

# **Madden-Julian Oscillation:**

## **Recent Evolution, Current Status and Predictions**



**Update prepared by the Climate Prediction Center**  
**Climate Prediction Center / NCEP**  
**17 January 2022**

# Overview

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- Following a period of renewed eastward propagation earlier in January, the RMM index indicates the MJO has lost much of its amplitude, falling within the unit circle during the last week.
- Dynamical models generally show the MJO remaining weak and incoherent as other modes of tropical variability are favored to prevail over the Indian Ocean and Pacific through the end of January.
- Tropical cyclone formation remains most likely in the Southern Indian Ocean, and along the South Pacific Convergence Zone (SPCZ) during the next two weeks.

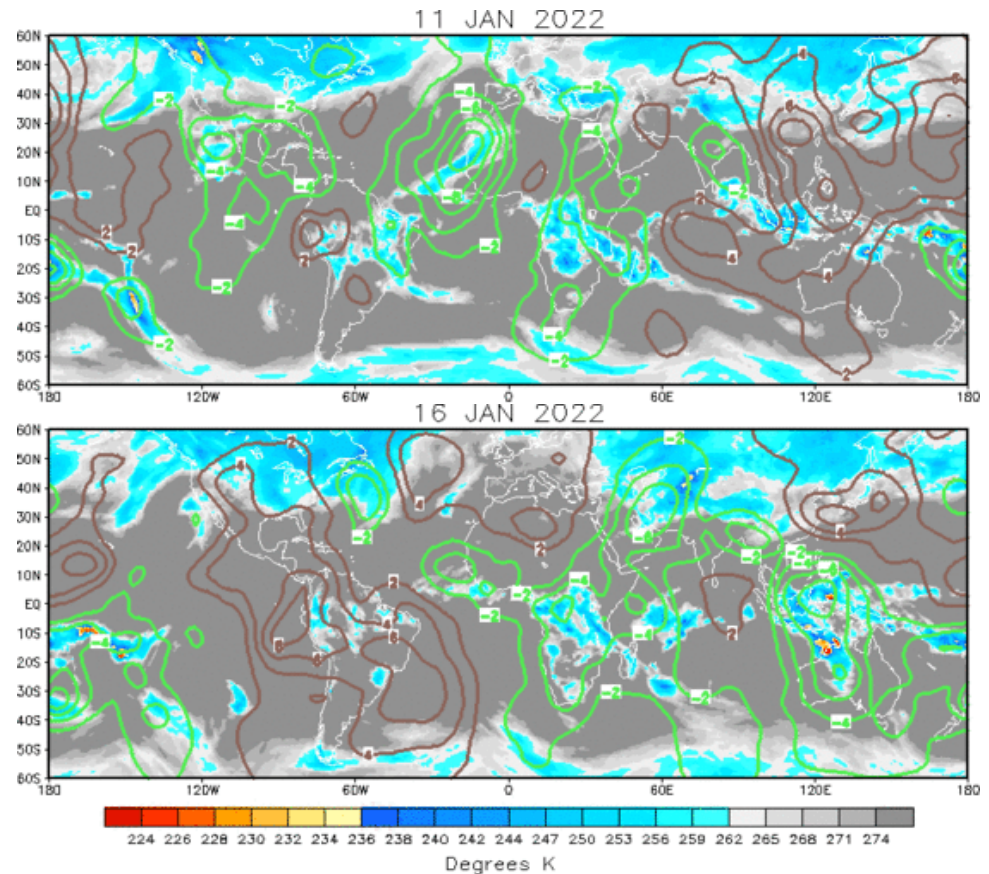
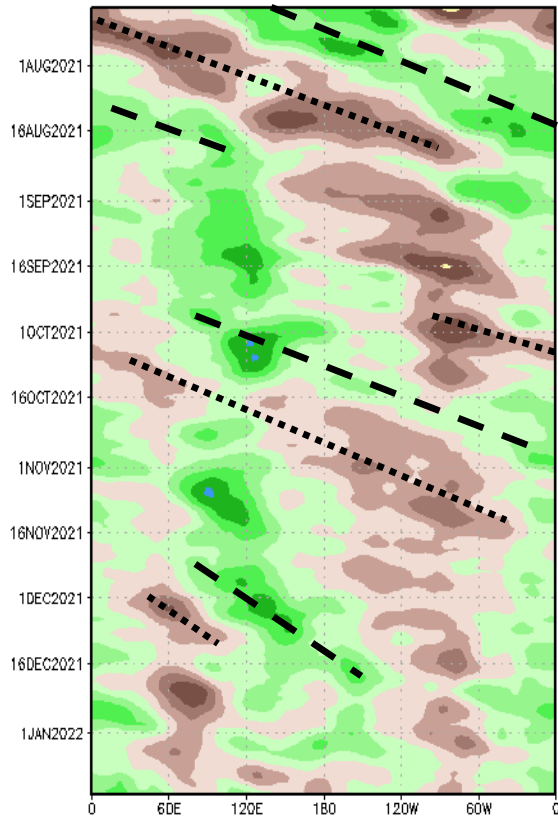
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:  
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

# 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

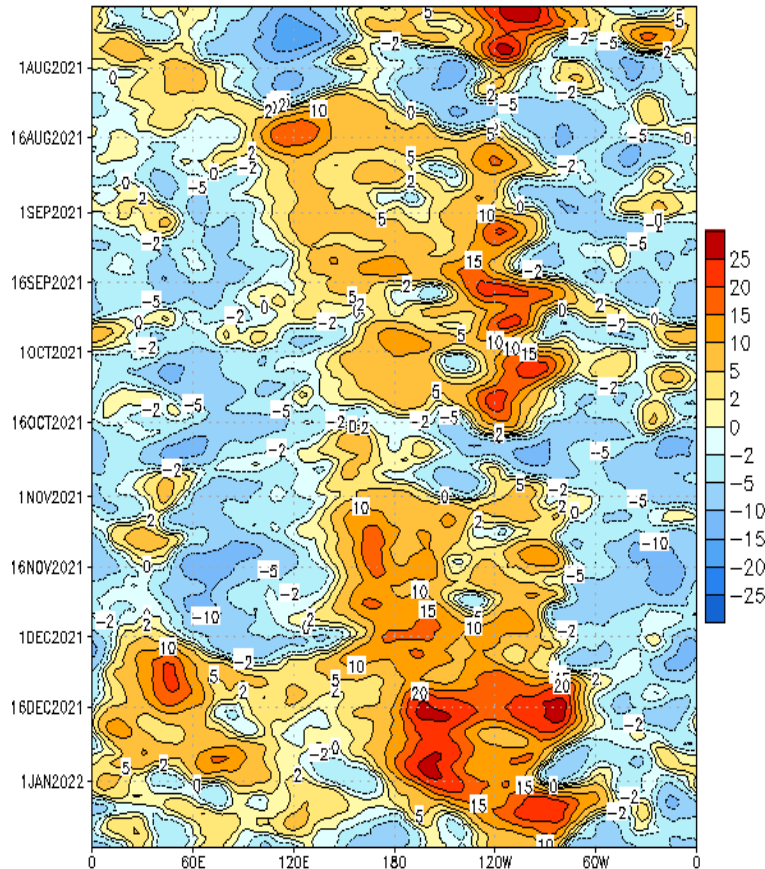


- The upper-level velocity potential anomaly field remains incoherent with multiple centers that would support enhanced convection.
- Anomalous upper-level divergence and recently returned over the Maritime Continent with enhanced convection persisting across the South Pacific east of the Date Line.

