

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



**Update prepared by the Climate Prediction Center**  
Climate Prediction Center / NCEP  
4 November 2019

# Overview

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- The MJO is in RMM Phase 5 and most model guidance predicts it to progress into Phases 6 and 7 throughout the next two weeks.
- An equatorial Rossby (ER) wave is expected to move through the MJO's convective envelope during early Week-1.
- Large scale ascent extending from the Bay of Bengal to the western Pacific will be enhanced by the MJO and an ER wave, which will contribute to several regions of enhanced probabilities of TC formation during Week-1.

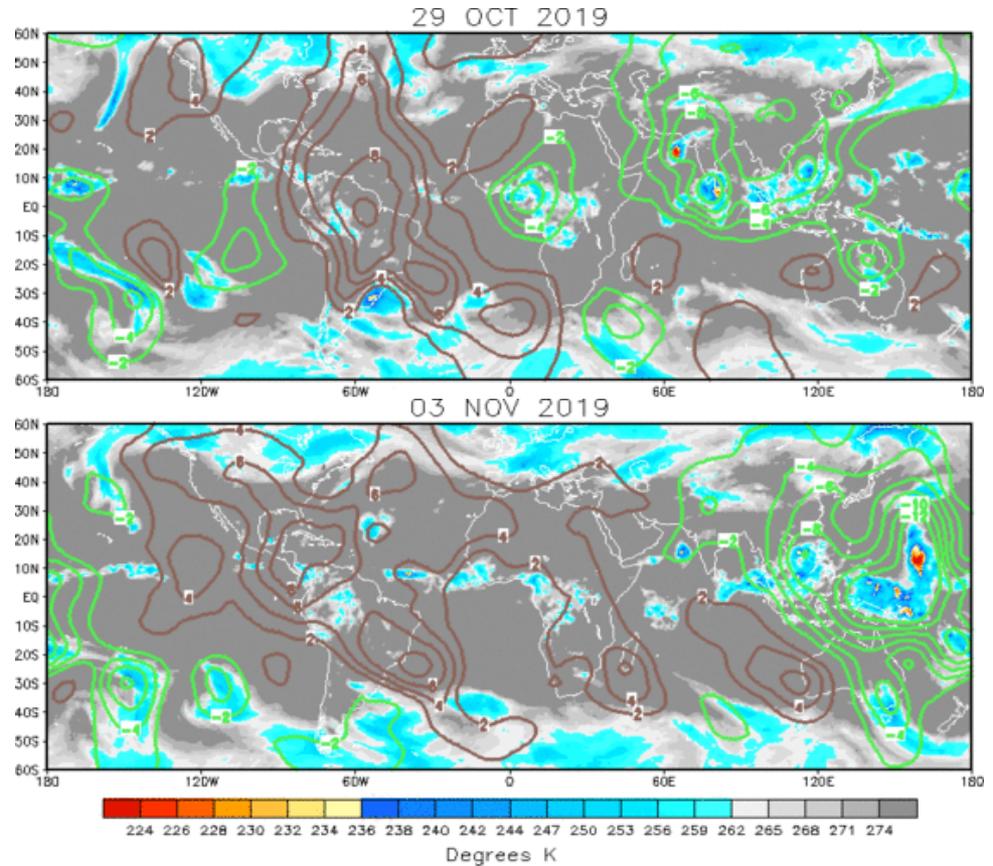
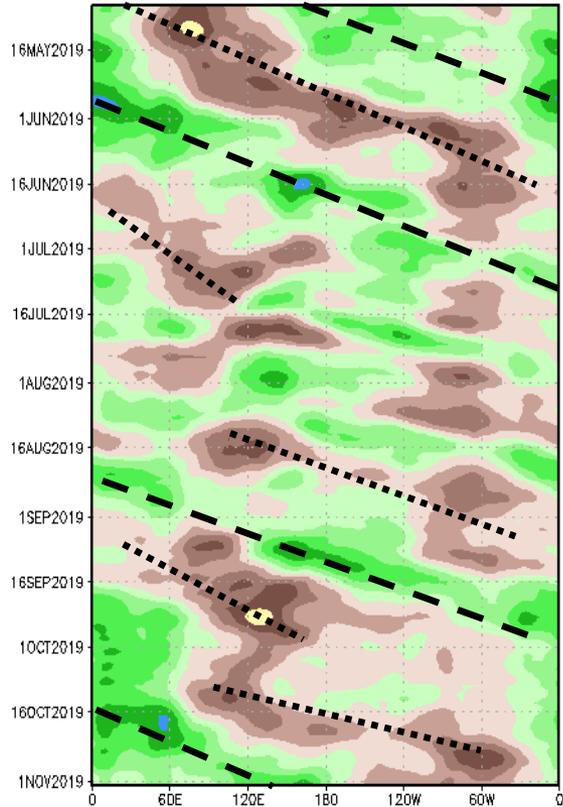
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:  
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

