

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



Update prepared by the Climate Prediction Center  
NWS / NCEP / CPC  
3 February 2025

# Overview

---

- There has been a steady eastward propagation of the MJO across the Indian Ocean into the Maritime Continent during the past several weeks.
- Dynamical models indicate a continued eastward propagation into the Western Pacific but with uncertainty regarding its amplitude.
- The MJO supports increased chances of tropical cyclone (TC) development across northern Australia and the Coral Sea during weeks 2 and 3. Additional TCs cannot be ruled out across the Indian Ocean, although chances are forecast to diminish given the trend to more suppressed convection aloft.
- While the current placement of the MJO historically supports a relatively warmer pattern across the central and eastern U.S., possible eastward propagation into phases 7 or 8 combined with the Arctic Oscillation trending negative may begin to reverse some of the warming by mid-February.

A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:

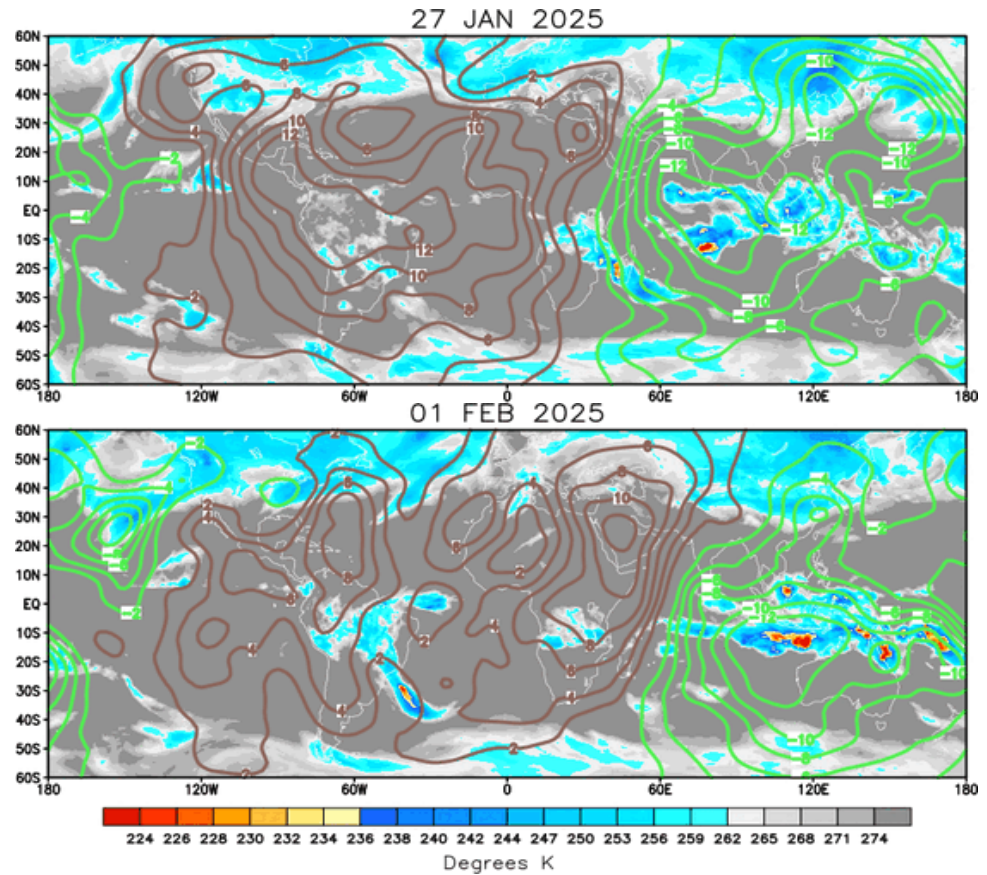
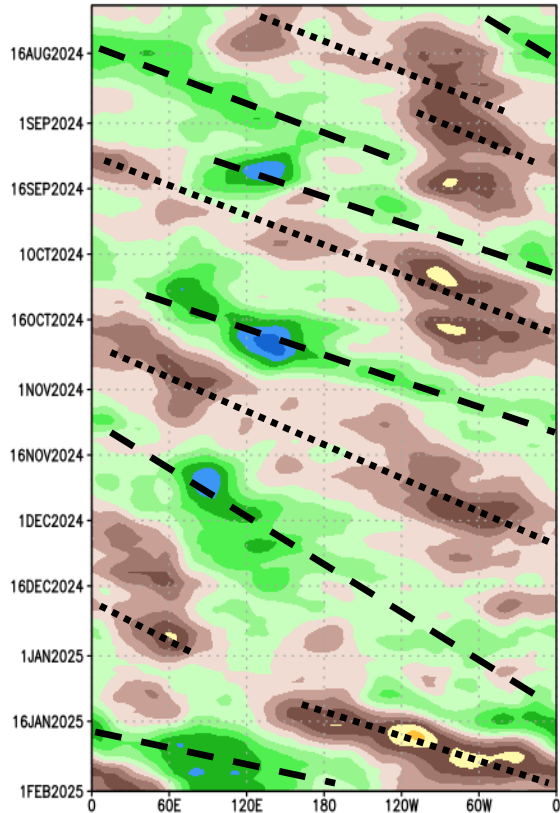
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