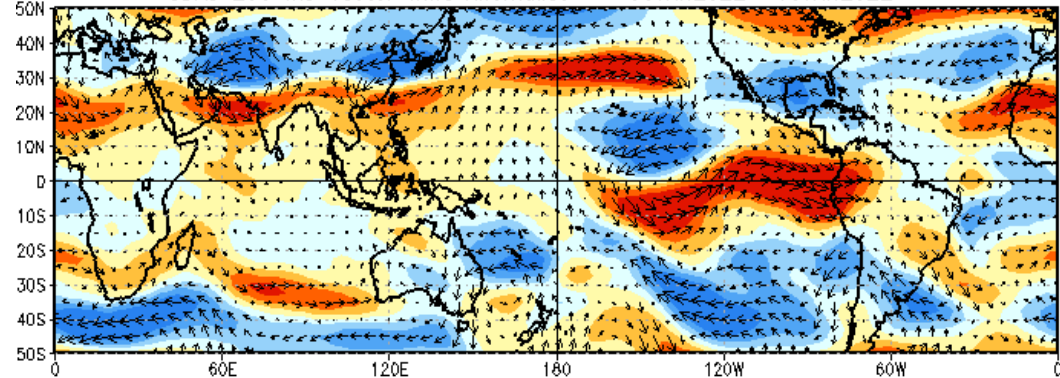
# 200-hPa Wind Anomalies

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

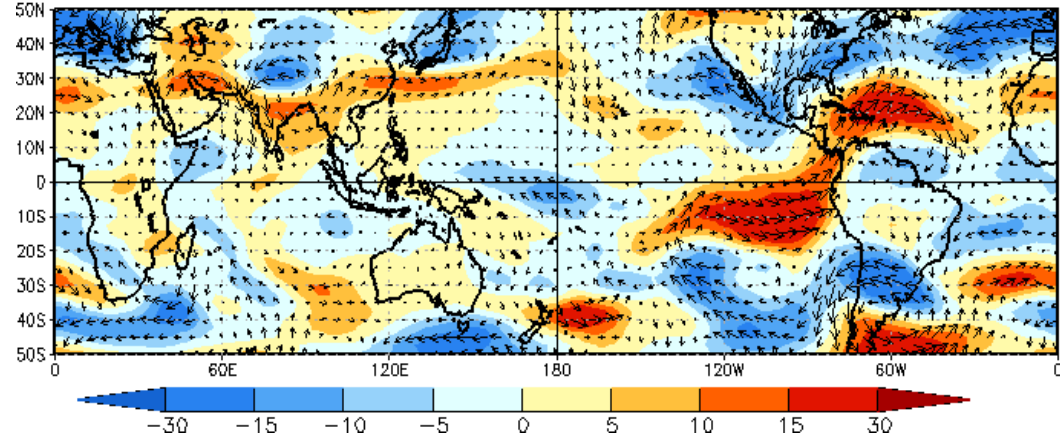
CDAS 200-hPa U Anoms. (5N–5S)



CDAS 200 mb Vector Wind Anomalies -- 06JAN2022-- 10JAN2022



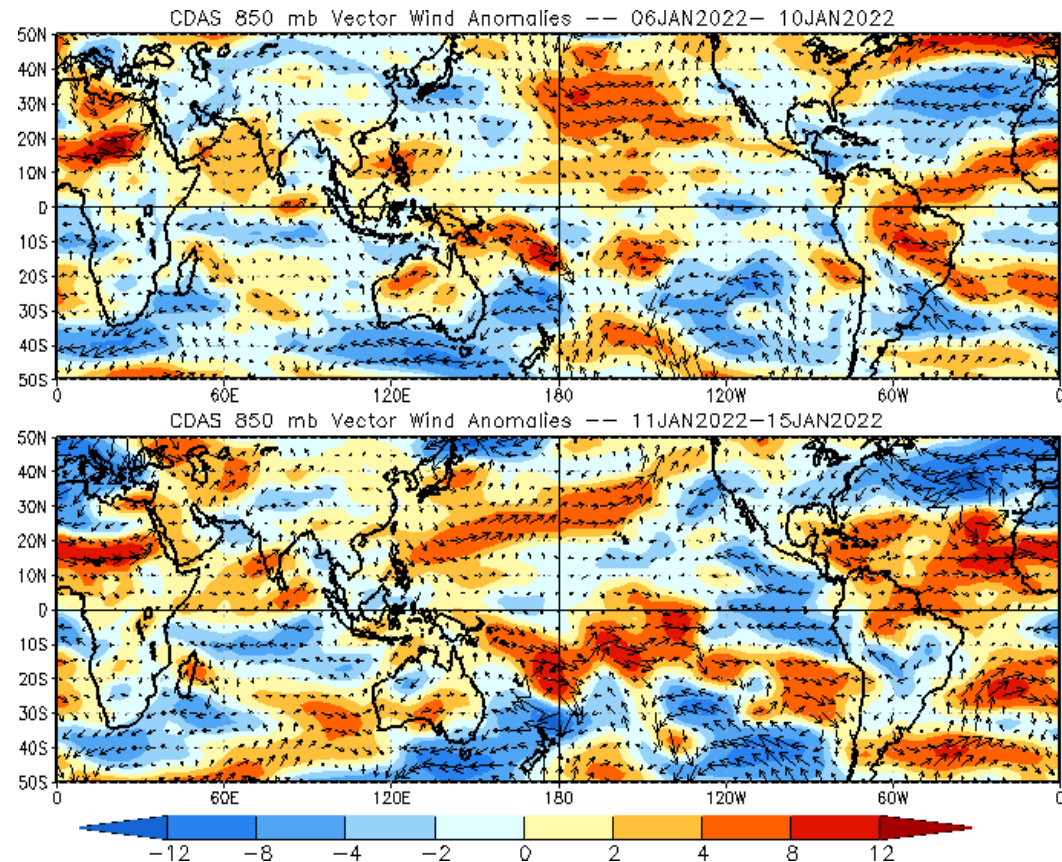
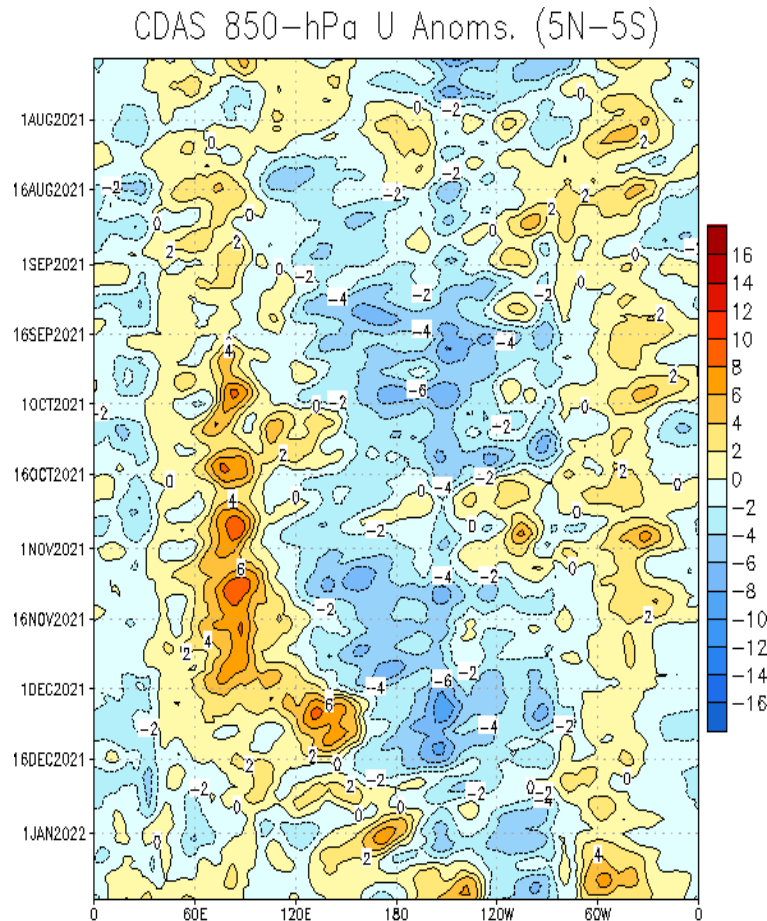
CDAS 200 mb Vector Wind Anomalies -- 11JAN2022--15JAN2022



