

Madden-Julian Oscillation:

Recent Evolution, Current Status and Predictions



Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
5 May 2025

Overview

- Although RMM observations show an eastward propagating signal suggestive of some renewed subseasonal activity, both OLR and zonal wind anomalies generally reflect a largely disorganized MJO throughout the global tropics.
- Other modes of tropical variability, namely equatorial Kelvin wave passages, appear to be the predominate driver of convection amidst a weakening La Nina base state since early April.
- Based on RMM forecasts from the dynamical models, the recent uptick in amplitude over the Western Hemisphere are likely to be short-lived, with the signal quickly returning to the Maritime Continent and Western Pacific at a low amplitude during the next week or so.
 - This behavior in RMM space is consistent with convectively coupled Kelvin Wave activity, which is supported in the objective wave filtered velocity potential forecasts during the next several weeks.
- Model guidance maintain relatively low odds of tropical cyclogenesis during the forecast period. Over the eastern Pacific, there are increased signals in the probabilistic tools for early season tropical cyclone development later in May.

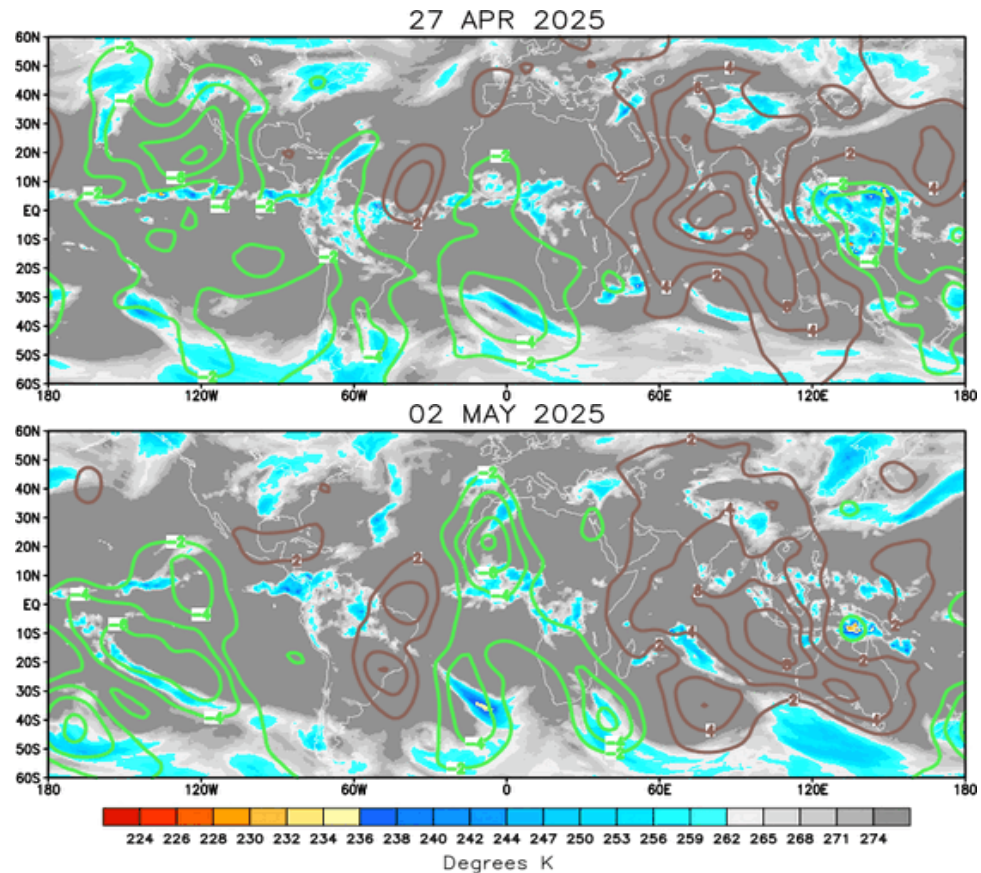
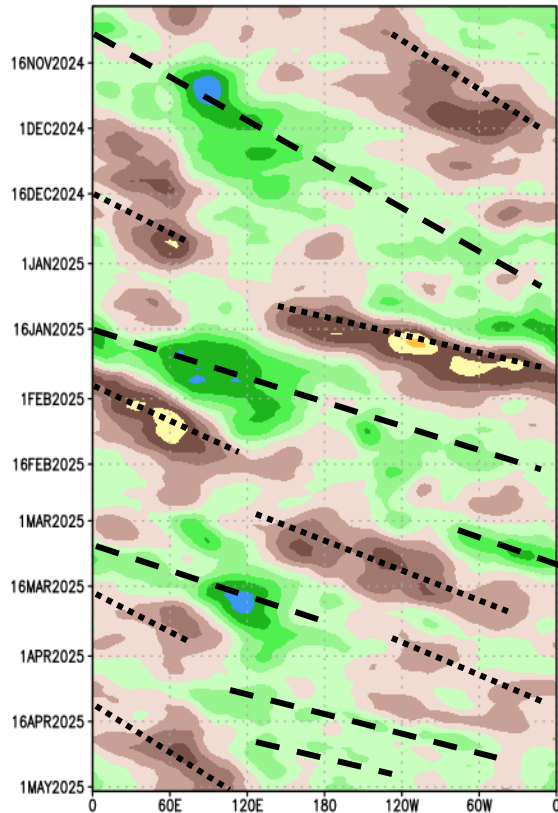
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

