

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



**Update prepared by the Climate Prediction Center**  
Climate Prediction Center / NCEP  
26 August 2019

# Overview

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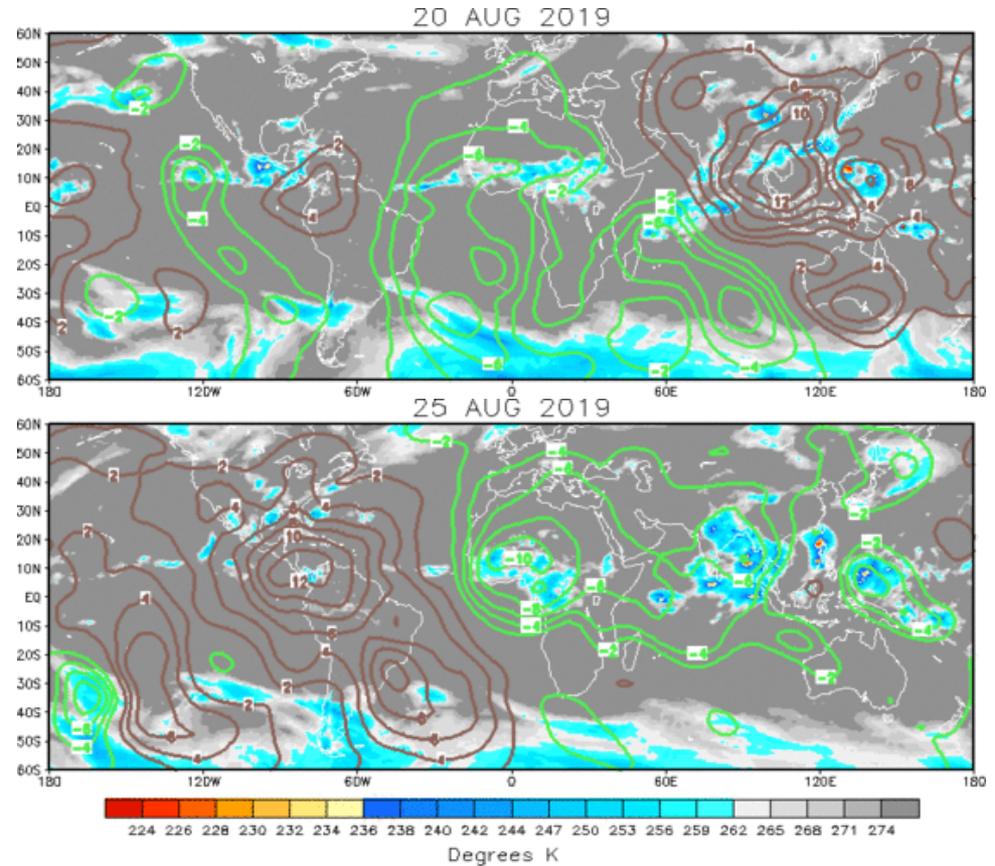
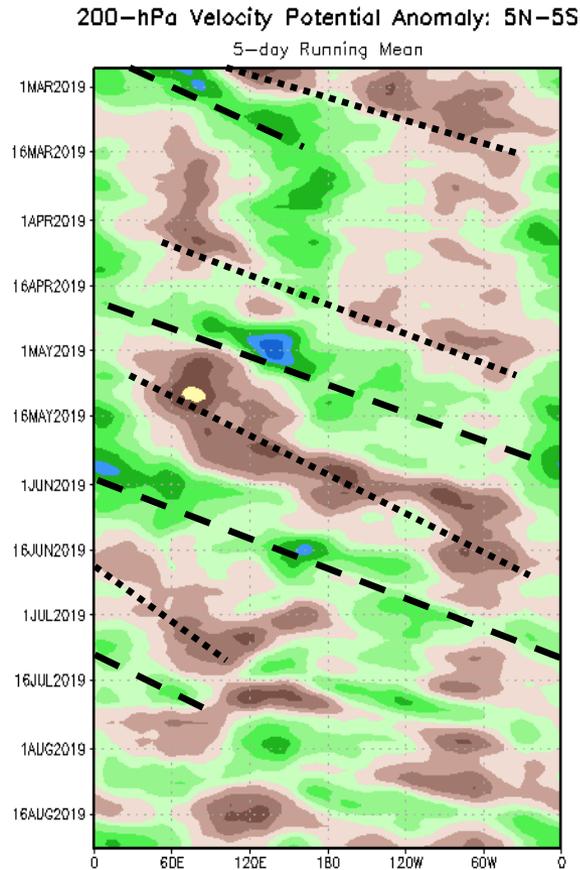
- The MJO remains weak with a Kelvin wave recently propagating east from the tropical Atlantic to Africa.
- Dynamical models diverge on the MJO evolution during the next two weeks but there is an increasing chance of a more coherent MJO developing over the Maritime Continent by Week-2.
- Climatology favors at least one tropical cyclone forming across the main development region of the Atlantic during the next two weeks.
- Tropical cyclone development is less likely across the East Pacific.

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).

