

# **Madden-Julian Oscillation:**

## Recent Evolution, Current Status and Predictions



**Update prepared by the Climate Prediction Center**  
**NWS / NCEP / CPC**  
**8 August 2022**

# Overview

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- The MJO remains not well defined which is reflected in both the velocity potential anomaly index and RMM observations during the past week.
- There is better agreement in the dynamical models depicting continued eastward propagation of the signal across the western Pacific and into the western Hemisphere, but several RMM forecasts generally maintain a low amplitude during the next two weeks.
  - The rapid phase speed in RMM space is suggestive of a convectively coupled Kelvin wave over the Pacific projecting onto the index.
  - Some model solutions (BOM, CFS) hint at a more coherent signal possibly emerging over Africa and the western Indian Ocean, which could be tied to Kelvin wave activity aiding in the reorganization of the MJO in the eastern Hemisphere later in August.
- Other modes of tropical variability are more likely to be primary contributors to precipitation and tropical cyclogenesis in the Pacific and Atlantic during the outlook period.

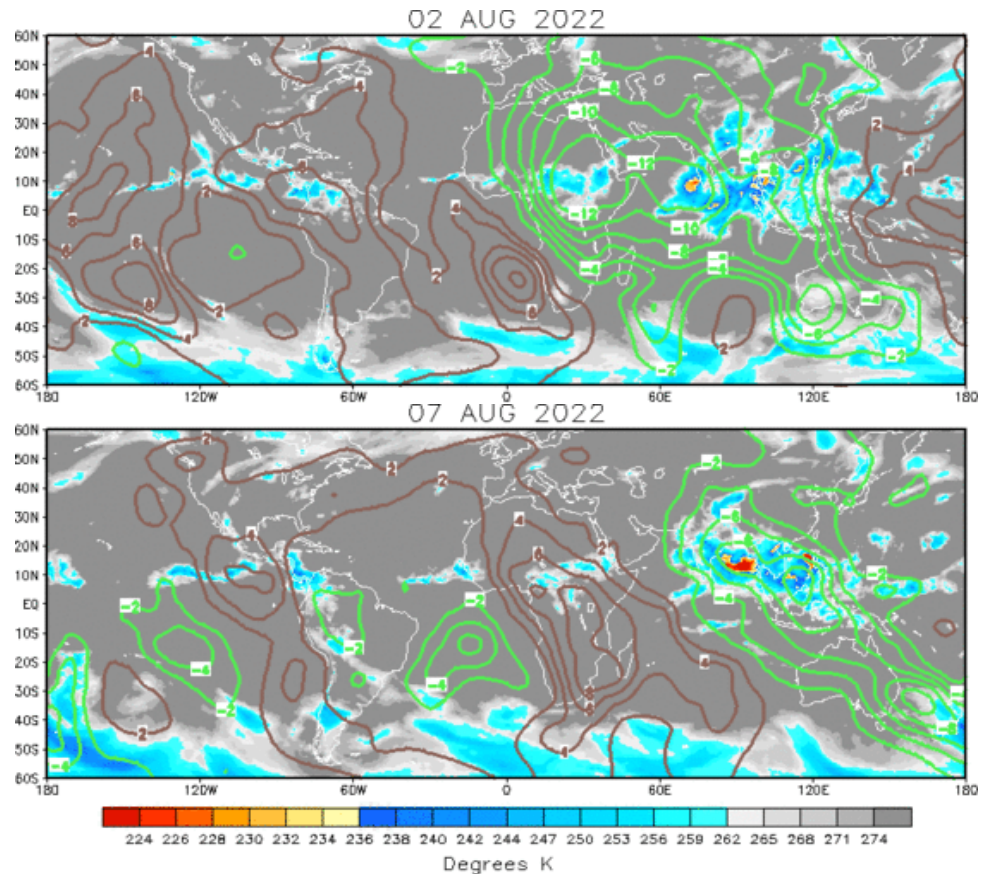
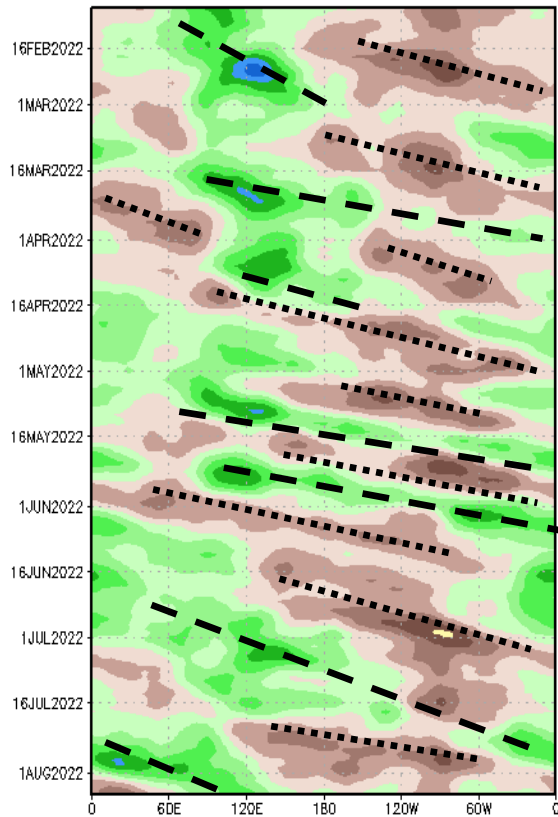
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:  
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