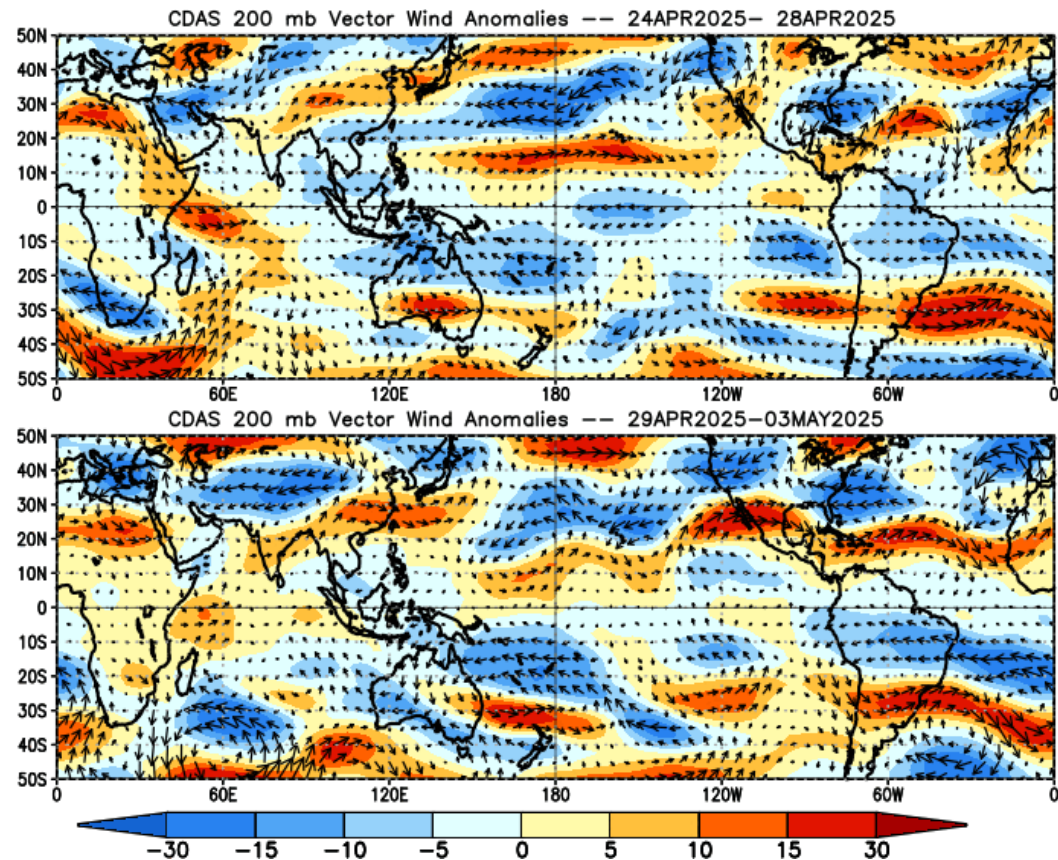
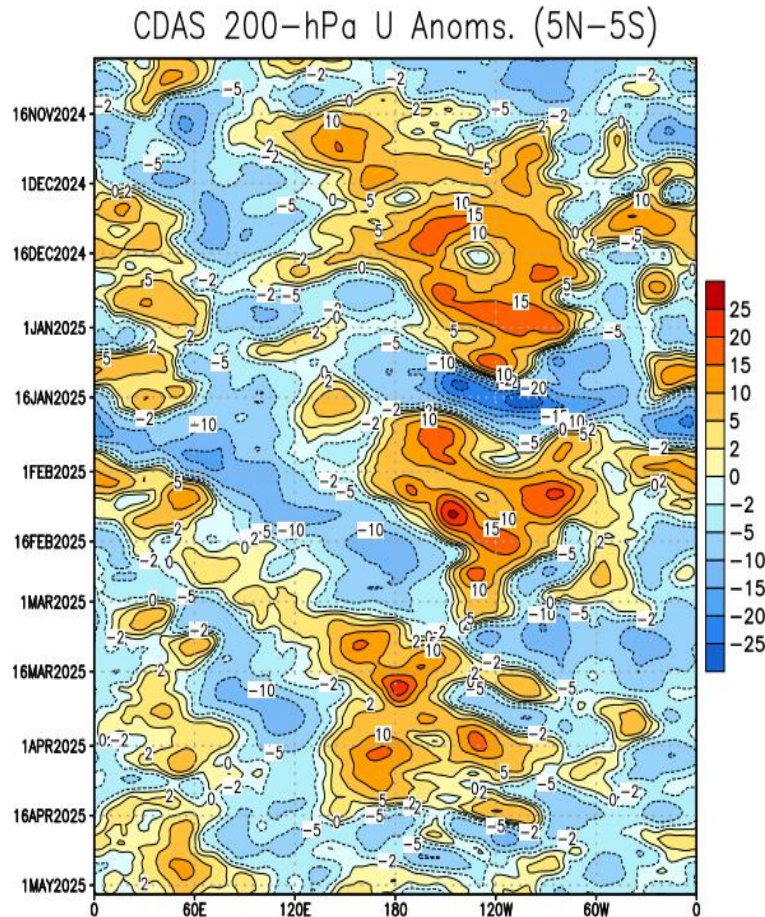
200-hPa Velocity Potential Anomaly: 5N–5S
5-day Running Mean



- Spatially, the upper-level pattern remains fairly incoherent, with multiple envelopes of enhanced and suppressed divergence aloft suggestive of other modes of tropical variability continuing into early May.
- However, a region of suppressed divergence aloft has expanded eastward into the eastern Indian Ocean and Maritime Continent possibly tied to MJO activity.

