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

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

Overview

- The MJO remains incoherent based on RMM observations and other fields. Kelvin Wave activity and a low frequency convective footprint near the Maritime Continent appear to remain the predominant modes of tropical variability since late March.

- There is general agreement in the dynamical model RMM forecasts depicting an uptick in amplitude of the MJO signal over the Maritime Continent later in May. However, any renewed activity is favored to be short-lived, and absent of any sustained eastward propagation consistent with a MJO.

- There is some support in the extended range RMM forecasts favoring a more canonical eastward propagating MJO signal over the Western Pacific and into the Western Hemisphere. However, forecast confidence for a more coherent MJO developing remains low in the outlook, amidst an ENSO neutral background state.

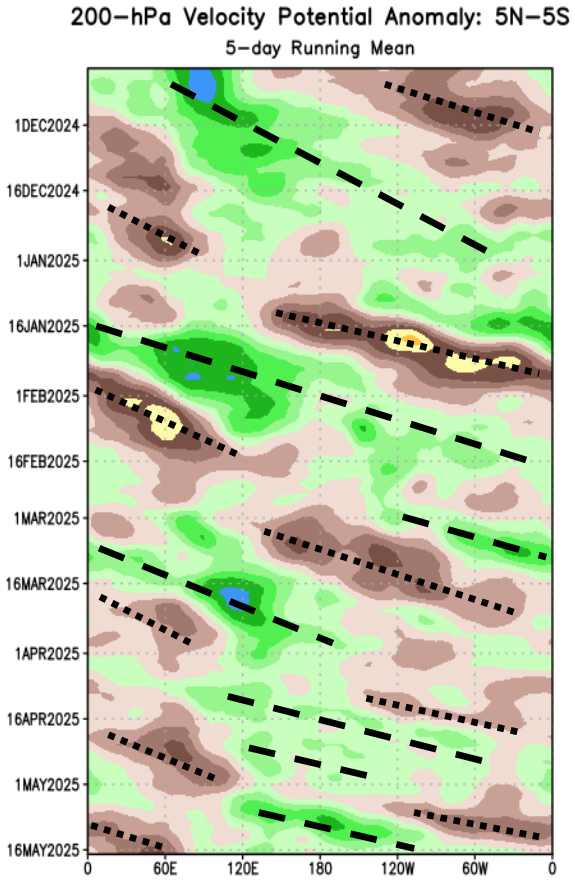
- Any tropical cyclogenesis that occurs over the next few weeks is likely to be triggered by other modes of variability, such as Kelvin or equatorial Rossby waves.

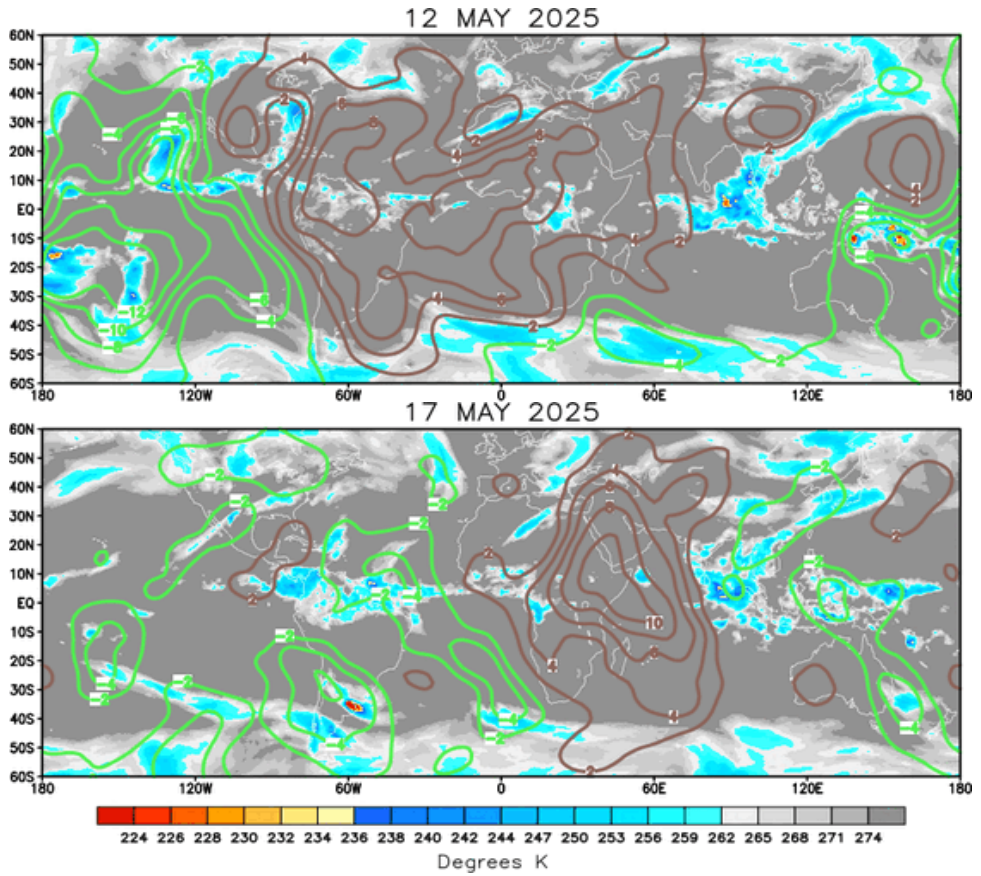
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