# 200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

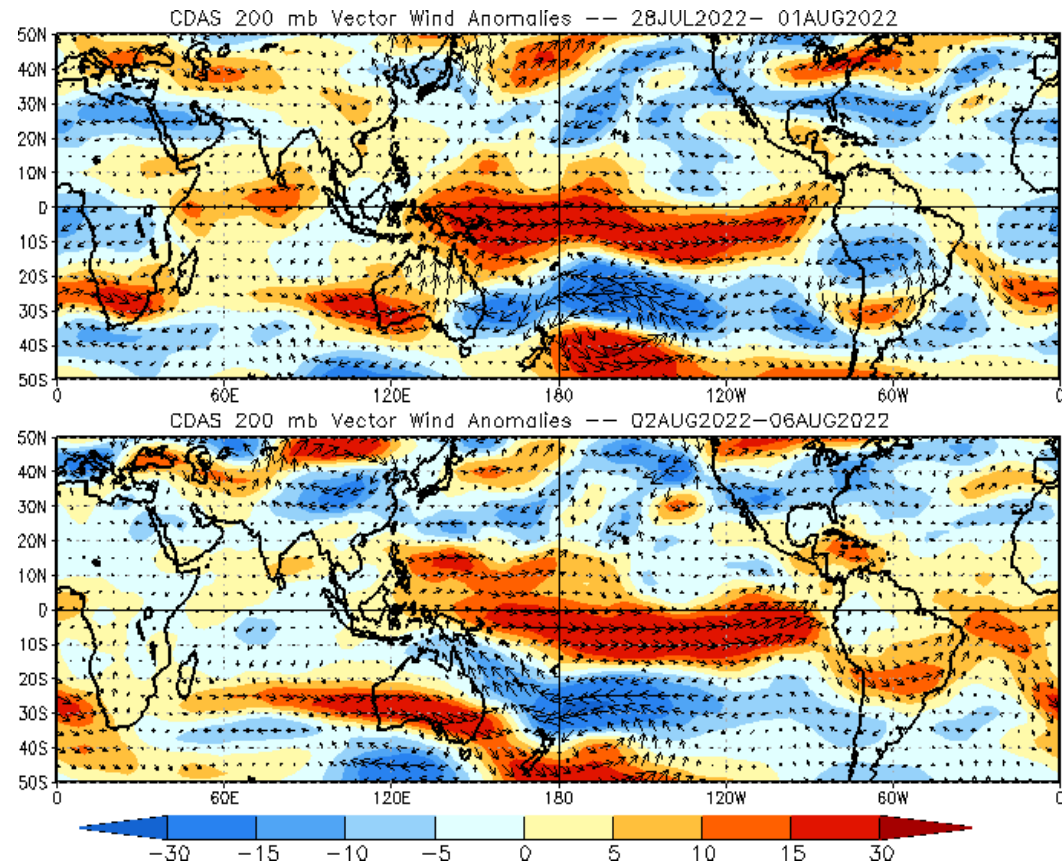
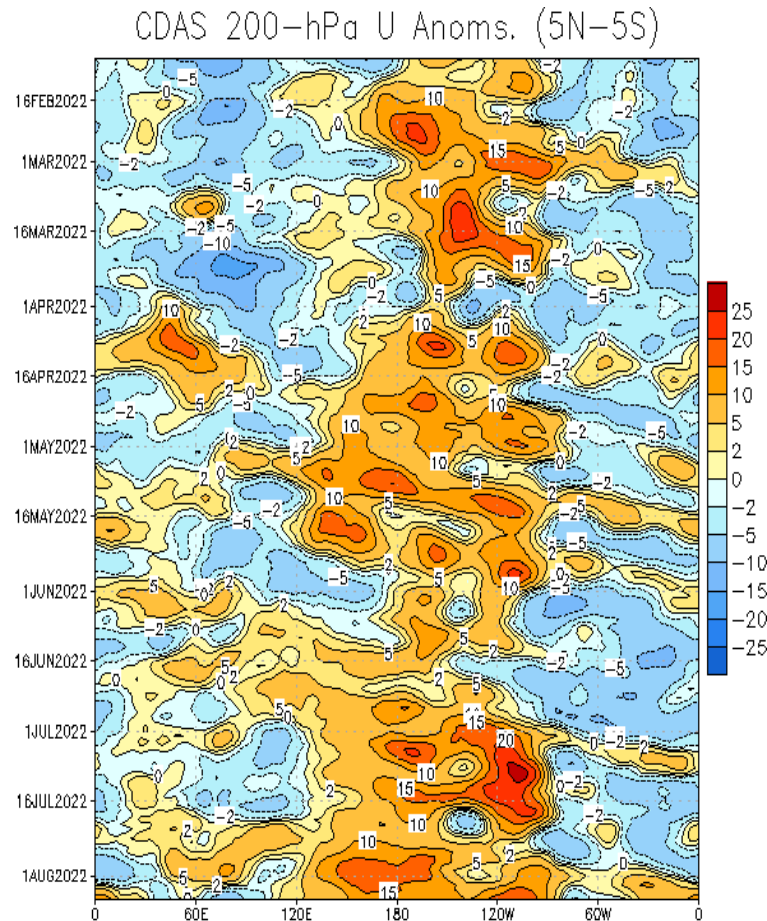
200-hPa Velocity Potential Anomaly: 5N-5S  
5-day Running Mean



- A wave-1 pattern is evident during early August, but has since become much less defined with enhanced convection remaining entrenched across the eastern Indian Ocean and Maritime Continent during the past week.
- An area of increasing anomalous divergence aloft is recently observed east of the Date Line, which appears to be tied to a Kelvin Wave over the Pacific in the objective filtering of velocity potential fields (not pictured).

# 200-hPa Wind Anomalies

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

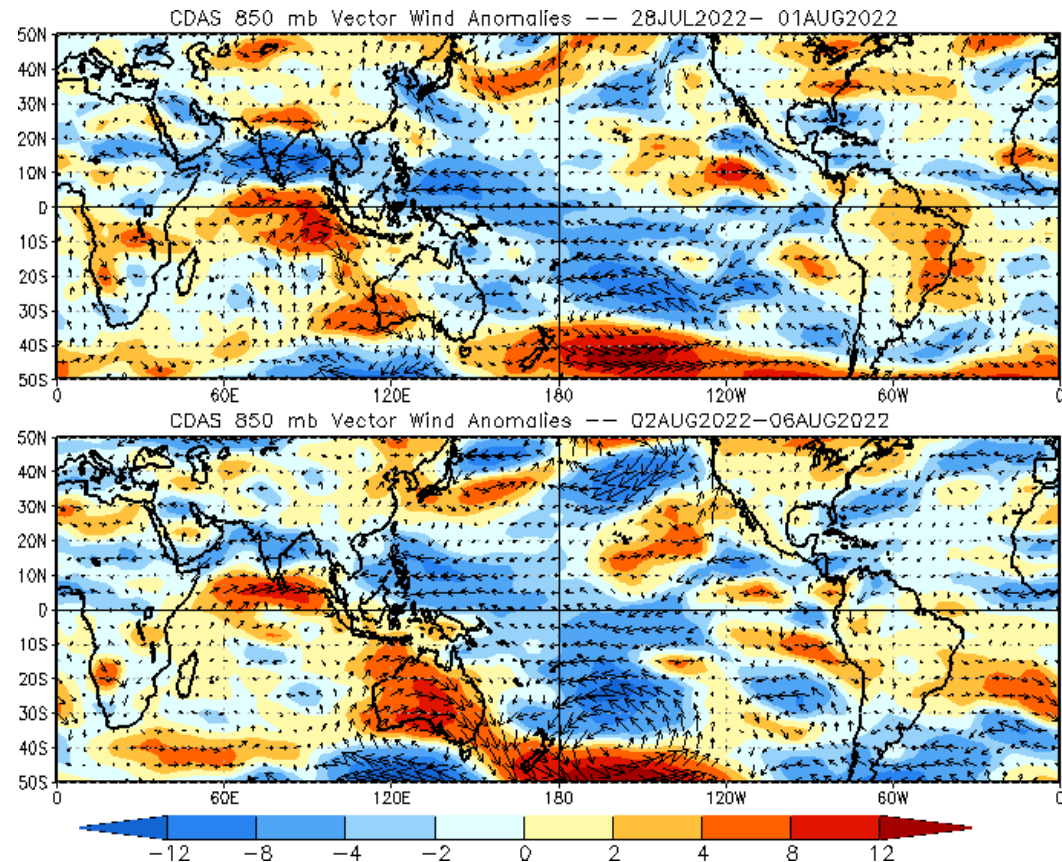
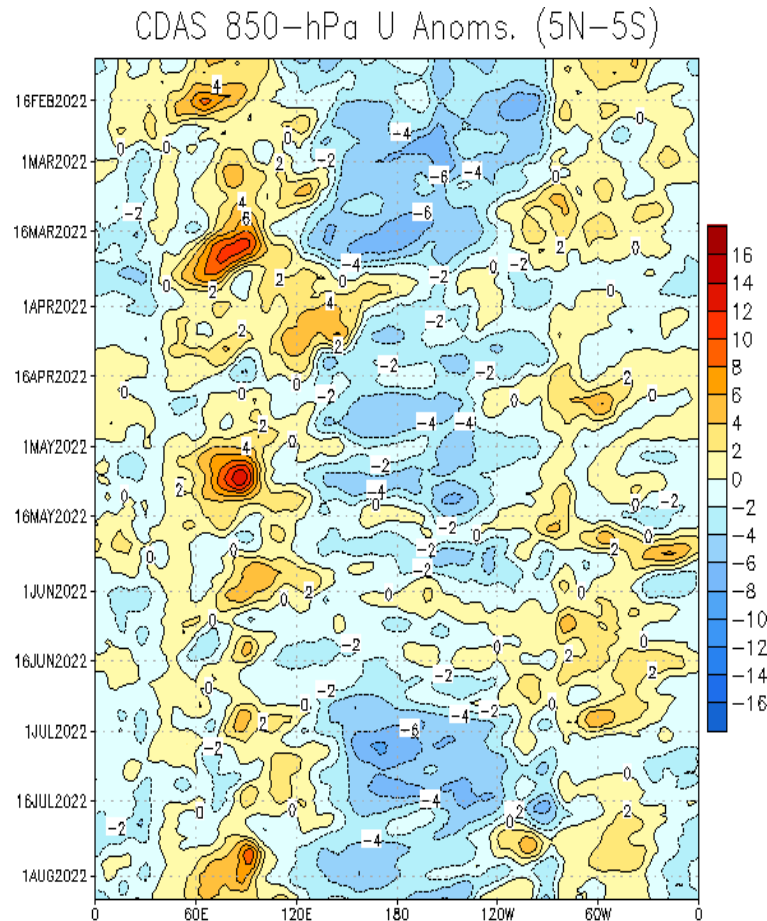


