

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



Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
14 October 2019

Overview

- If an MJO exists, it remains a low amplitude event that continues to be superimposed on a significant positive phase Indian Ocean Dipole (IOD) event. This has manifested itself in RMM space as a stationary feature over the past 3 weeks with the low frequency mode of the IOD driving the signal.
- Model guidance is in better agreement with an increased chance that an active MJO emerges with eastward propagation across the Indian Ocean during the next two weeks. However, lower-level easterly anomalies over the equatorial Indian Ocean are forecast to remain in place through the end of October, suggesting the likely continuation of IOD driven conditions.

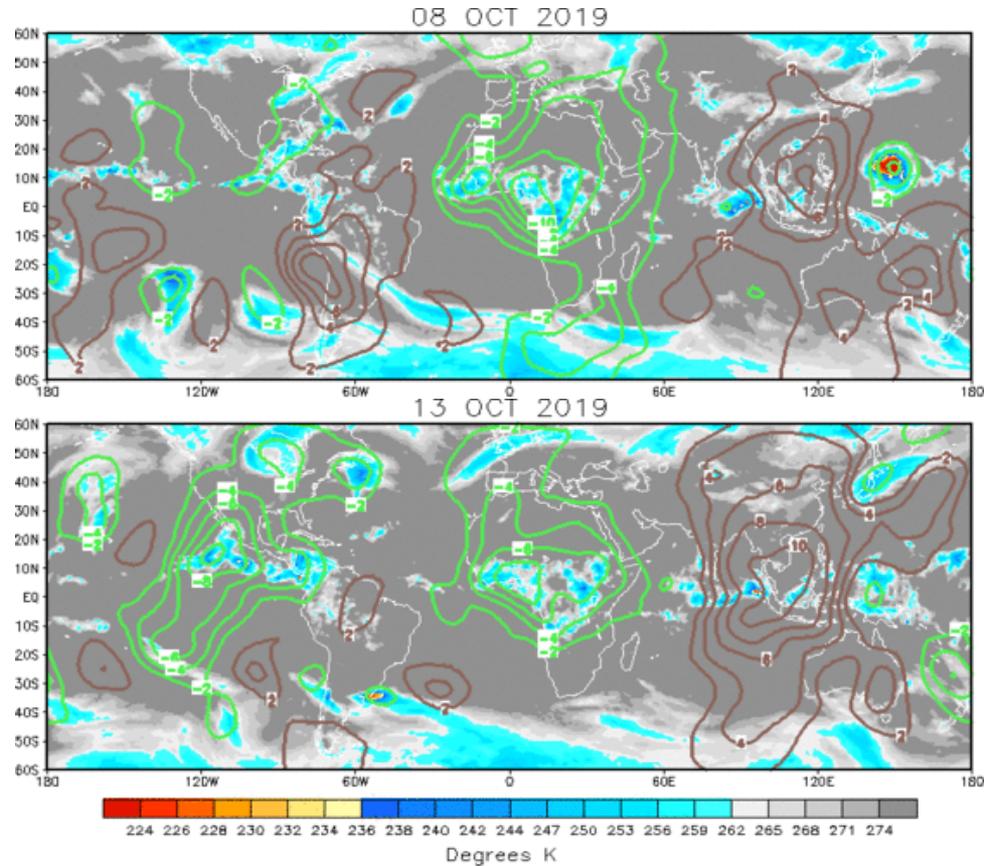
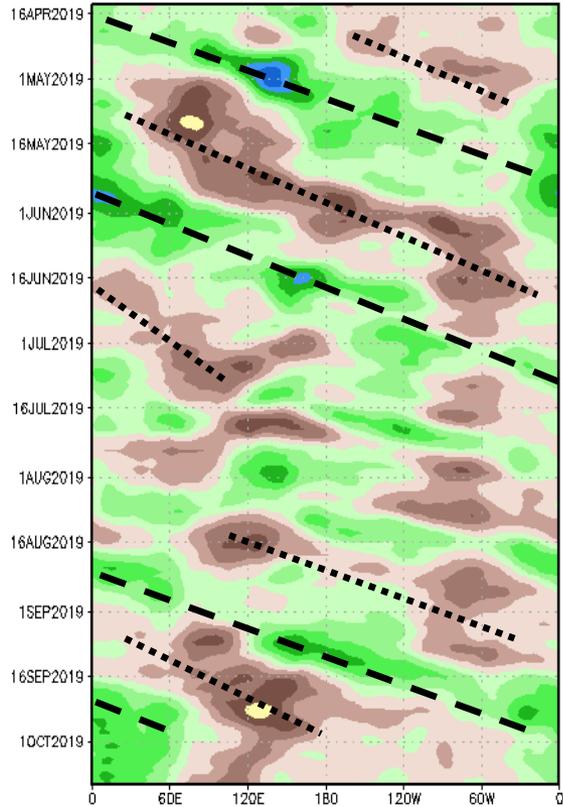
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