# 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

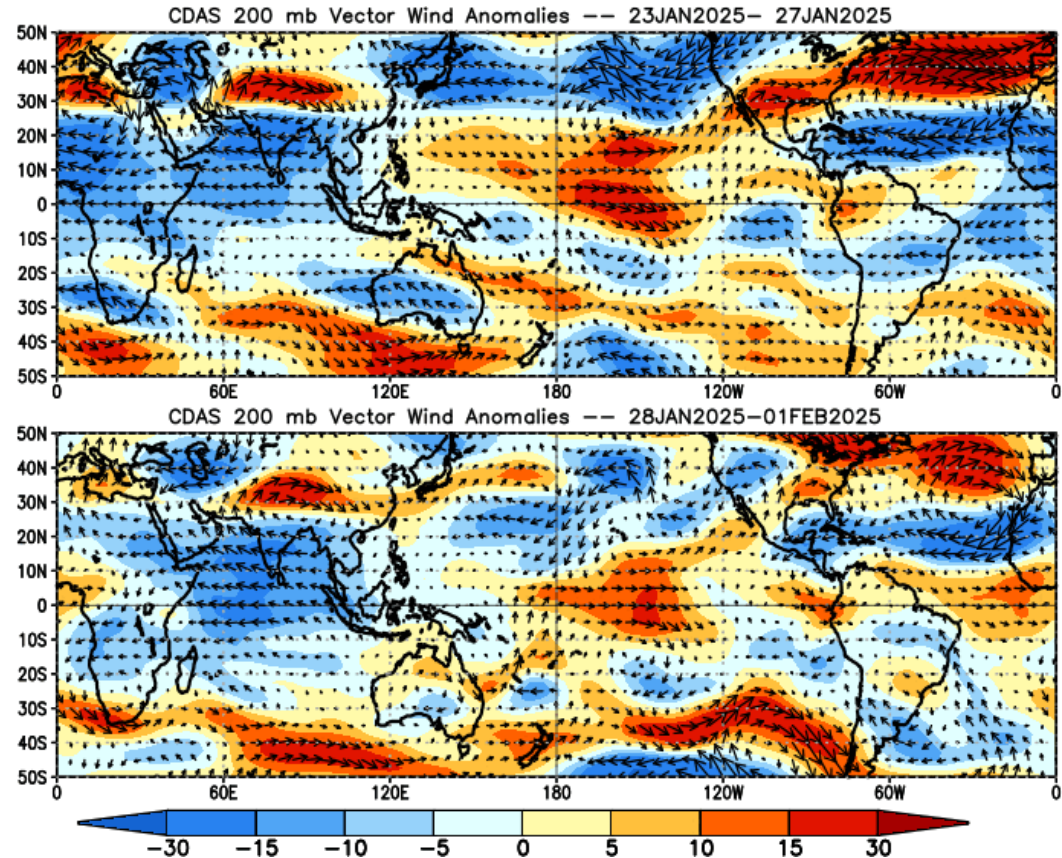
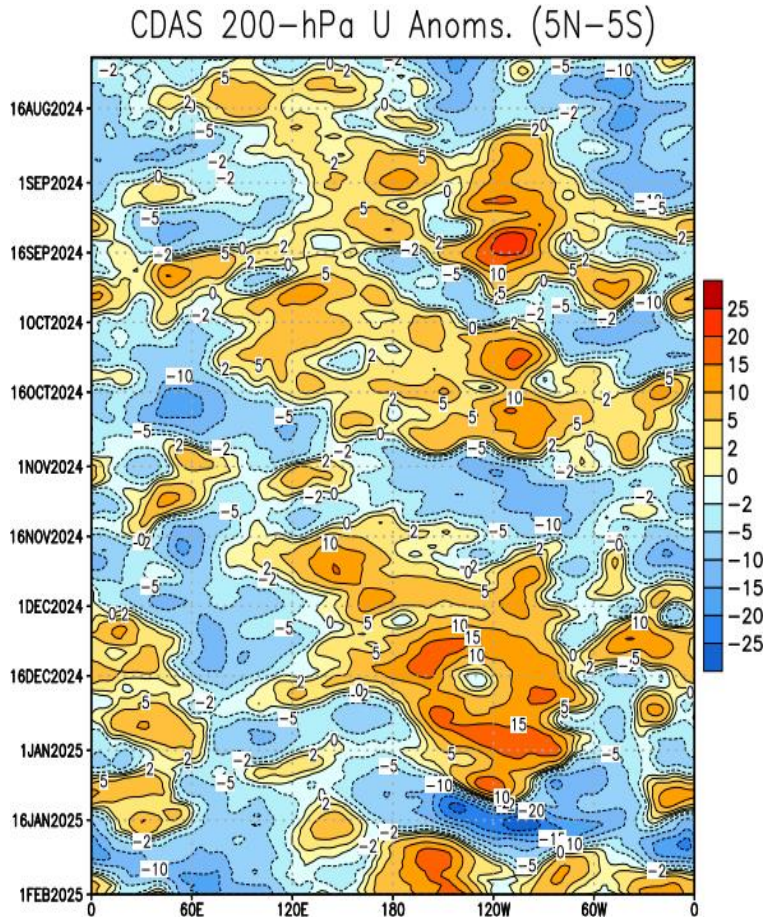


- A very robust wave-1 asymmetry pattern has developed in the upper-level global velocity potential field during the past week.
- Anomalous divergence aloft extends from the eastern Indian Ocean to about the Date Line; anomalous convergence aloft extends across the Eastern Pacific, Americas, Atlantic, and Africa.