- The strongest upper-level westerly anomalies continued to shift eastward and became more focused south of the equator in the East Pacific, as anomalous easterlies aloft strengthened near the Date Line.
- A pronounced jet extended from eastern Asia to the northern Pacific. Further east of that, broad anomalous anticyclonic flow aloft is observed over the northeastern Pacific and the western CONUS.

# 850-hPa Wind Anomalies

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

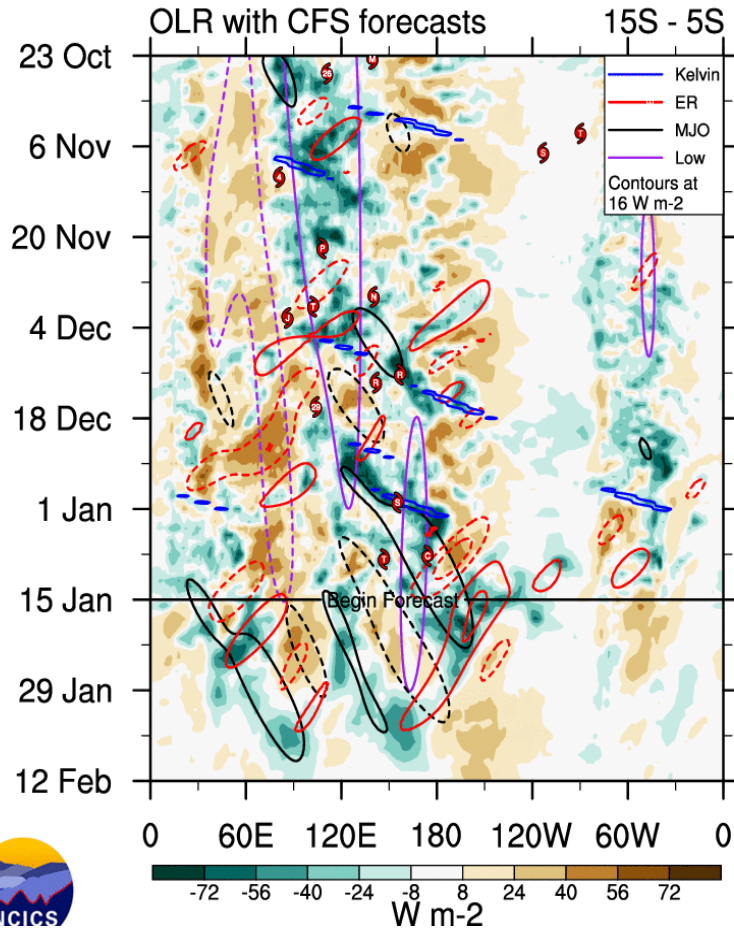


- Another westerly wind burst is observed near 130W in the equatorial Pacific, which continues to disrupt the enhanced low frequency trade wind regime tied to La Nina.
- Anomalous lower-level easterlies have strengthened over the Indian Ocean mainly south of the equator.

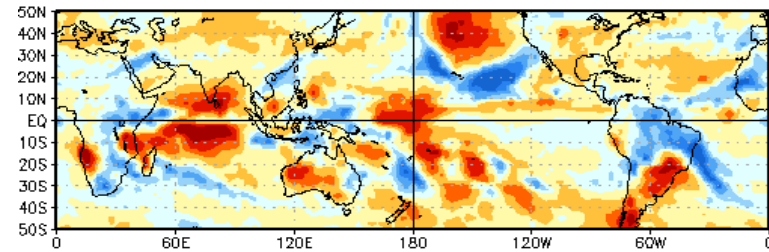
# Outgoing Longwave Radiation (OLR) Anomalies

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

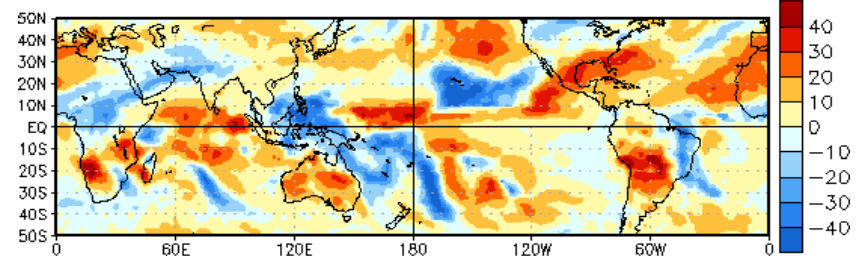
**Brown shades: Anomalous subsidence (dryness)**



