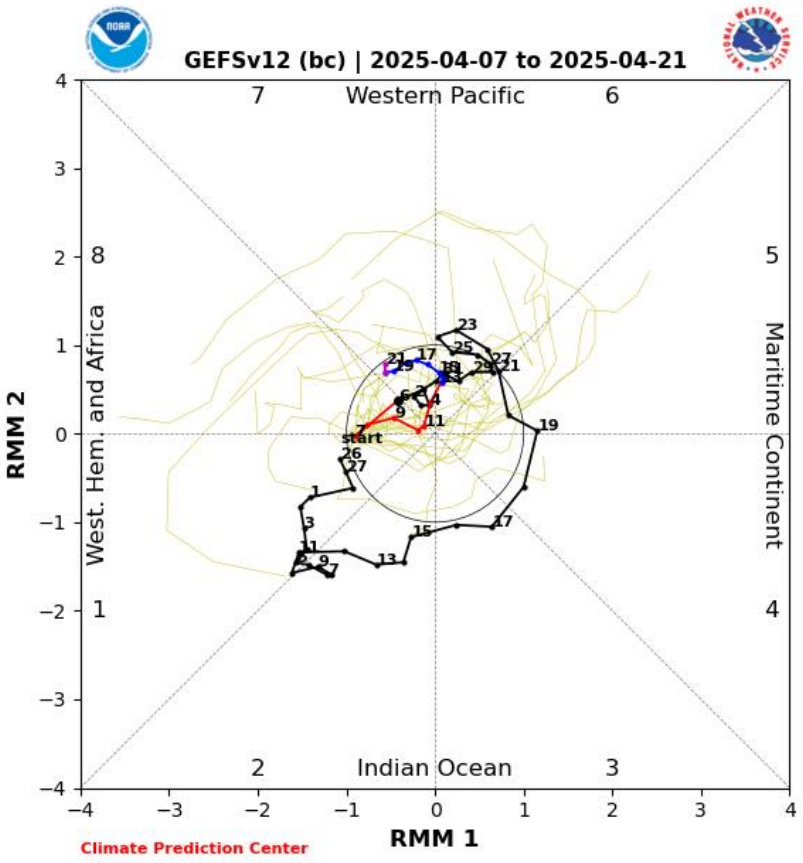
MJO Index: Recent Evolution

- Since entering the Western Pacific last month, RMM observations show a weakening MJO and lack any coherent eastward propagating behavior.