# 200-hPa Wind Anomalies

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

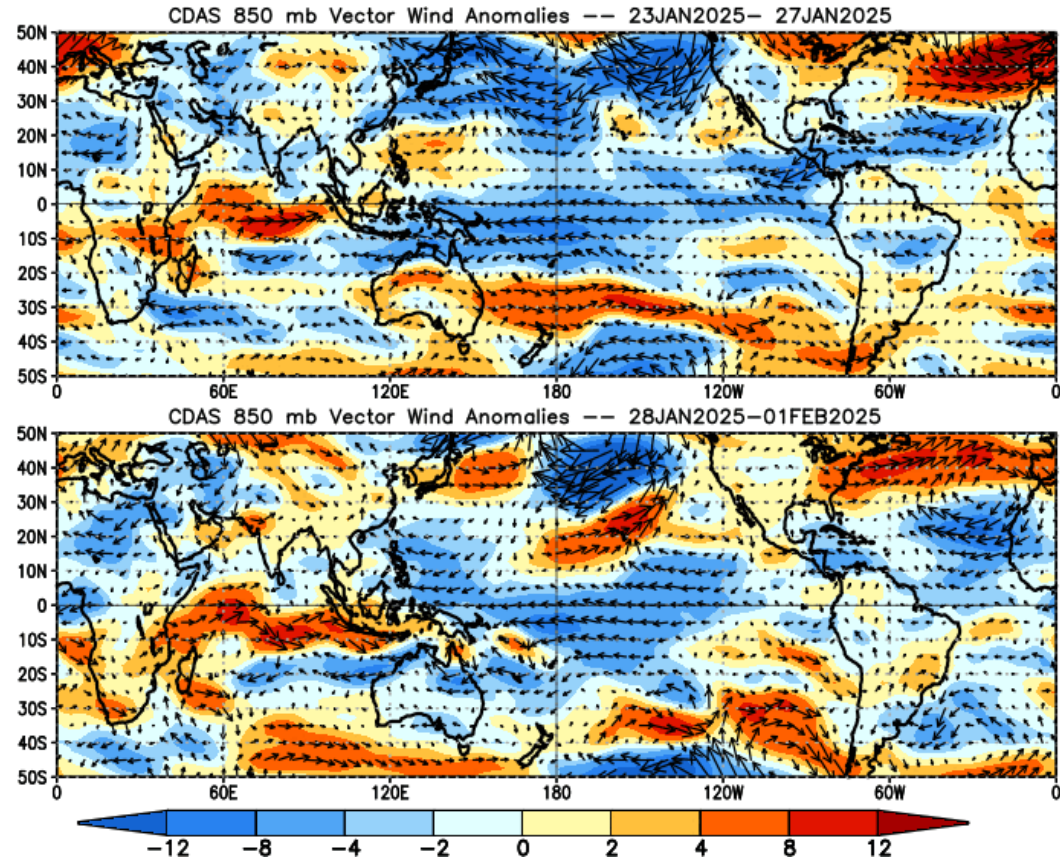
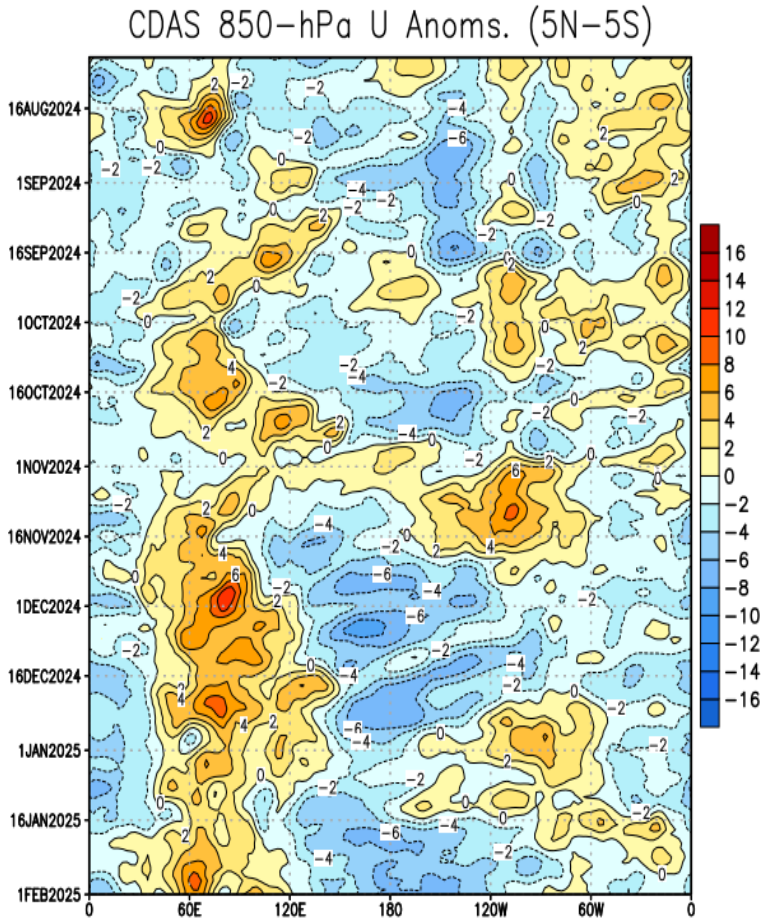


- An enhanced subtropical jet is noted extending from the Central Pacific and Hawaii to the southern U.S., with anomalous upper-level easterlies to the north across the northeastern Pacific and northwestern U.S.
- Anomalous upper-level easterlies (westerlies) are observed across much of the equatorial Indian (Pacific) Ocean.



# 850-hPa Wind Anomalies

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

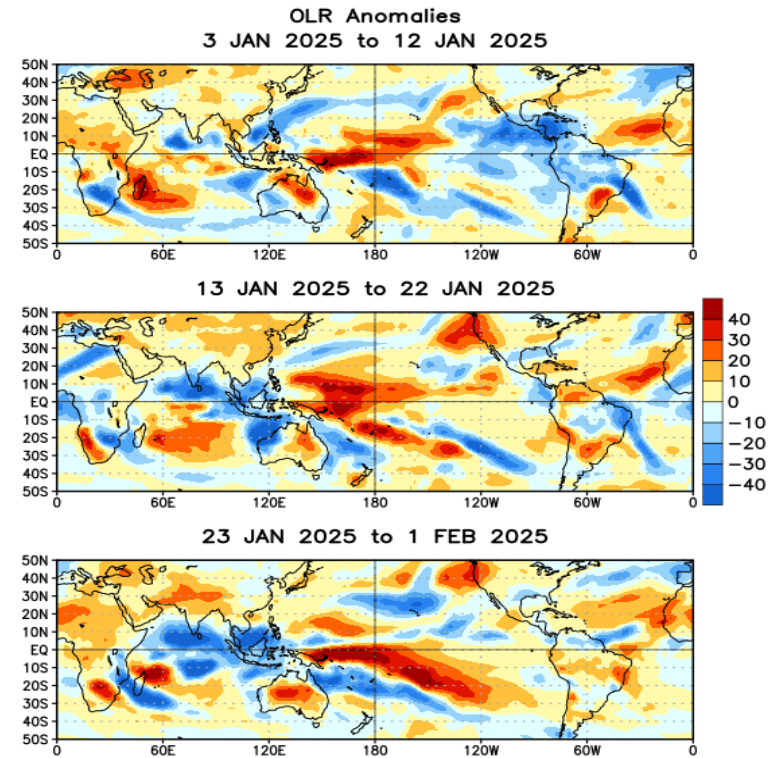
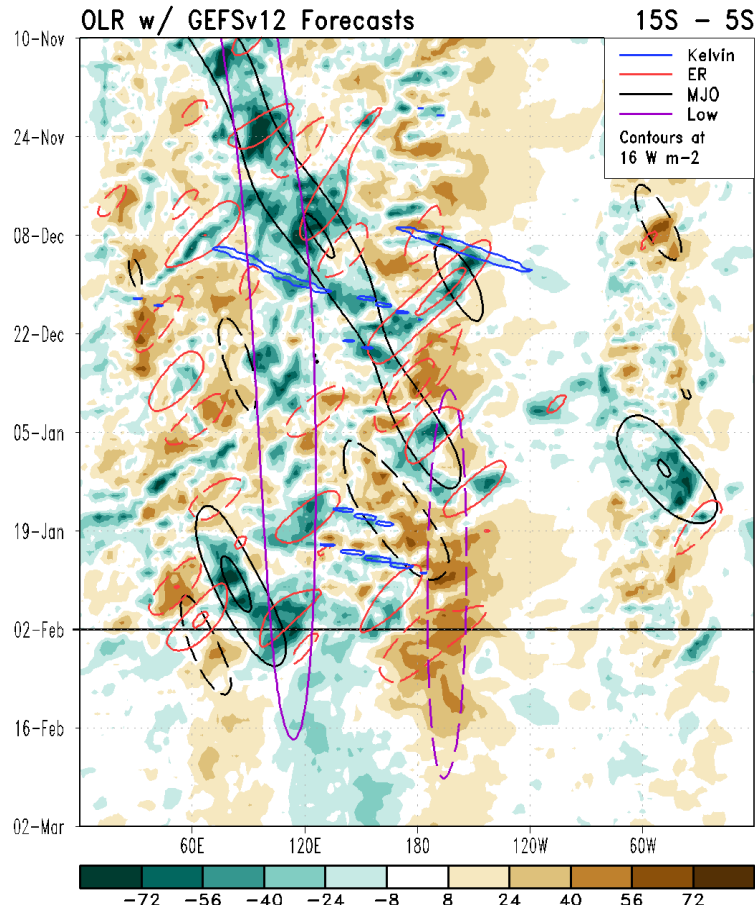


- A persistent area of low-level westerlies has remained established across the equatorial Indian Ocean for the past several months.
- Enhanced trades continue over the equatorial Pacific, tied to La Niña.