- Anomalous westerlies aloft continue across much of the equatorial Pacific consistent with the ongoing La Nina which has exhibited an unusually strong atmospheric response during the boreal summer.
- Anomalous easterlies have developed across the equatorial Indian Ocean supporting the enhancement of convection across the western Indian Ocean and Maritime Continent.



# 850-hPa Wind Anomalies

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

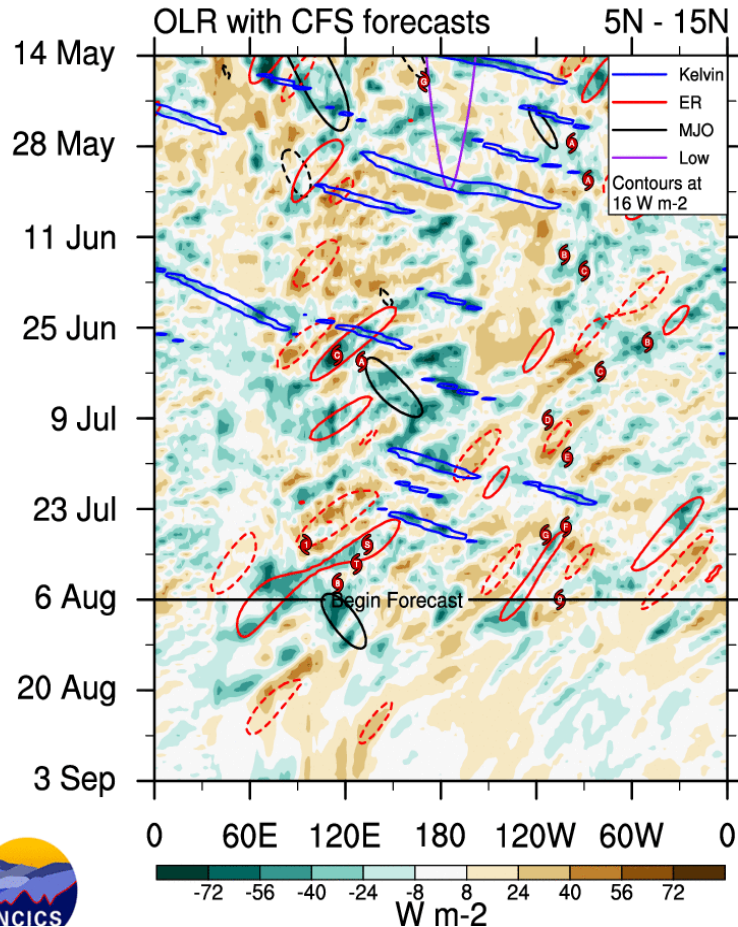


- An enhanced trade wind regime continues across the equatorial Pacific, with anomalous westerlies to the north supportive of tropical cyclone activity in the Pacific.
- Anomalous westerlies remain over the equatorial Indian Ocean, but have decreased in intensity during the past week mostly south of the equator.

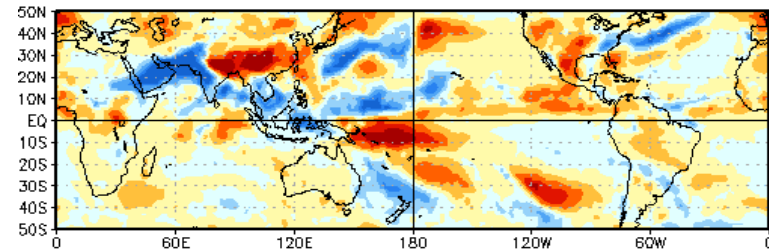
# Outgoing Longwave Radiation (OLR) Anomalies

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

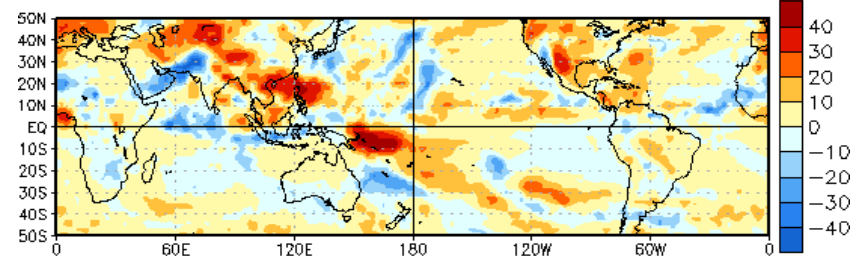
**Brown shades:** Anomalous subsidence (dryness)