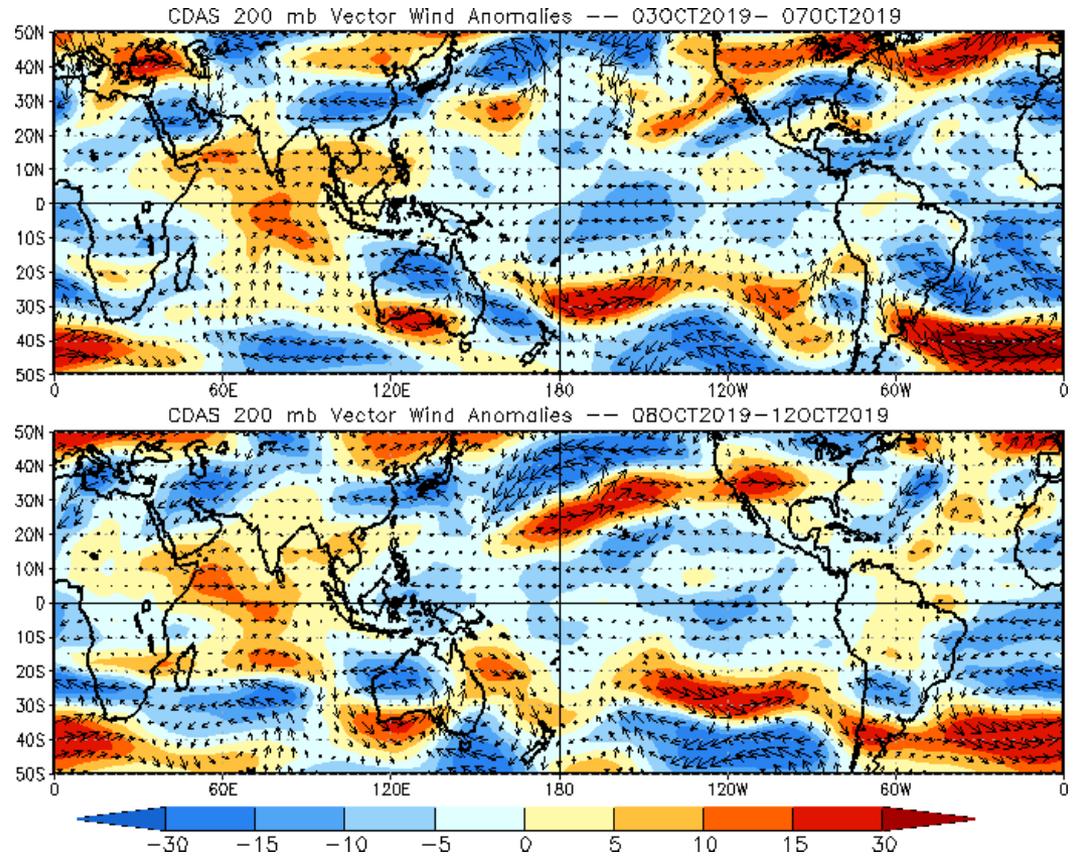
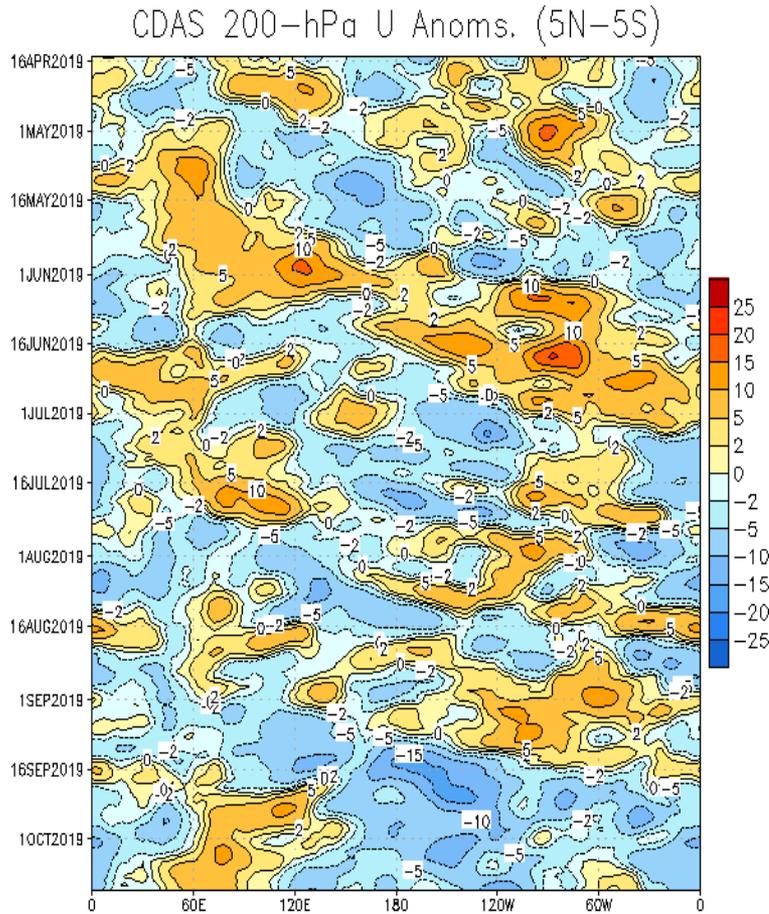
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- Since early October, little change is evident in the zonal evolution of upper-level velocity potential anomaly analyses over the Eastern Hemisphere.
- The enhanced phase remains centered over Africa and the suppressed phase across the eastern Indian Ocean and Maritime Continent. This perspective is representative of a robust positive phase of the Indian Ocean Dipole (IOD).