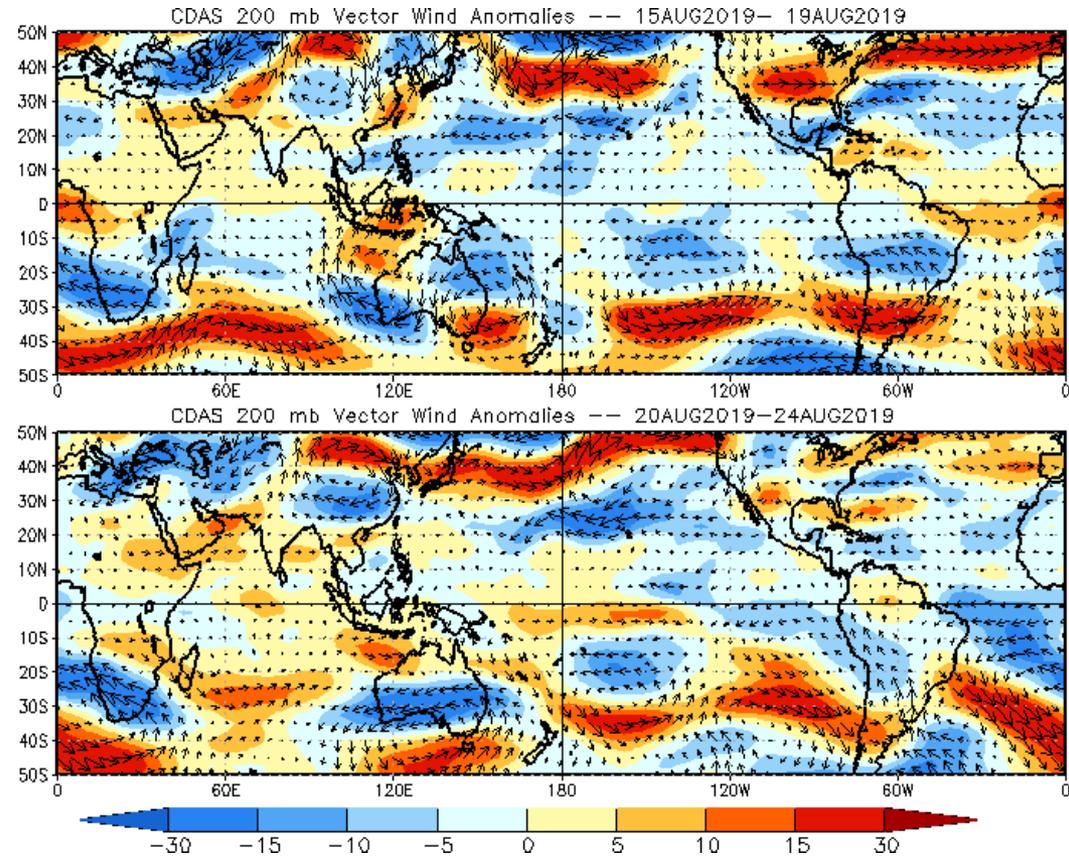
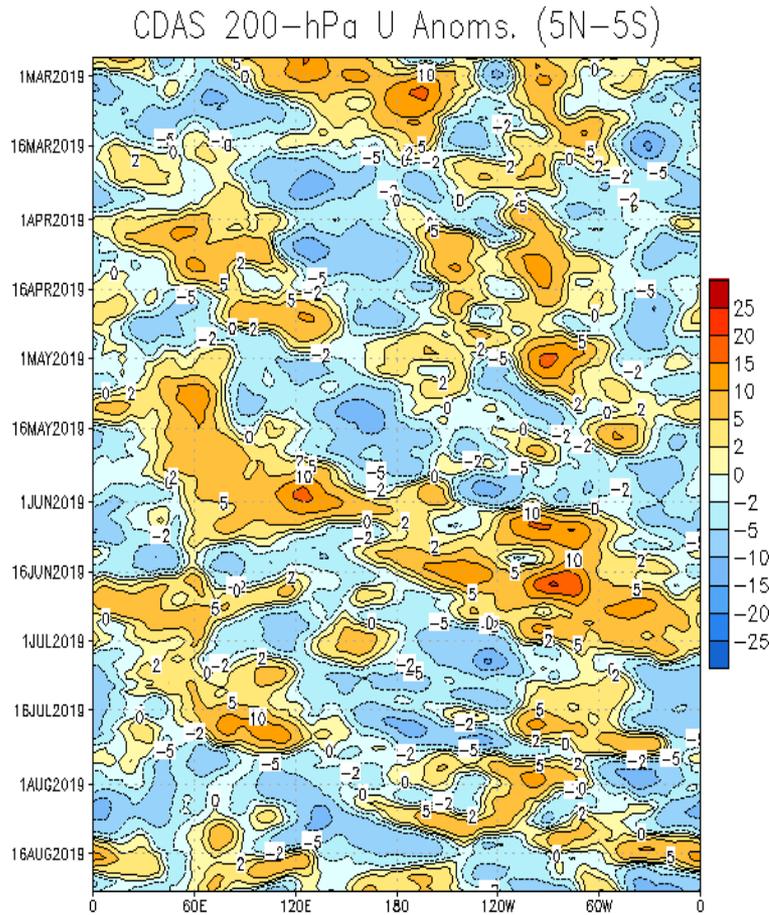
**Brown shades:** Anomalous convergence (unfavorable for precipitation).



- A Kelvin wave crossed the Western Hemisphere during mid-August and recently propagated east of the Prime Meridian to Africa.
- Related to that Kelvin wave, upper-level divergence is enhanced over Africa while anomalous upper-level convergence has overspread the East Pacific and the Americas.