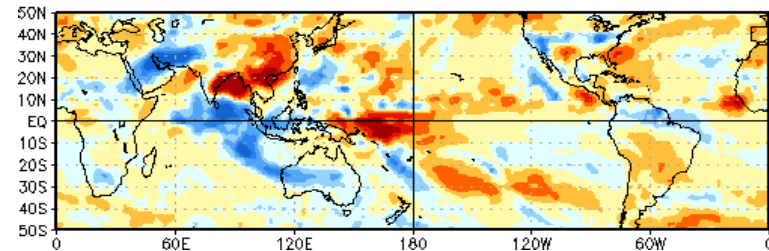
OLR Anomalies  
5 JUL 2022 to 14 JUL 2022



15 JUL 2022 to 24 JUL 2022

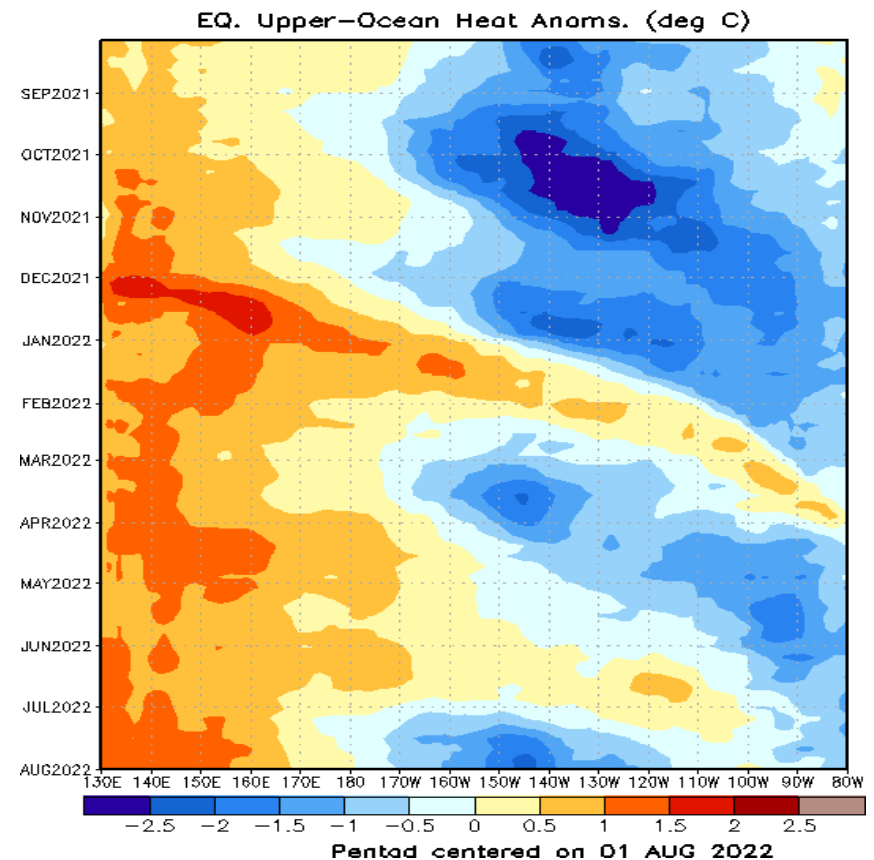
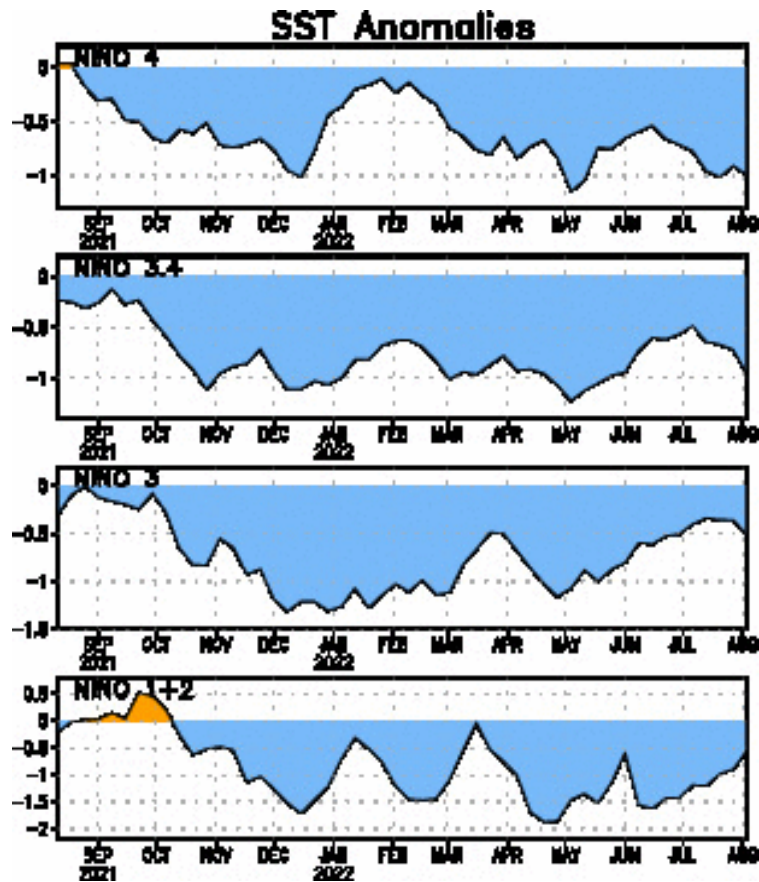


25 JUL 2022 to 3 AUG 2022



- Combined with favorable upper-level conditions, a westerly wind burst event in late July led to the widespread enhancement of convection across the Indian Ocean, as well as an out of season tropical cyclone south of the equator.
- The CFS forecast depicts a number of westward moving convective features indicative of Rossby wave activity influencing the global tropics.