200-hPa Wind Anomalies

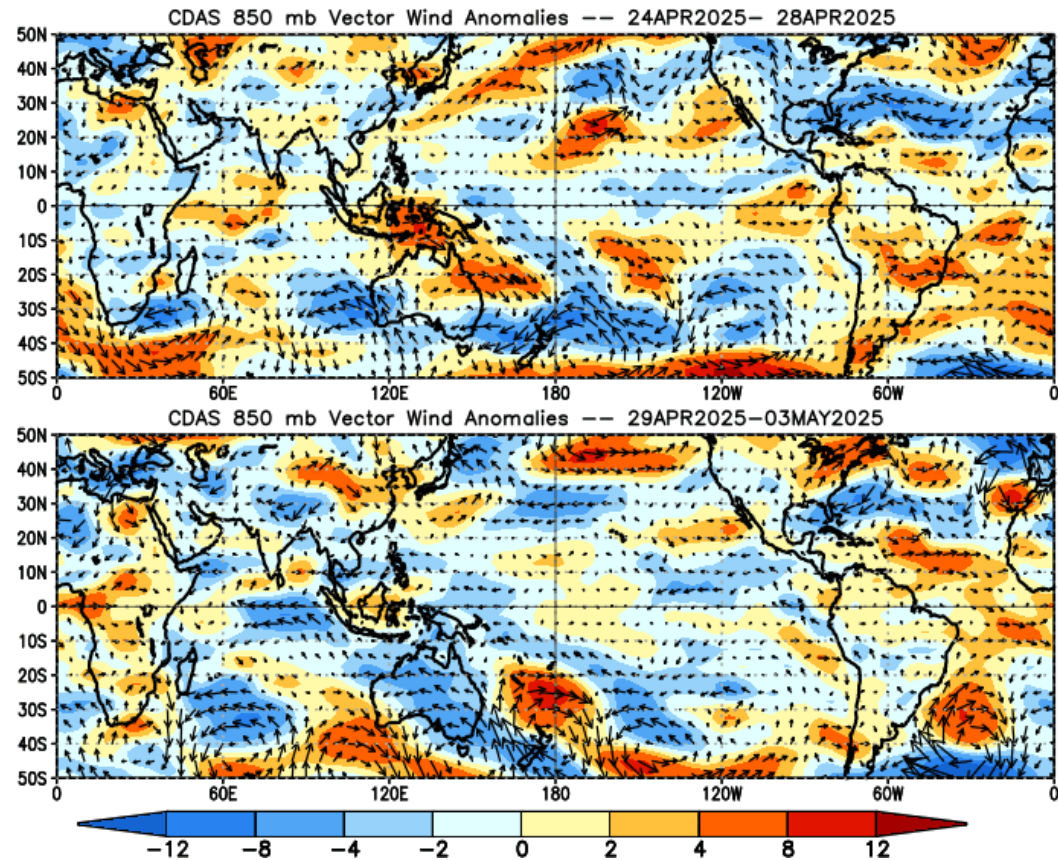
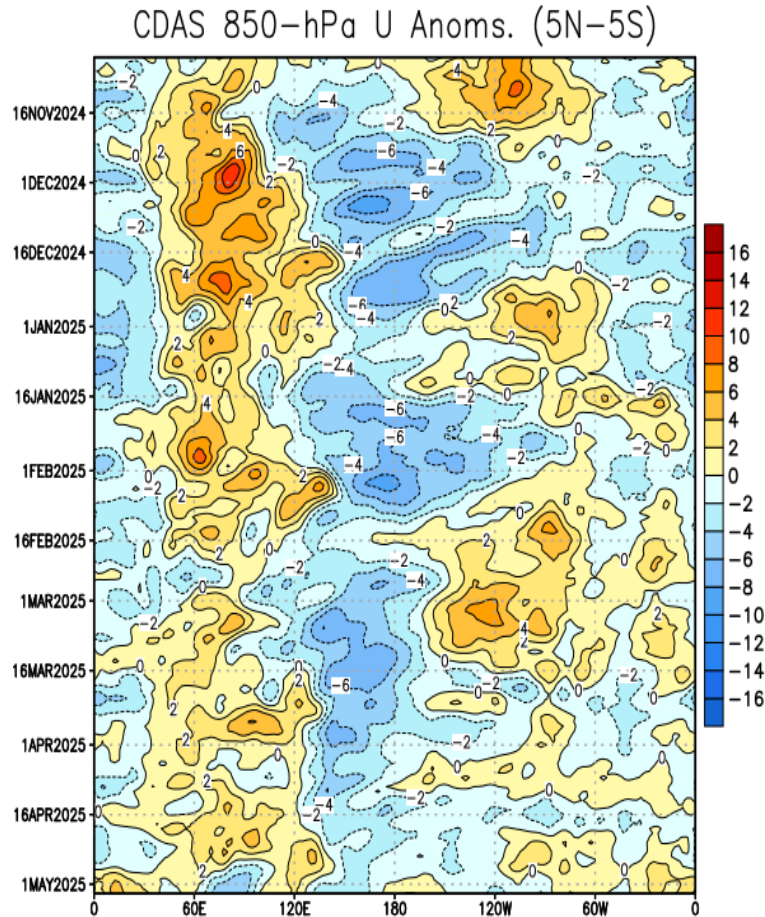
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Anomalous westerlies aloft shifted eastward into the eastern Indian Ocean, with anomalous easterlies becoming more limited to near 120°E. East of the Date Line, any eastward propagating westerly features appear to be tied to higher frequency variability.
- Anomalous westerlies reemerged across portions of the equatorial Pacific, mainly north of the equator.

850-hPa Wind Anomalies

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

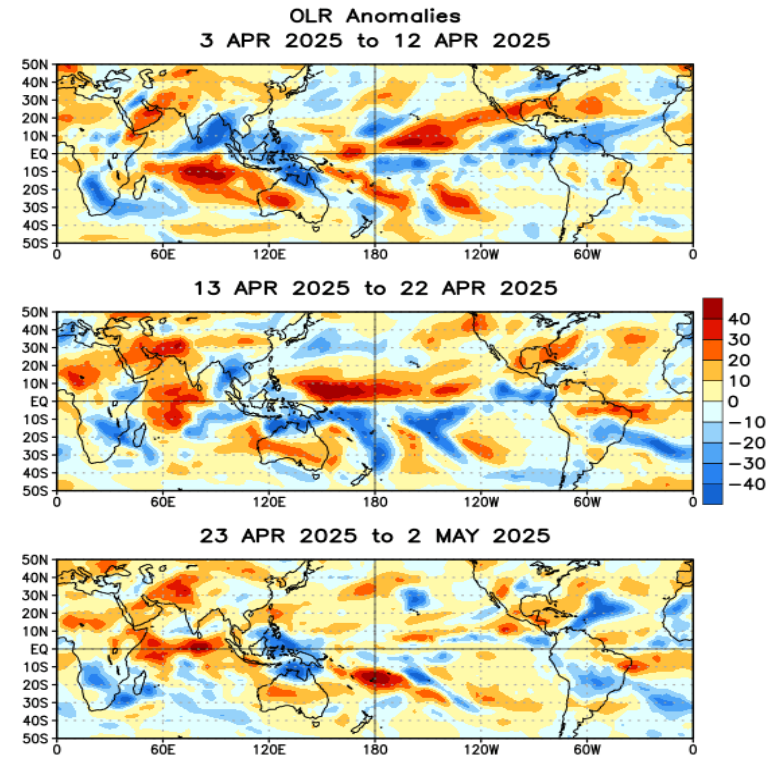
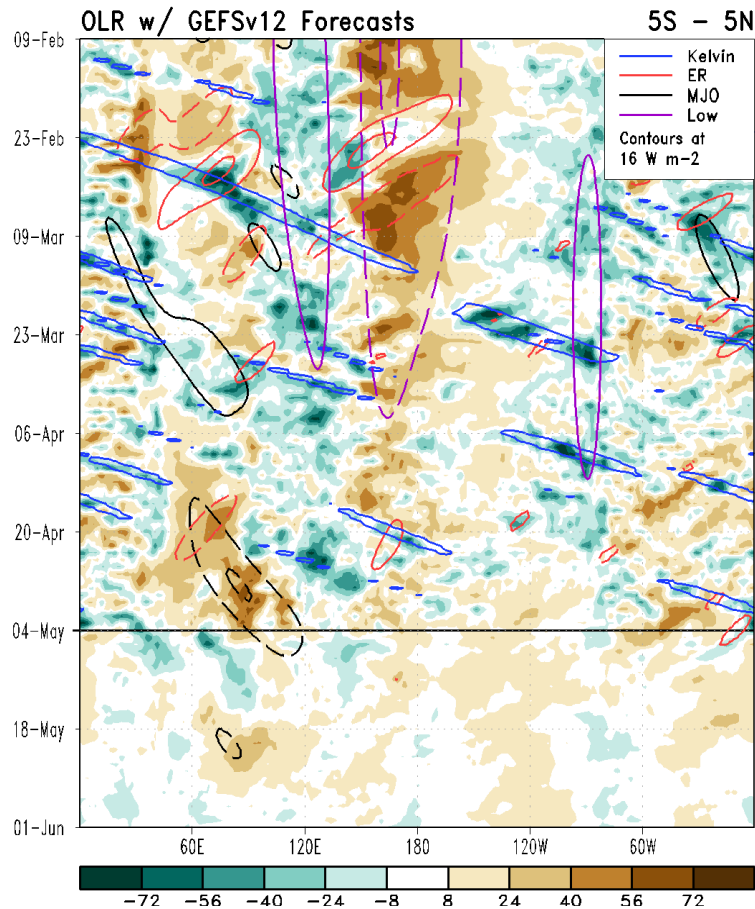