# 200-hPa Velocity Potential Anomalies

**Green shades:** Anomalous divergence (favorable for precipitation).

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

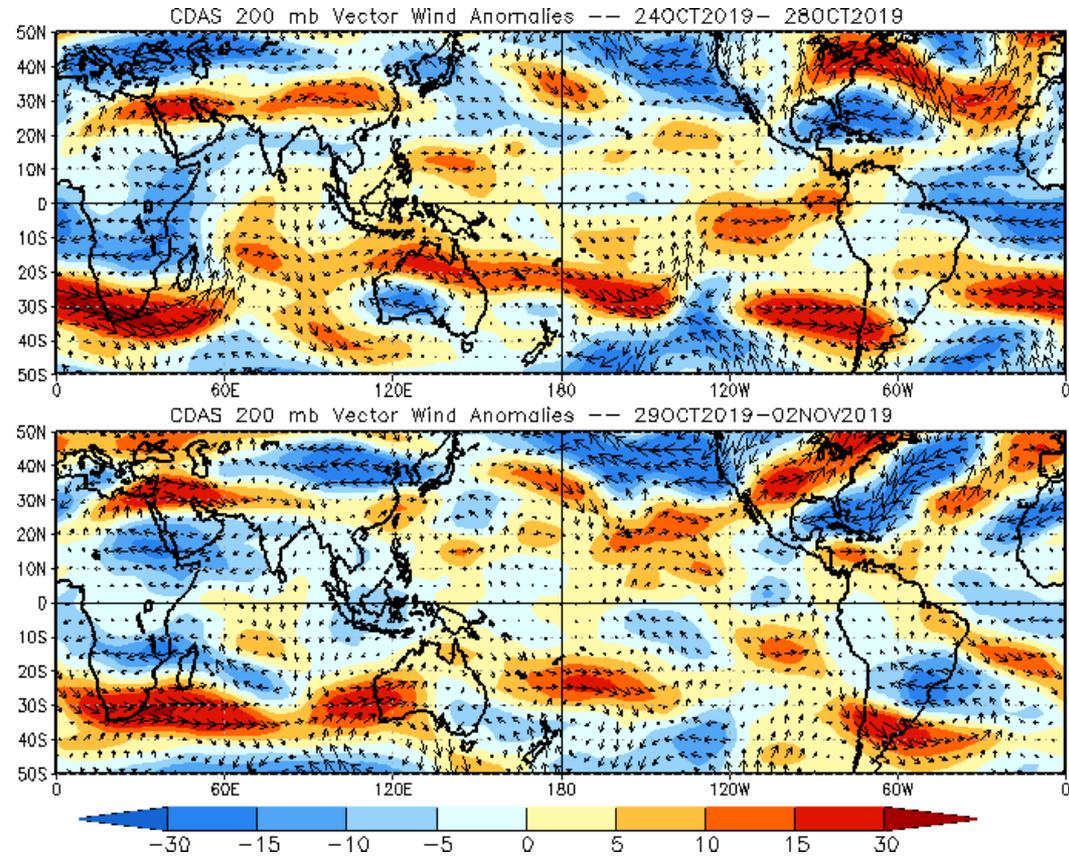
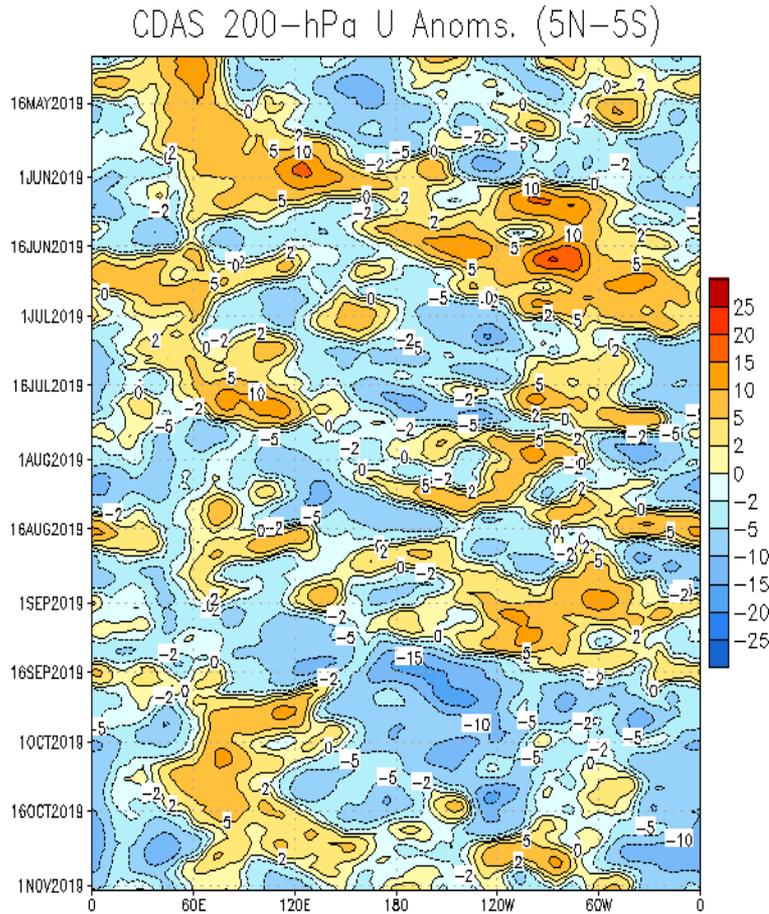
200-hPa Velocity Potential Anomaly: 5N-5S  
5-day Running Mean



- The upper-level velocity potential fields show an eastward propagating MJO.
- Large scale enhanced convection is expected to create a favorable environment for tropical cyclogenesis between the Bay of Bengal and western Pacific.