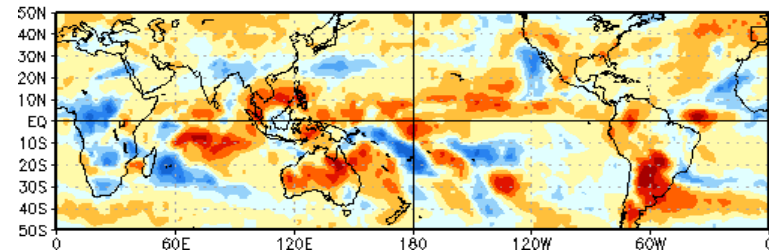
OLR Anomalies  
17 DEC 2021 to 26 DEC 2021



27 DEC 2021 to 5 JAN 2022

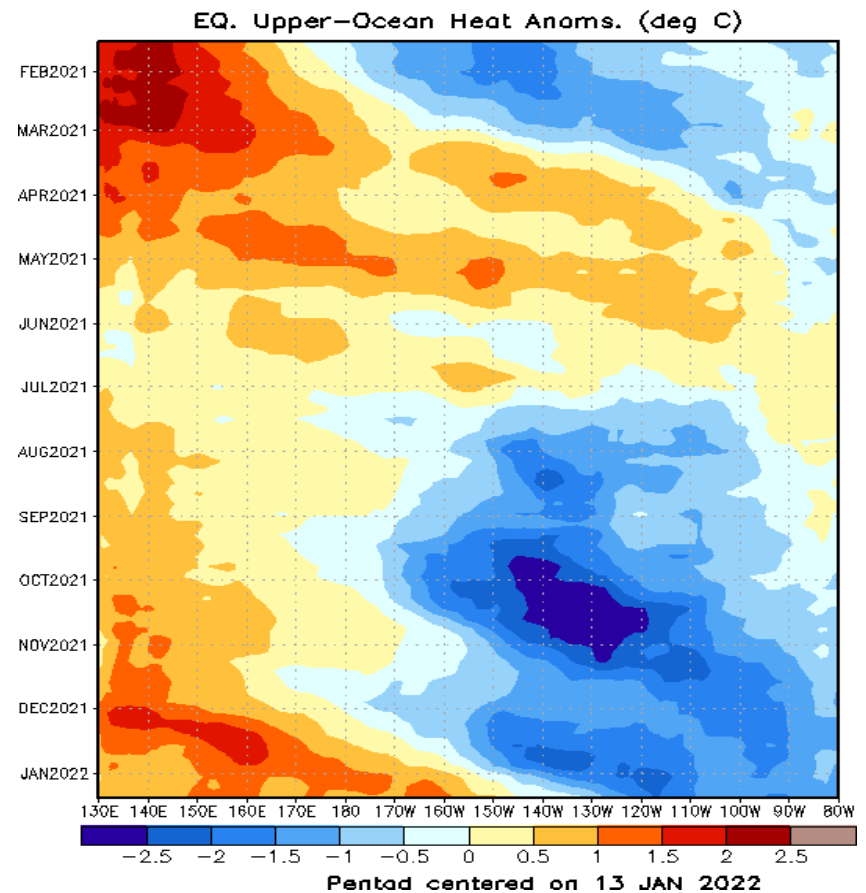
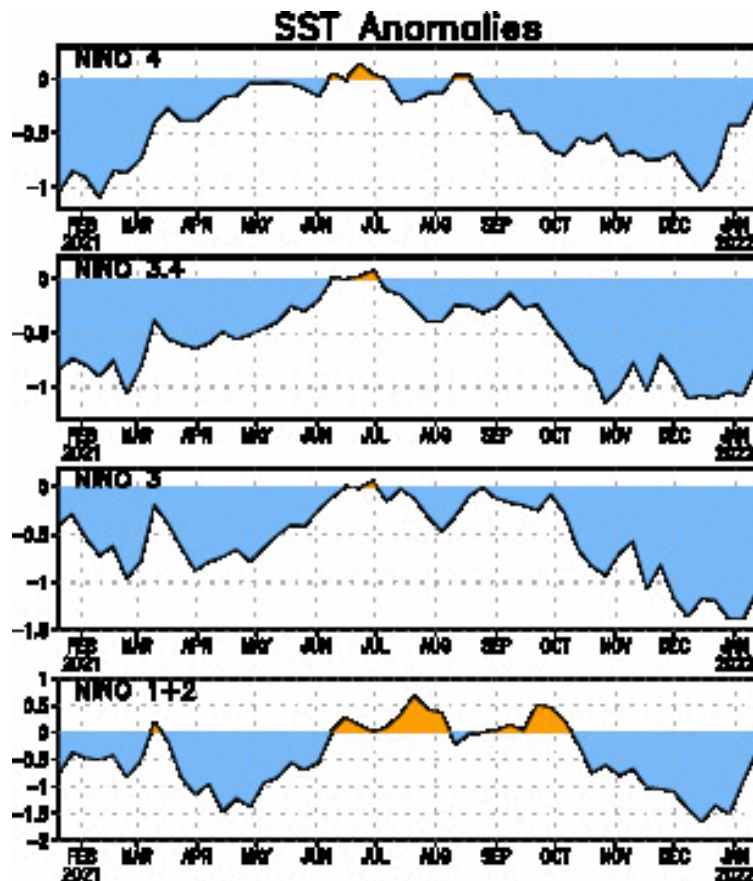


6 JAN 2022 to 15 JAN 2022



- The development of enhanced convection is evident to the east of the Date Line where strong Equatorial Rossby wave activity is analyzed in the OLR field.
- The CFS favors the return of enhanced convection over the southern Indian Ocean and the Maritime Continent during the next two weeks.