- Over the eastern equatorial Indian Ocean, anomalous easterlies emerged and contributed to more suppressed convection over this part of the basin.
- Over the equatorial Pacific, the enhanced trade regime associated with La Nina was weakened considerably.

Outgoing Longwave Radiation (OLR) Anomalies

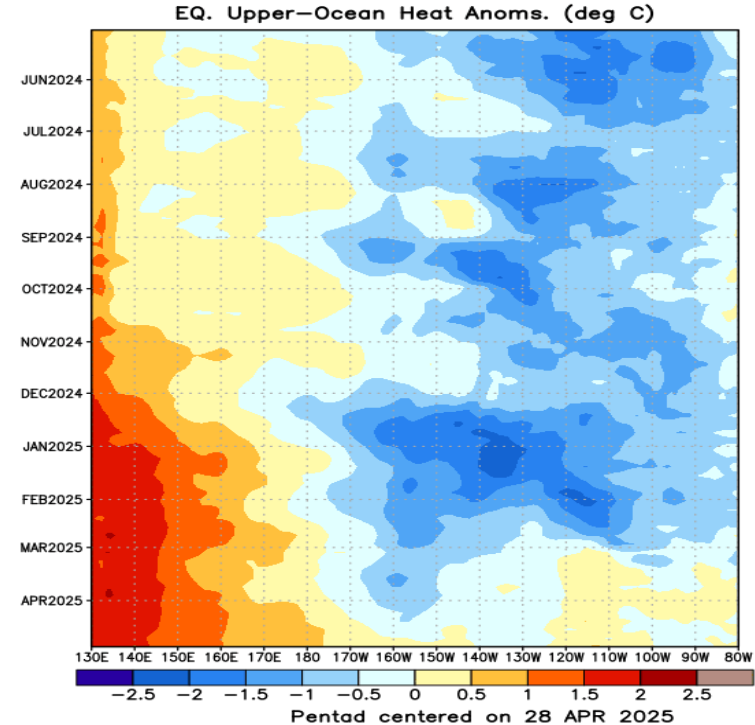
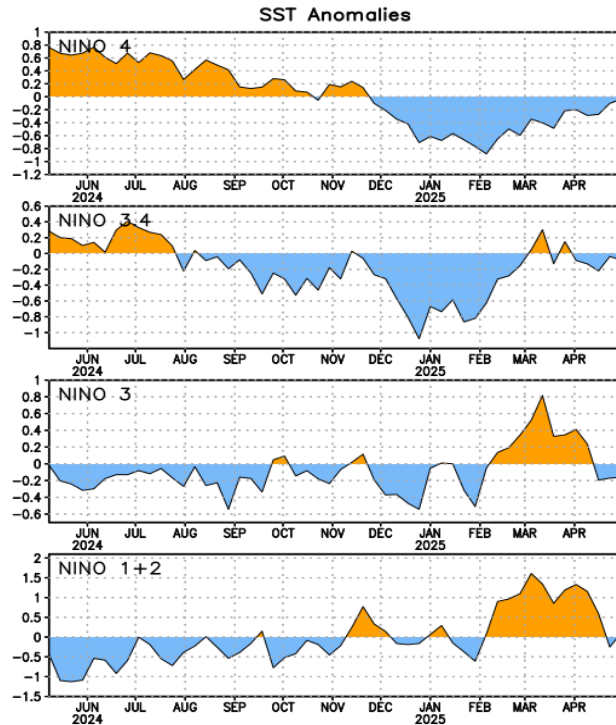
Green shades: Anomalous convection (wetness)

Brown shades: Anomalous subsidence (dryness)



- La Niña-induced suppressed convection near the Date Line has likewise relaxed considerably, with enhanced convection persisting over the Maritime Continent, mainly north of Australia.
- Based on the GEFS OLR forecasts, there is little support for MJO or ENSO related conditions.

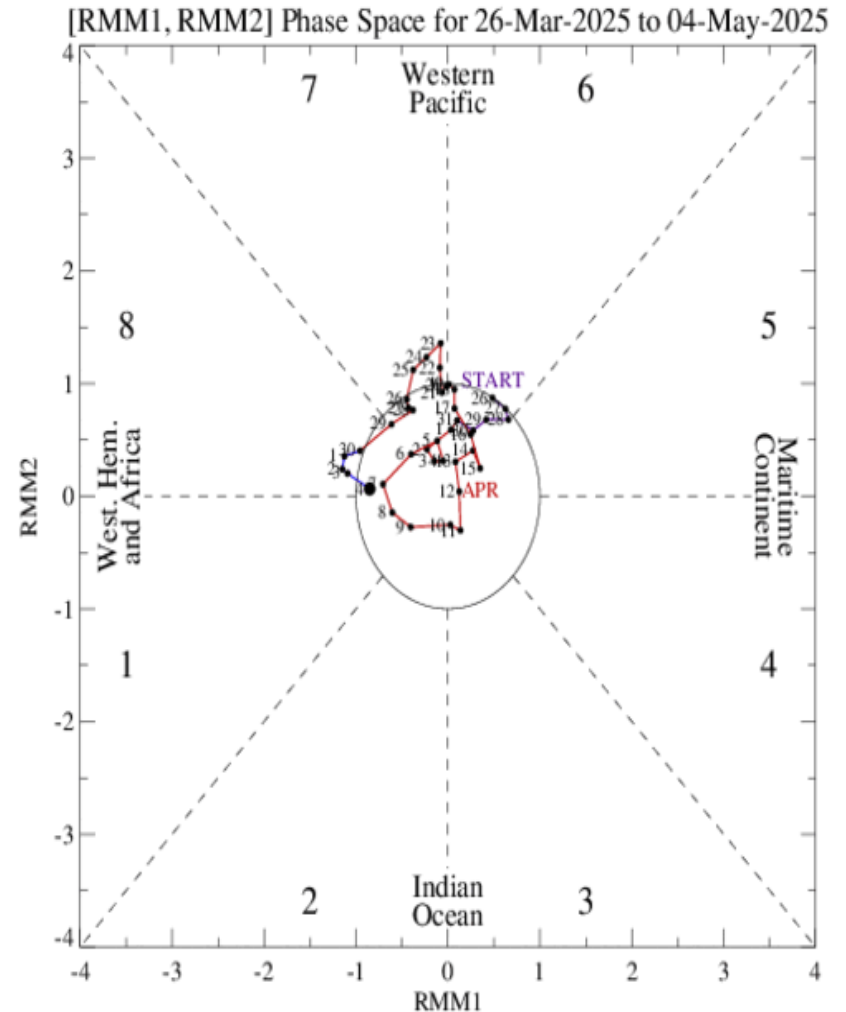
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Consistent with the transition to ENSO-neutral conditions, SST anomalies in Niño regions remain near zero with much of the warming in the eastern equatorial Pacific also returning to more neutral conditions within the past few weeks.
- Subsurface negative temperature anomalies continue to weaken across the central Pacific, with positive anomalies emerging east of 120°W. Positive heat content anomalies are gradually increasing in magnitude west of the Date Line.