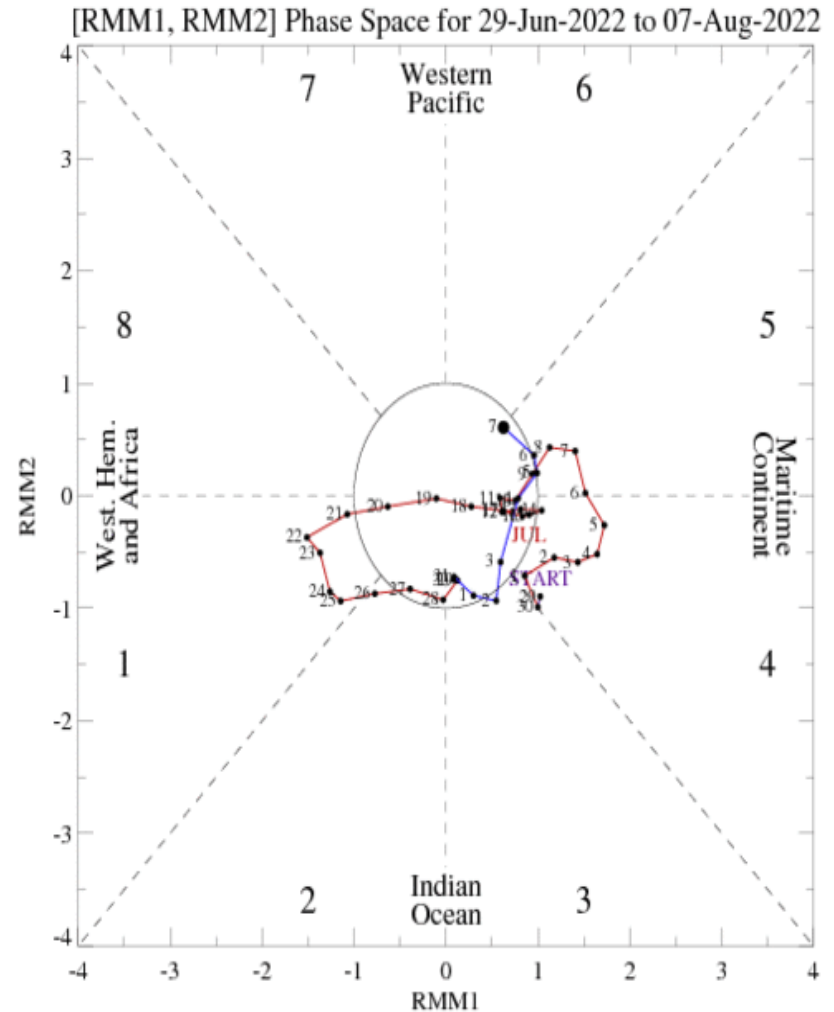
# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- The persistence of strongly enhanced trade winds and an upwelling oceanic Kelvin wave response have resulted in the continued strengthening of cold subsurface anomalies east of the Date Line during the last few weeks.
- SSTs has remained below average across all Niño basins.

# MJO Index: Recent Evolution

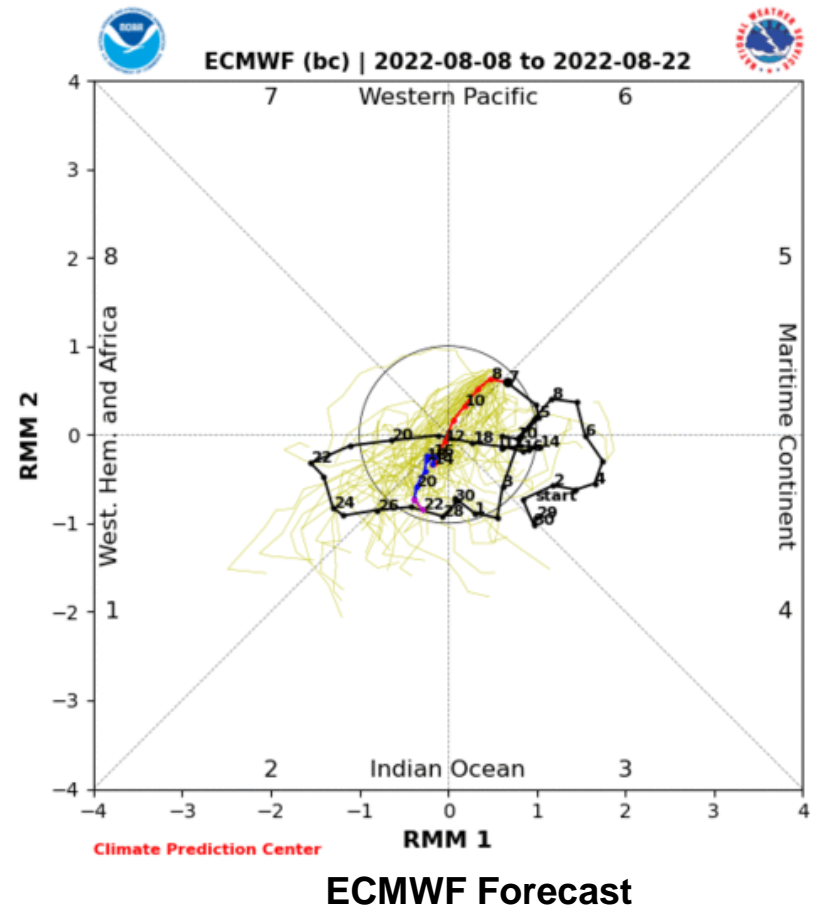
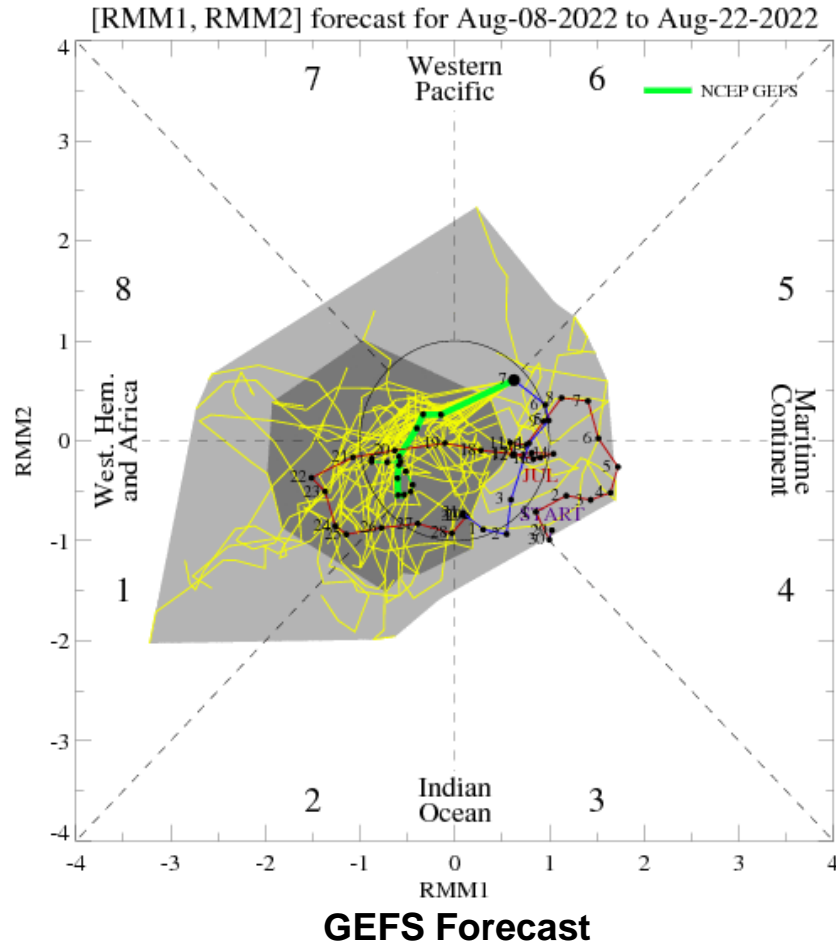
- After a period of renewed MJO activity in late July, the intraseasonal signal fell back within the RMM unit circle where it has largely remained since.