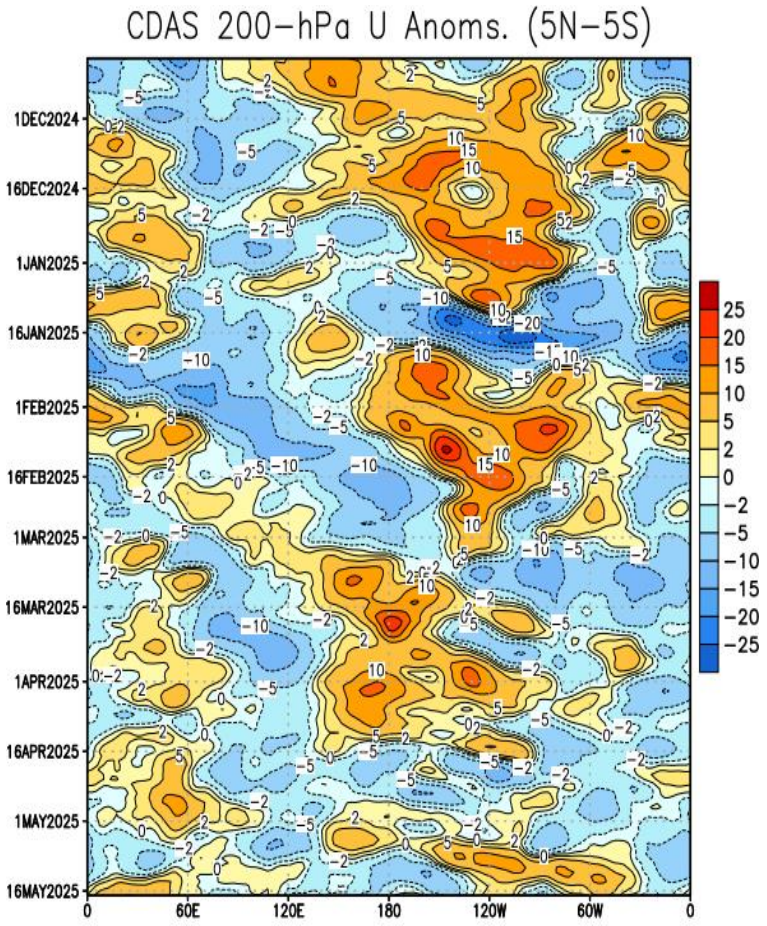


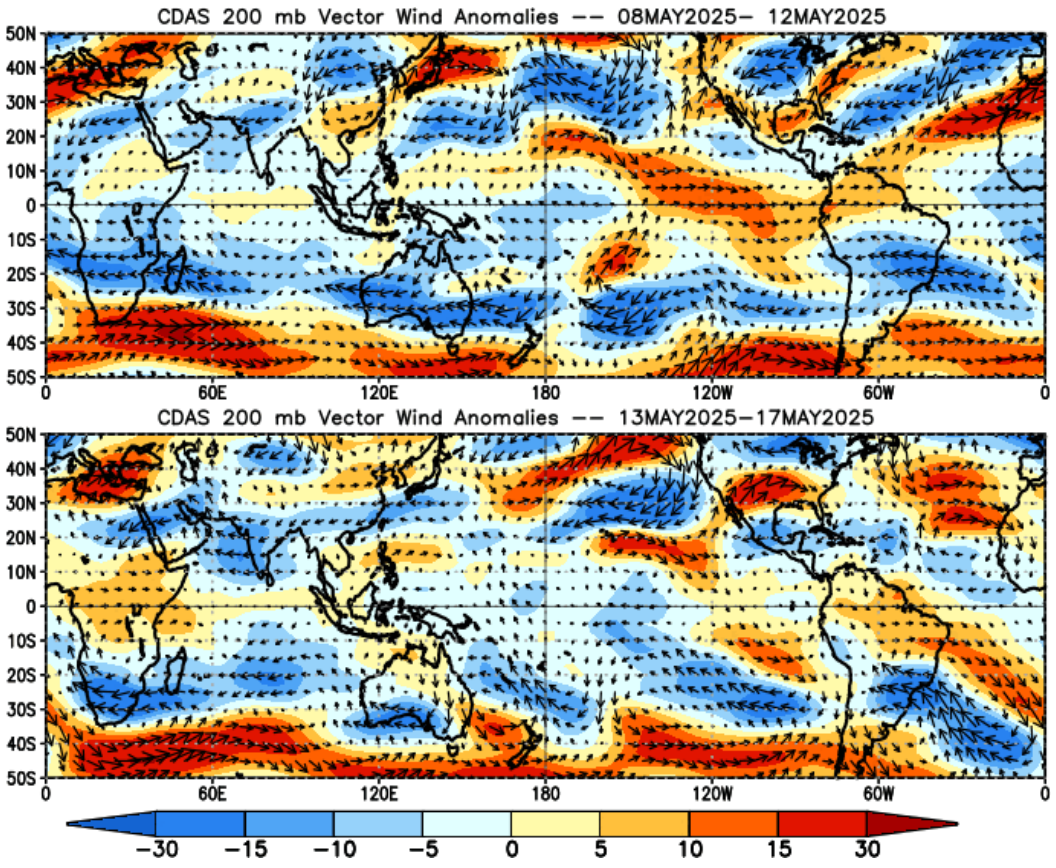


- An envelope of suppressed divergence aloft shifted eastward from the western Hemisphere into the Indian Ocean, while the enhanced divergence envelope weakened and became more disorganized.
- The time/longitude plot shows several eastward propagating features this spring, but these appear to be more characteristic of equatorial Kelvin Wave passages rather than a canonical MJO activity.