# 200-hPa Wind Anomalies

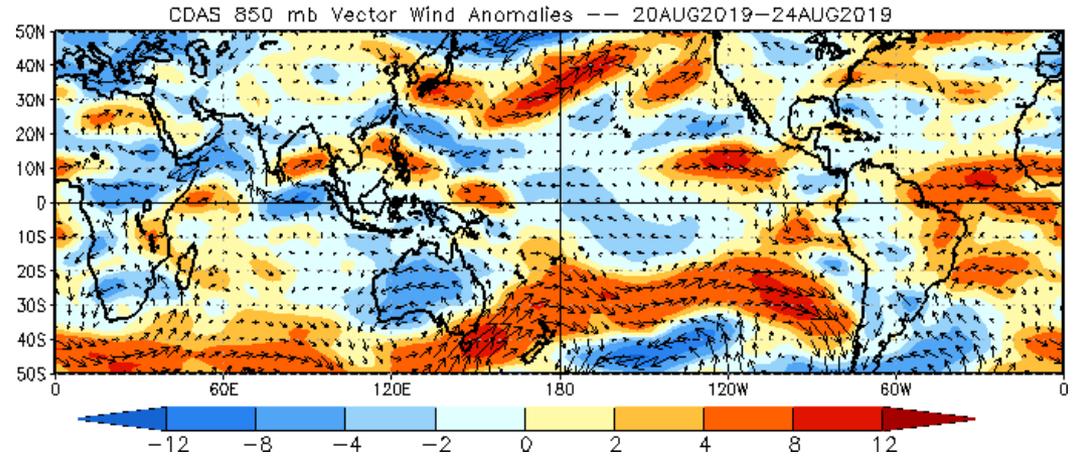
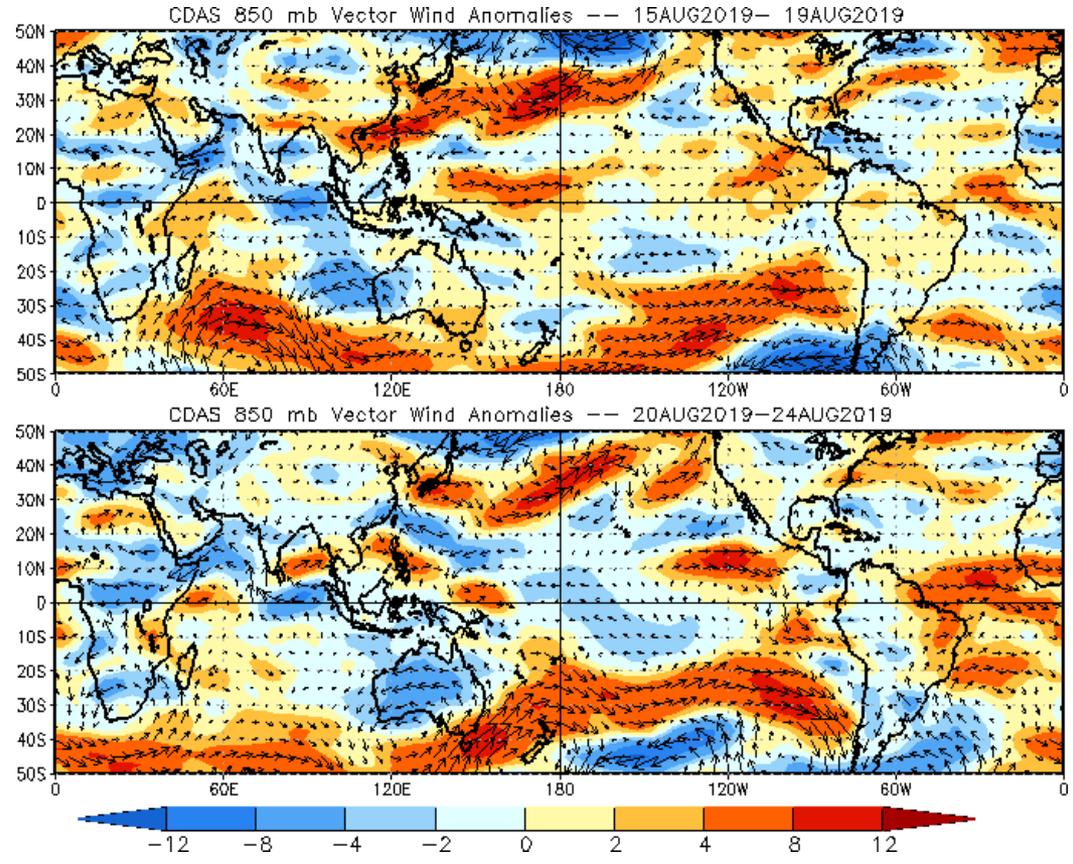
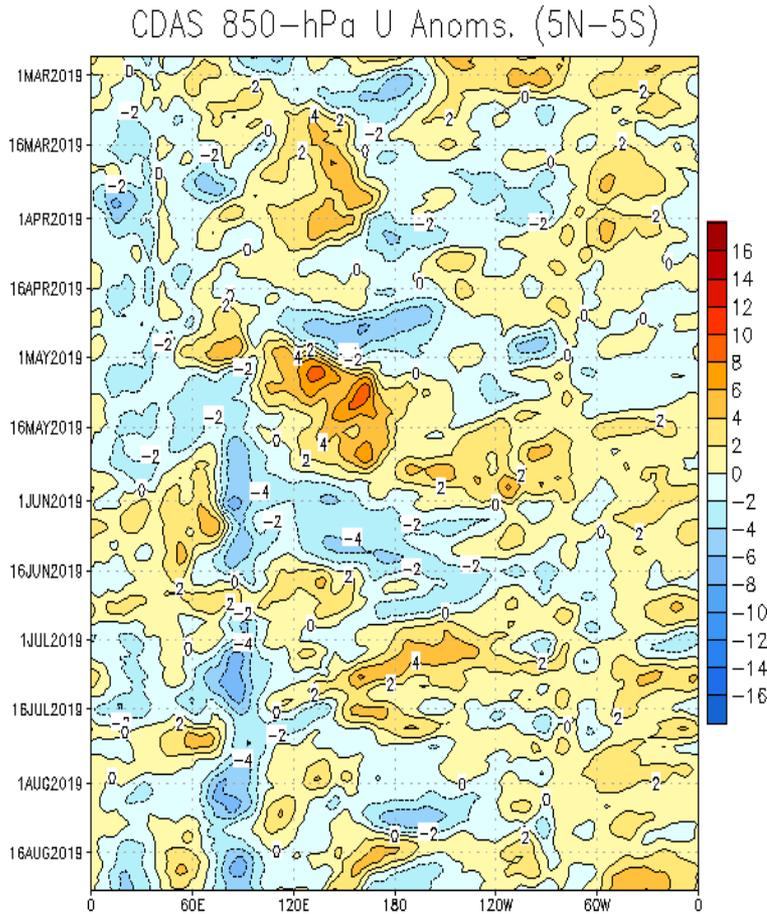
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- A fast-moving envelope of upper-level easterlies shifted east from the Pacific, briefly reducing wind shear over the tropical Atlantic during mid to late August.
- Upper-level easterlies were replaced with upper-level westerlies over the Maritime Continent with influence from the higher latitudes of the Southern Hemisphere.

# 850-hPa Wind Anomalies

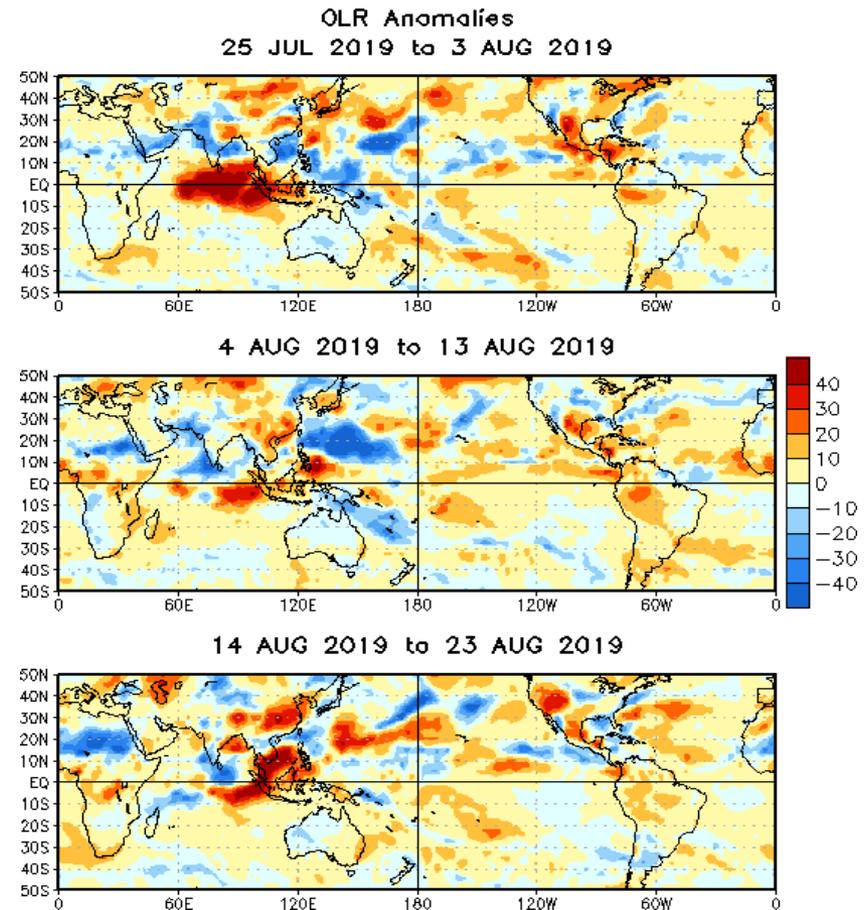
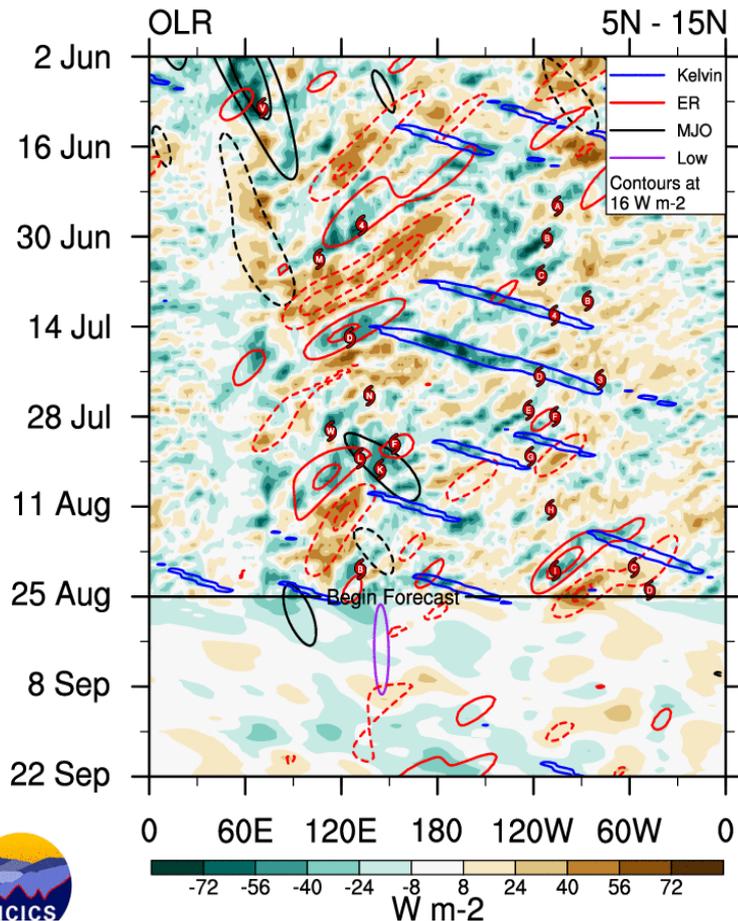
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Low-level westerlies strengthened across the main development region of the tropical Atlantic during the past five days.
- Anomalous easterly flow recently developed across much of the Indian Ocean.