# Outgoing Longwave Radiation (OLR) Anomalies

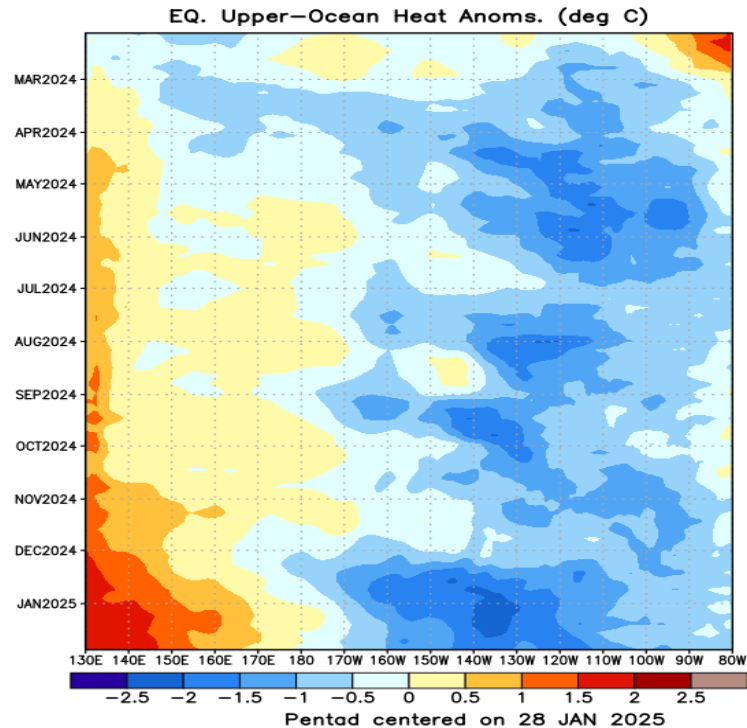
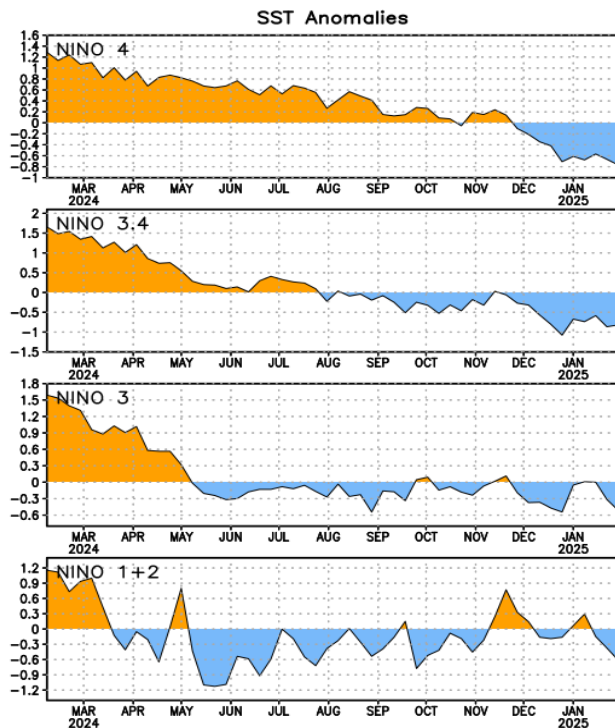
**Green shades:** Anomalous convection (wetness)

**Brown shades:** Anomalous subsidence (dryness)



- MJO activity resulted in negative OLR anomalies across the Indian Ocean, and an enhanced low frequency convective signal extending through the Maritime Continent and southwestern Pacific.
- Positive OLR anomalies are noted across much of the equatorial Pacific, centered around the Date Line, tied to La Niña.
- OLR forecasts from the GEFS depict some eastward propagation of negative OLR anomalies into the Western Pacific later in February.

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

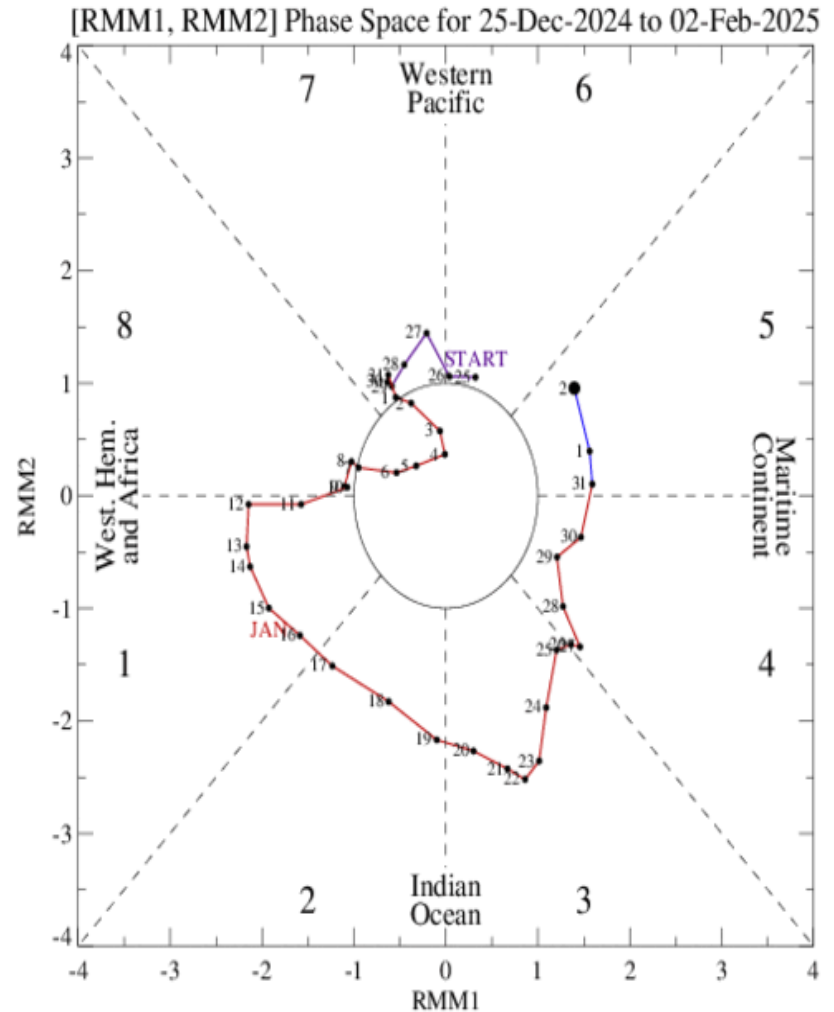


- Enhanced trades across the Central Pacific and subsequent upwelling continue to result in larger negative SST anomalies across all NINO regions consistent with La Niña.
- Positive subsurface heat content anomalies have increased west of the Date Line, with negative subsurface heat content anomalies remaining in place across the Central and Eastern Pacific.