200-hPa Wind Anomalies

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

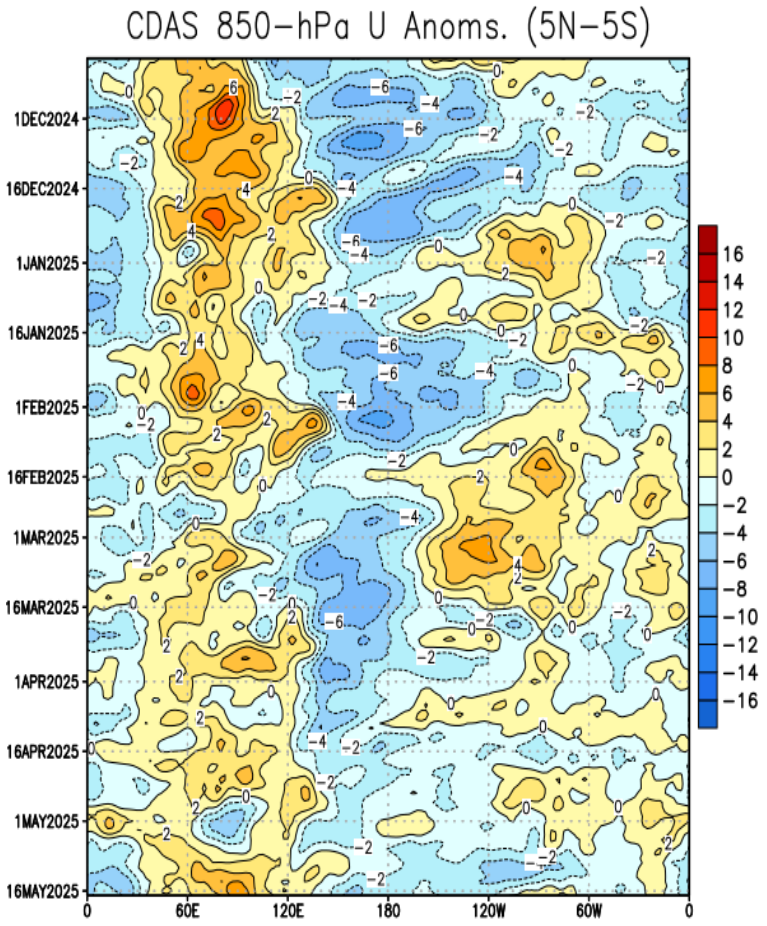


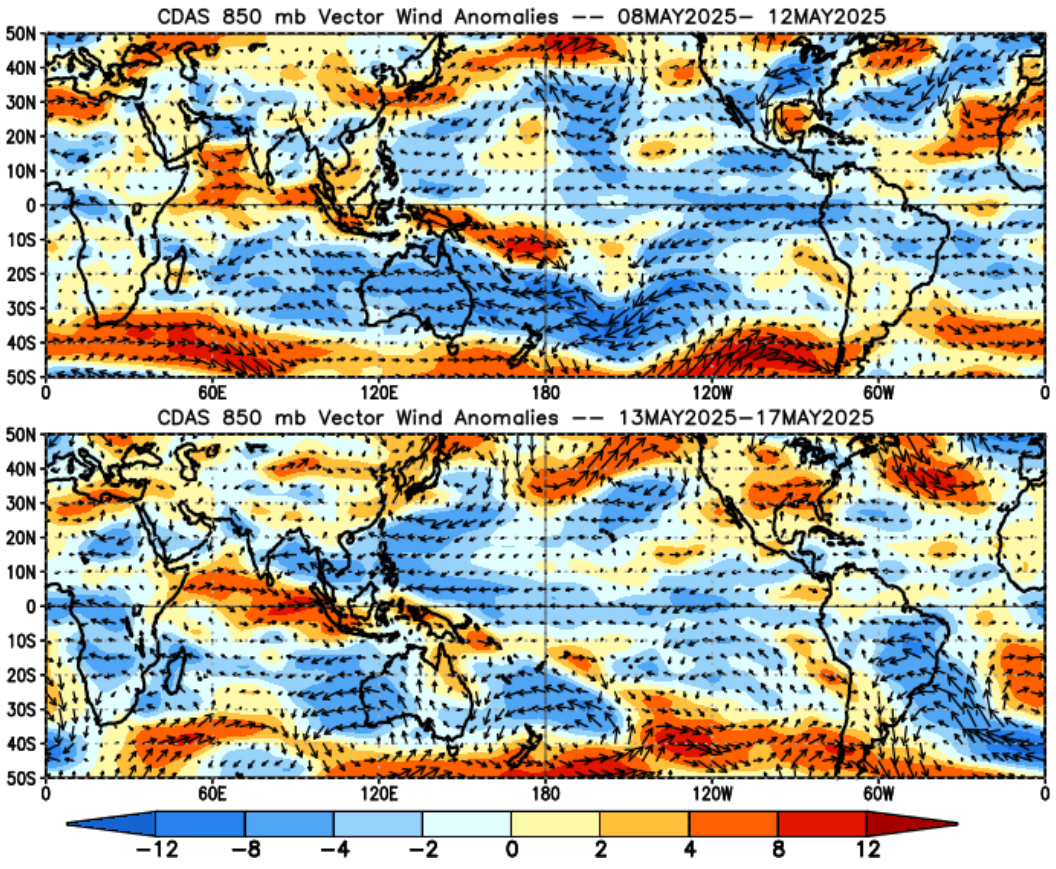


- Consistent with the upper-level velocity potential anomalies, rapid shifts between westerlies to easterlies across portions of the Indian Ocean and Pacific point more towards Kelvin wave activity than an active MJO.
- Anomalous westerlies re-emerged across equatorial Africa and the western Indian Ocean, and appear to be a part of a low frequency response established since last year.
- An upper-level trough persisted over the central and eastern CONUS

850-hPa Wind Anomalies

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

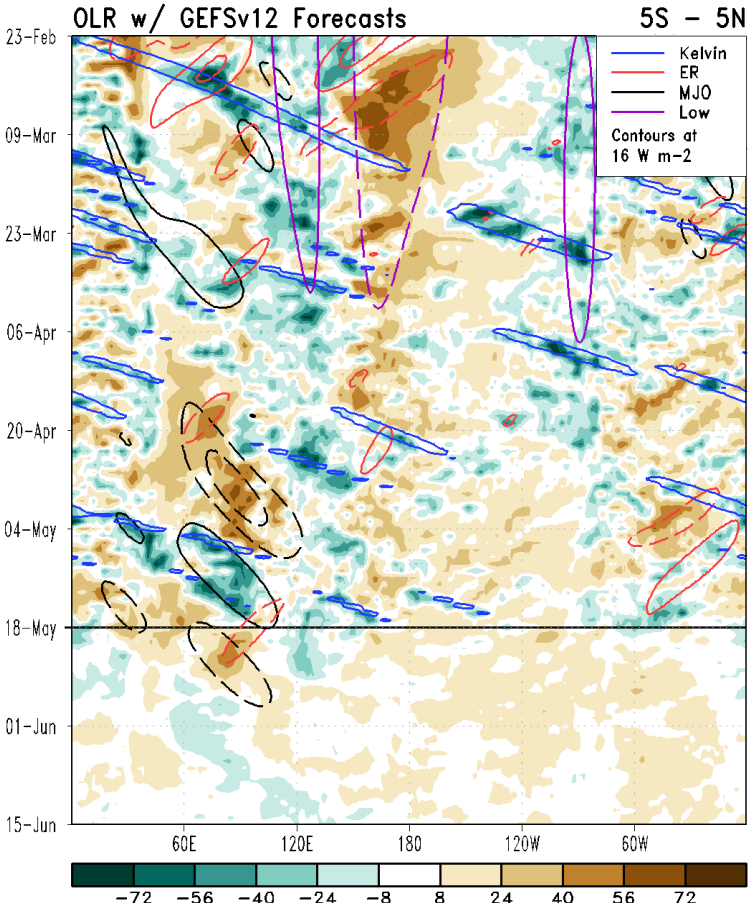


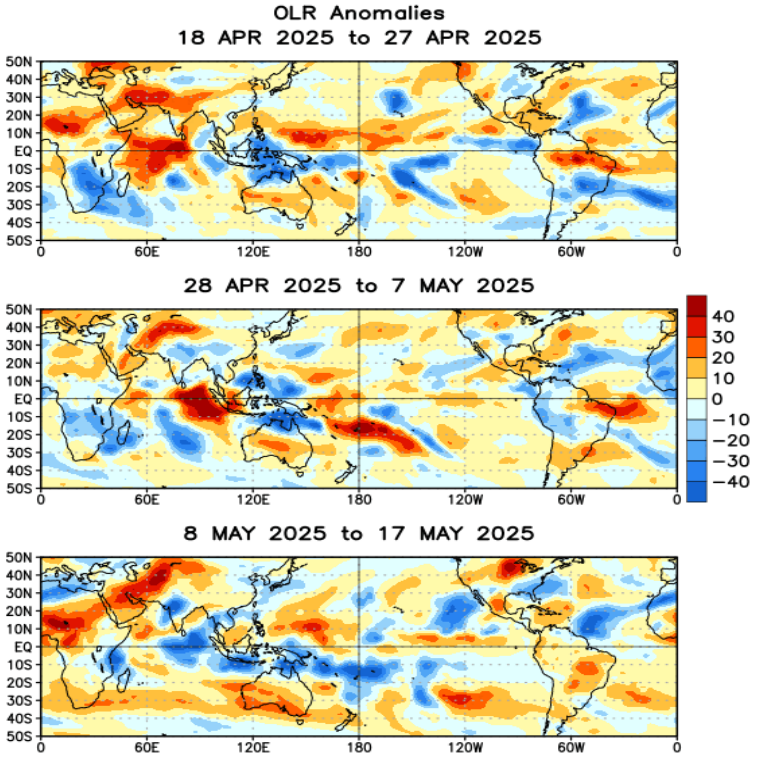


- Anomalous westerlies strengthened over the Indian Ocean, and continued to extend eastward below the equator to the South Pacific.
- Enhanced trades envelope much of the equatorial Pacific, with some strengthening observed over the northwestern Pacific, contributing to a delayed start of the Western Pacific Tropical Cyclone season.
- Overall, the lower-level pattern is not reflective of coherent subseasonal activity.