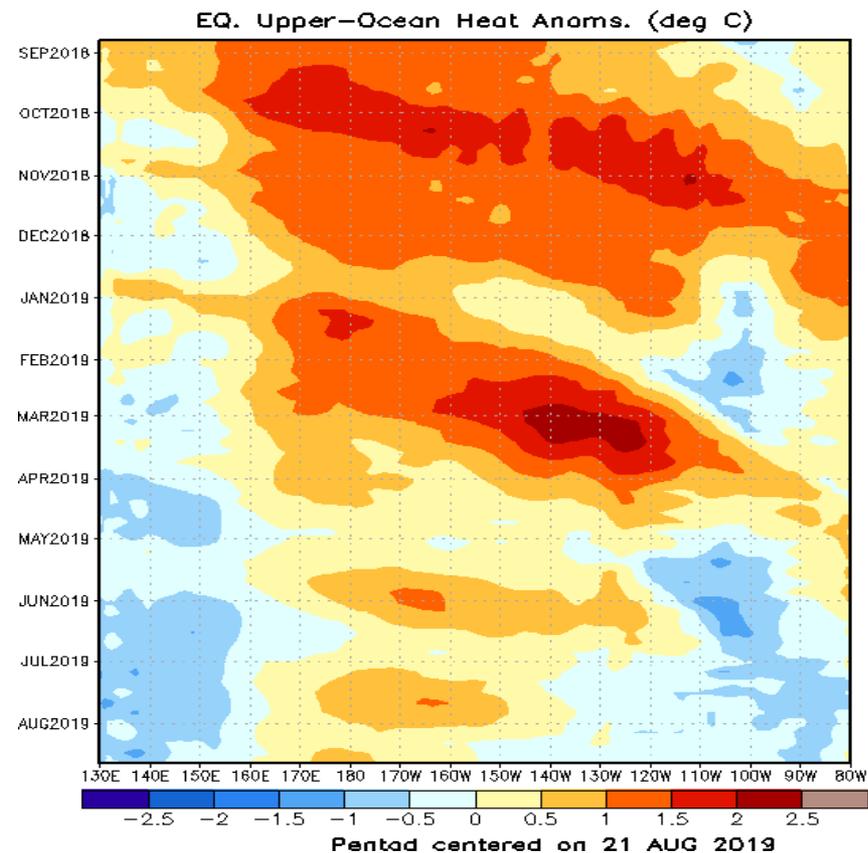
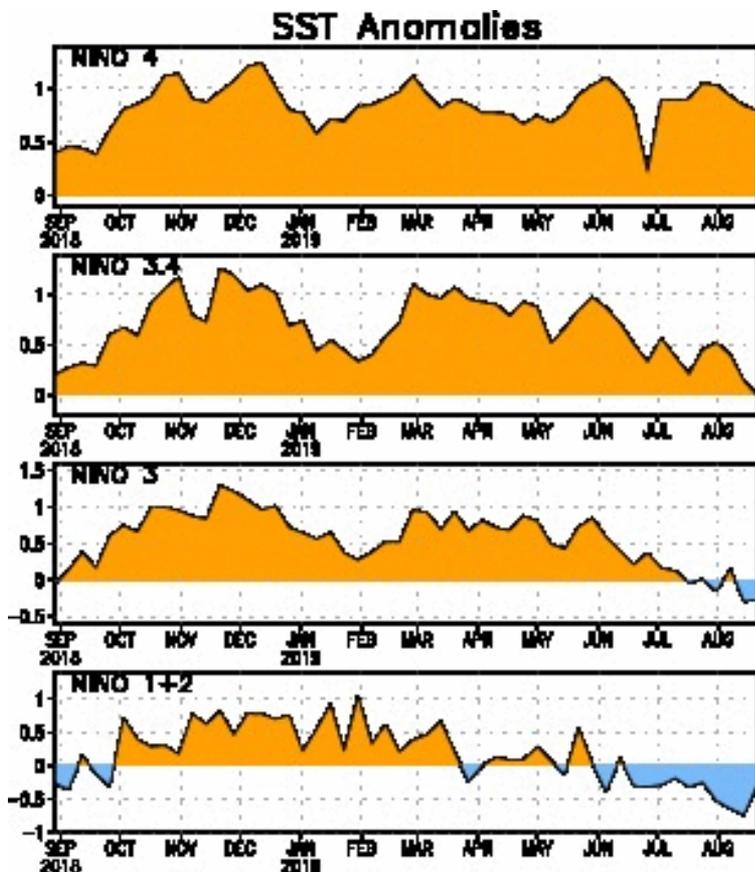
# Outgoing Longwave Radiation (OLR) Anomalies

**Blue shades:** Anomalous convection (wetness). **Red shades:** Anomalous subsidence (dryness).



- A Kelvin wave crossing the Western Hemisphere was the most coherent feature in the OLR field during mid-August.
- Convection, associated with the North American monsoon, became well suppressed during the past ten days.
- Suppressed convection continues to persist throughout the Maritime Continent.