# 200-hPa Wind Anomalies

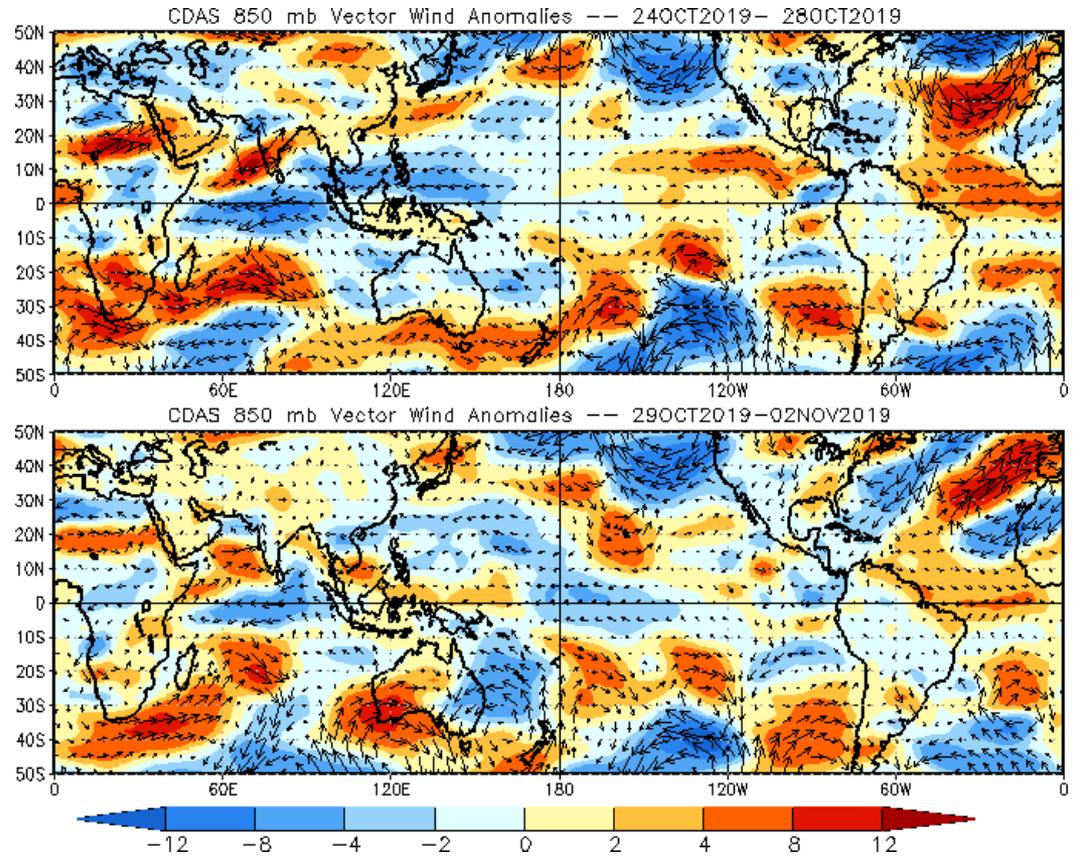
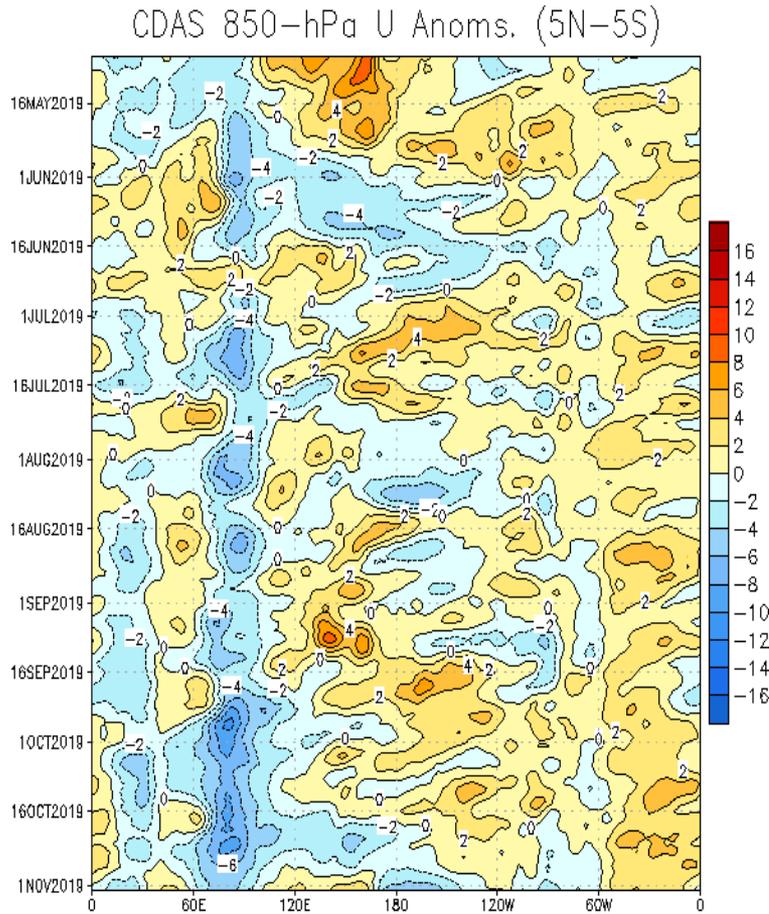
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- An active Rossby wave train is evident over the Northern Hemisphere.
- The wave train appears to be associated with the MJO's area of enhanced convection over the South China Sea.
- There also appears to be Rossby wave breaking activity into the central Pacific from the midlatitudes in both hemispheres.