Outgoing Longwave Radiation (OLR) Anomalies

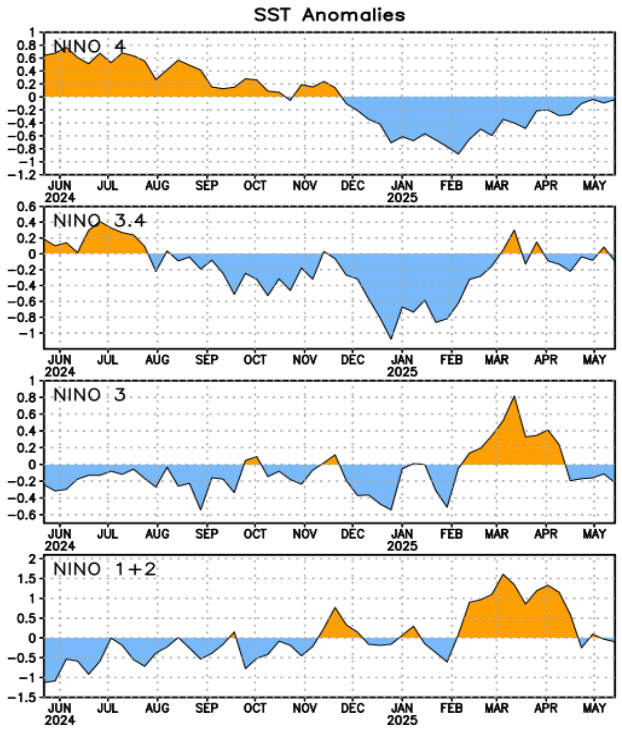
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

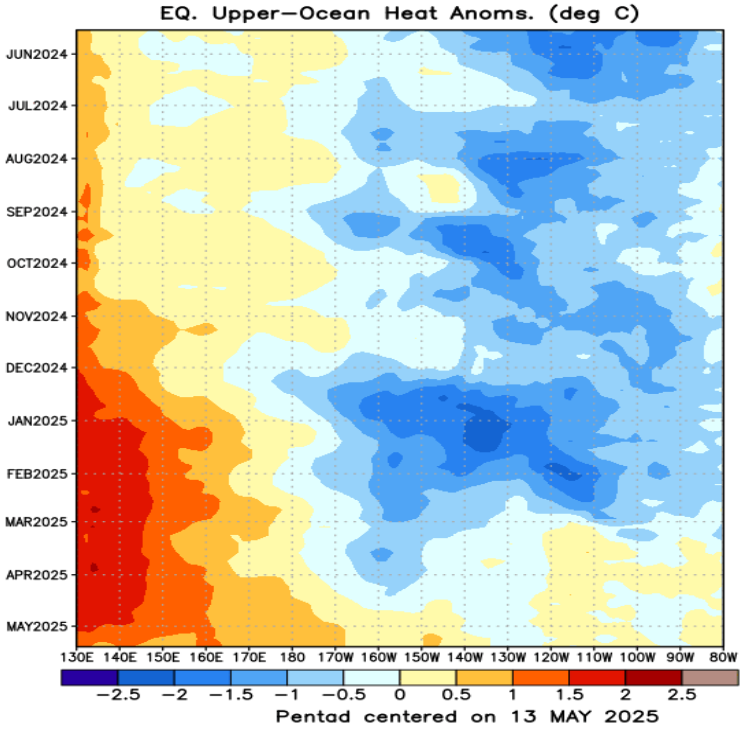




- Consistent with a band of anomalous lower-level westerlies, convection became more enhanced north of Australia and in the SPCZ region.
- Tied to the outgoing La Nina, residual suppressed convection remains observed mostly north of the equator.
- Enhanced convection persists along and to the east of 120E, with Kelvin wave activity remaining the predominant eastward propagating tropical mode since late March .

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

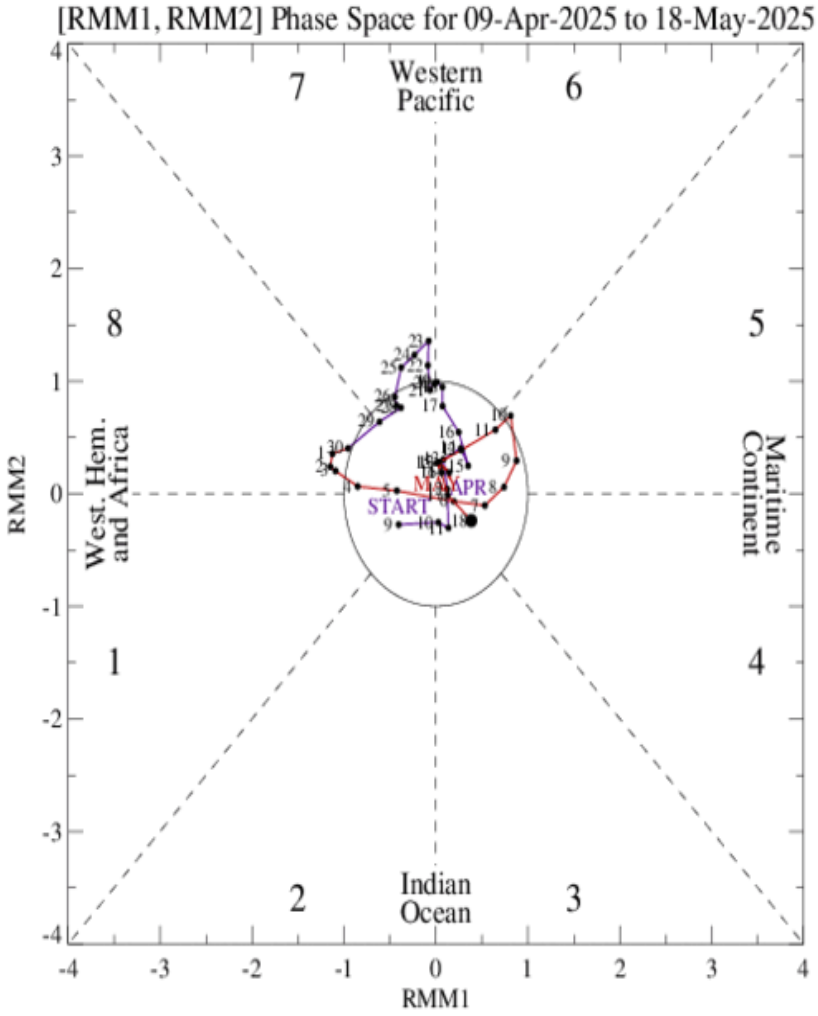




- Consistent with the transition to ENSO-neutral conditions, SST anomalies in Niño regions remain near zero with much of the warming in the eastern equatorial Pacific also returning to more neutral conditions within the past few weeks.
- Negative subsurface anomalies have been further reduced to near zero east of the Date Line, while warmer waters continue to expand eastward west of the Date Line.