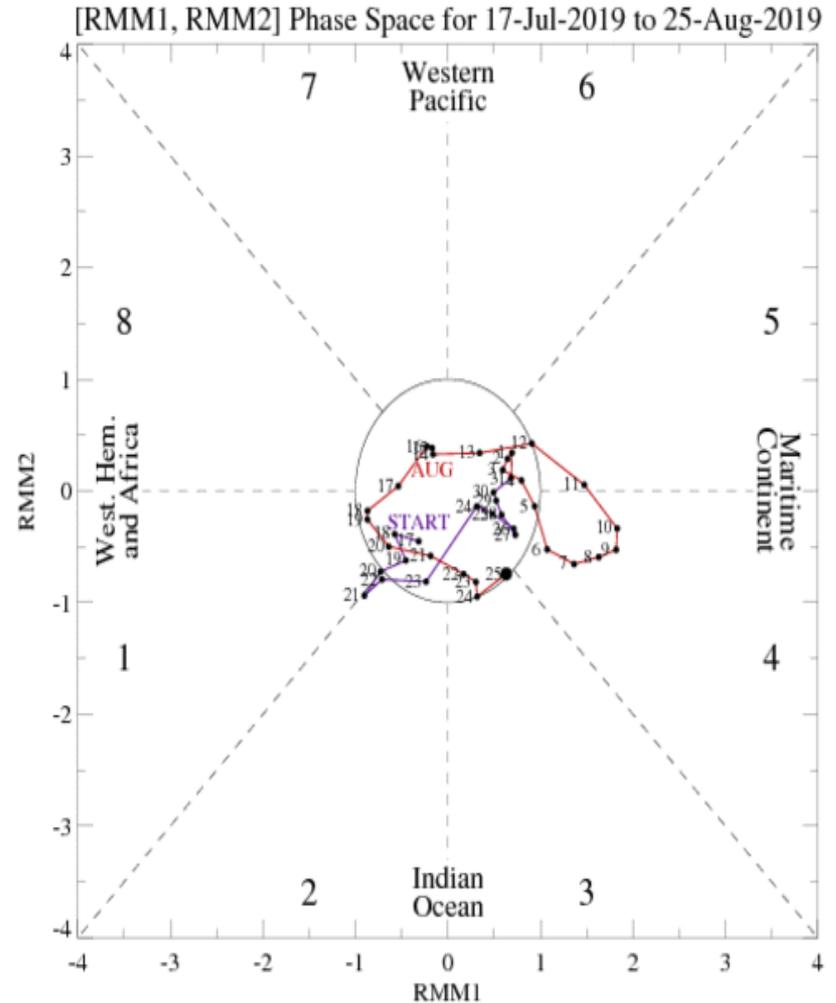
# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Equatorial SST anomalies are near to slightly negative across the eastern Pacific.
- A downwelling Kelvin wave event was evident over the central and eastern Pacific during mid-May through mid-June, but its amplitude was weaker than what was observed in previous events. Overall, upper-ocean heat content has continued to steadily decline over the past several months.
- Another weak downwelling wave developed in response to recent period of anomalous westerlies over the central Pacific.

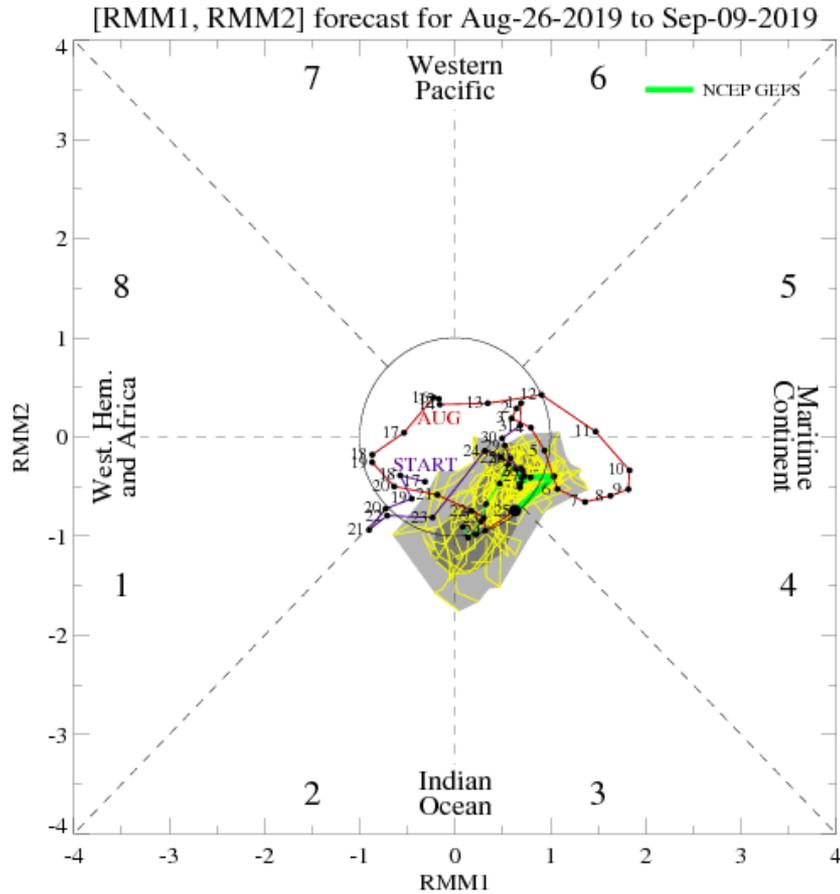
# MJO Index: Recent Evolution

- The projection of the intraseasonal signal in RMM space remains weak.

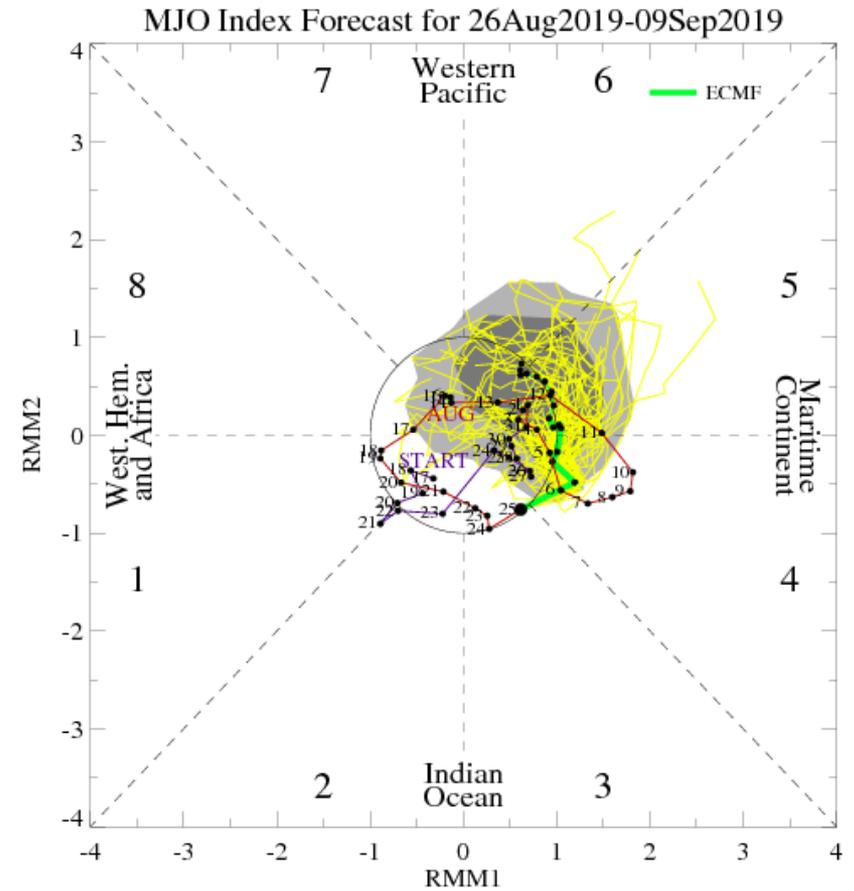


For more information on the RMM index and how to interpret its forecast please see:  
[https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC\\_MJOinformation.pdf](https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf)