200-hPa Wind Anomalies

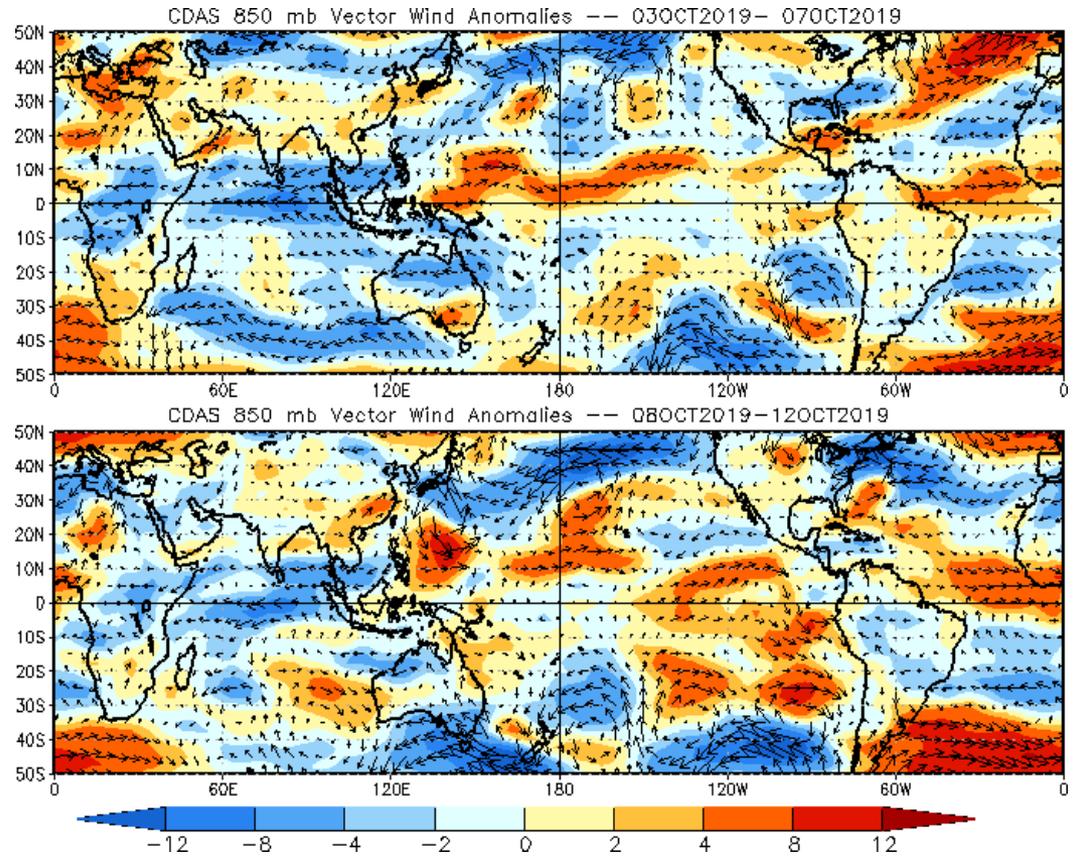
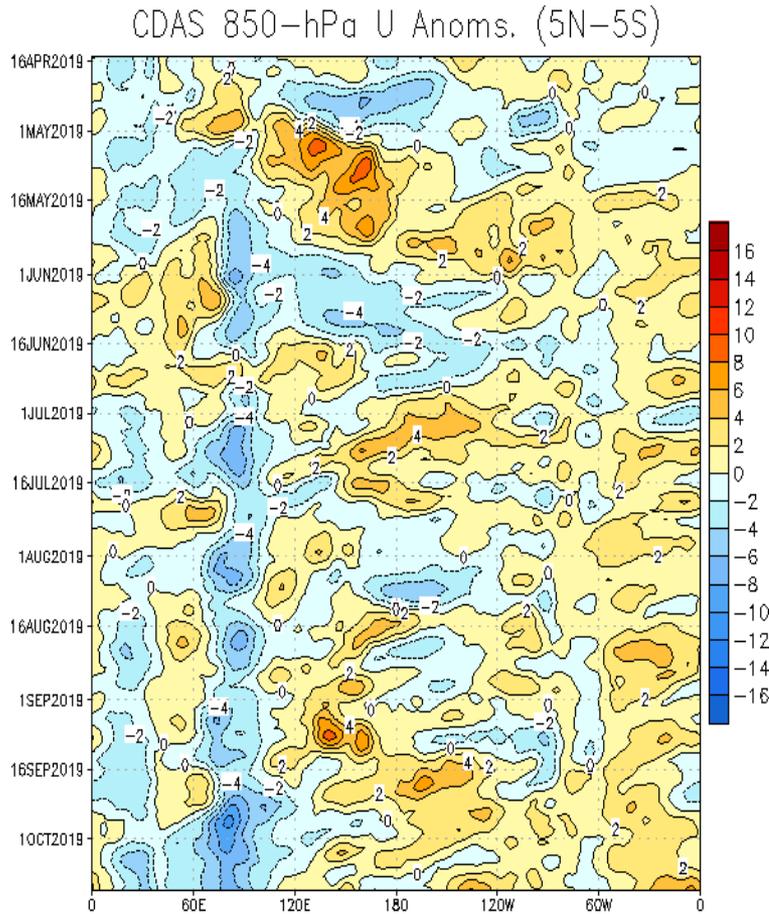
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Anomalous upper-level westerlies remain across the Indian Ocean, with anomalous easterlies slightly strengthening over the Maritime continent.
- Anomalous upper-level westerlies have emerged over the tropical Atlantic, consistent with the decrease in tropical cyclogenesis across the Main Development Region.