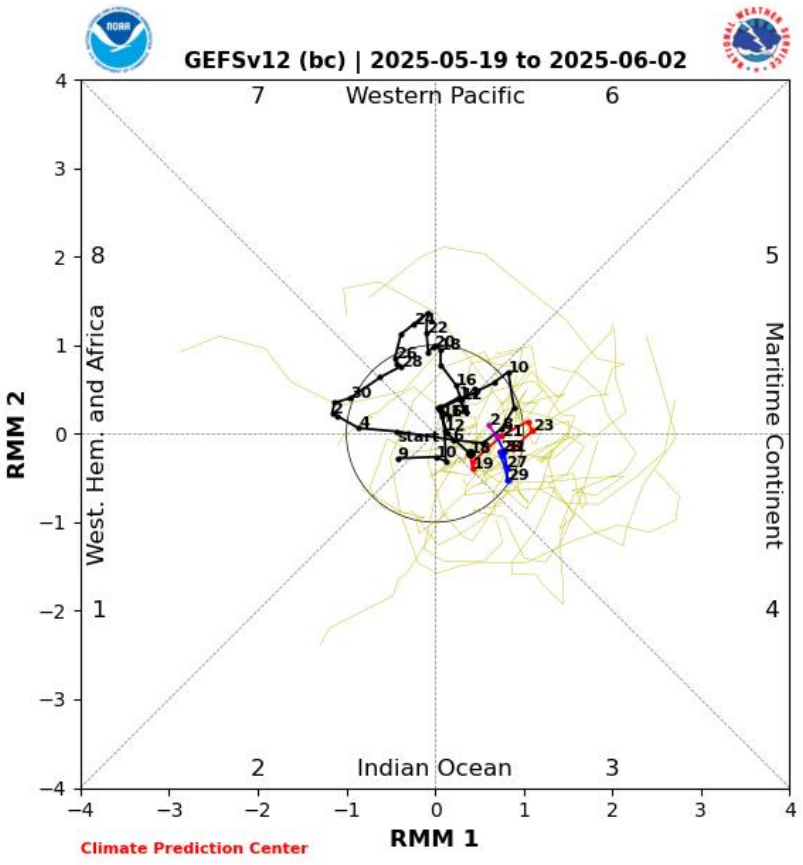
MJO Index: Recent Evolution

- The RMM-index continues to reflect a weak and incoherent MJO signal, with the latest observations residing near the RMM origin.
- Over the past 40 days, only a small fraction of observations were spent outside the RMM unit circle.