# MJO Index: Forecast Evolution



**GEFS Forecast**



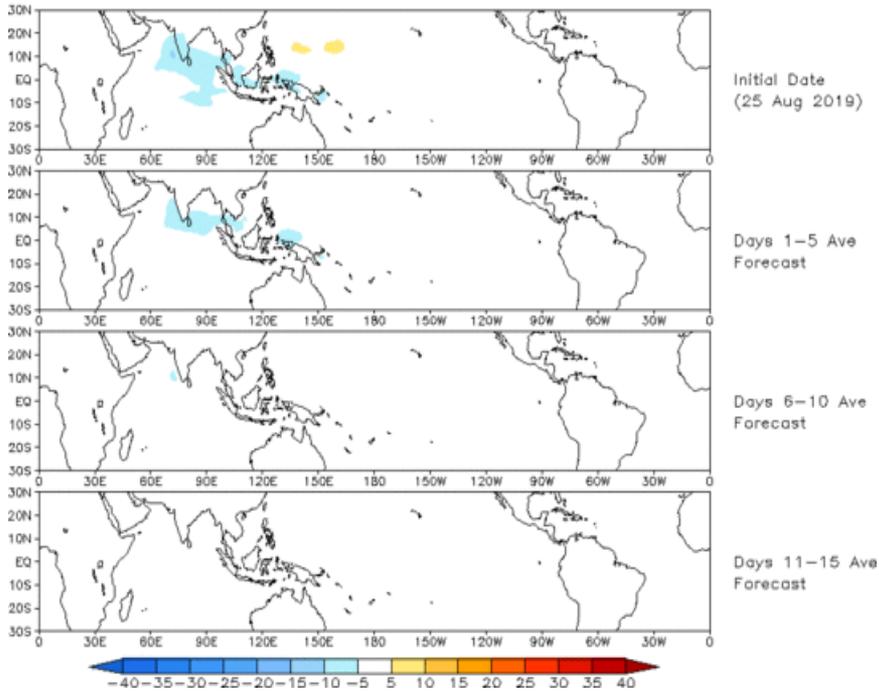
**ECMWF Forecast**

- The GEFS indicates a continued weak MJO signal during the next two weeks.
- Many of the ECMWF ensemble members feature a slight increase in the amplitude of the RMM index with eastward propagation over the Maritime Continent.

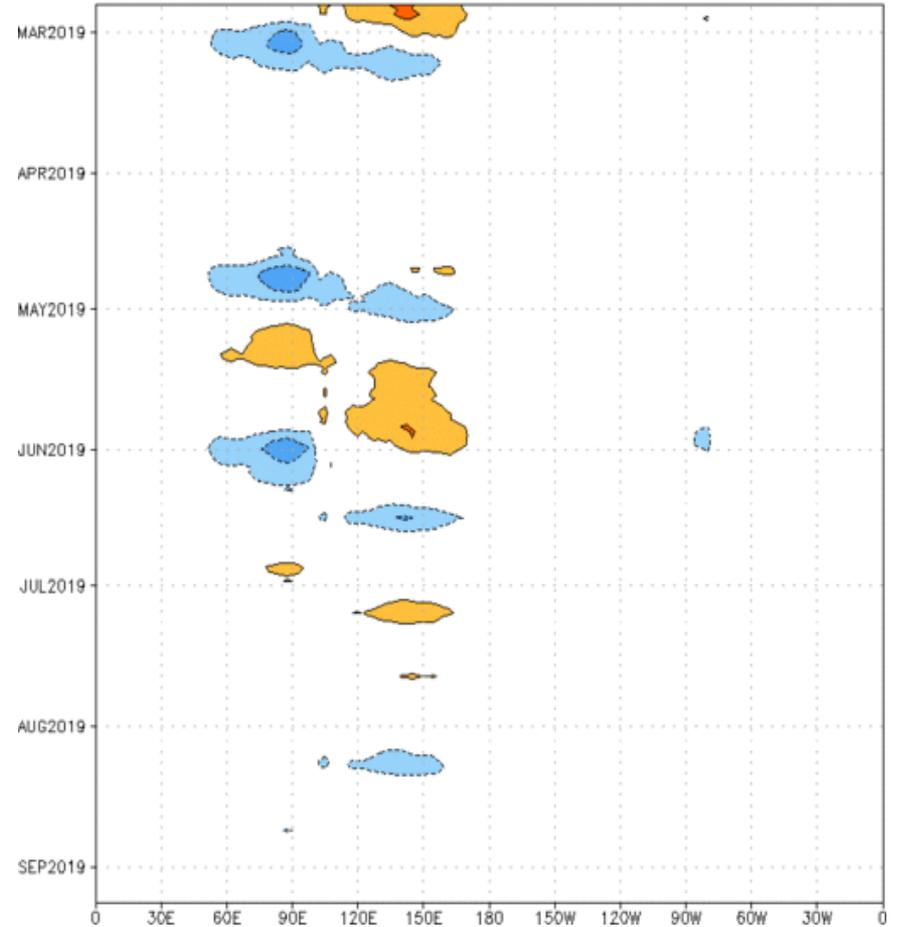
# MJO: GEFS Forecast Evolution

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: 25 Aug 2019  
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2  
OLR [ $7.5^{\circ}S, 7.5^{\circ}N$ ] (cont:  $4Wm^{-2}$ ) Period: 23-Feb-2019 to 25-Aug-2019  
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