# 850-hPa Wind Anomalies

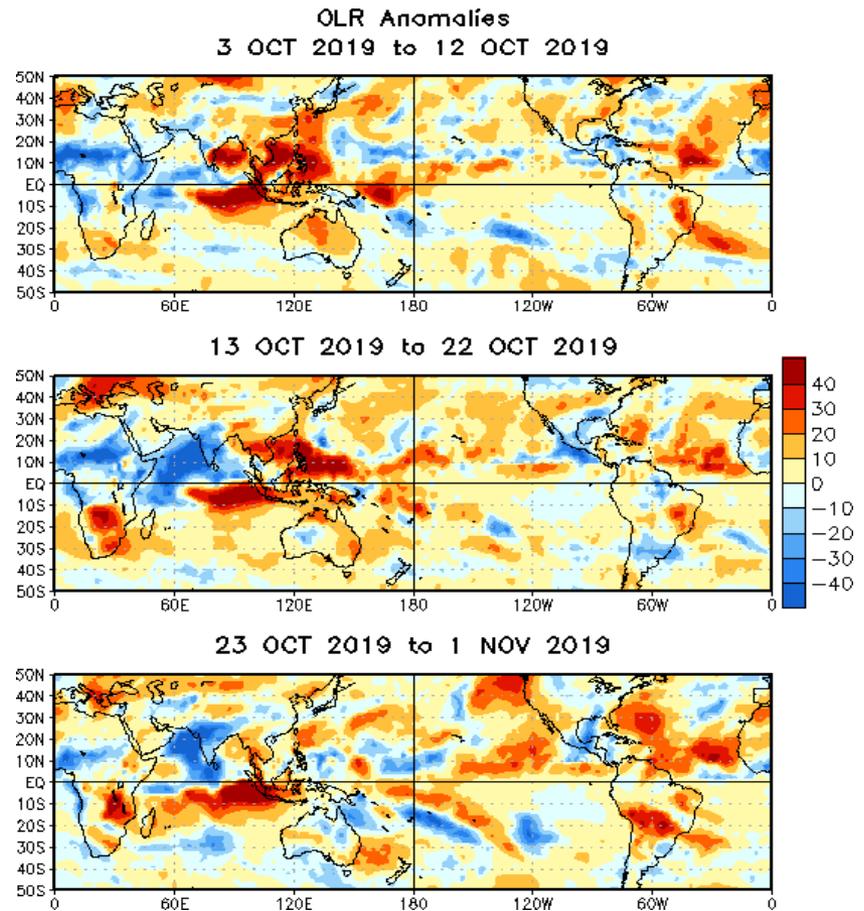
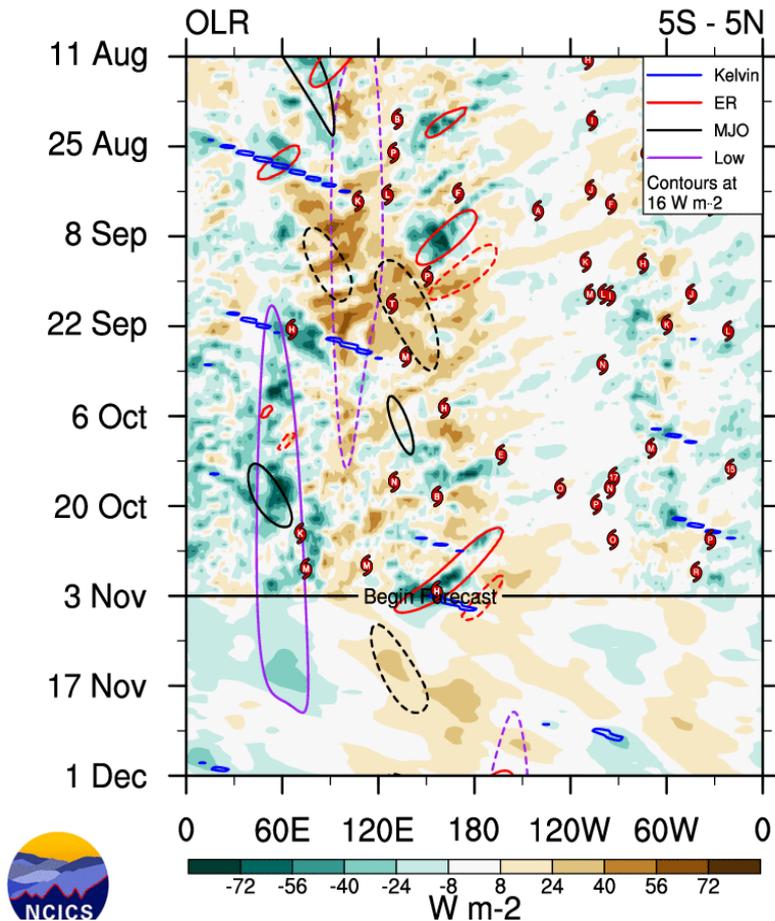
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Low-level anomalous winds have weakened during the past week over the Indian Ocean and South China Sea.
- Anomalous westerlies and lower level convergence have strengthened over the central Pacific as the MJO has propagated eastward.

# Outgoing Longwave Radiation (OLR) Anomalies

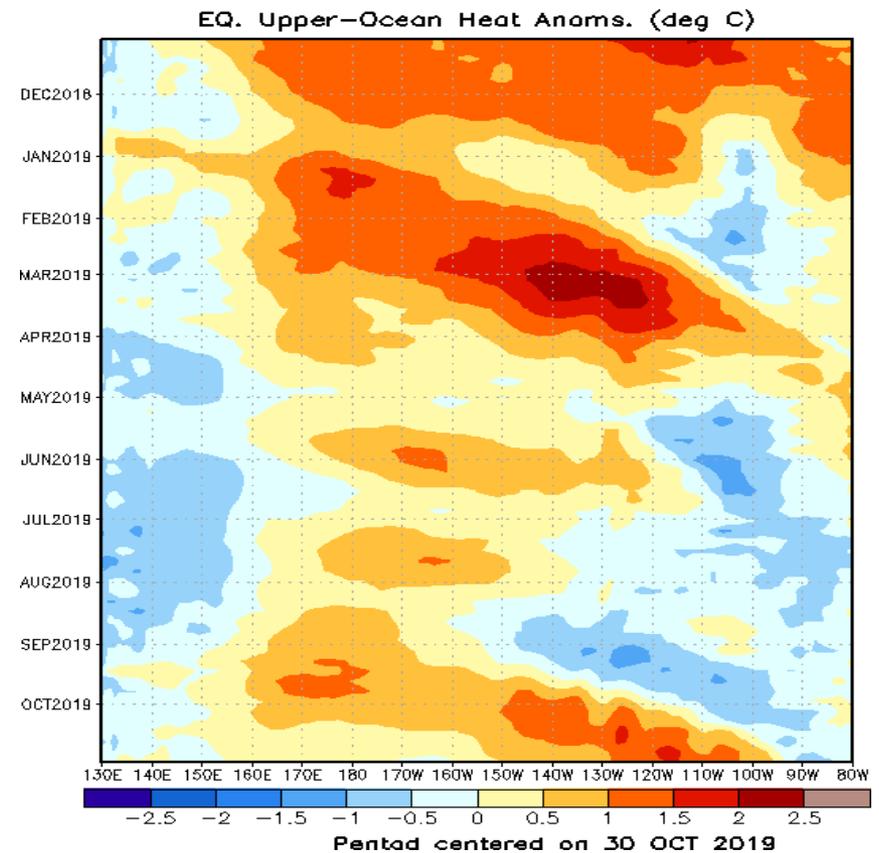
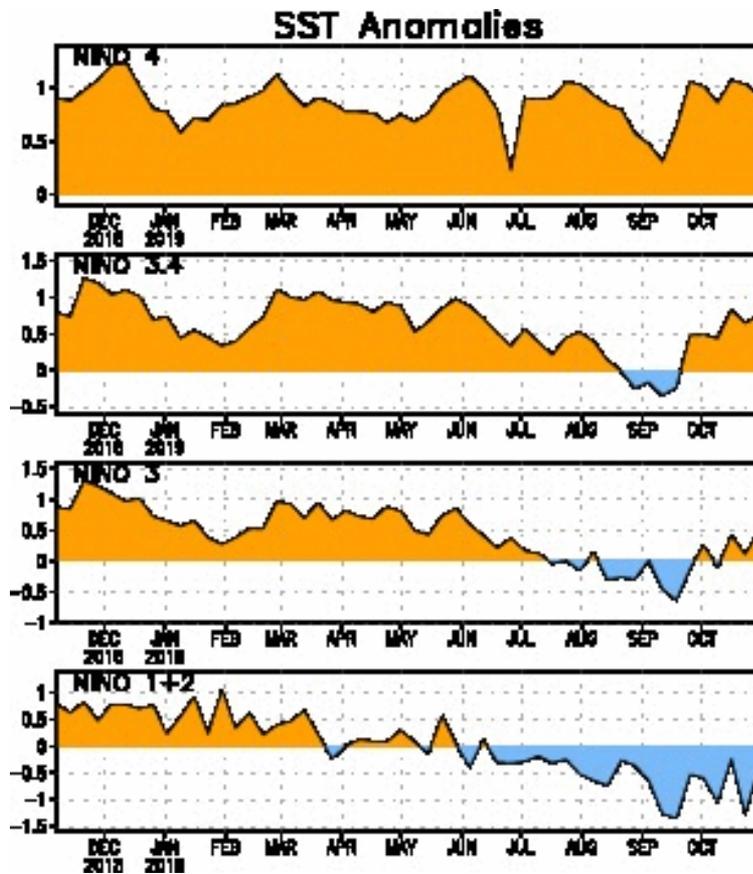
**Blue shades: Anomalous convection (wetness).** **Red shades: Anomalous subsidence (dryness).**