850-hPa Wind Anomalies

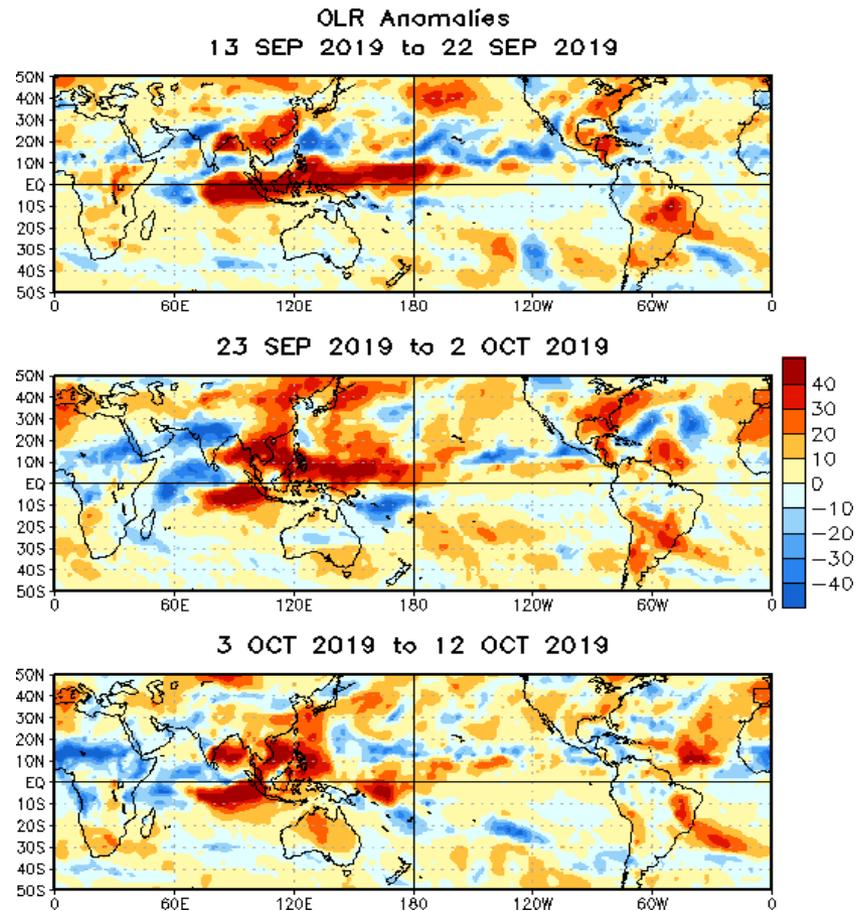
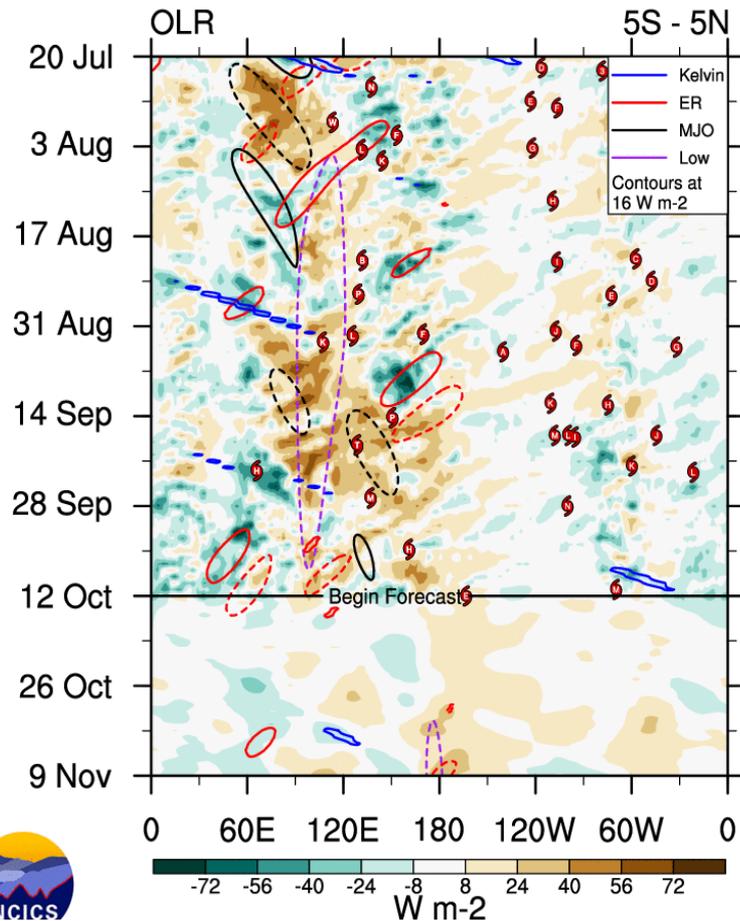
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Anomalous easterlies persisted across the Indian Ocean during early October, although at a lesser amplitude compared to late September/early October.
- Anomalous westerlies have strengthened across the East Pacific, and the West Pacific associated with Super Typhoon Hagibis.