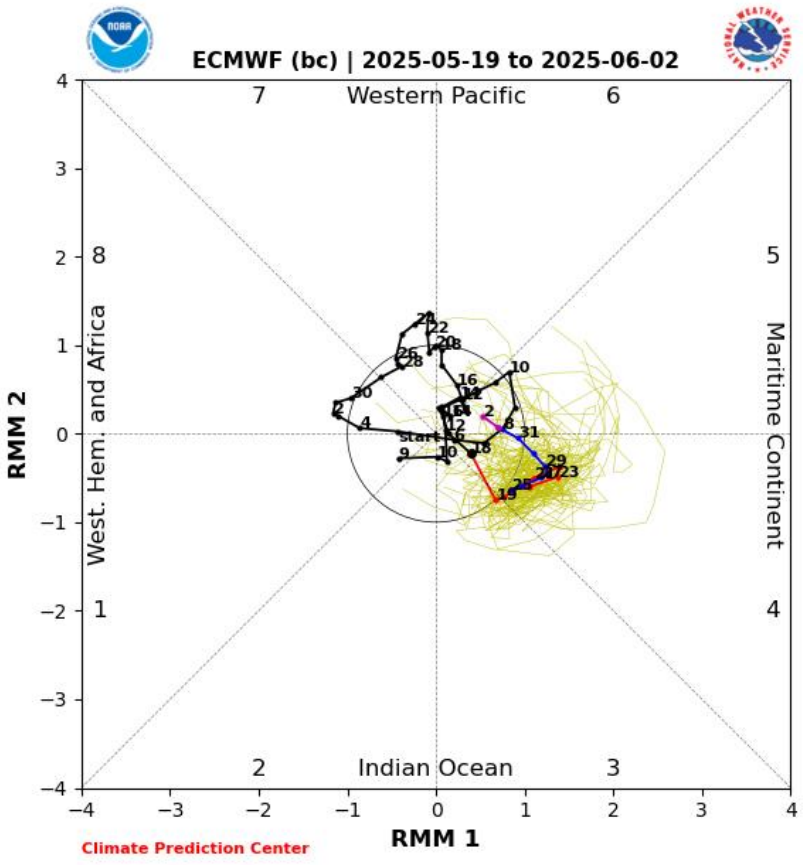


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

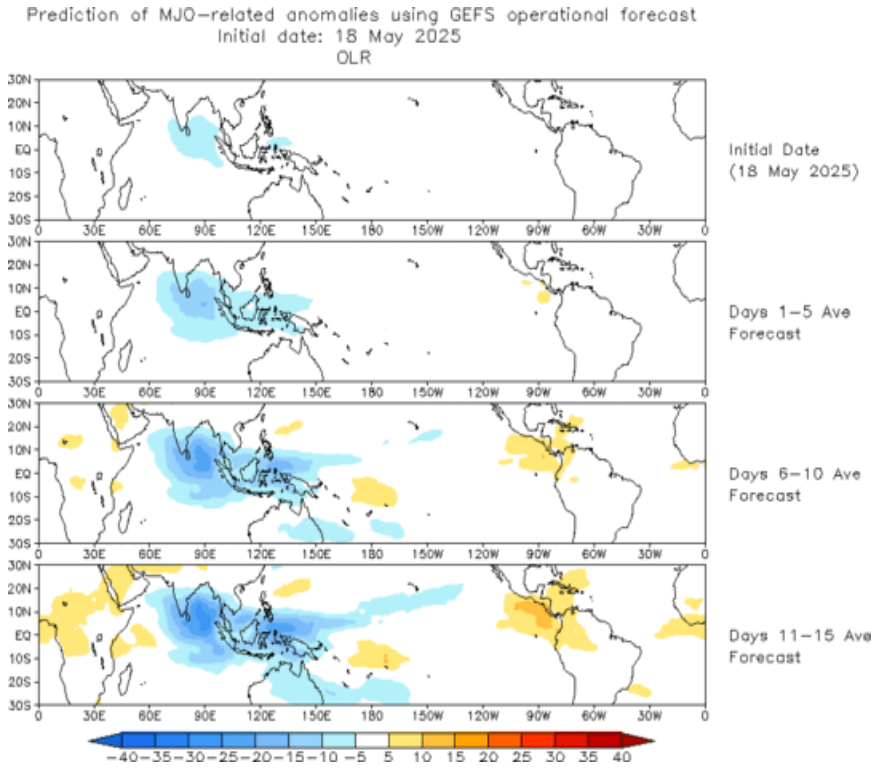


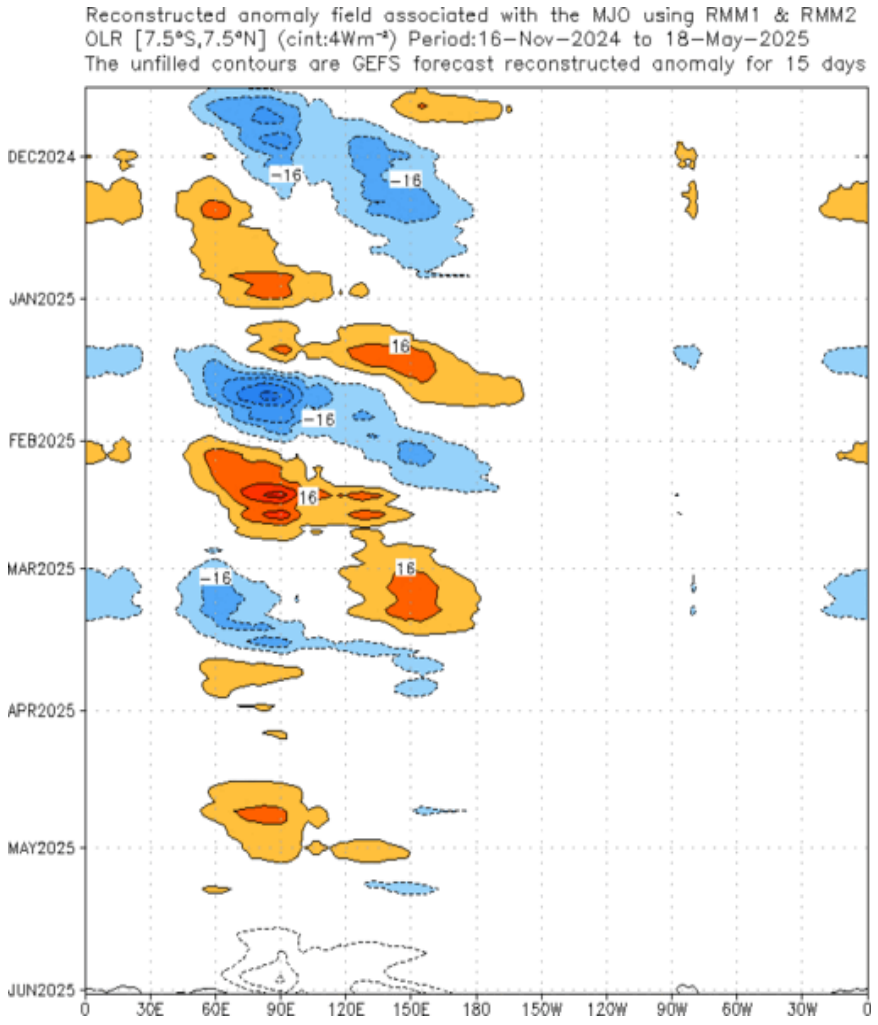
ECMWF Forecast

- RMM-index forecasts from both the GEFS and ECMWF favor a strengthening signal over the Maritime Continent, but any renewal is short-lived and absent of any sustained eastward propagation, which is likely tied to other modes of tropical variability.
- There is some support in the extended range RMM forecasts for a more canonical eastward propagating signal in the western Pacific, though its amplitude remains low.

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.)

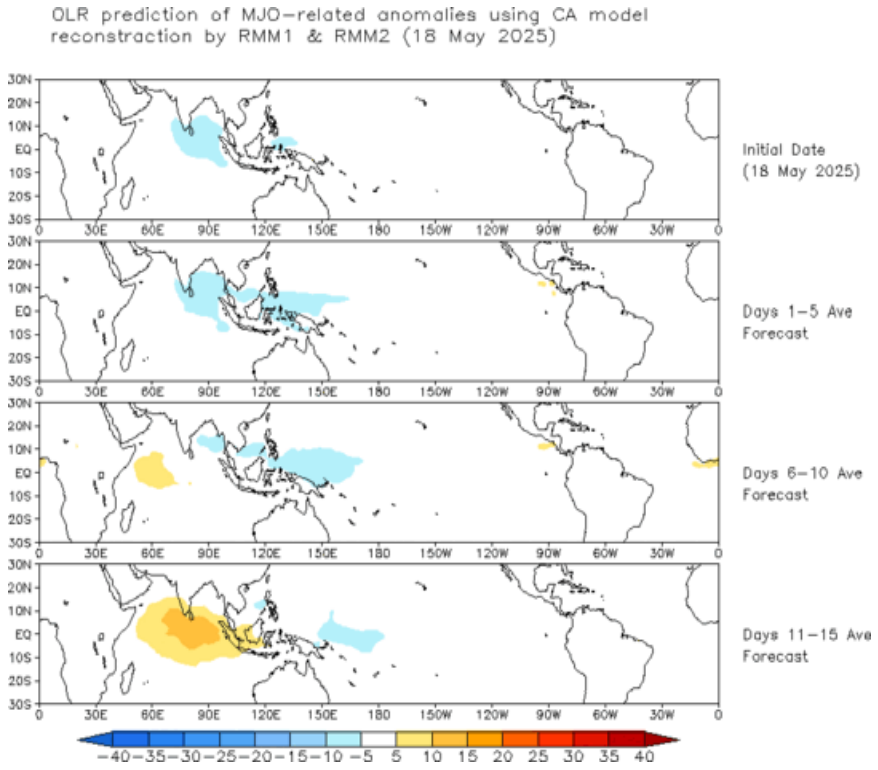


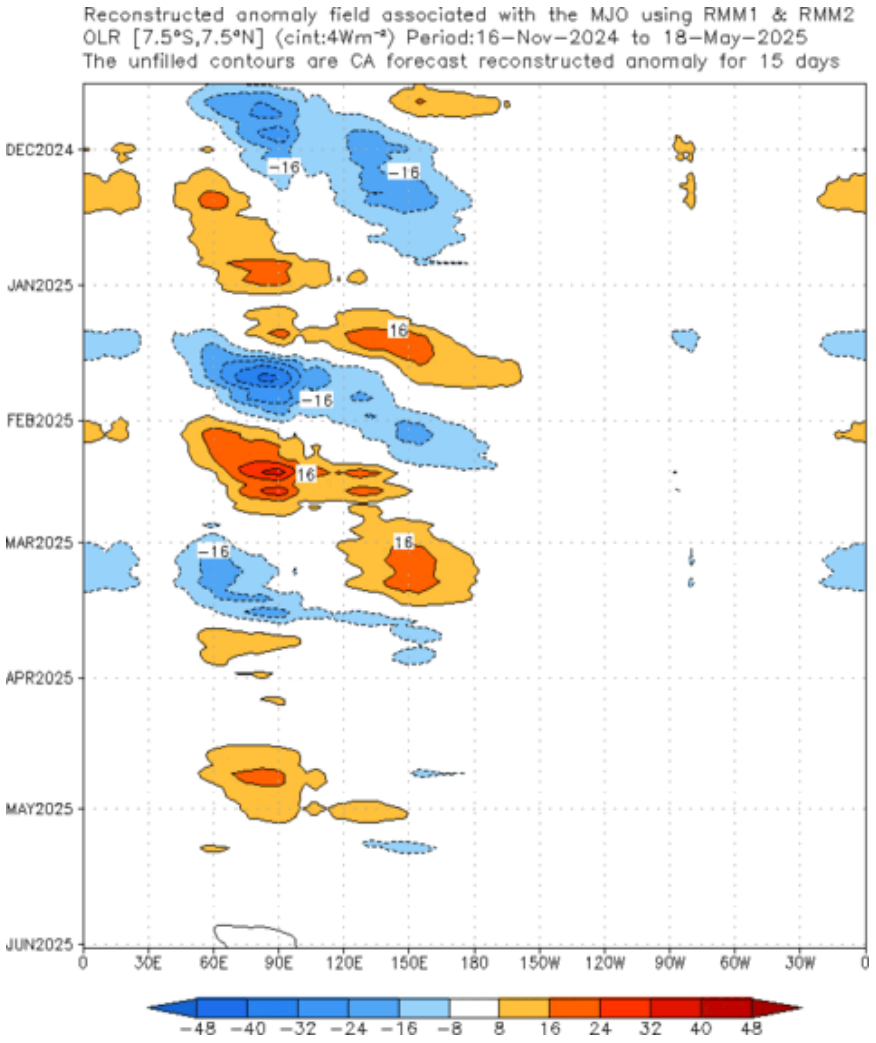


- The GEFS OLR forecast depicts a nearly stationary convective pattern, with enhanced (suppressed) conditions grower stronger of the Indian Ocean and Maritime Continent (western Hemisphere) .