- The area of anomalous convection over the Indian Ocean associated with the positive Indian Ocean Dipole event has persisted during the past week.
- The MJO does not present itself as strongly in the OLR field as it does in the upper-level velocity potential field.



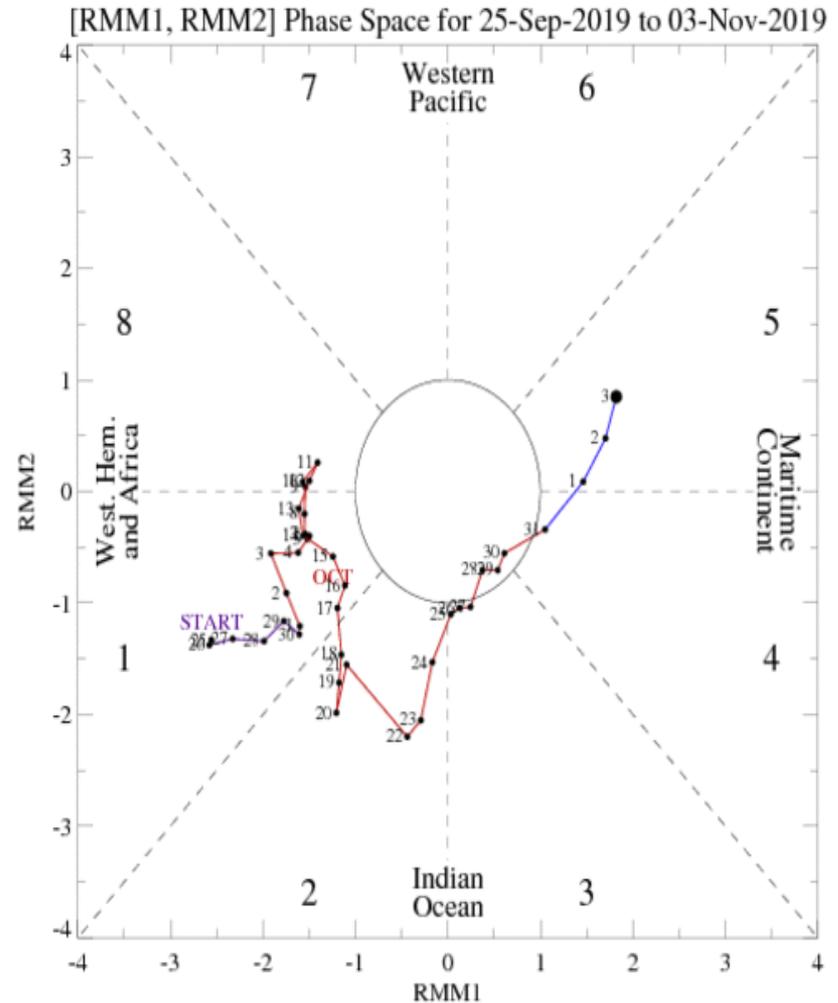
# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- SSTs in the eastern Pacific remains moderately above normal from the Nino 3 and 4 regions.
- There is evidence of a downwelling oceanic Kelvin wave during October.