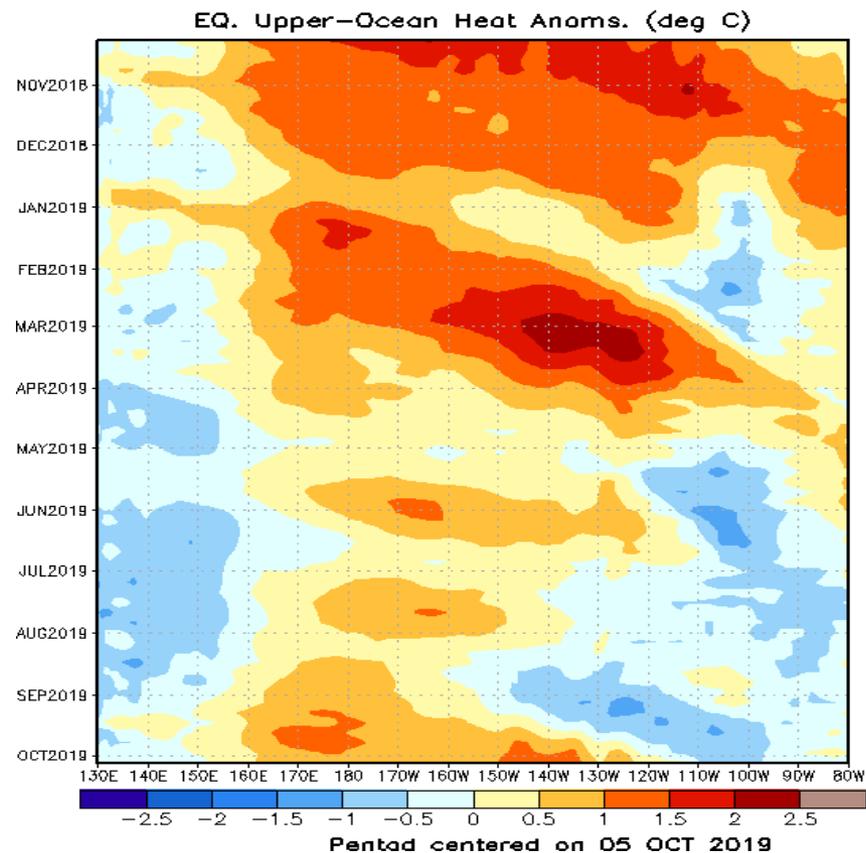
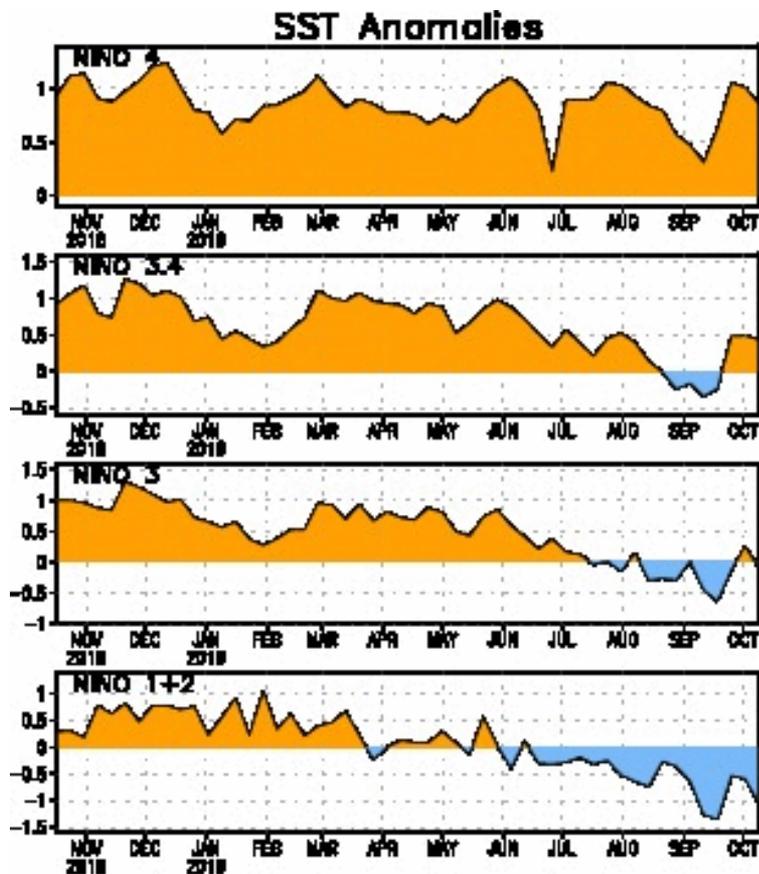
Outgoing Longwave Radiation (OLR) Anomalies