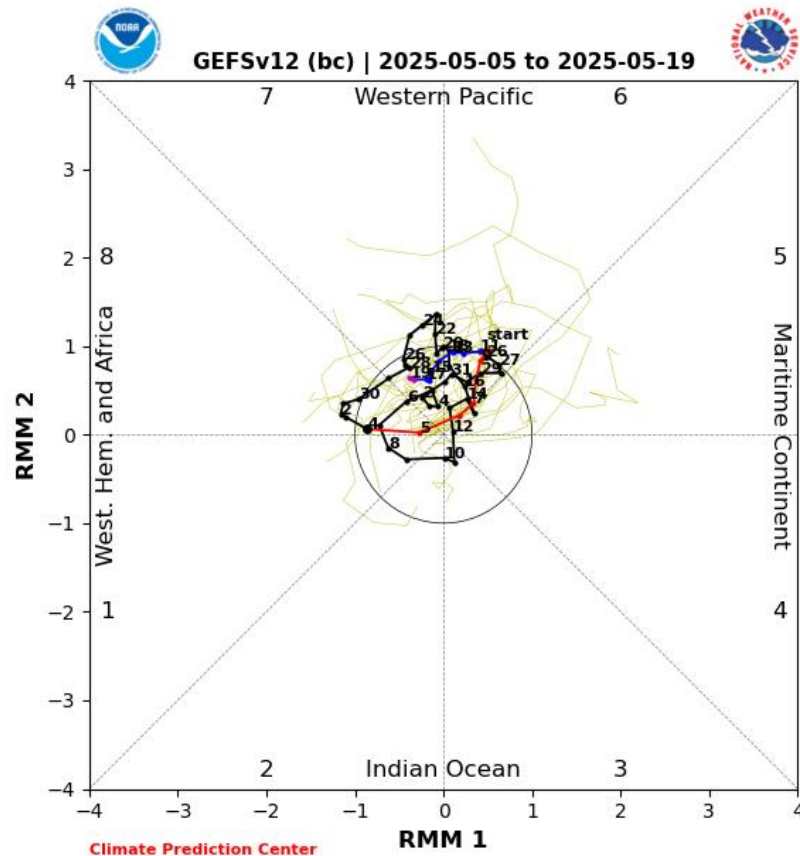
MJO Index: Recent Evolution

- The RMM based MJO index shows an eastward propagating signal from the western Pacific into the Western Hemisphere at a low amplitude during the past week or so.
- More recently, the signal has reentered the unit circle over phase 8.