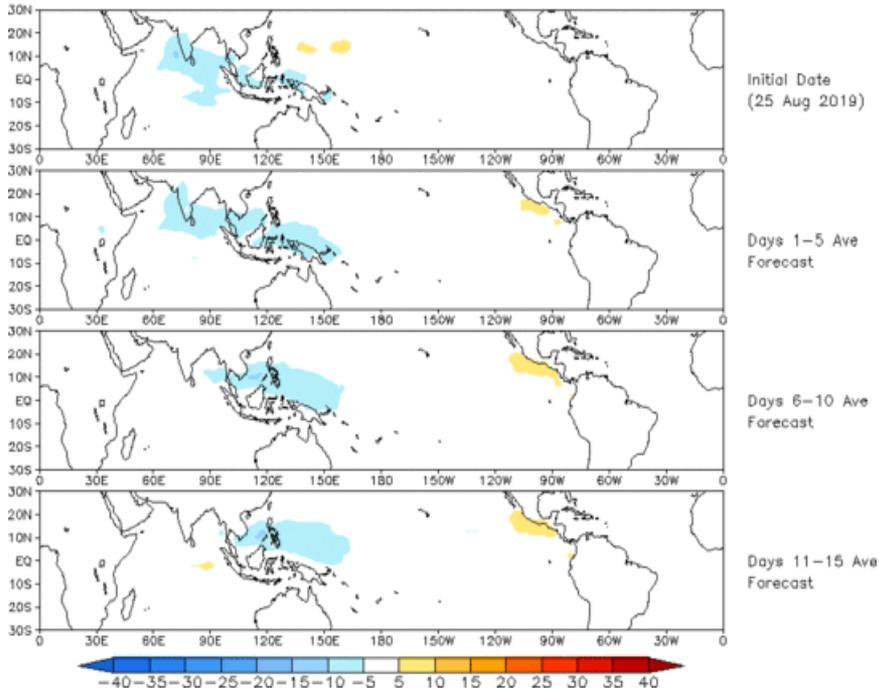


- The spatial depiction of OLR anomalies based on the GEFS RMM index depicts little or no anomalies.

# MJO: Constructed Analog Forecast Evolution

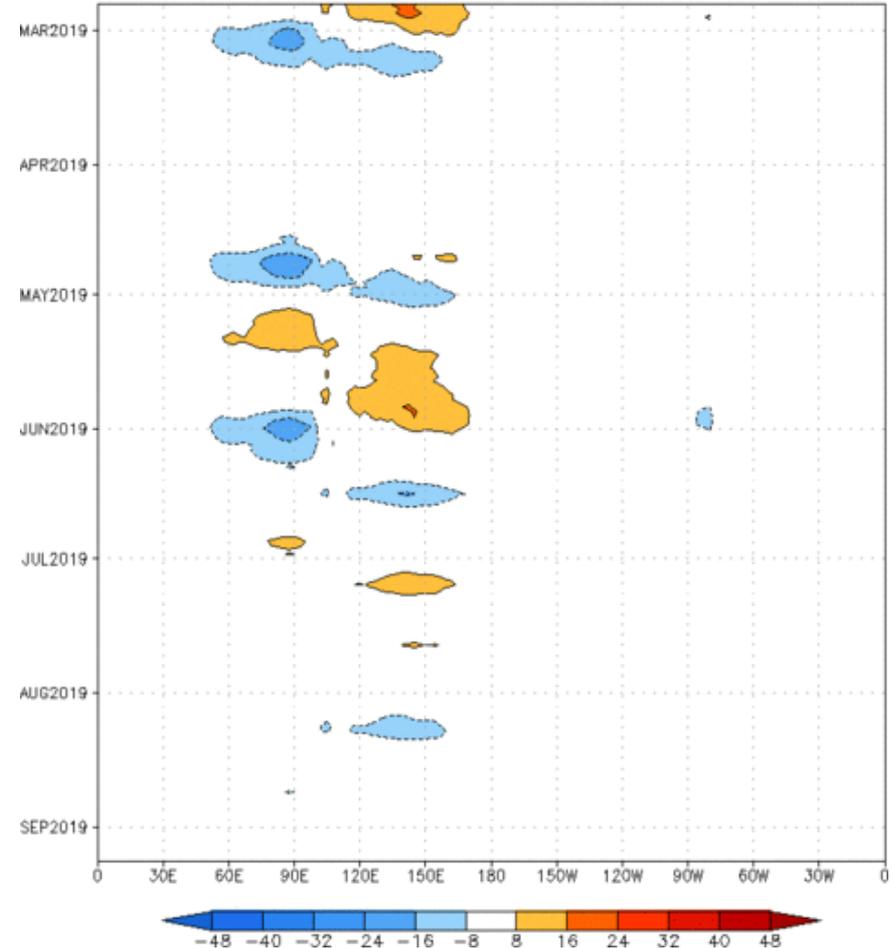
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (25 Aug 2019)



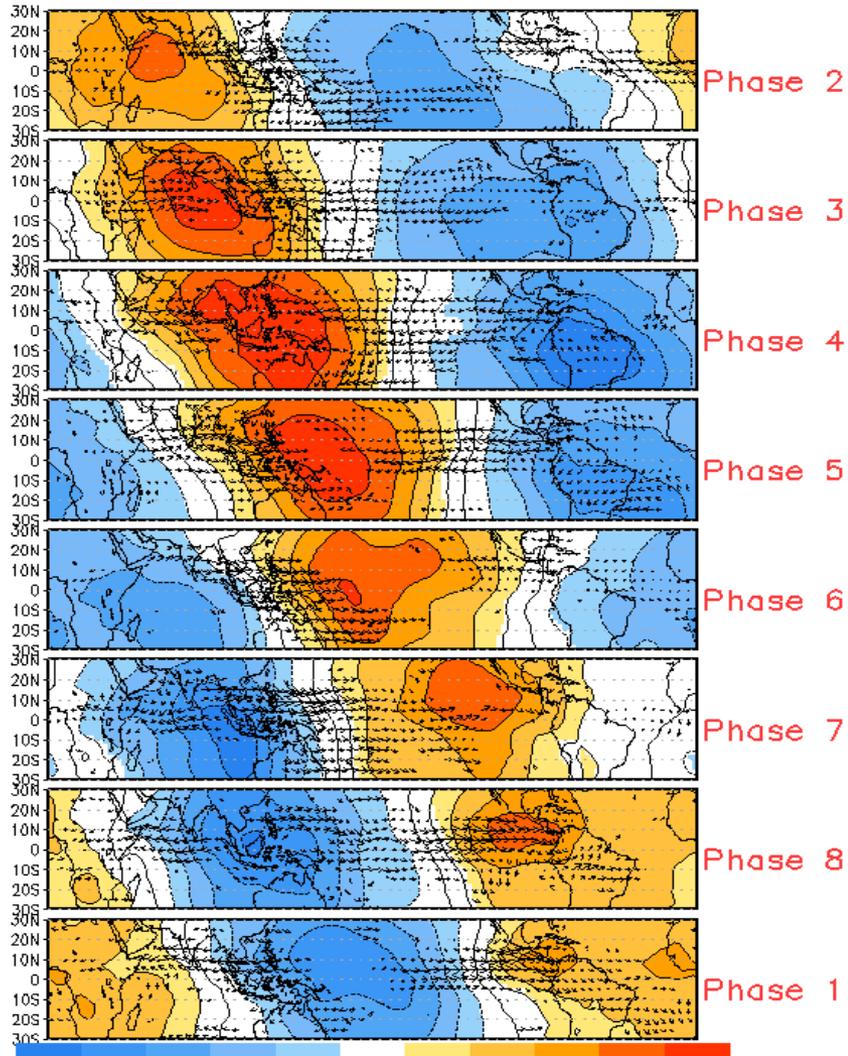
- The constructed analog MJO forecast indicates enhanced convection shifting east from the Indian Ocean to the Maritime Continent and West Pacific during the next two weeks.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm<sup>-2</sup>) Period:23-Feb-2019 to 25-Aug-2019  
The unfilled contours are CA forecast reconstructed anomaly for 15 days