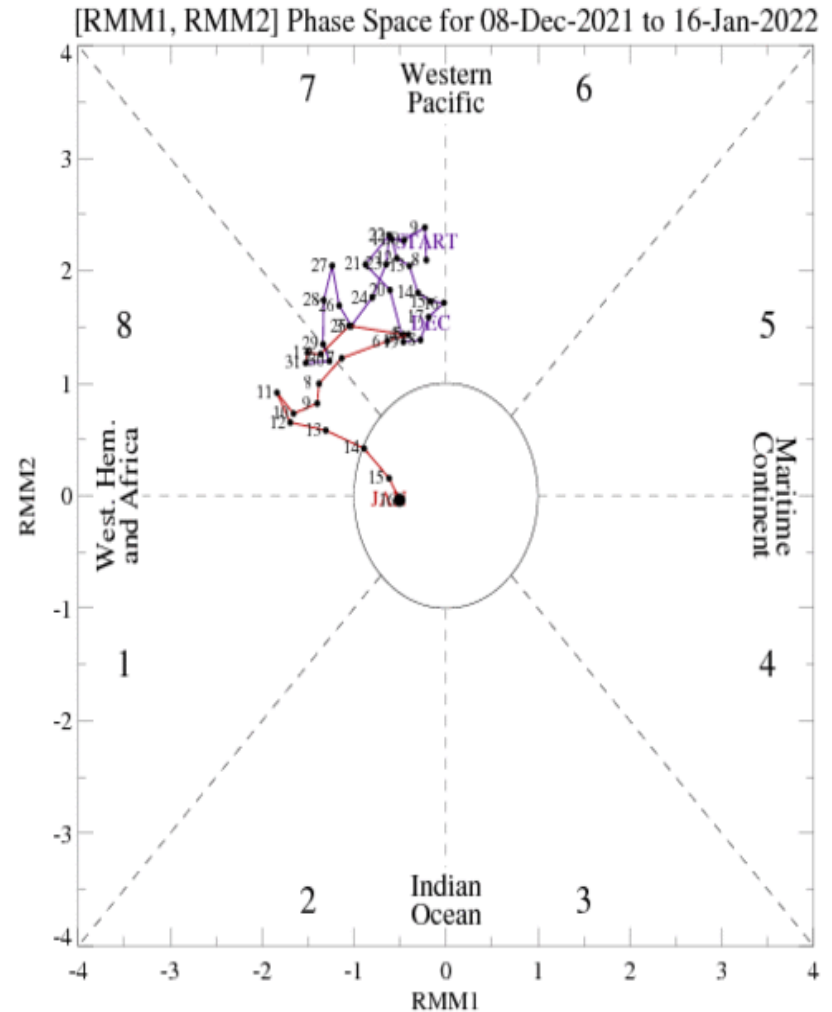
# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Following a westerly wind burst over the West Pacific last month, a strong downwelling oceanic Kelvin wave event was initiated and resulted in increased above-average heat content progressing as far east as 145W.
- Below-average sea surface temperature anomalies persist across all of the Niño regions, however these regions have trended warmer over the past several weeks.

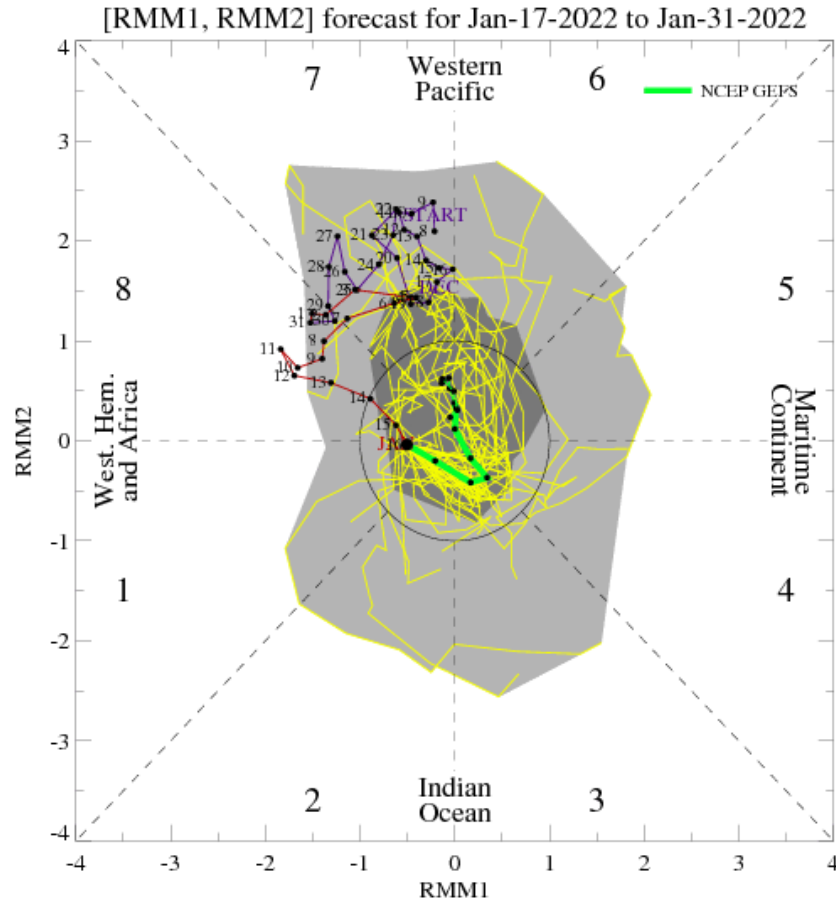
# MJO Index: Recent Evolution

- The RMM based MJO index fell to within the unit circle, indicating a decaying intraseasonal signal.

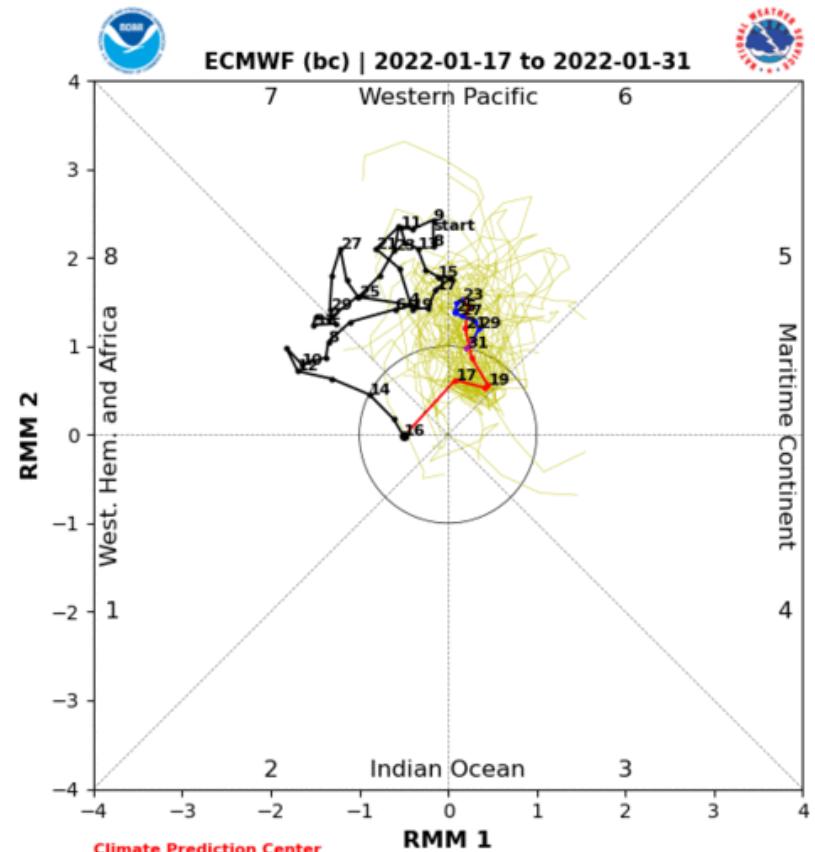


For more information on the RMM index and how to interpret its forecast please see:  
[https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC\\_MJOinformation.pdf](https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf)