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.)

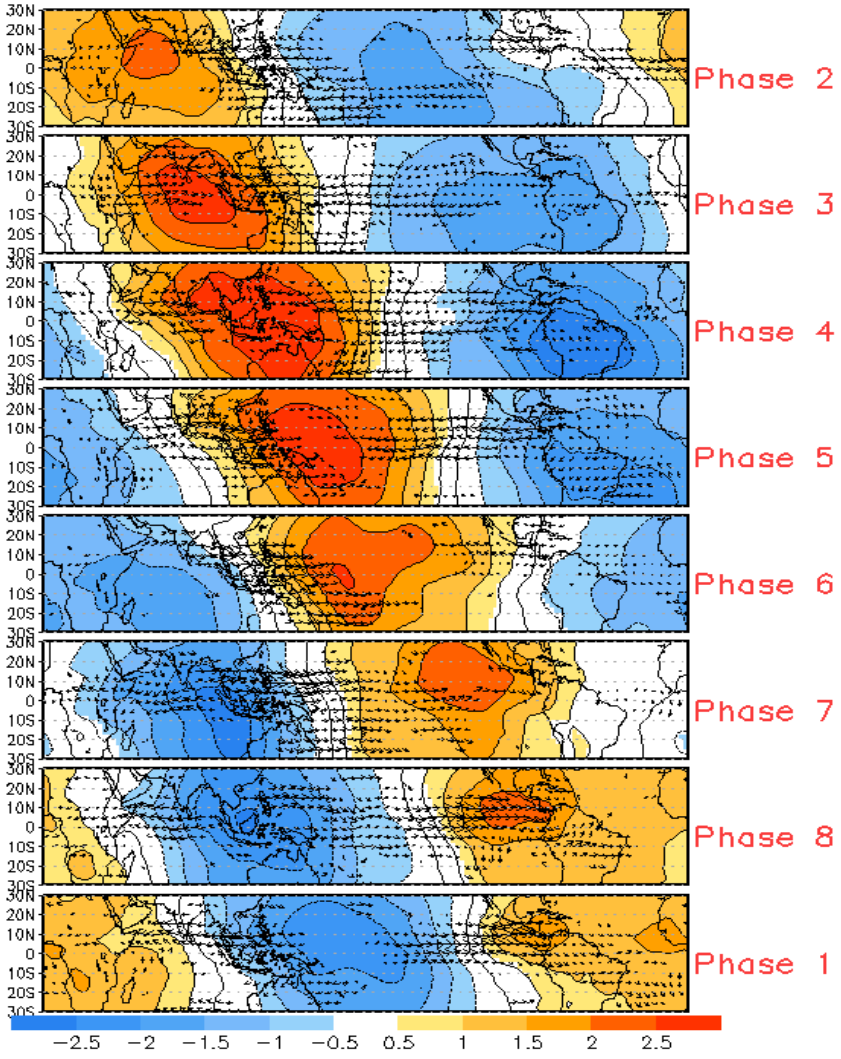




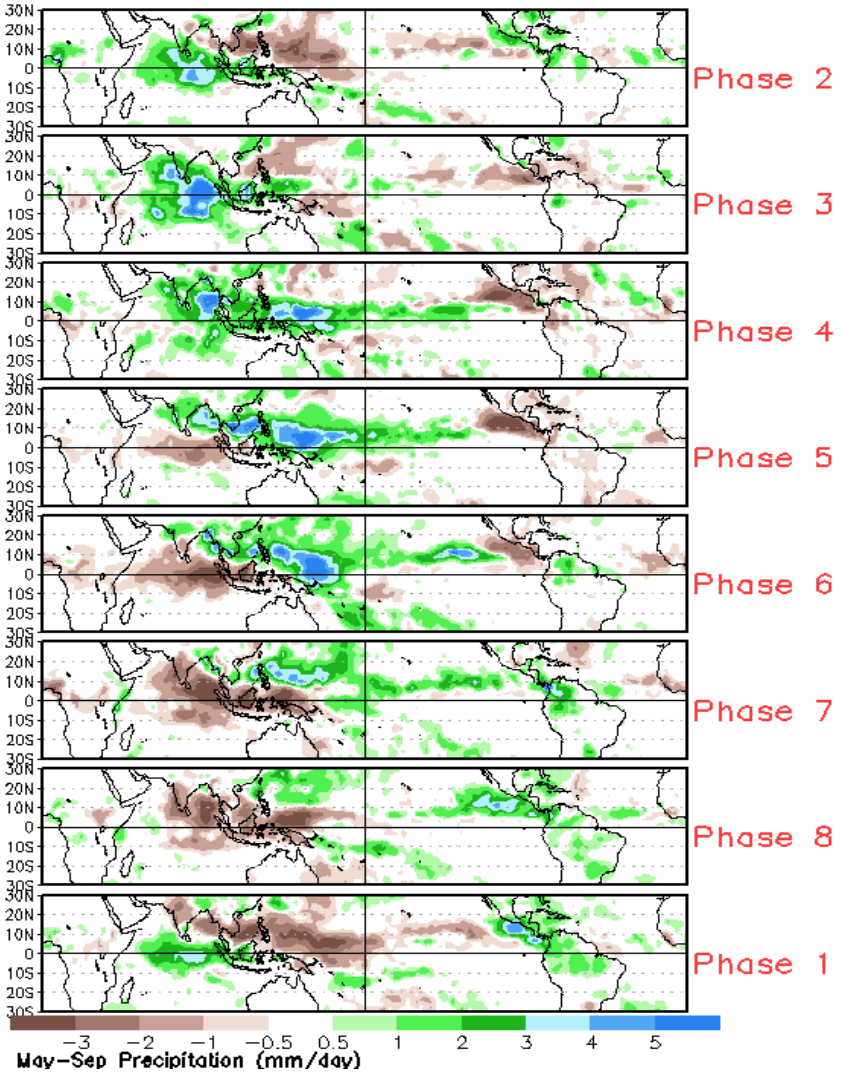
- The constructed analog forecast is at odds with the GEFS, instead favoring the development of suppressed convection over the Indian Ocean.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