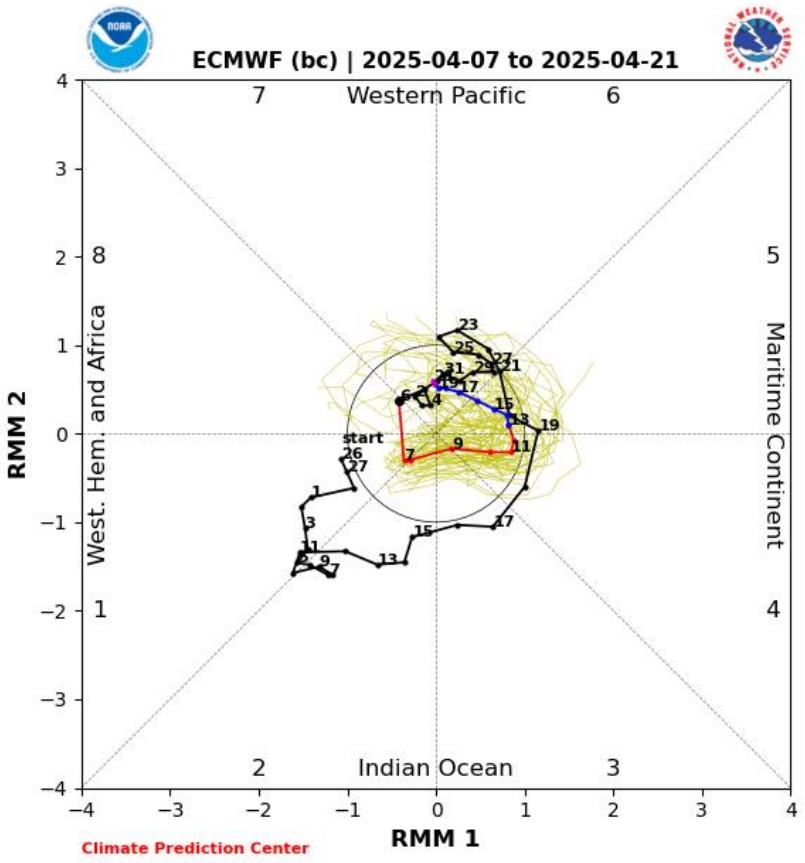


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

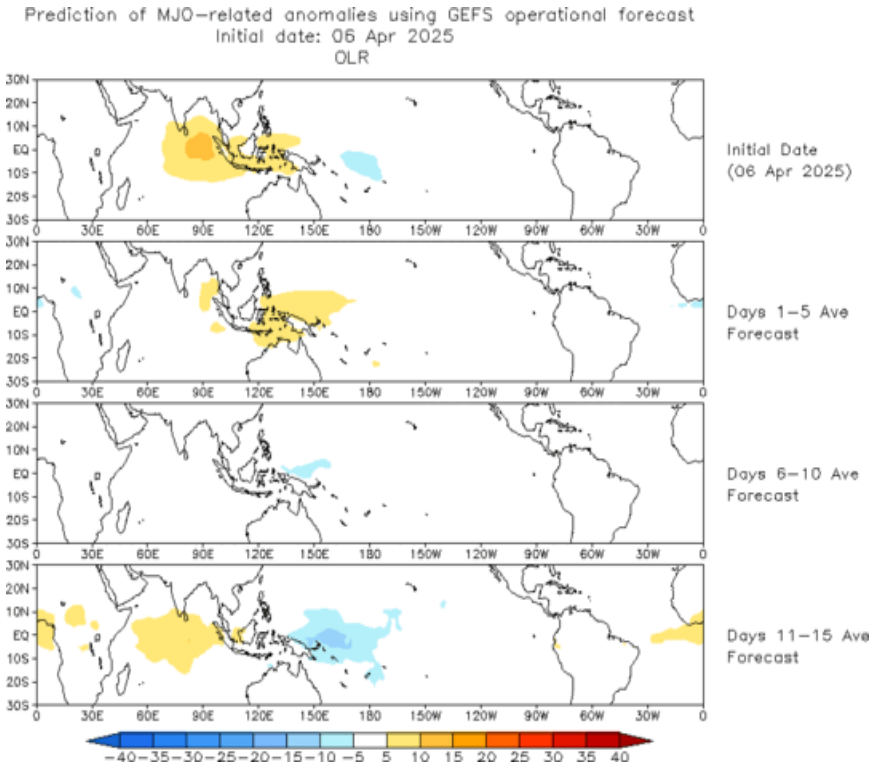


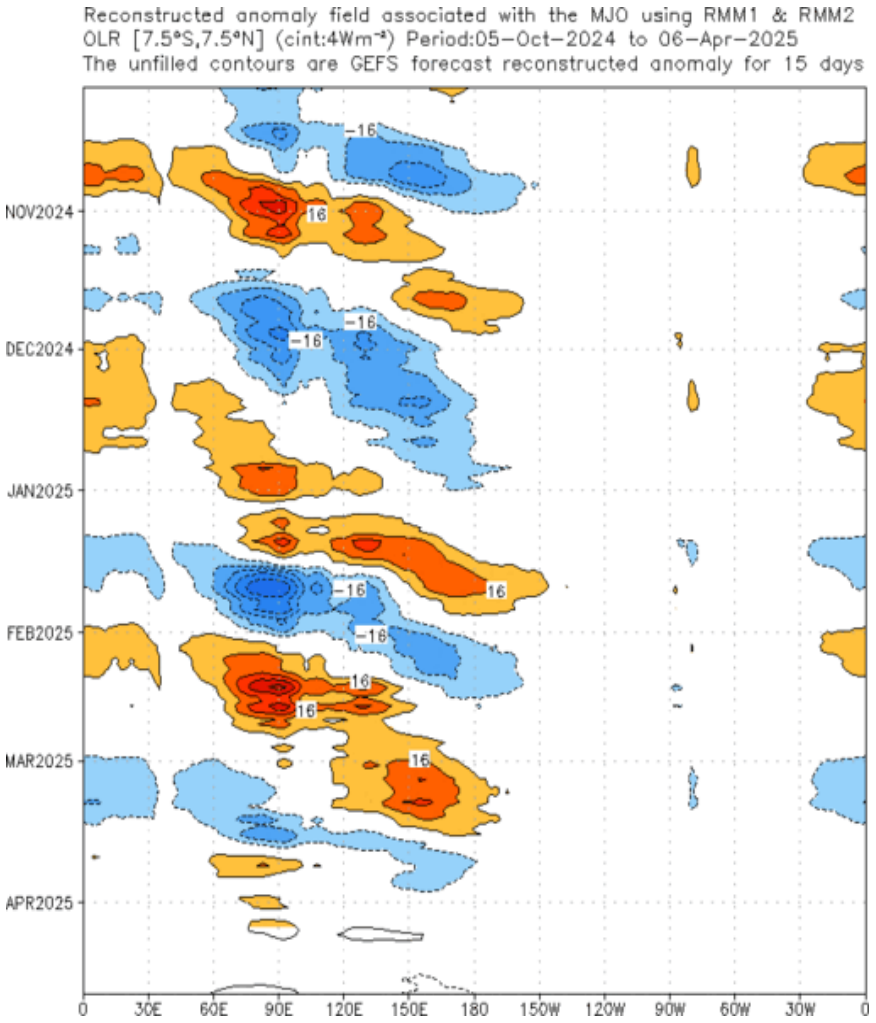
ECMWF Forecast

- While weak, both the GEFS and ECMWF models depict a mean MJO signal that nearly circumnavigates the RMM origin during the next two weeks.
- The behavior is likely to tied to equatorial Kelvin wave activity, with the main enhanced MJO convective envelope remaining dormant in the Western Pacific.
- There are growing number of ensemble members favoring a strengthening MJO signal over the Western Pacific during the week-3 timeframe.

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.)