# MJO Index: Forecast Evolution



**GEFS Forecast**



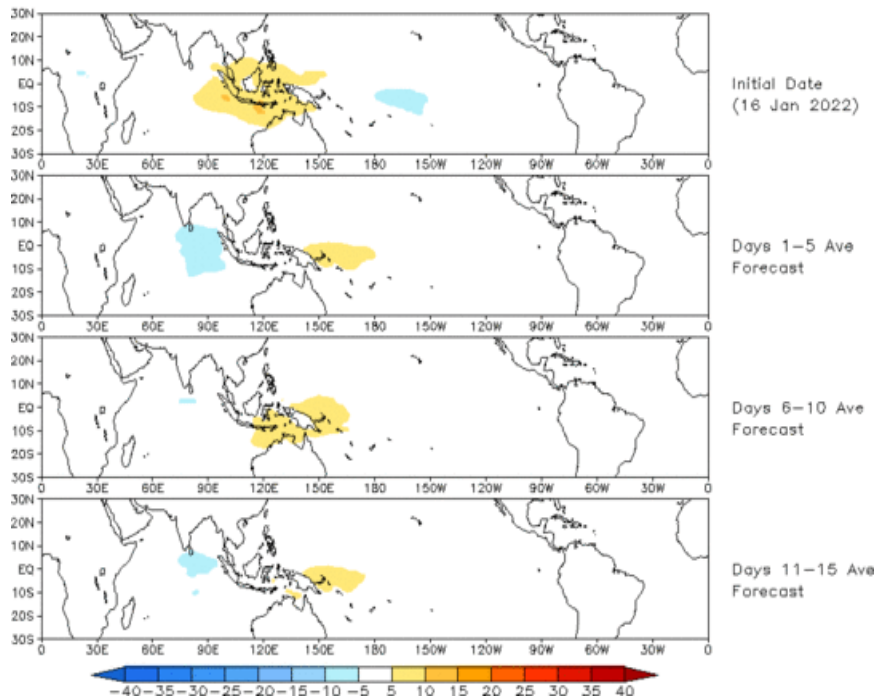
**ECMWF Forecast**

- The GEFS, as well as other dynamical models, favor a weak intraseasonal signal that generally remains within the RMM unit circle during the next two weeks.
- The ECMWF forecast shows a westward retreating signal likely tied to Rossby wave activity on the near term, while favoring more of reemerging signal over the western Pacific later in the outlook period.

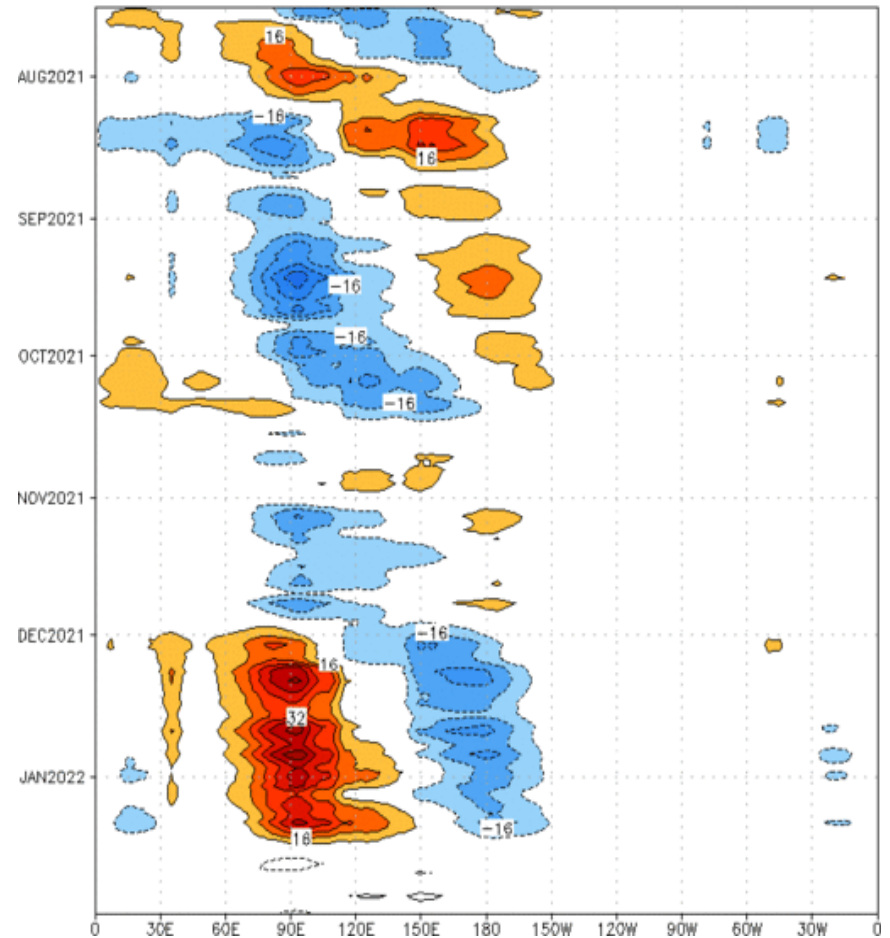
# MJO: GEFS Forecast Evolution

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: 16 Jan 2022  
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2  
OLR [7.5°S, 7.5°N] ( $\text{cint: } 4\text{Wm}^{-2}$ ) Period: 17-Jul-2021 to 16-Jan-2022  
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

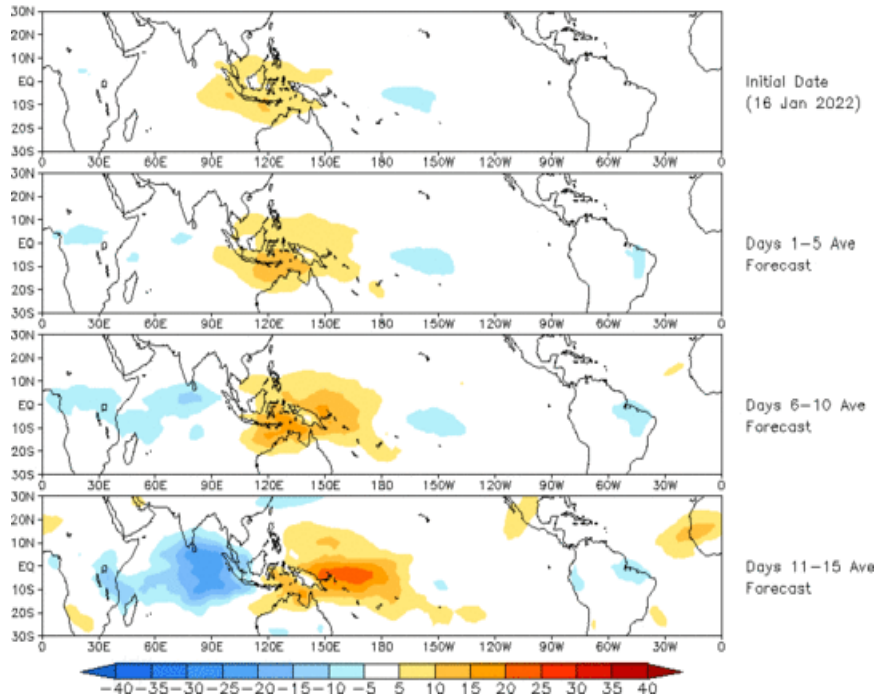


- The GEFS RMM-based OLR anomaly forecast depicts weakly convective anomalies during the next two weeks.