# MJO Index: Recent Evolution

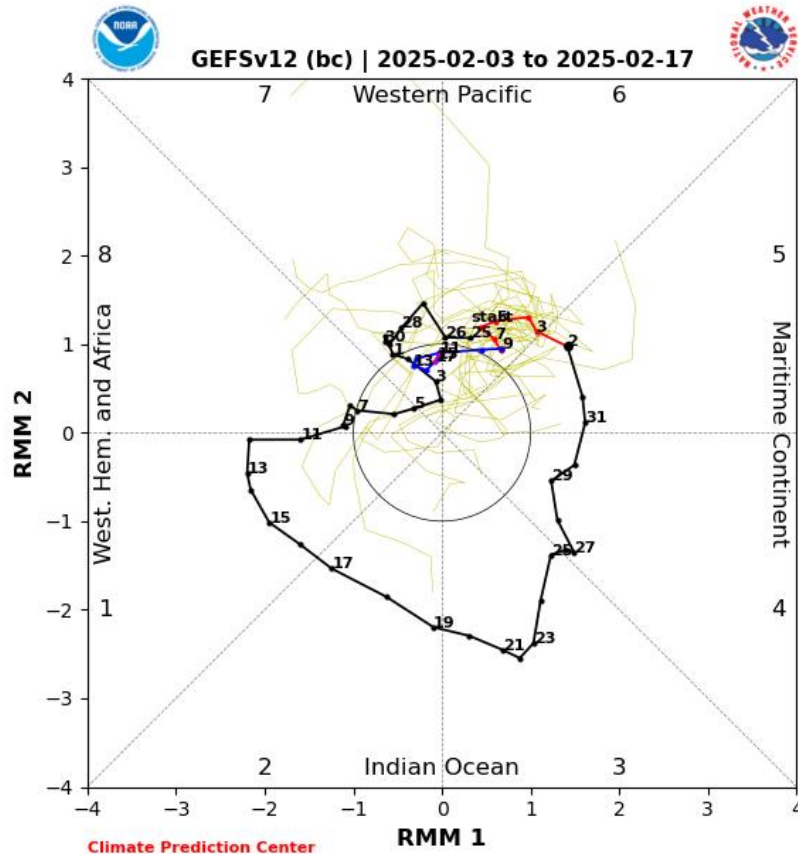
- During the past several weeks, there has been a robust propagation of the MJO across the Indian Ocean, aided by constructive interference with the low frequency La Niña base state.
- The MJO continues to propagate eastward into the Maritime Continent, although its amplitude has decreased compared to prior weeks.



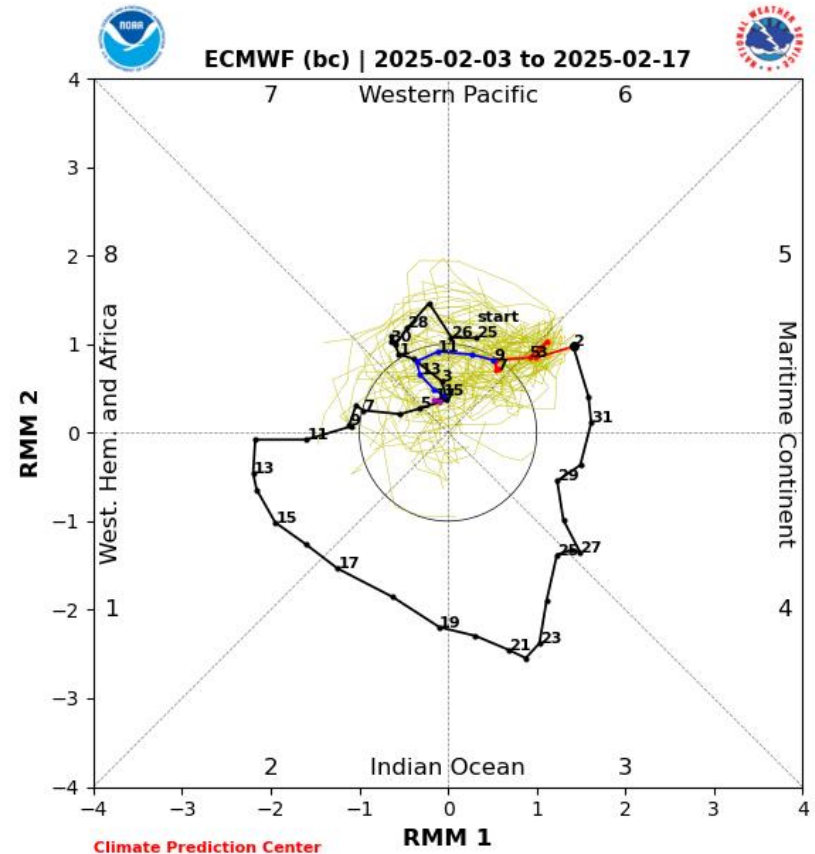
For more information on the RMM index and how to interpret its forecast please see:  
[https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC\\_MJOinformation.pdf](https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf)