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



- The anomalous dipole of convection across much of the Indian Ocean and Maritime Continent tied to the ongoing positive IOD event persists. However, the anomalous convection across the western Indian Ocean has appeared to have weakened since early October.
- Suppressed convection is apparent across the Tropical Atlantic associated with a decrease in cyclone activity.

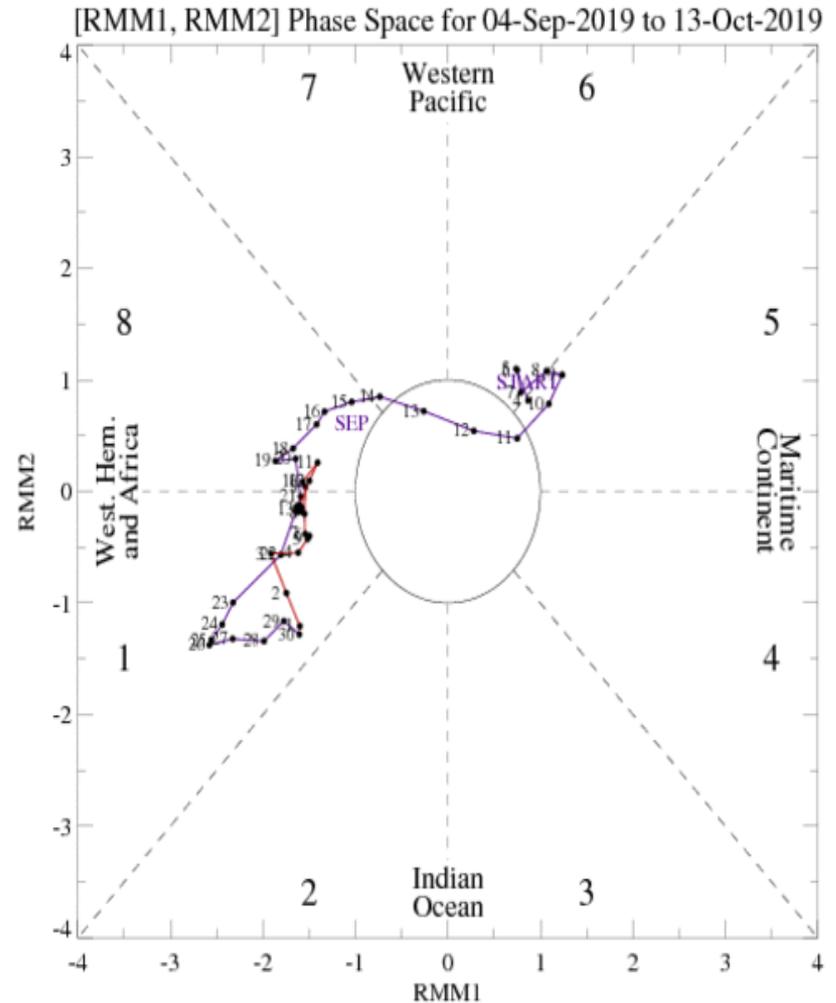
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Negative anomalies associated with the upwelling phase of an oceanic Kelvin wave increased over the East Pacific, resulting in negative SST anomalies from the Niño-3 region eastward.
- Upper-oceanic heat content remains above-average over the west-central Pacific.