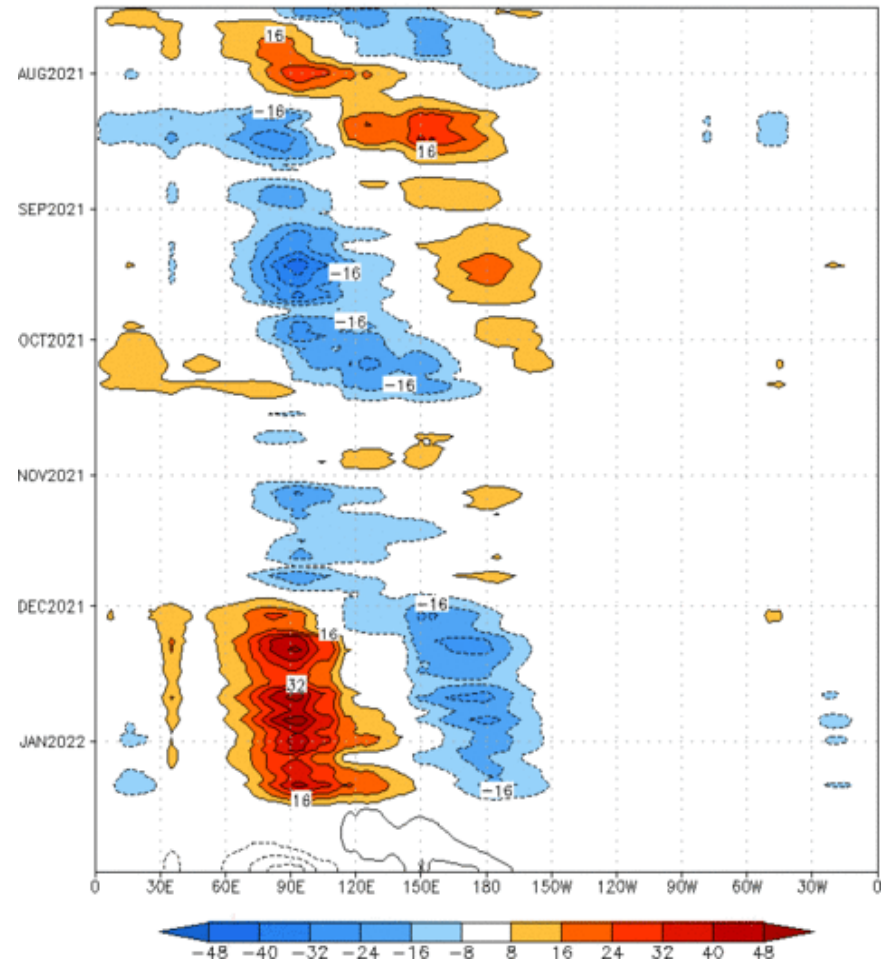
# MJO: Constructed Analog Forecast Evolution

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.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (16 Jan 2022)



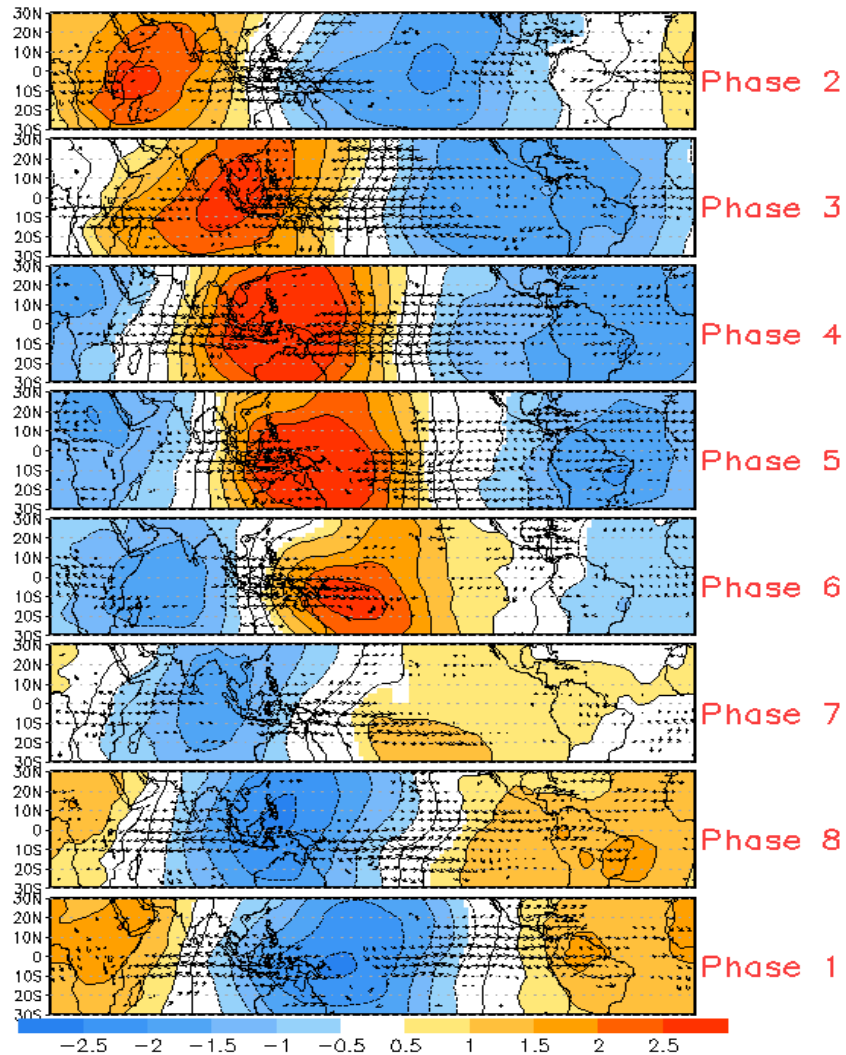
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cont:4Wm<sup>-2</sup>) Period:17-Jul-2021 to 16-Jan-2022  
The unfilled contours are CA forecast reconstructed anomaly for 15 days