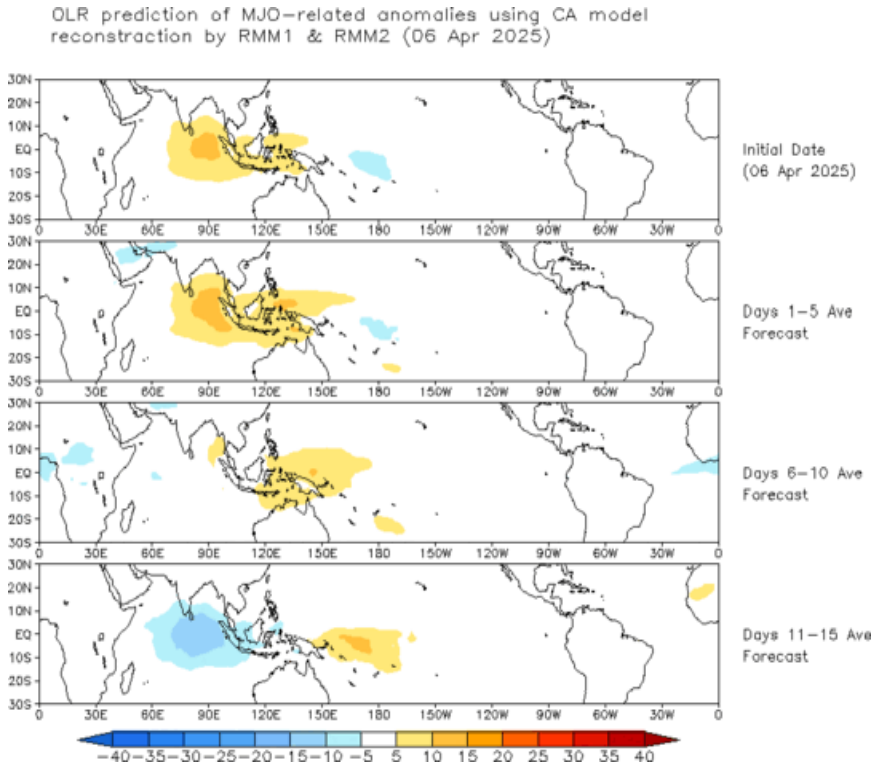


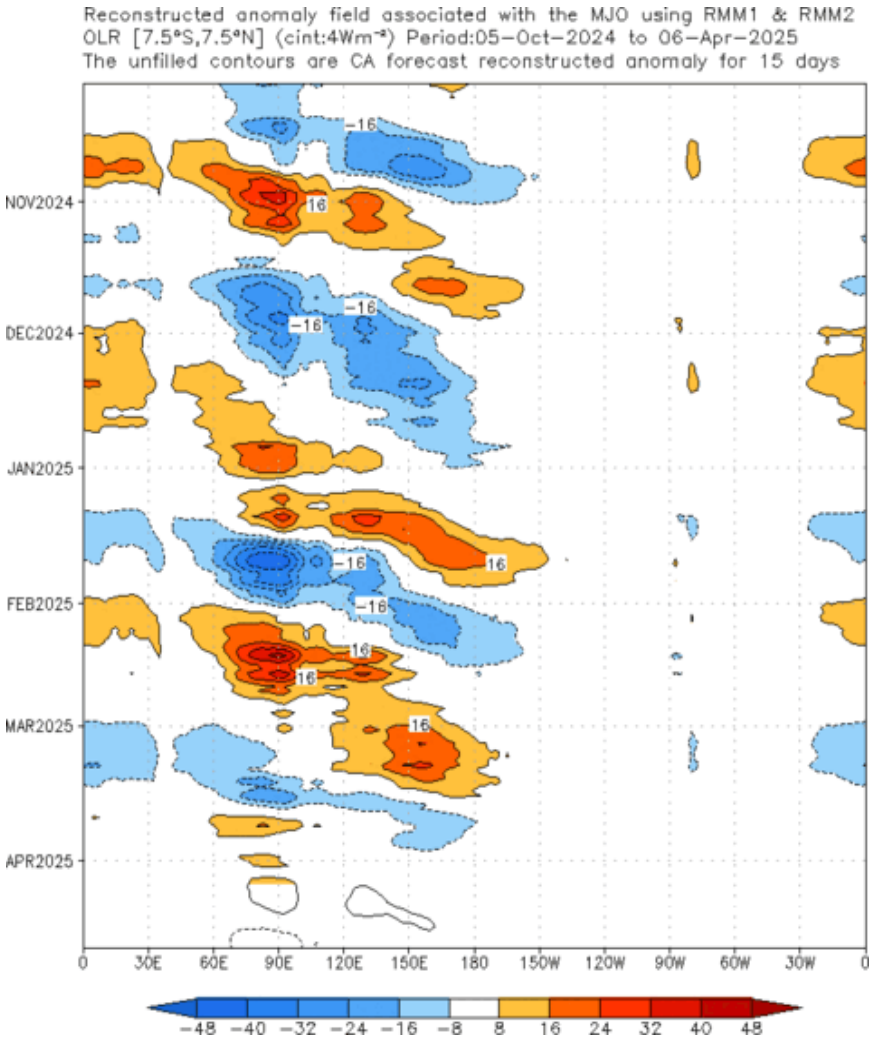


- The GEFS OLR forecast based on the RMM index forecast depicts a weak convective pattern during the next two weeks.

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.)