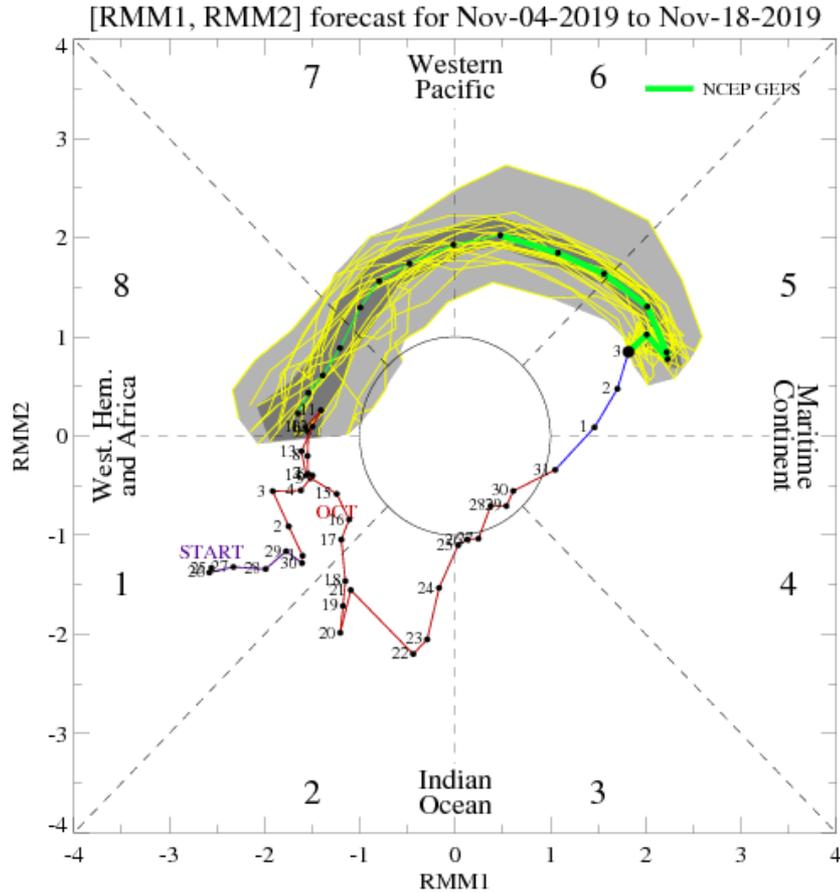
# MJO Index: Recent Evolution

- The RMM index places the MJO in Phase 5.

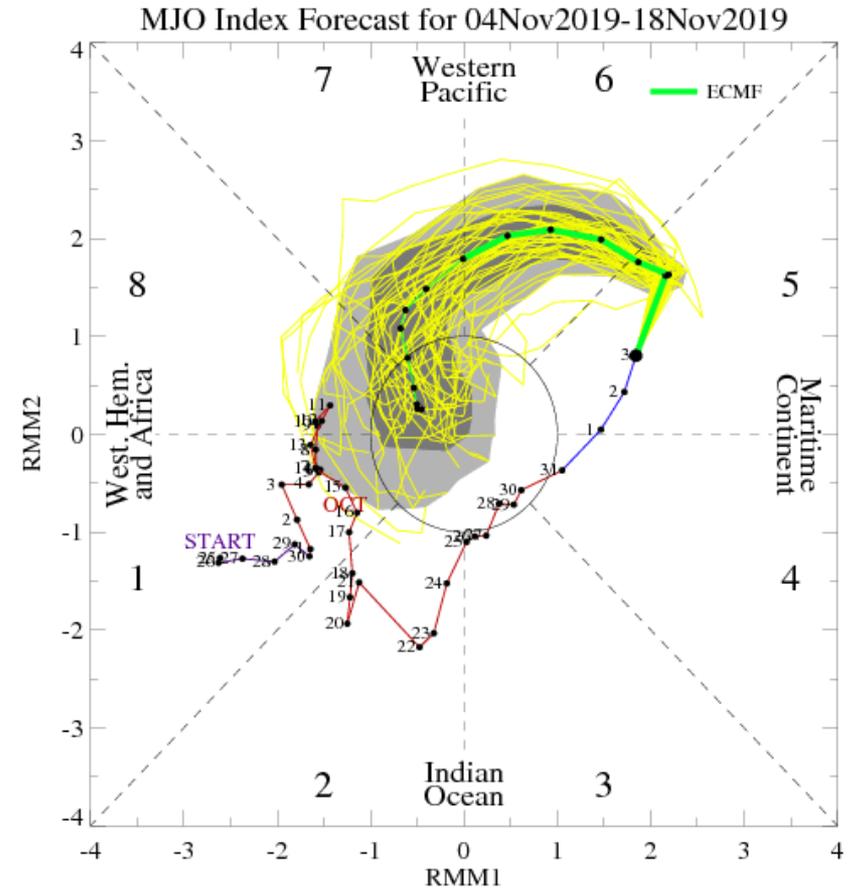


For more information on the RMM index and how to interpret its forecast please see:  
[https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC\\_MJOinformation.pdf](https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf)

# MJO Index: Forecast Evolution



**GEFS Forecast**



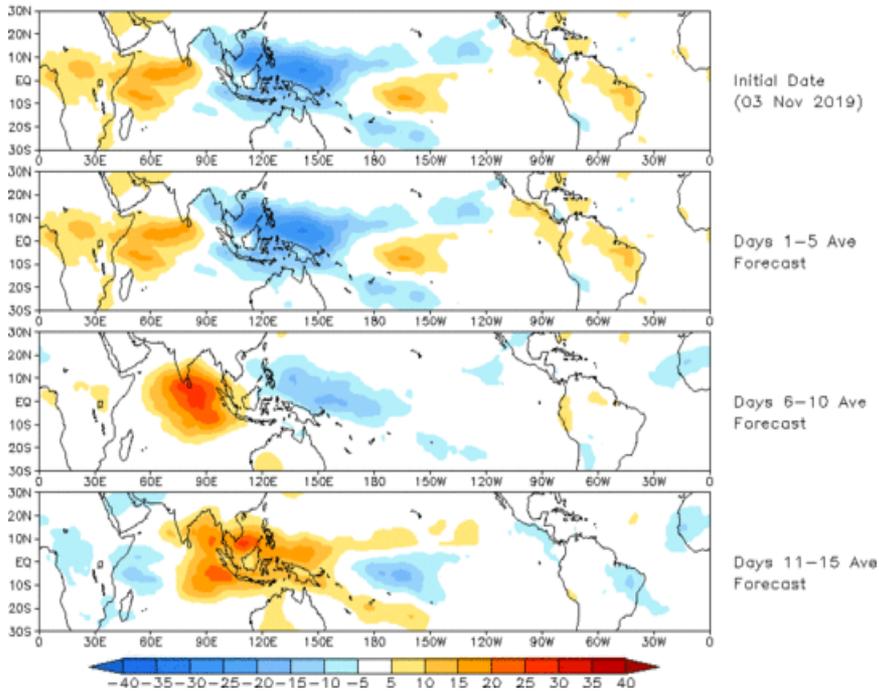
**ECMWF Forecast**

- There is fair agreement between the GEFS and ECMWF as both models propagate the MJO into Phase 6 during Week-1.
- The ECMWF weakens the MJO more than the GEFS as it propagates into Phase 7 during Week-2.