# MJO Index: Forecast Evolution



**GEFS Forecast**



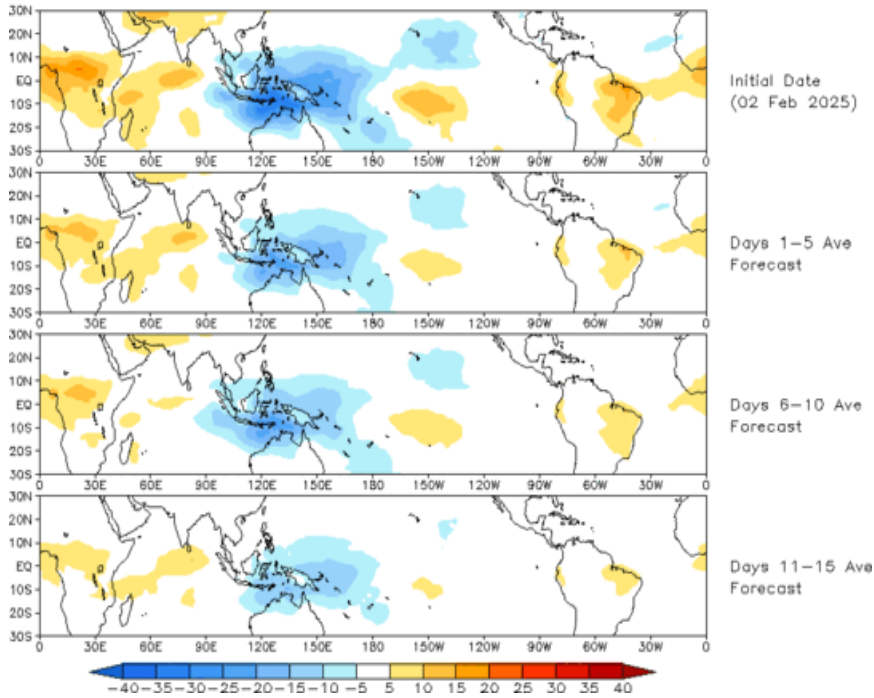
**ECMWF Forecast**

- Both the GEFS and ECMWF ensembles depict a continued eastward propagation of the MJO into the Western Pacific during the next week.
- While some ensembles weaken the intraseasonal signal back into the unit circle, others continue propagation into phases 7 and 8 later in February.

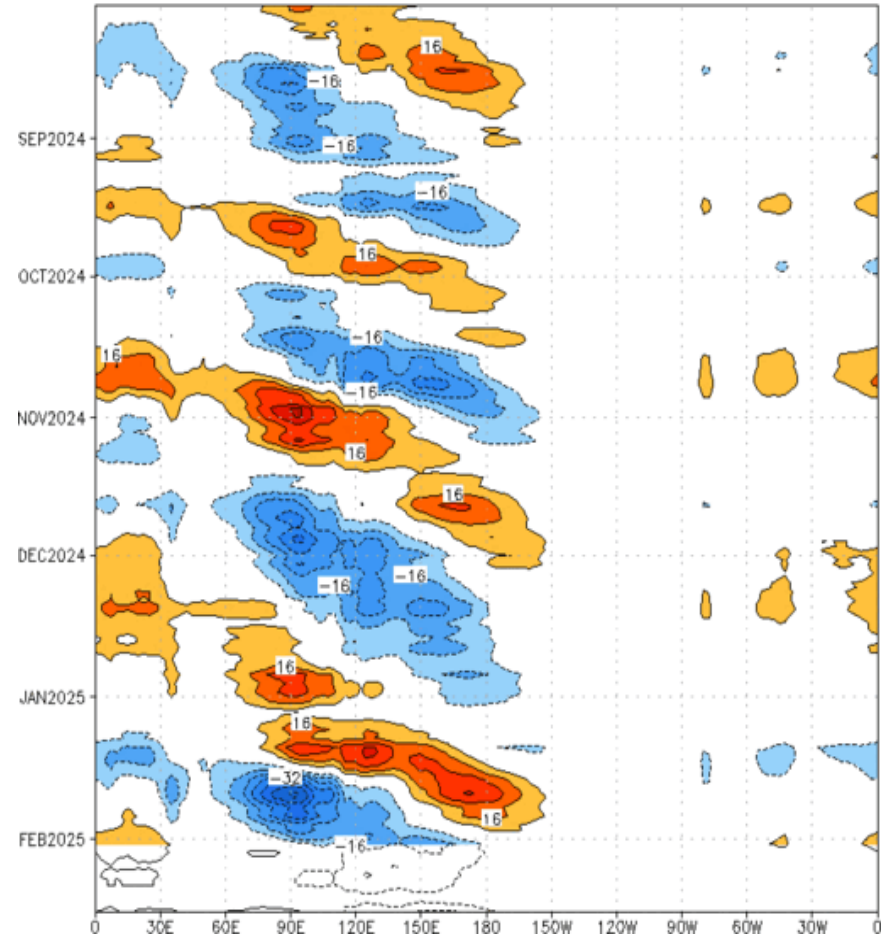
# MJO: GEFS Forecast Evolution

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: 02 Feb 2025  
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2  
OLR [ $7.5^{\circ}S, 7.5^{\circ}N$ ] (cont:  $4Wm^{-2}$ ) Period: 03-Aug-2024 to 02-Feb-2025  
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

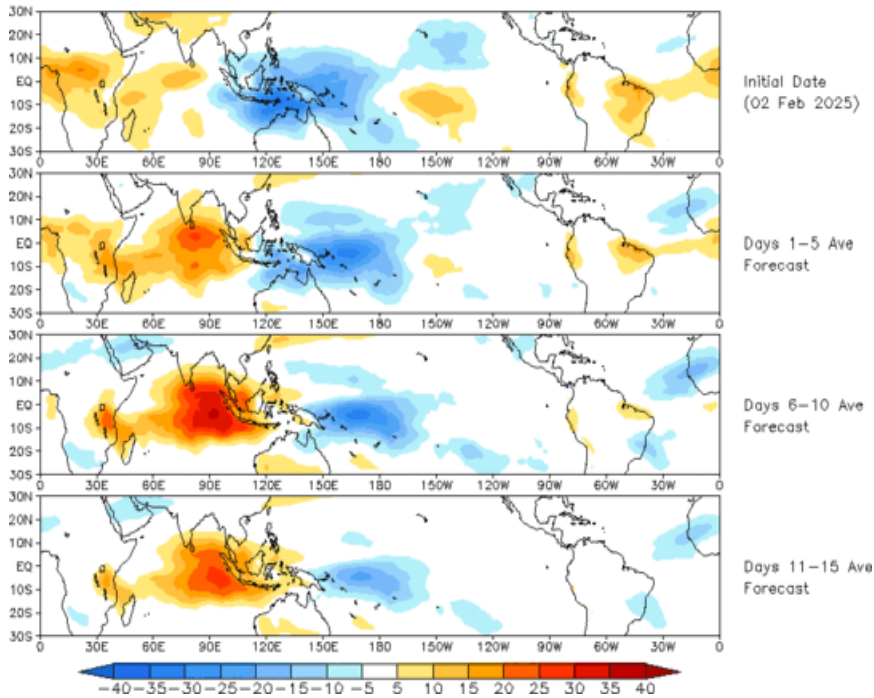


- The GEFS OLR forecast depicts positive OLR anomalies (suppressed convection) extending across Africa and the western Indian Ocean during the next 2 weeks.
- Conversely, negative OLR anomalies (enhanced convection) are predicted across the Maritime Continent and Western Pacific.