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

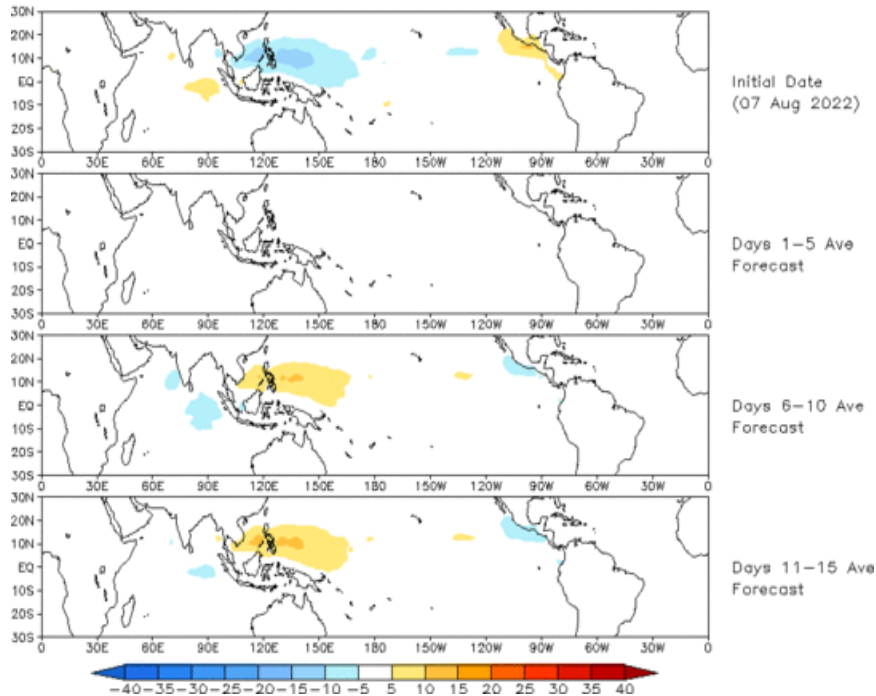


- Since last week, there is better agreement among the dynamical models favoring continued eastward propagation of the signal across the western Pacific and into the western Hemisphere/Indian Ocean, but generally maintain a low amplitude during the next two weeks. Some models (CFS, BOMM) point to a more coherent signal emerging by the middle of August.
- The rapid phase speed in the RMM forecasts is suggestive of a convectively coupled Kelvin wave projecting onto the index.

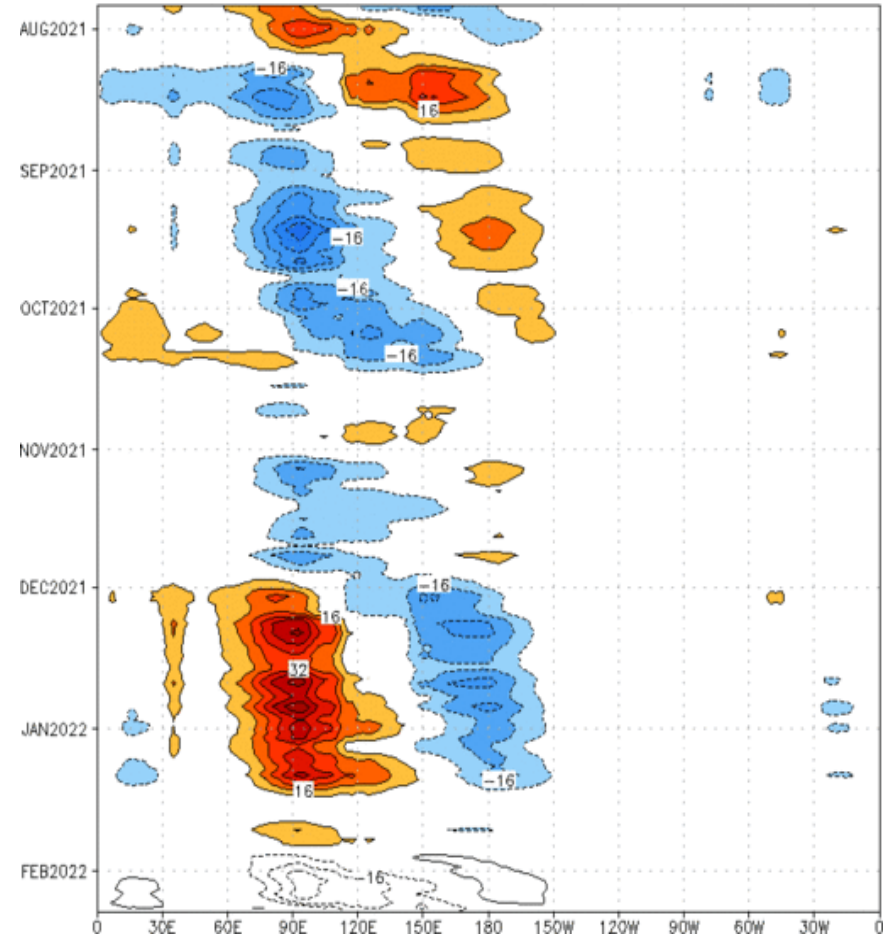
# MJO: GEFS Forecast Evolution

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: 07 Aug 2022  
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2  
OLR [ $7.5^{\circ}\text{S}, 7.5^{\circ}\text{N}$ ] (cont:  $4\text{Wm}^{-2}$ ) Period: 27-Jul-2021 to 26-Jan-2022  
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

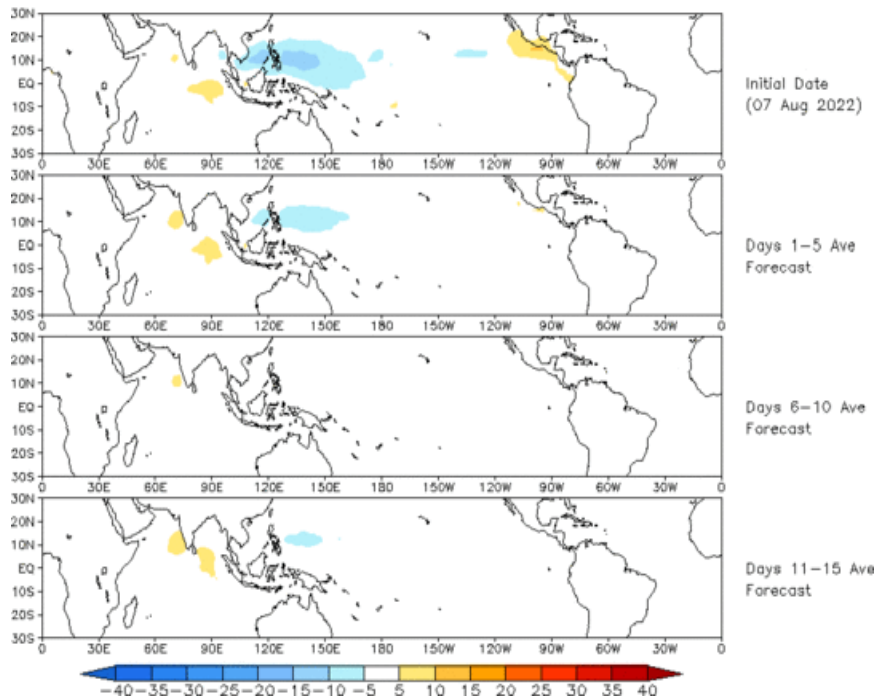


- The GEFS RMM-index based OLR anomaly field favors the return of enhanced (suppressed) convection over the Indian Ocean (Maritime Continent/Western Pacific), though this convective dipole appears both weak and quasi-stationary through the end of the outlook period.