# MJO: GEFS Forecast Evolution

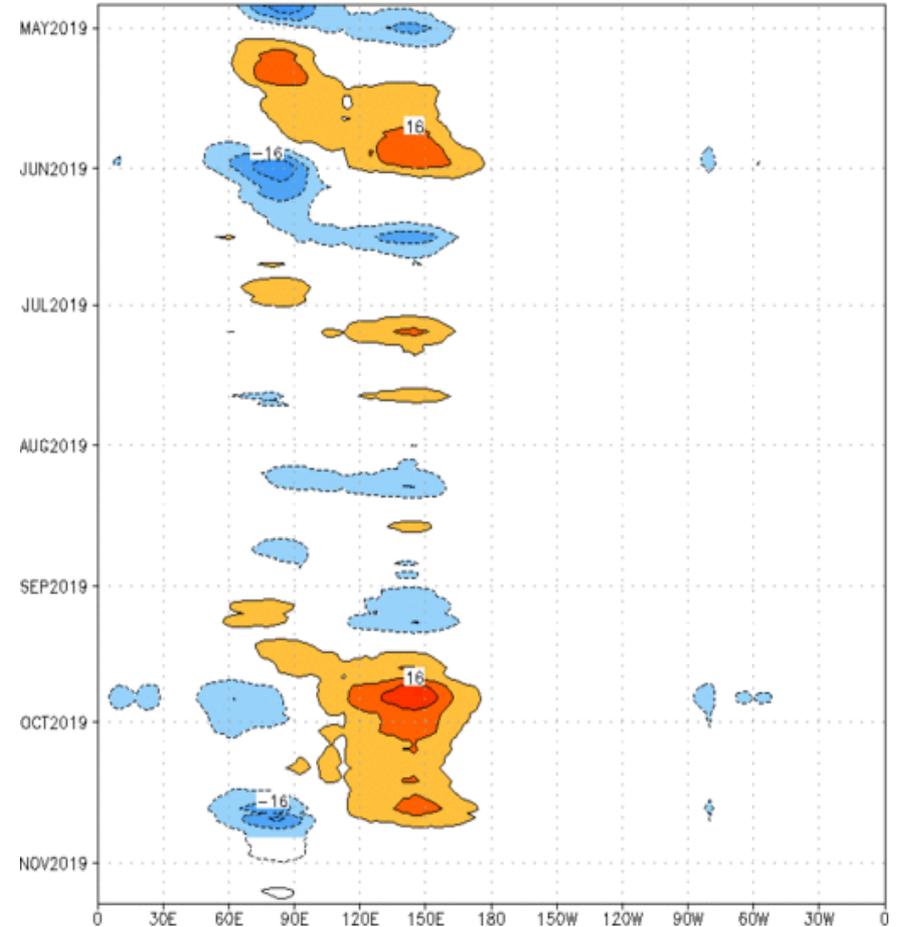
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

Prediction of MJO-related anomalies using GEFS operational forecast  
Initial date: 03 Nov 2019  
OLR



- The GEFS diminishes the active convective region of the MJO during the end of the Week-2 period, consistent with its aforementioned RMM forecast.

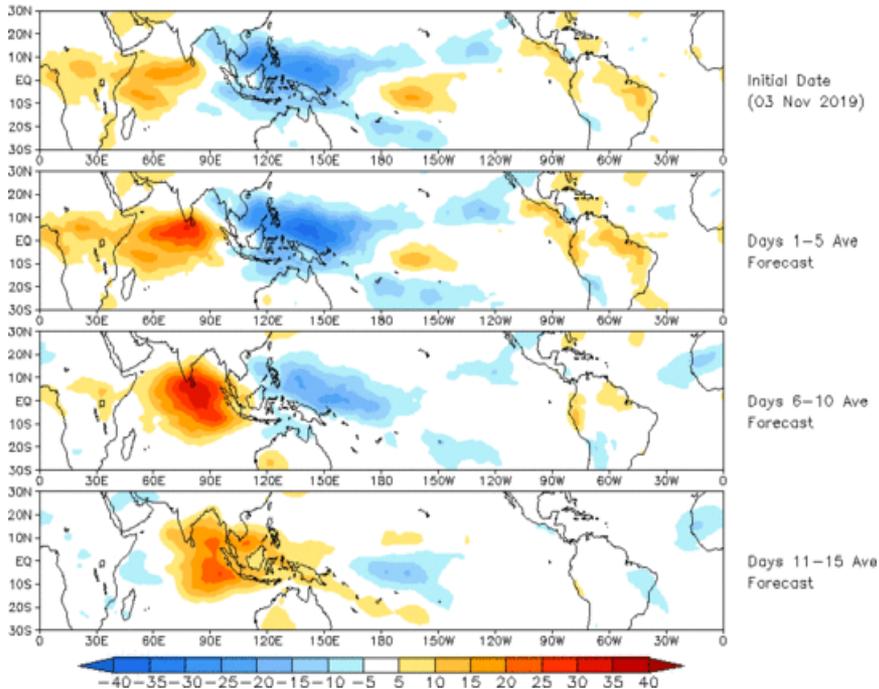
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2  
OLR [7.5°S,7.5°N] ( $\text{cint:}4\text{Wm}^{-2}$ ) Period:26-Apr-2019 to 26-Oct-2019  
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days