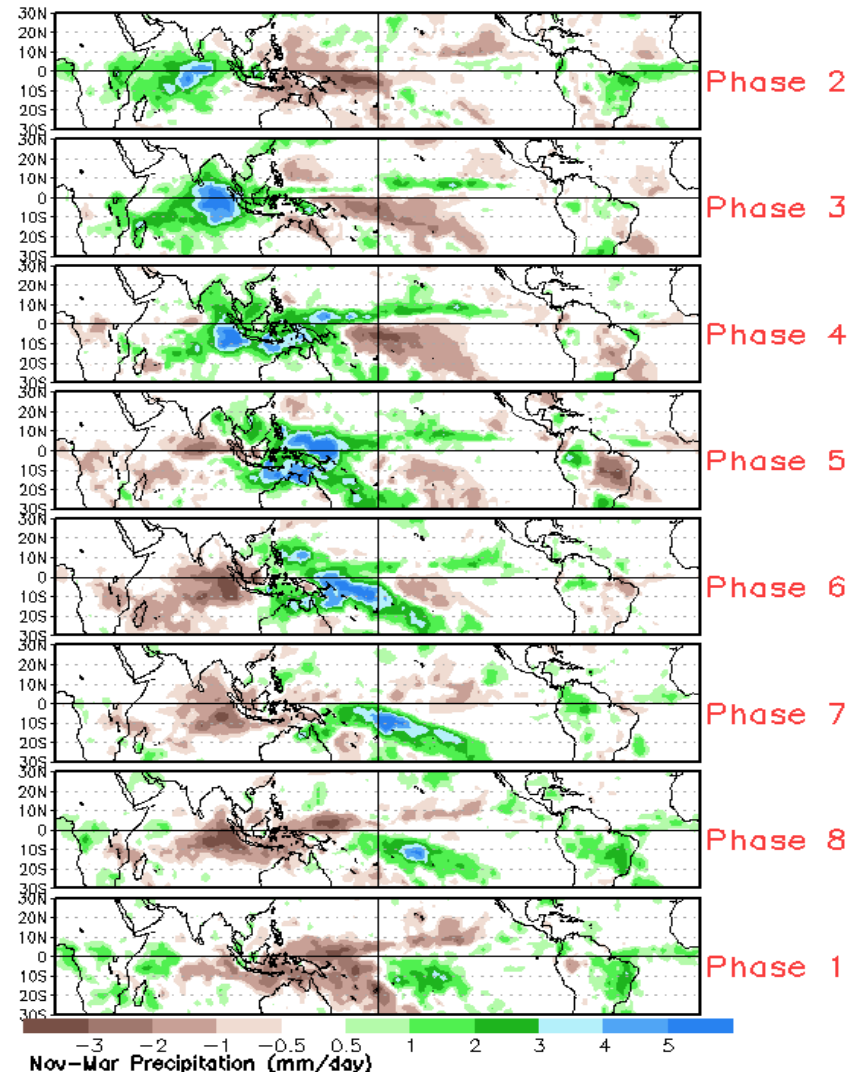
- Contrast to the GEFS, the constructed analog is more progressive, favoring renewed MJO activity with the development of enhanced (suppressed) convection over the Indian Ocean (Maritime Continent and West Pacific).

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and  
Wind Anomalies



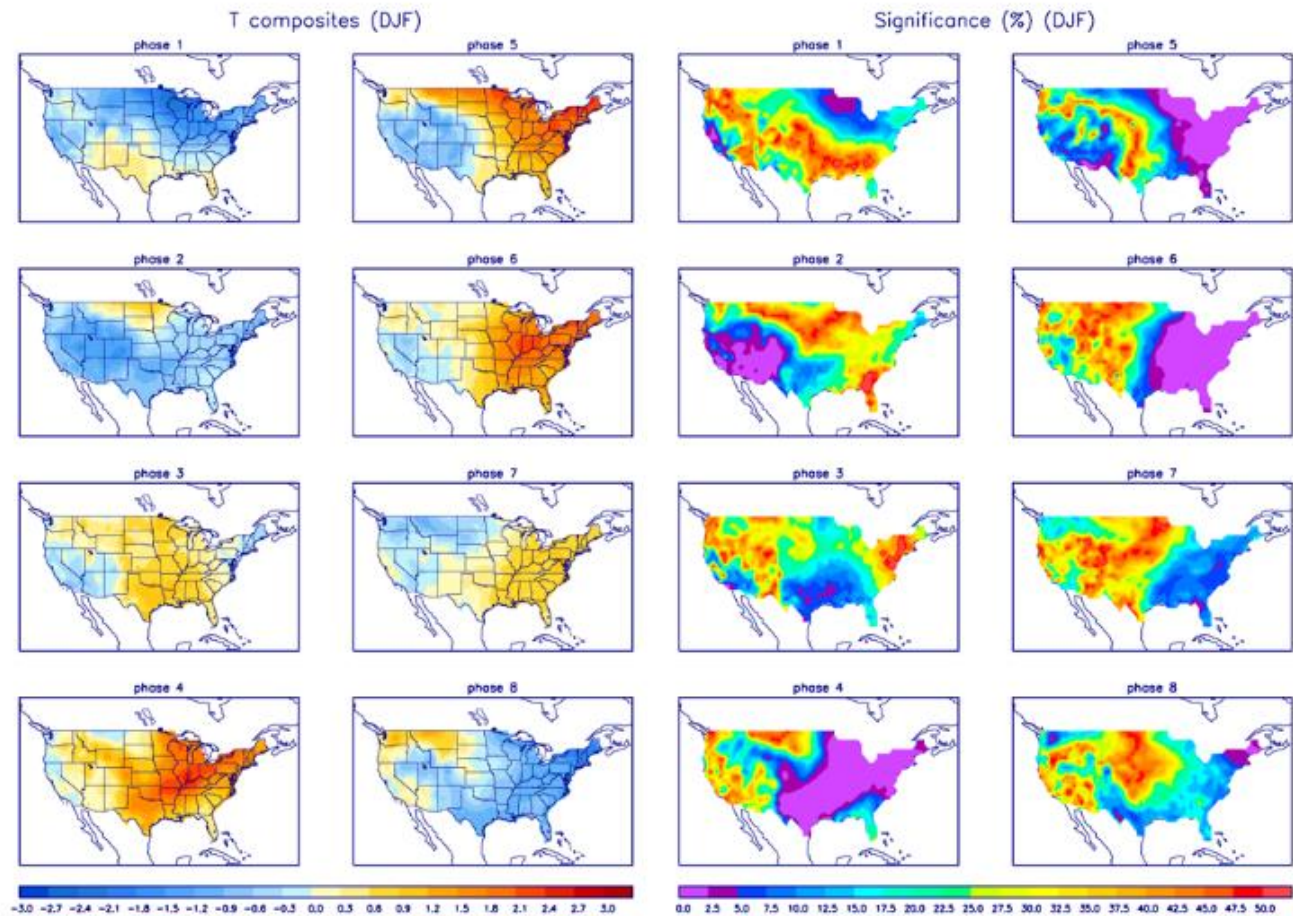
Precipitation Anomalies



# 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 - Temperature

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.