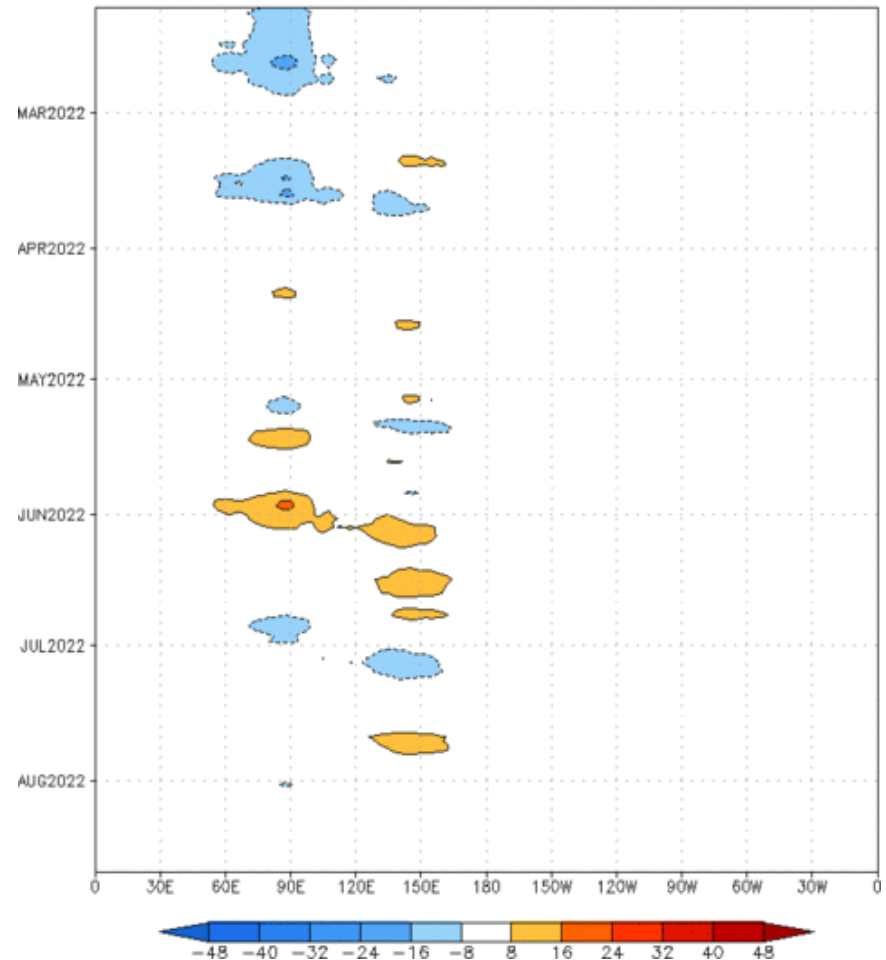
# MJO: Constructed Analog Forecast Evolution

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 (07 Aug 2022)



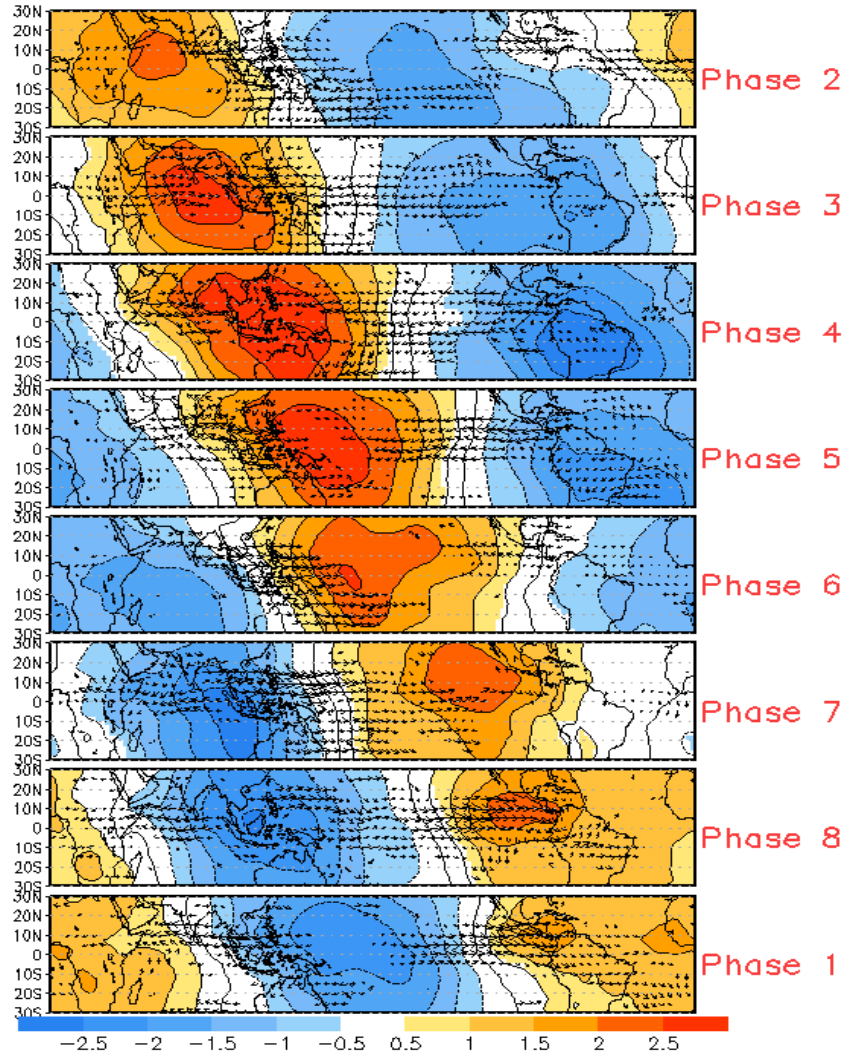
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cont:4Wm<sup>-2</sup>) Period:05-Feb-2022 to 07-Aug-2022  
The unfilled contours are CA forecast reconstructed anomaly for 15 days