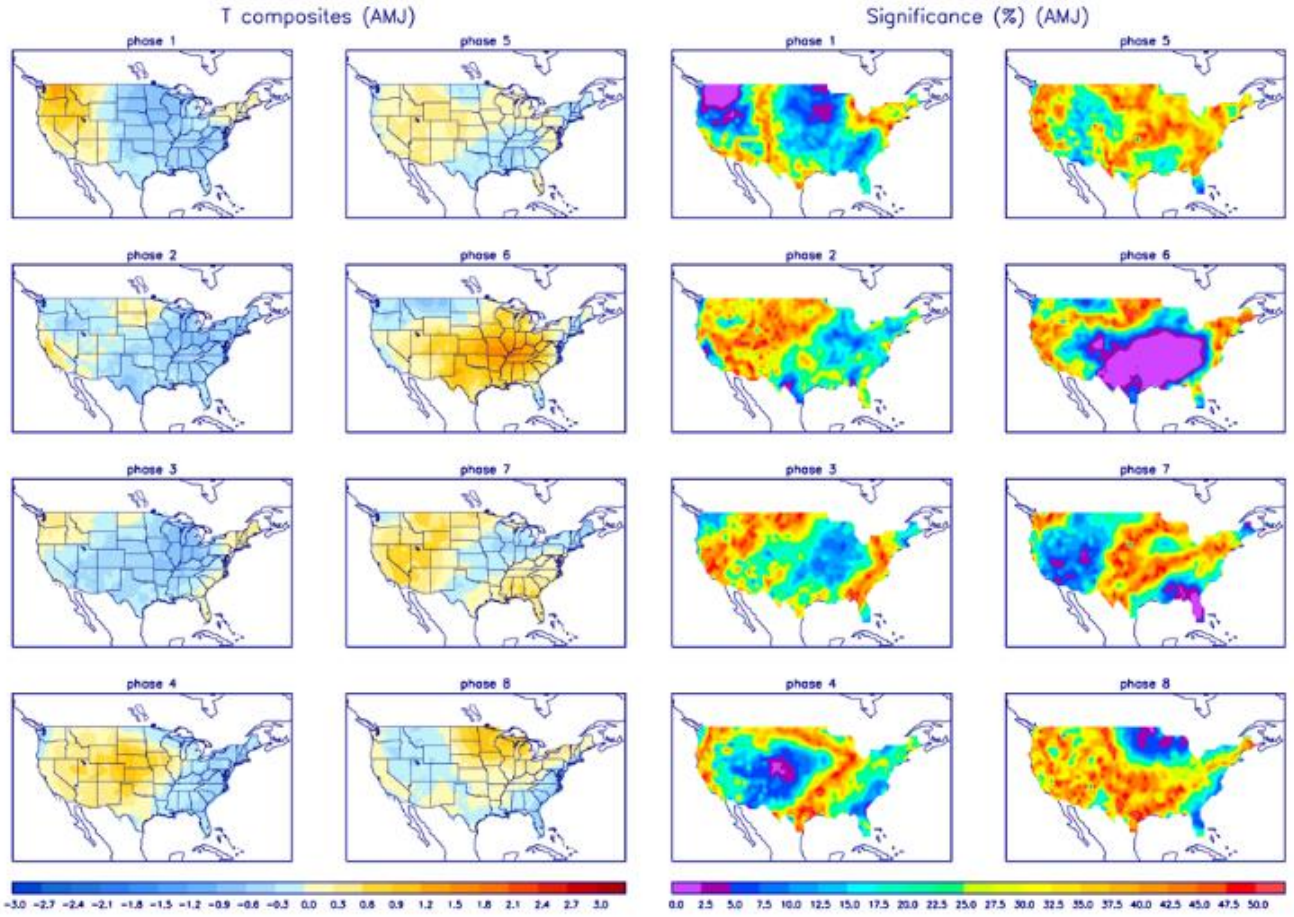
Precipitation Anomalies



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.

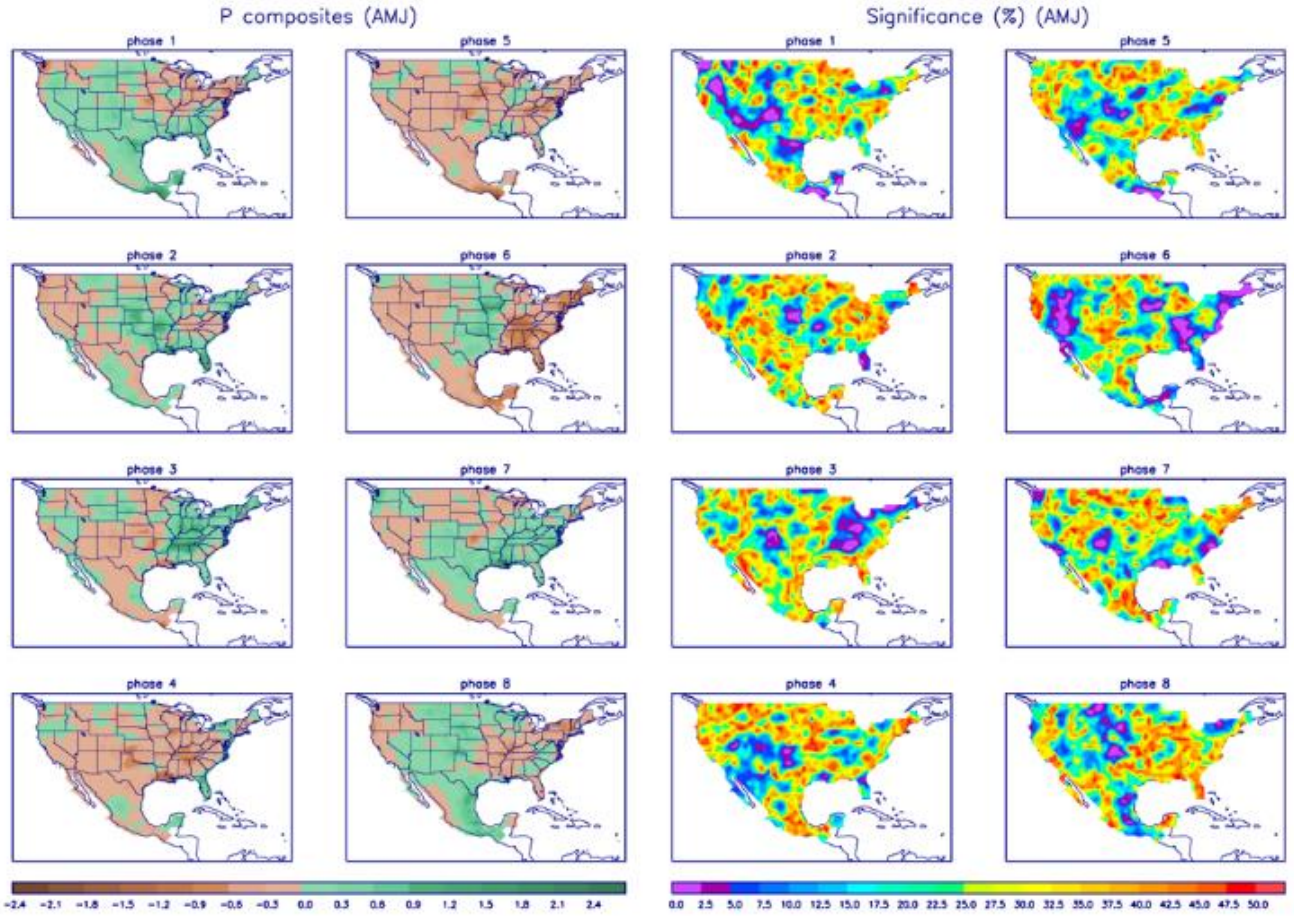


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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.



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