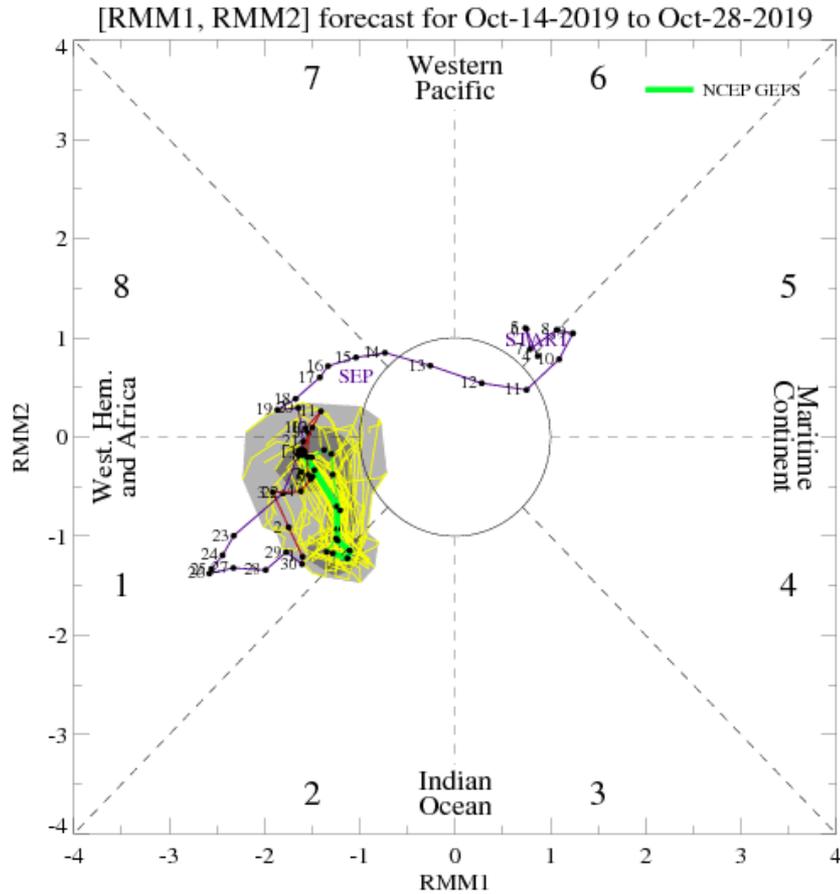
MJO Index: Recent Evolution

- The RMM index shows a relatively stationary intraseasonal signal over Africa over the past 3 weeks. This is associated with the positive IOD dominating other intraseasonal modes at this time supporting the lack of a robust MJO at present.