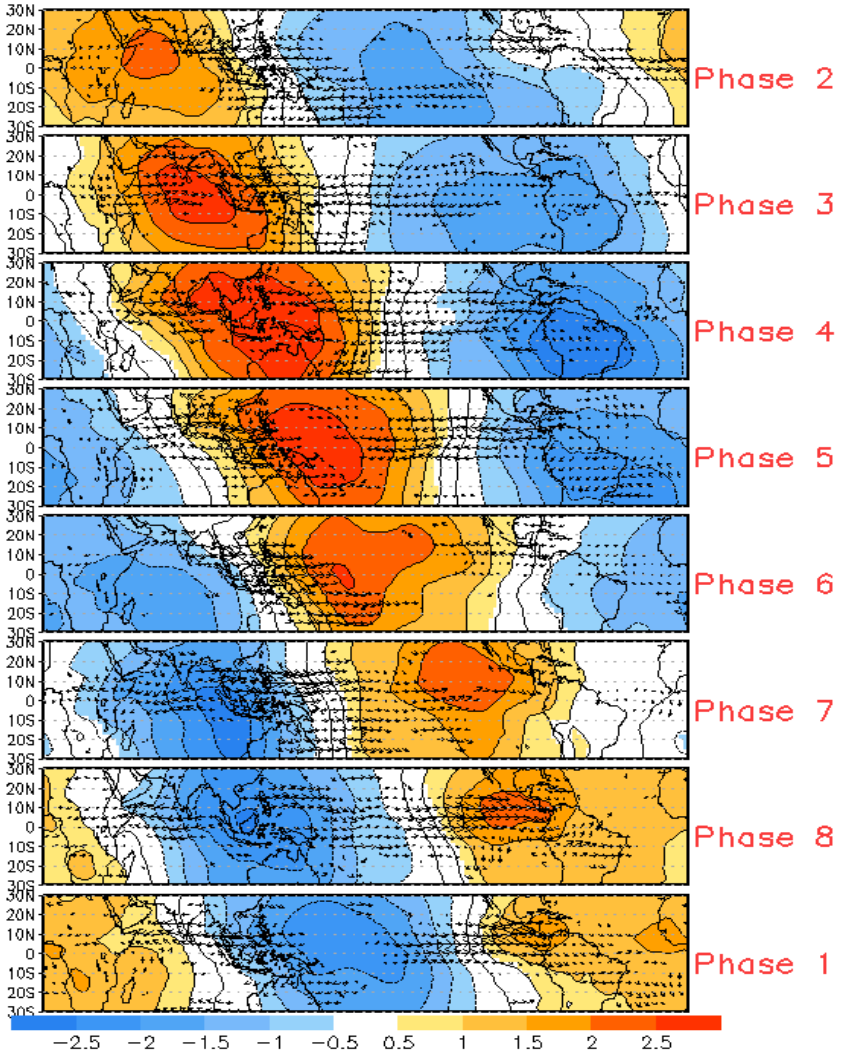




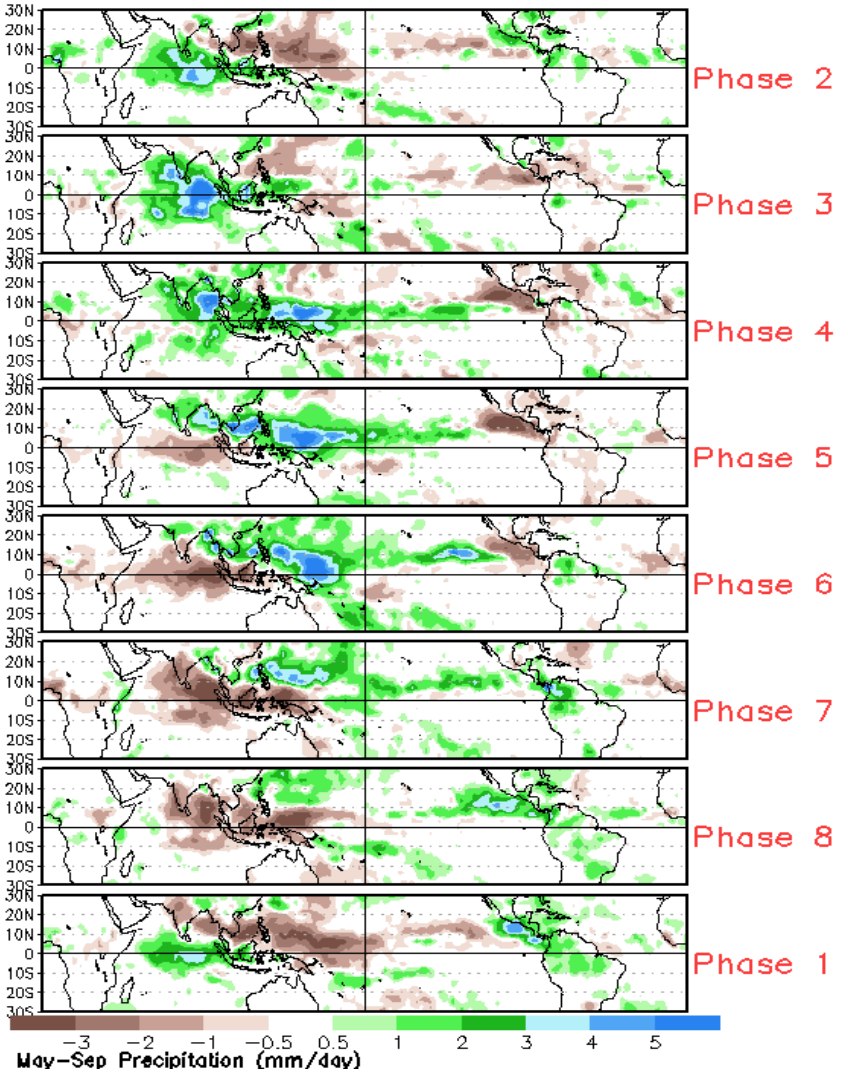
- The constructed analog forecast features a stronger convective pattern, and inconsistent with the convective dipole favored in the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