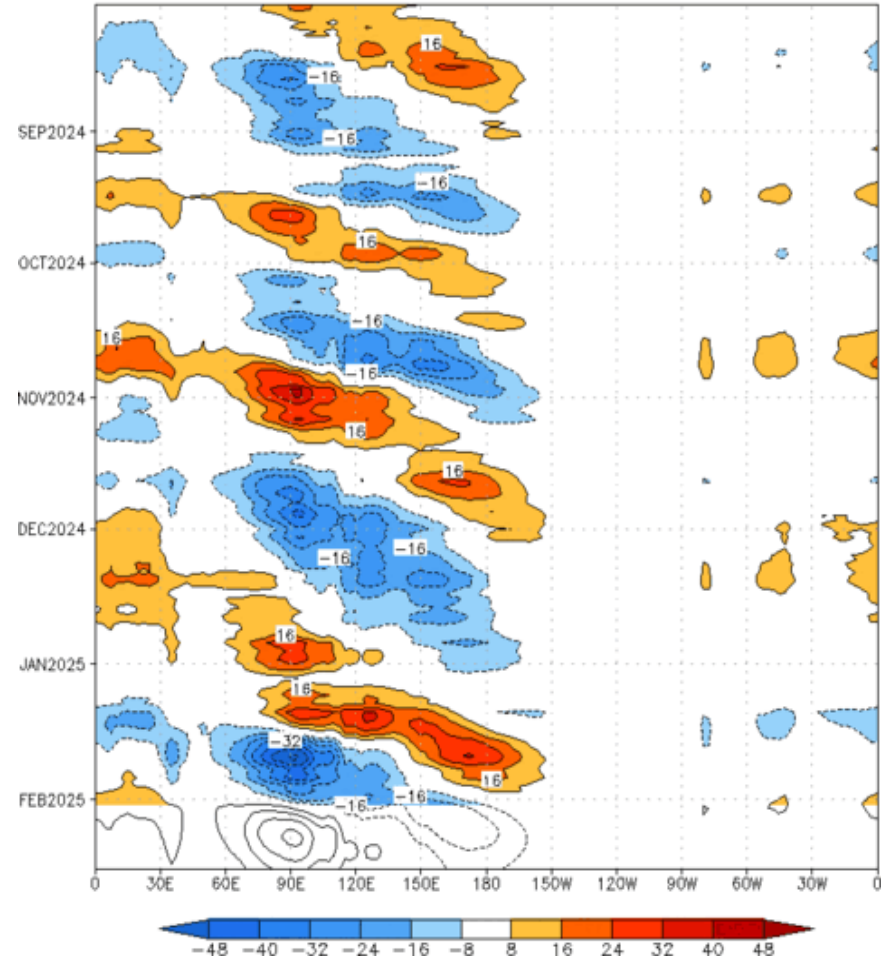
# MJO: Constructed Analog Forecast Evolution

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.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (02 Feb 2025)



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm<sup>-2</sup>) Period:03-Aug-2024 to 02-Feb-2025  
The unfilled contours are CA forecast reconstructed anomaly for 15 days

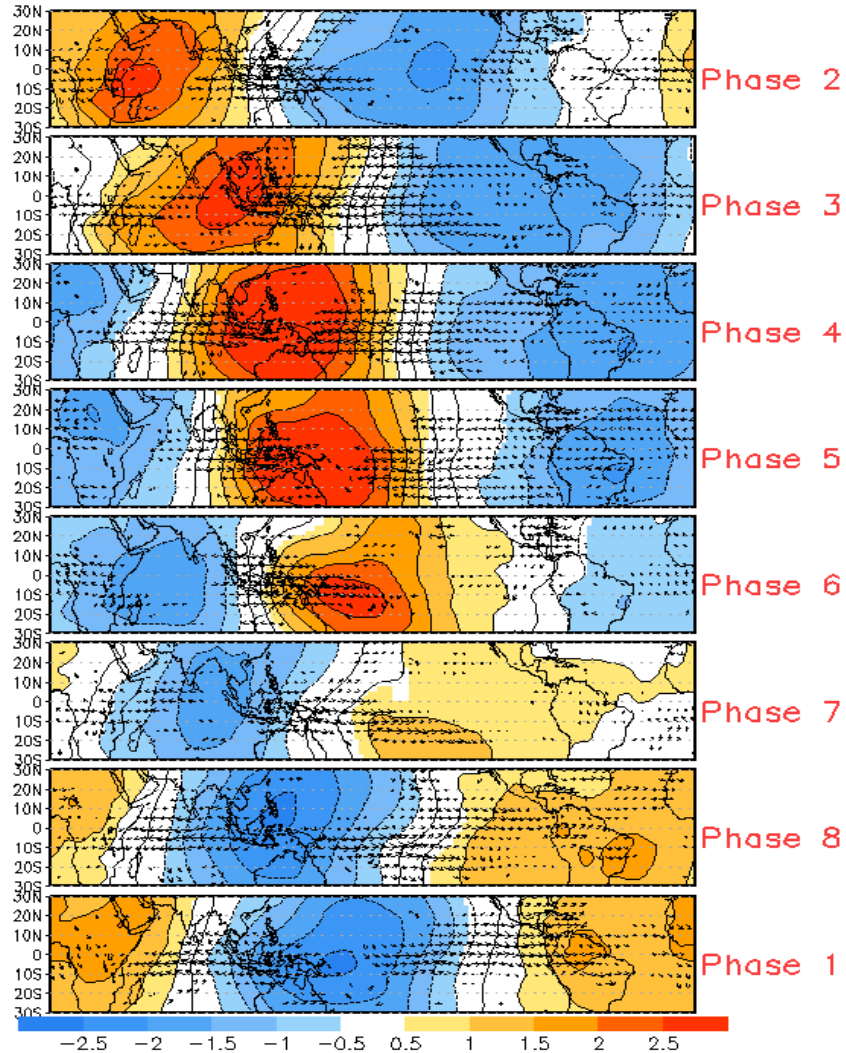


- The constructed analog forecast is similar to the GEFS although is faster with the eastward progression of the suppressed and enhanced convective envelopes.