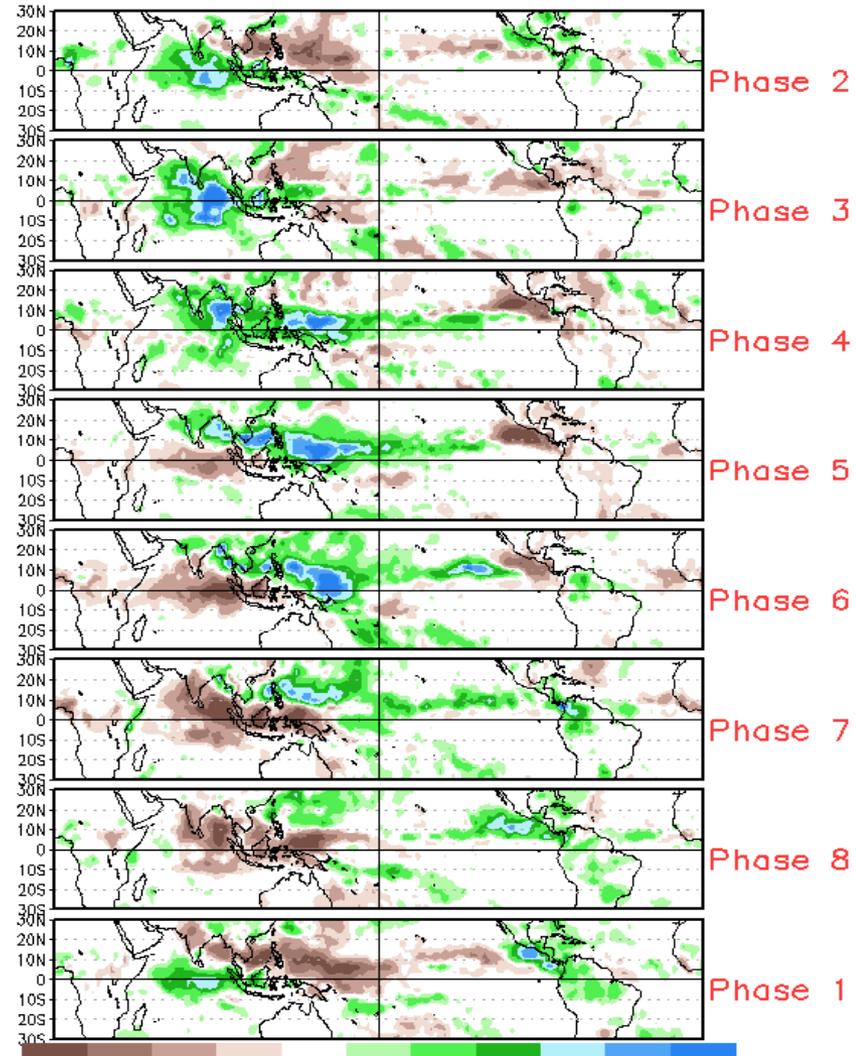


# MJO: Tropical Composite Maps by RMM Phase

## 850-hPa Velocity Potential and Wind Anomalies



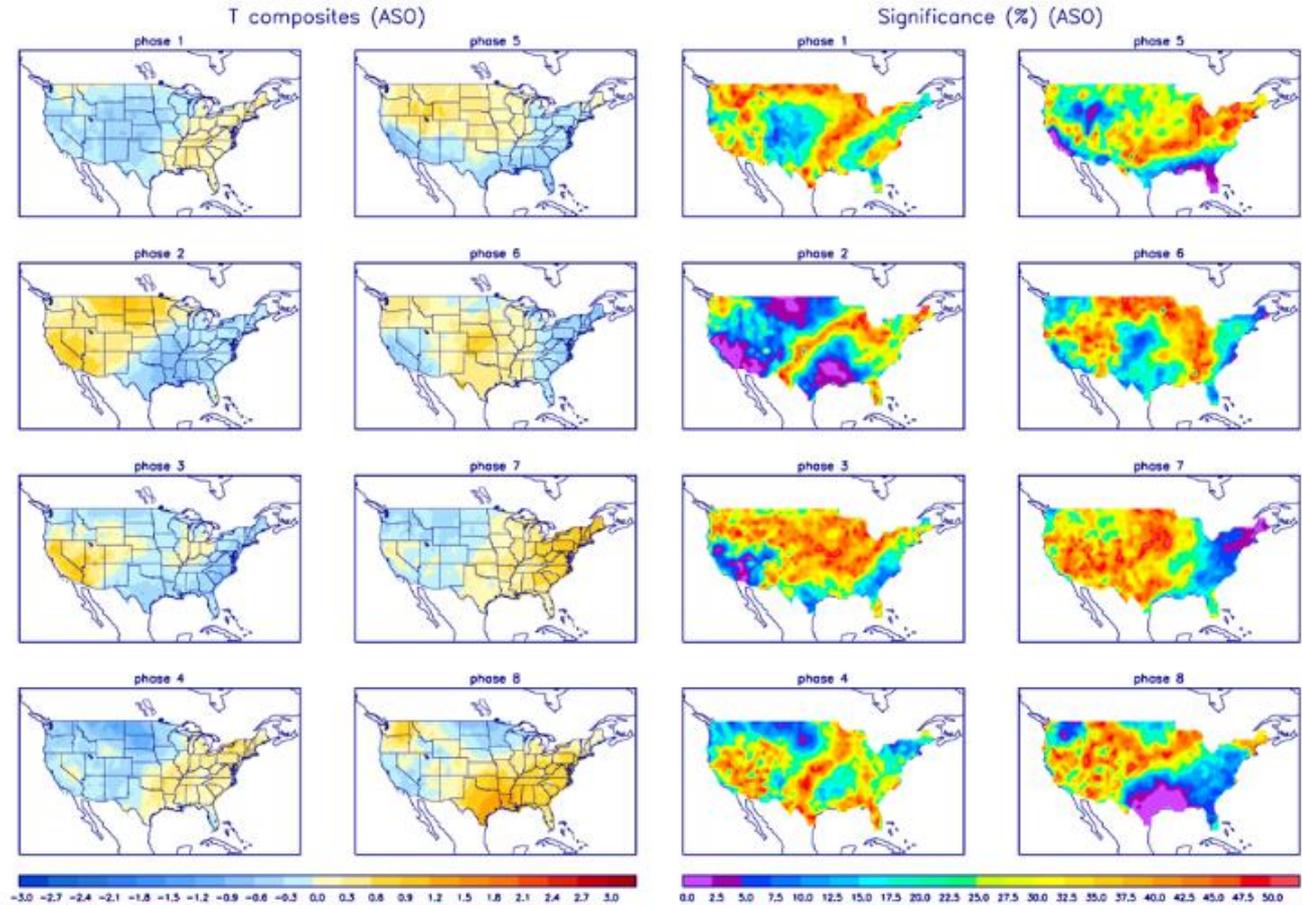
## Precipitation Anomalies



# 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.