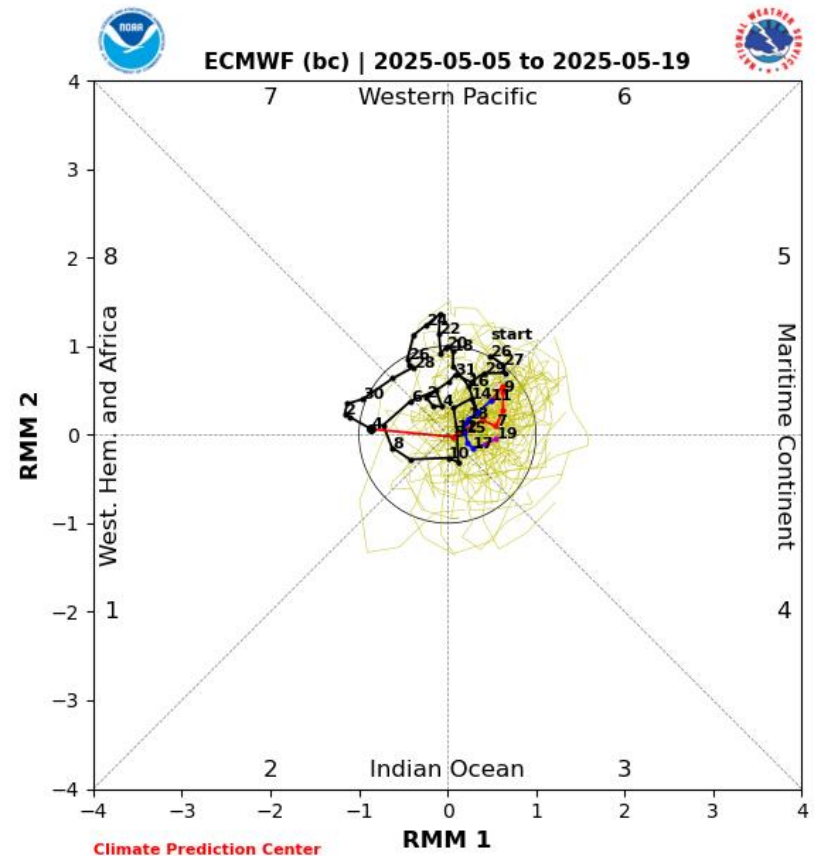


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



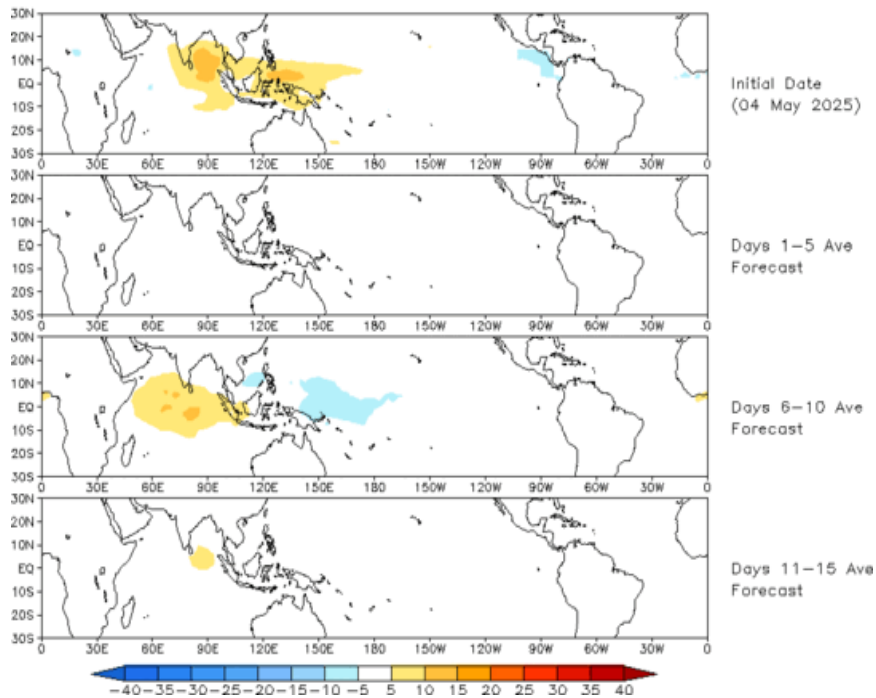
ECMWF Forecast

- Dynamical models are in good agreement favoring a rapid decrease in amplitude, with the signal quickly returning the Maritime Continent and western Pacific and remaining within the RMM unit circle.
- The fast propagating behavior (phase 8 to phase 4) appears fall more in line with Kelvin wave activity

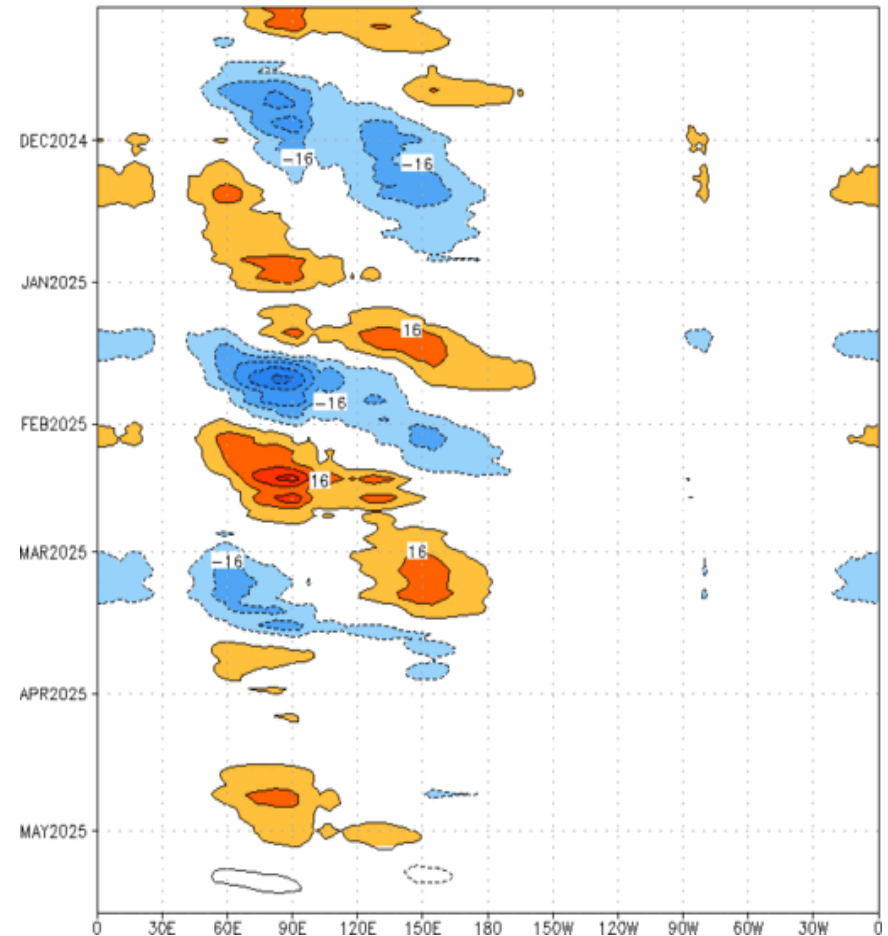
MJO: GEFS Forecast Evolution

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.)

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 04 May 2025
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:02-Nov-2024 to 04-May-2025
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

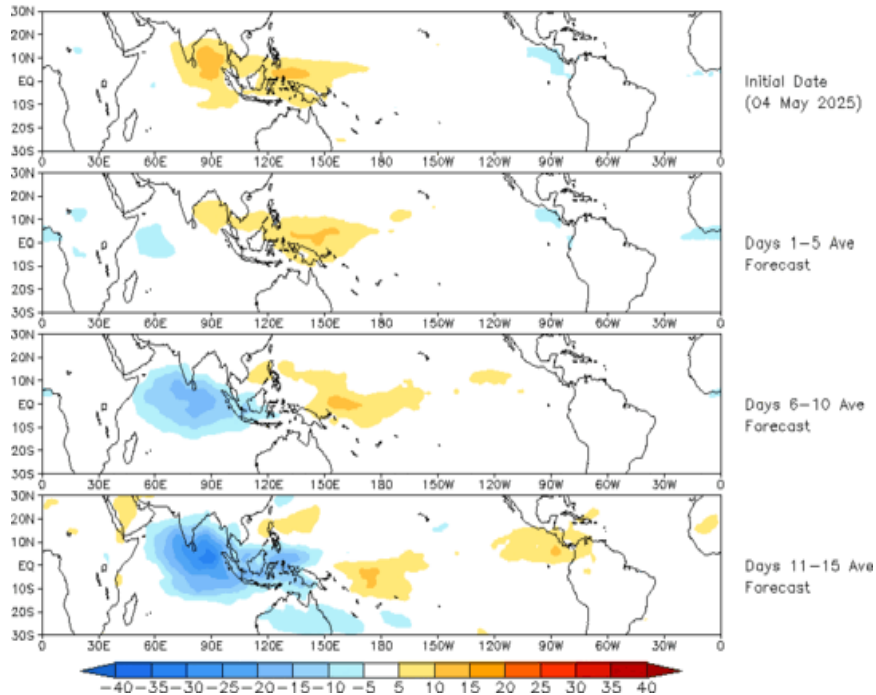


- The GEFS OLR forecast favors a reversal of the convective anomalies over parts of the Maritime Continent and western Pacific during week-1, with the anomalies weakening to near zero during week-2.