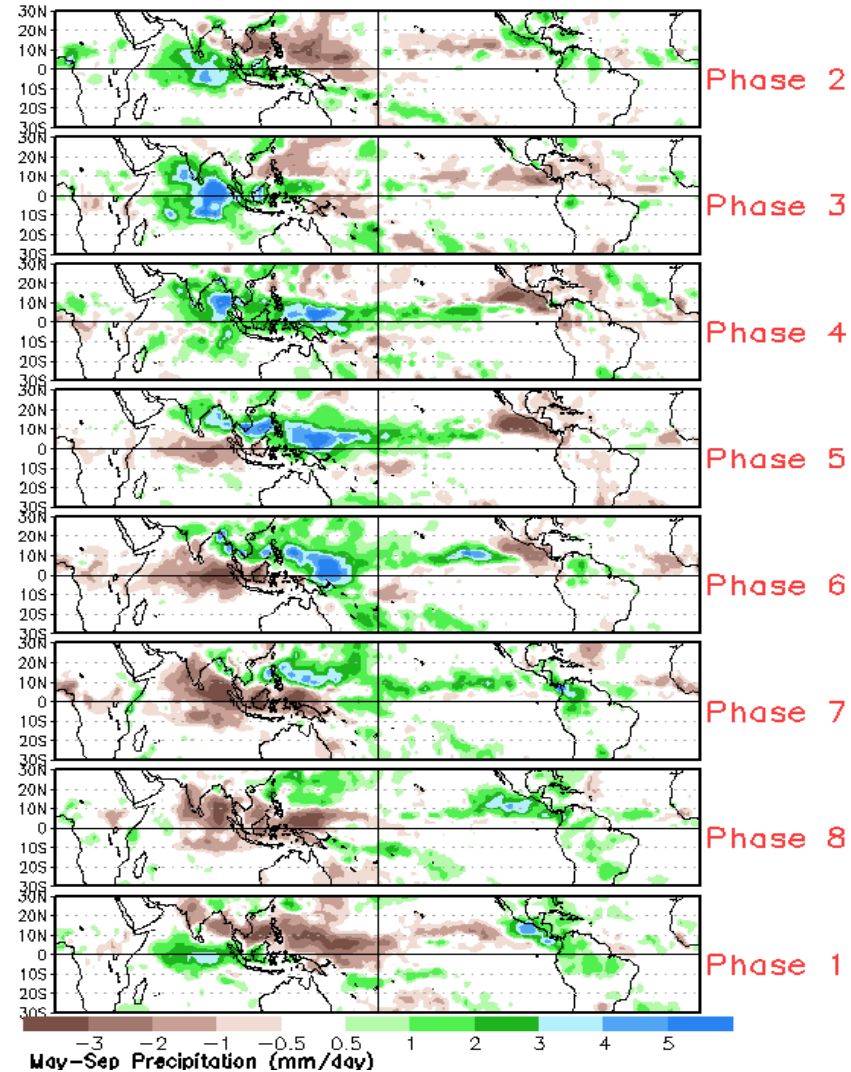
- The constructed analog forecast of RMM-based OLR contrasts the GEFS, favoring little change from the initial conditions.

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and  
Wind Anomalies



Precipitation Anomalies

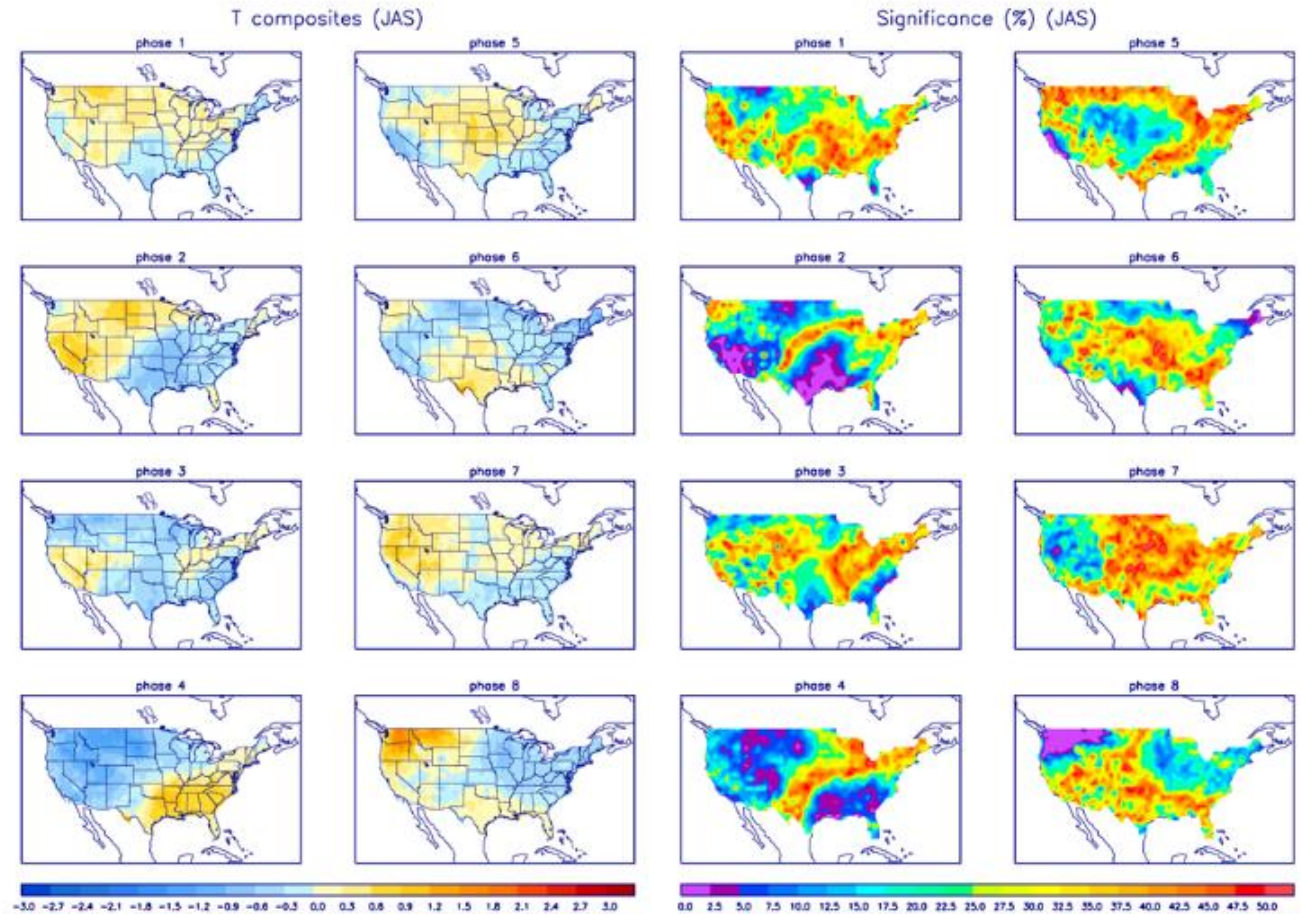




# MJO: CONUS Composite Maps by RMM Phase - Temperature

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.