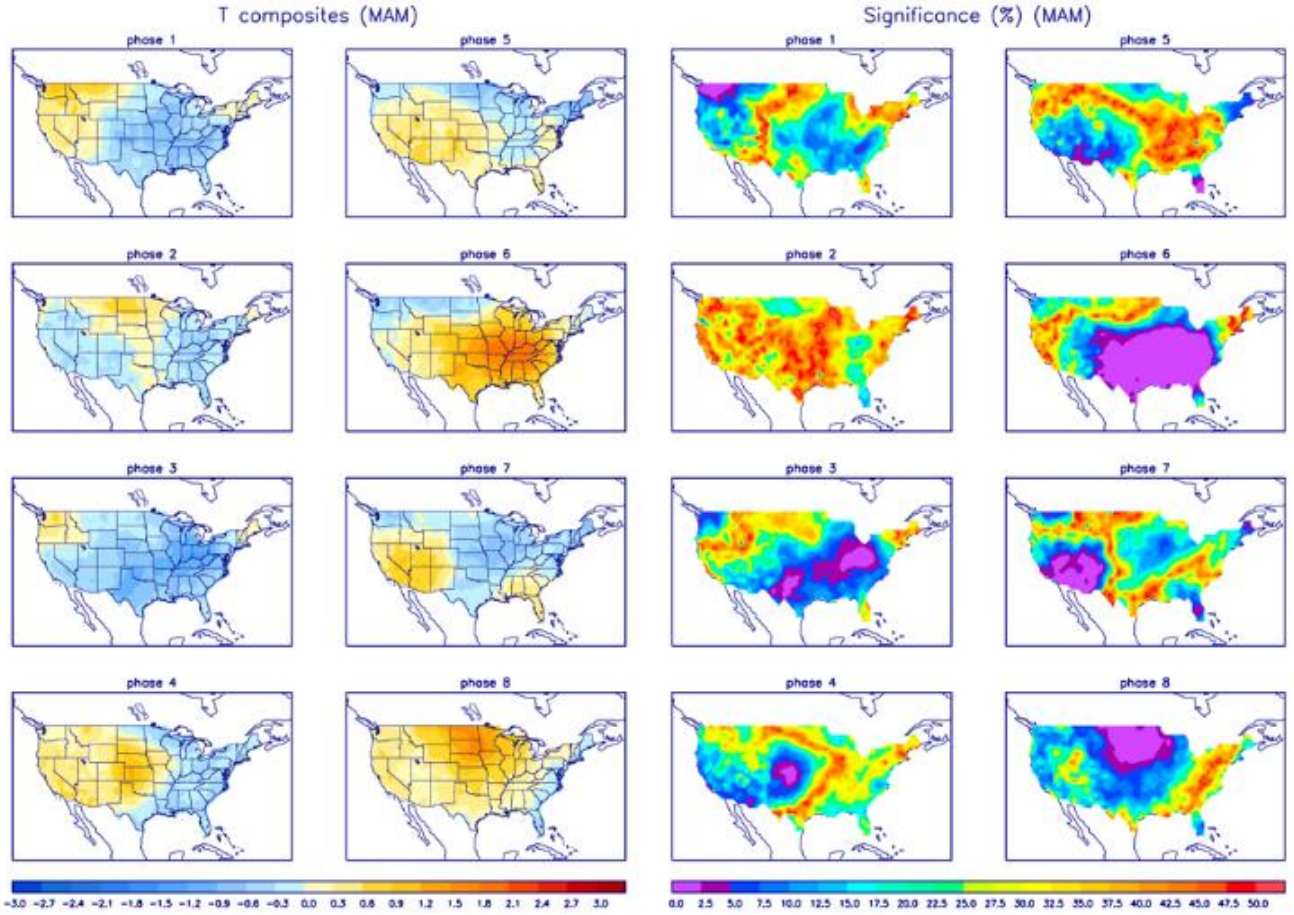
Precipitation Anomalies



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.