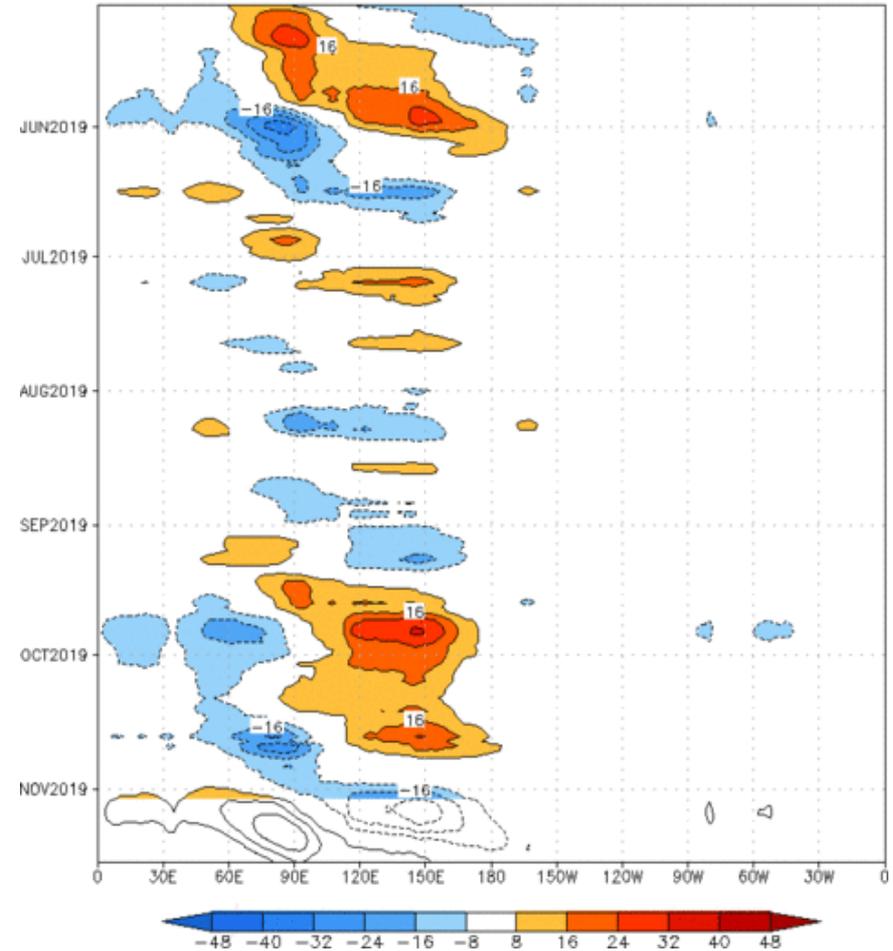
# MJO: Constructed Analog Forecast Evolution

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 (03 Nov 2019)



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm<sup>-2</sup>) Period:04-May-2019 to 03-Nov-2019  
The unfilled contours are CA forecast reconstructed anomaly for 15 days



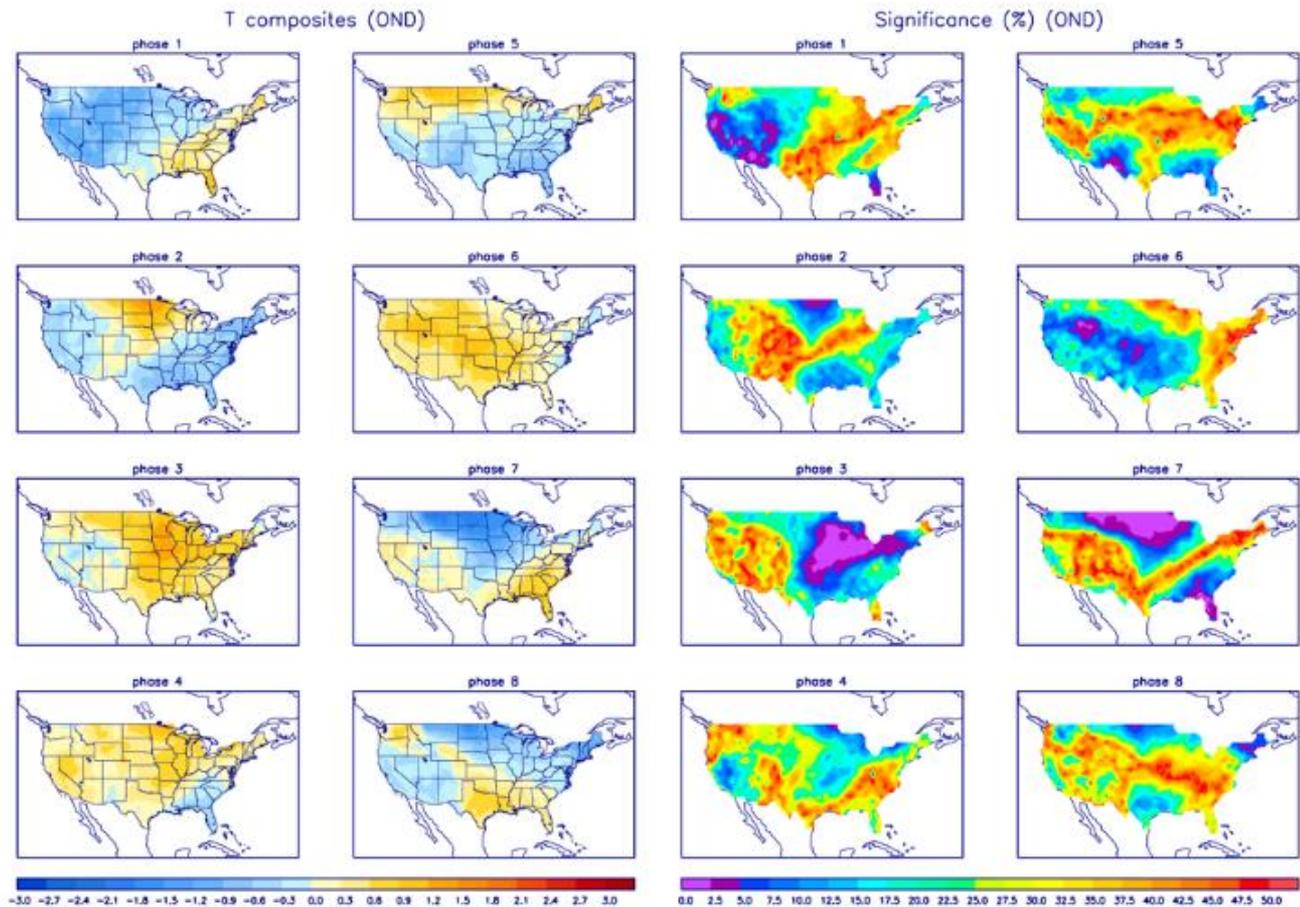
- The constructed analog forecast is similar to the GEFS, also diminishing the MJO by the end of Week-2.



# 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.