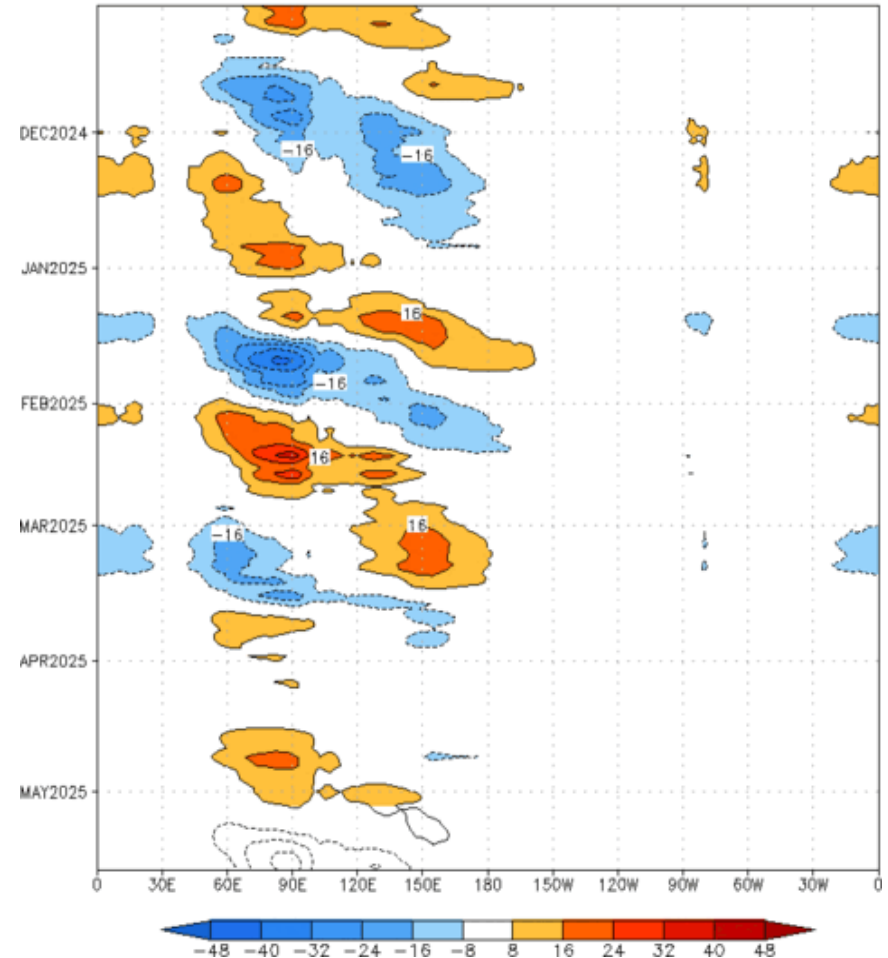
MJO: Constructed Analog Forecast Evolution

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.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (04 May 2025)



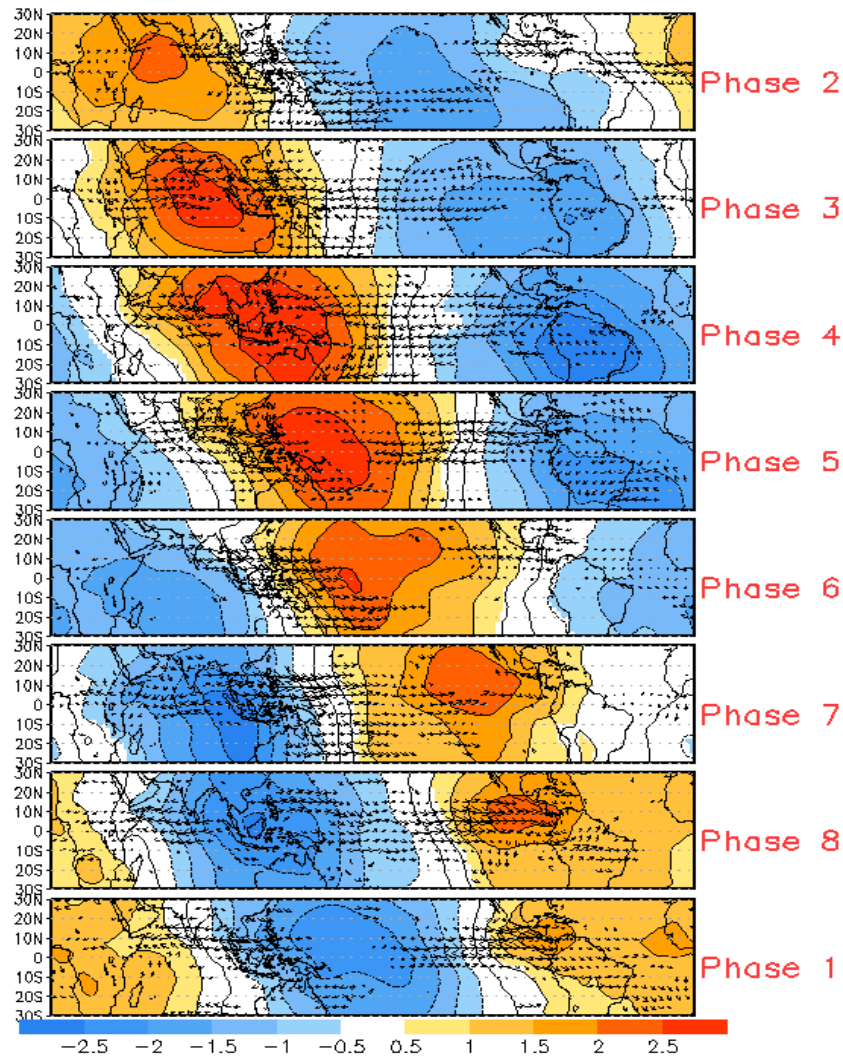
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cont:4Wm⁻²) Period:02-Nov-2024 to 04-May-2025
The unfilled contours are CA forecast reconstructed anomaly for 15 days