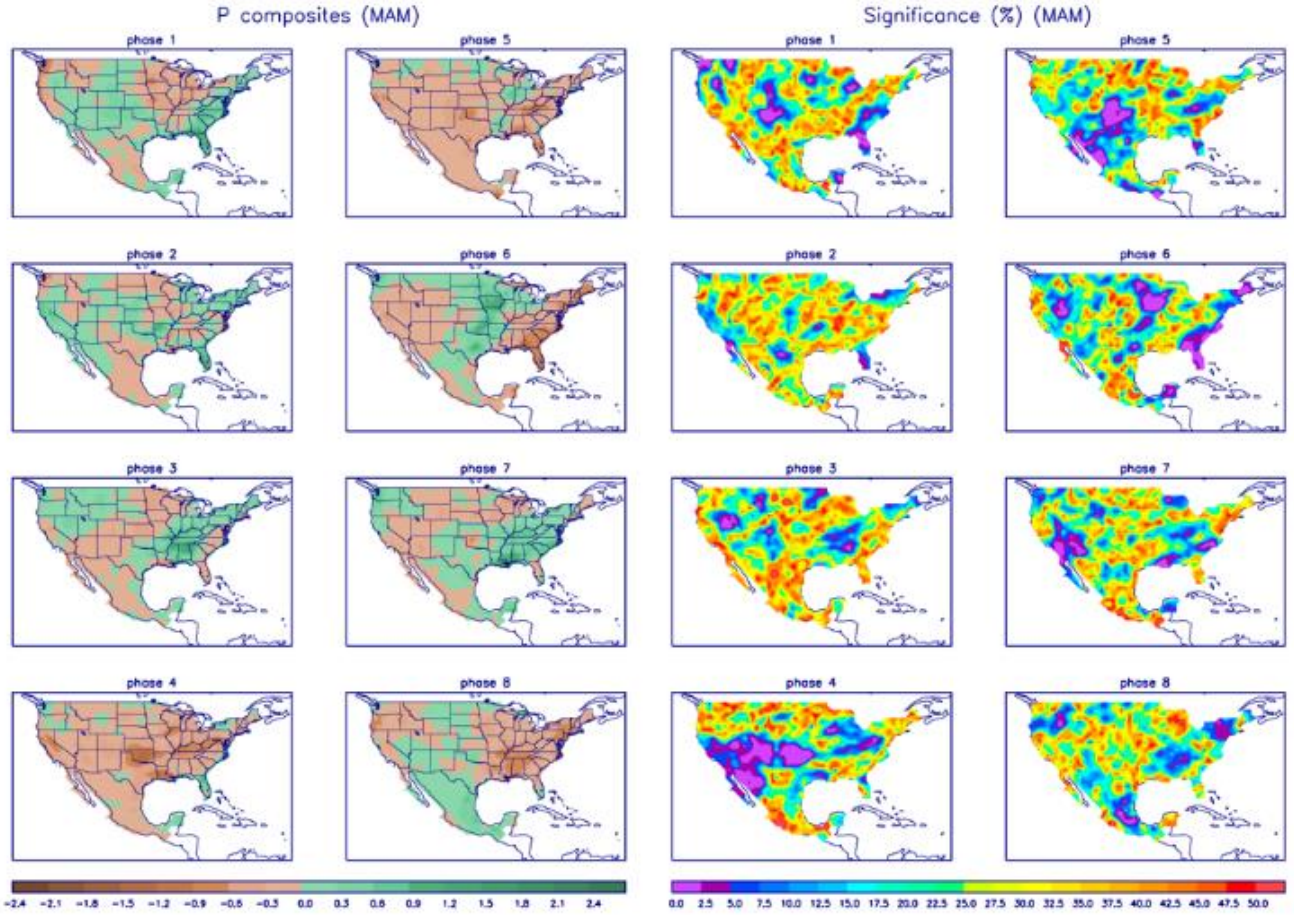


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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