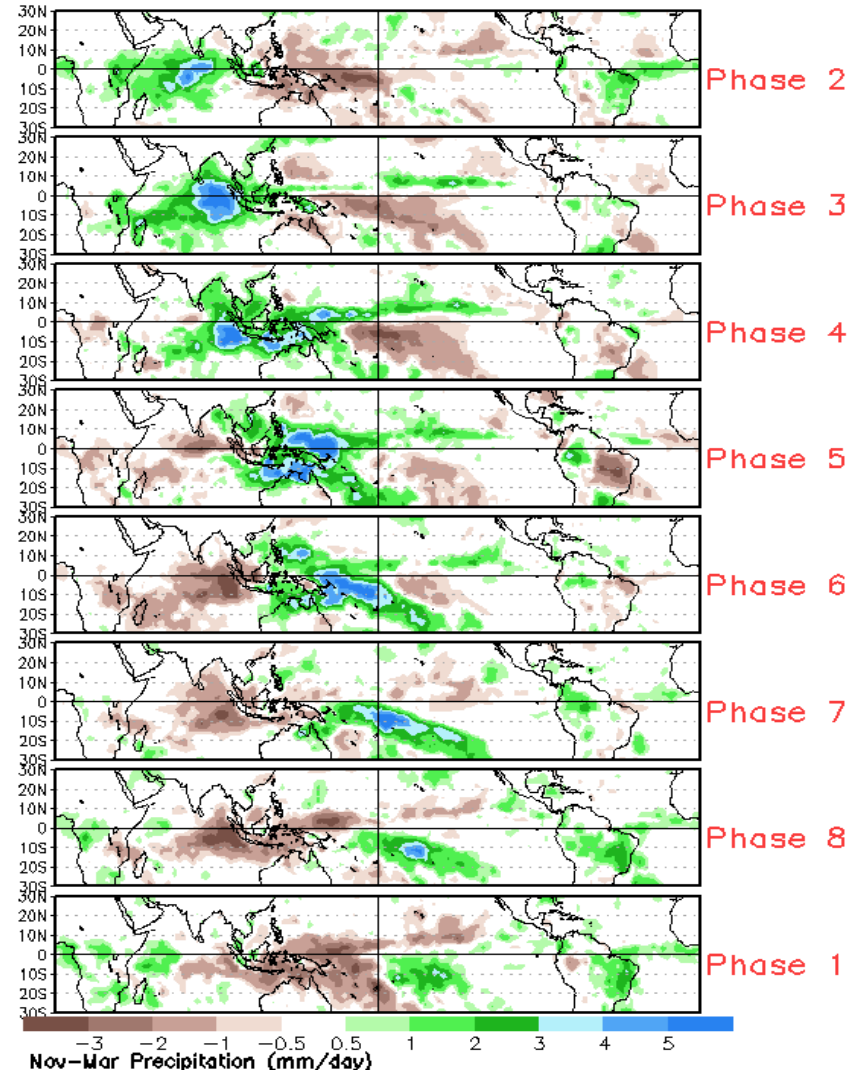


# MJO: Tropical Composite Maps by RMM Phase

## 850-hPa Velocity Potential and Wind Anomalies



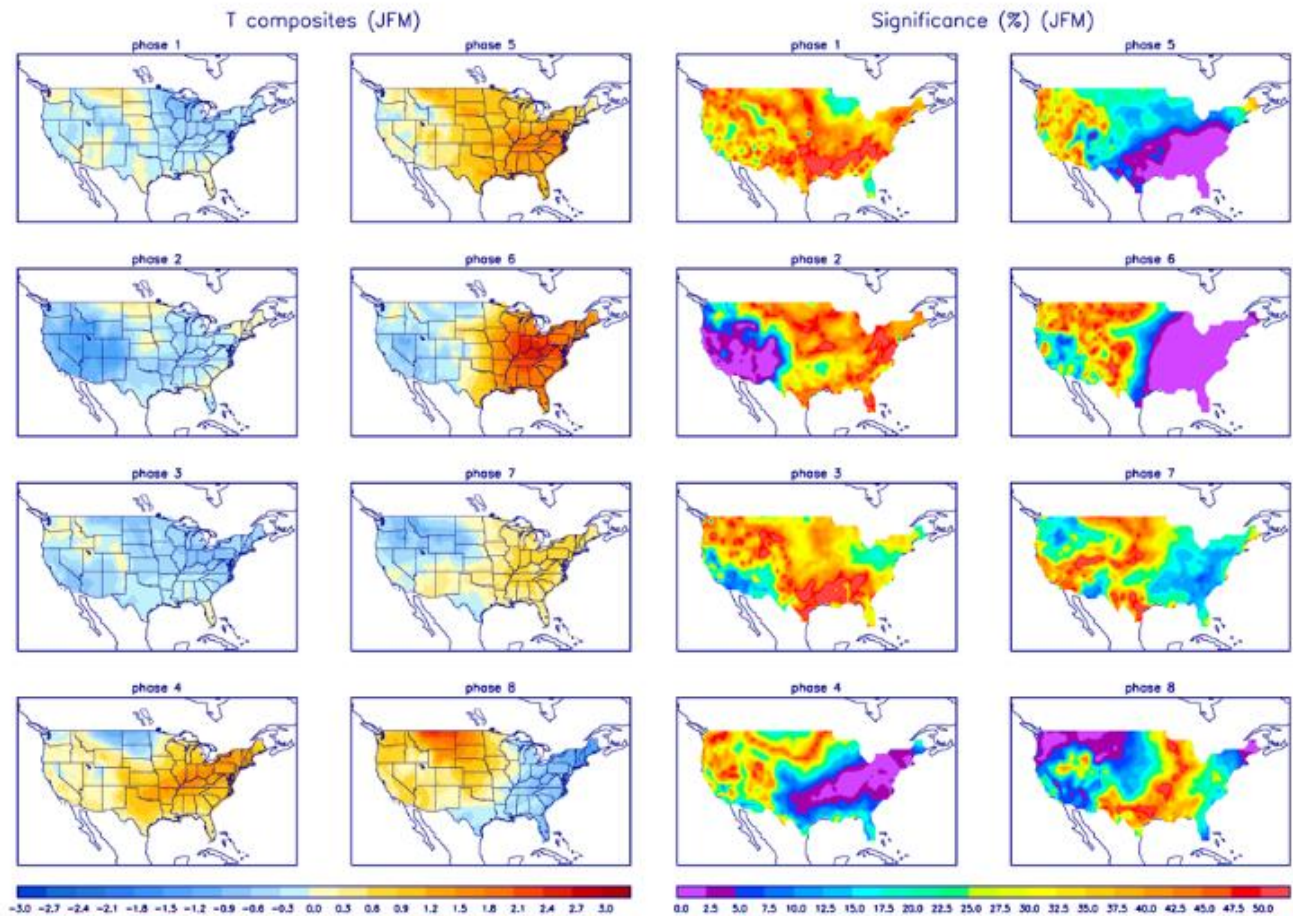
## Precipitation Anomalies



# 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.