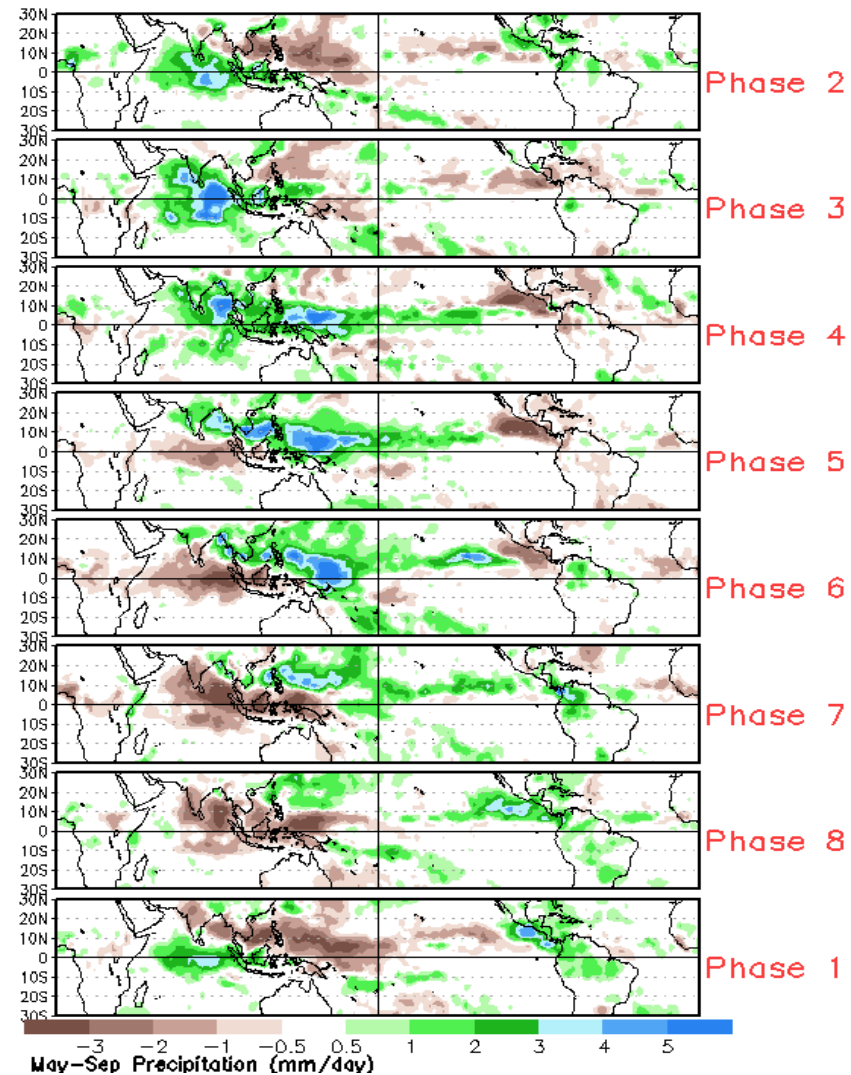
- The constructed analog forecast favors a more canonical MJO evolution, with enhanced convection shifting eastward from the Indian Ocean with more suppressed convection developing over the equatorial Pacific and tropical Americas.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and
Wind Anomalies



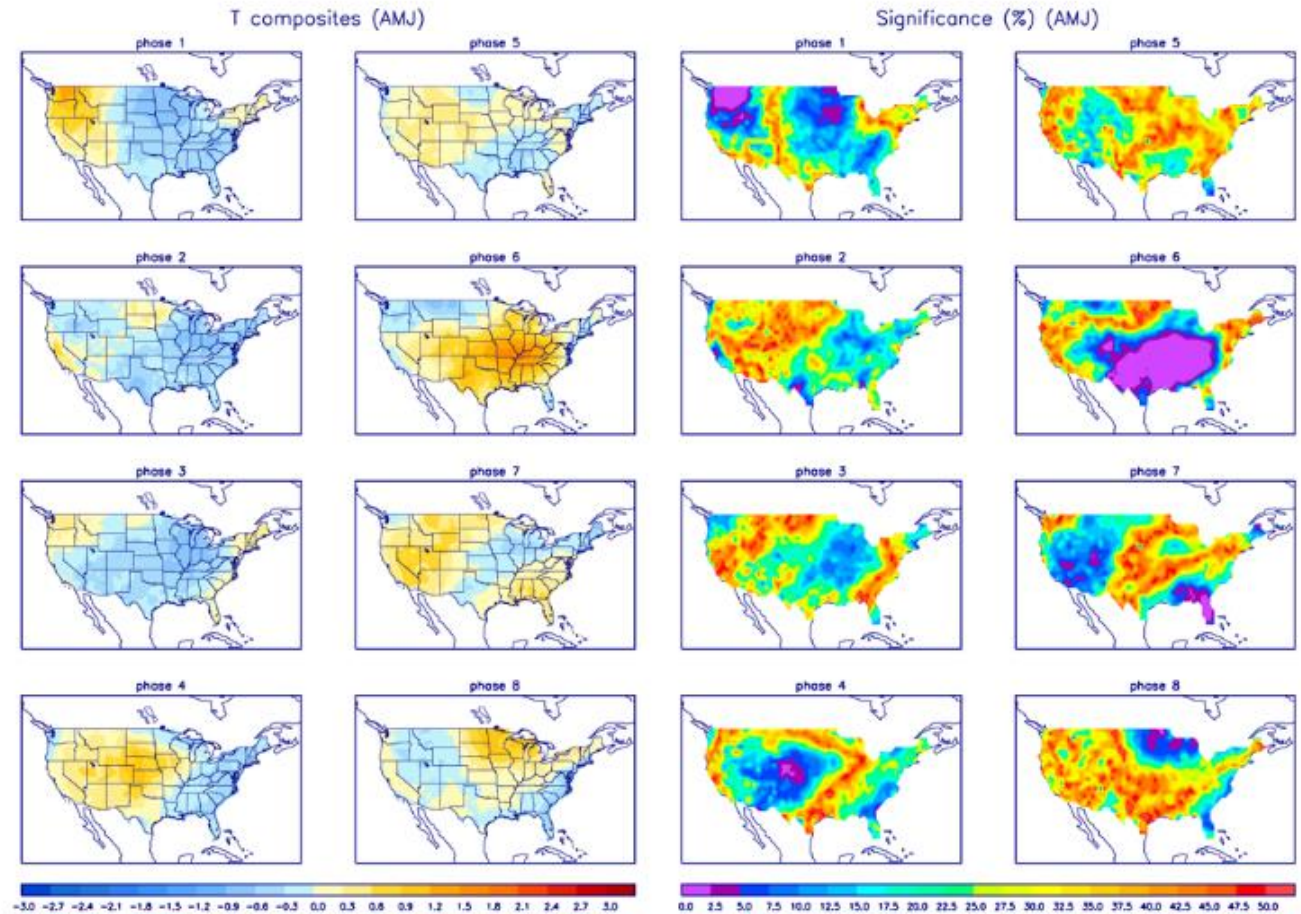
Precipitation Anomalies



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.



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.