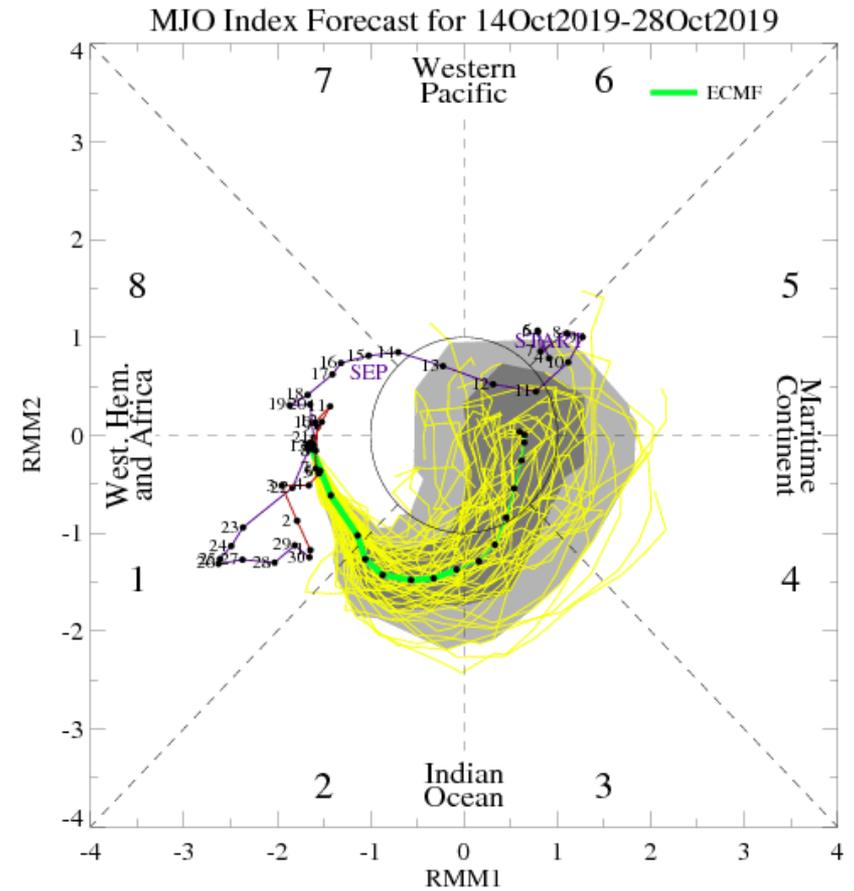


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



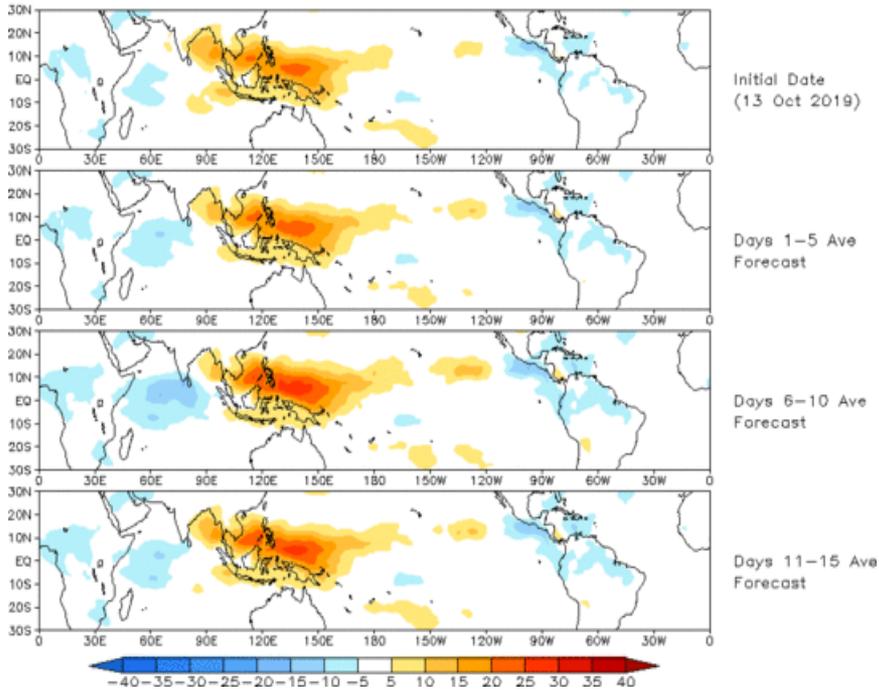
ECMWF Forecast

- Both models suggest the reemergence of the MJO, with the ECMWF mean and ensemble members being the most robust during Weeks 1 and 2.
- However, model guidance does not suggest much change to the lower and upper-level circulation in the eastern Hemisphere, with anomalous easterlies forecast to strengthen across the equatorial Indian Ocean supportive of the positive IOD event persisting into late October.

MJO: GEFS Forecast Evolution

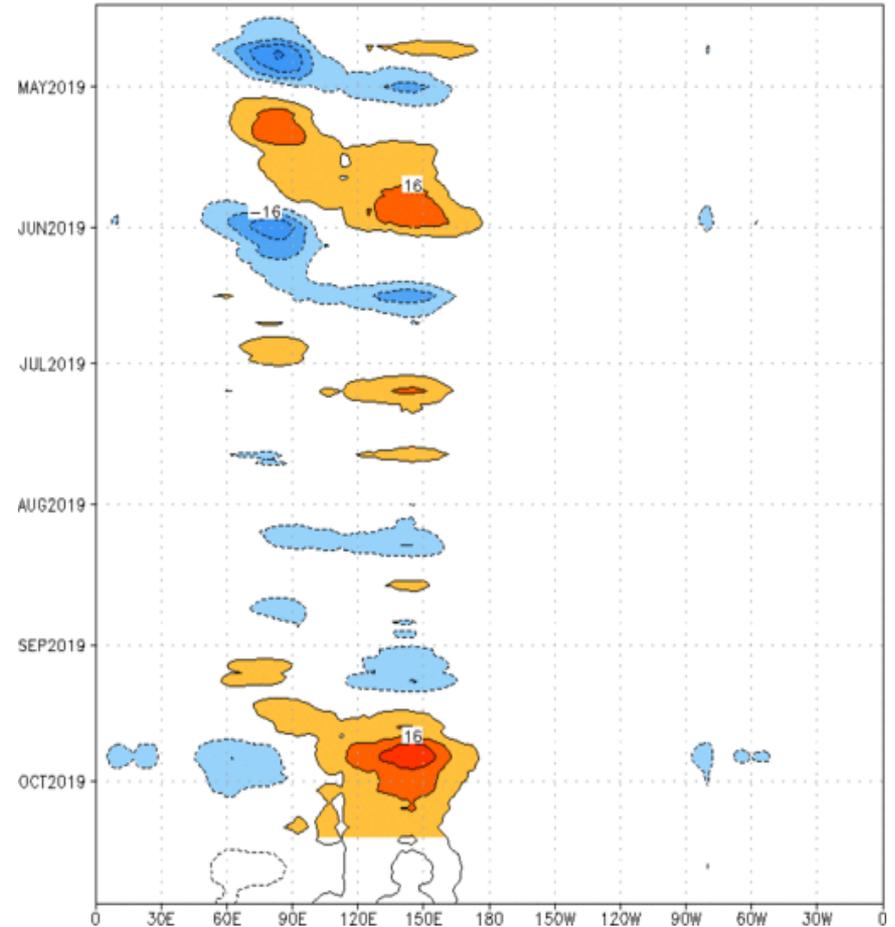
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 13 Oct 2019
OLR



- OLR anomalies based on the GEFS reflect a stationary pattern favoring Western Hemisphere convective enhancement over the Eastern Pacific along with the western Indian Ocean. Suppressed convection is forecast to persist over the Maritime Continent and West Pacific.

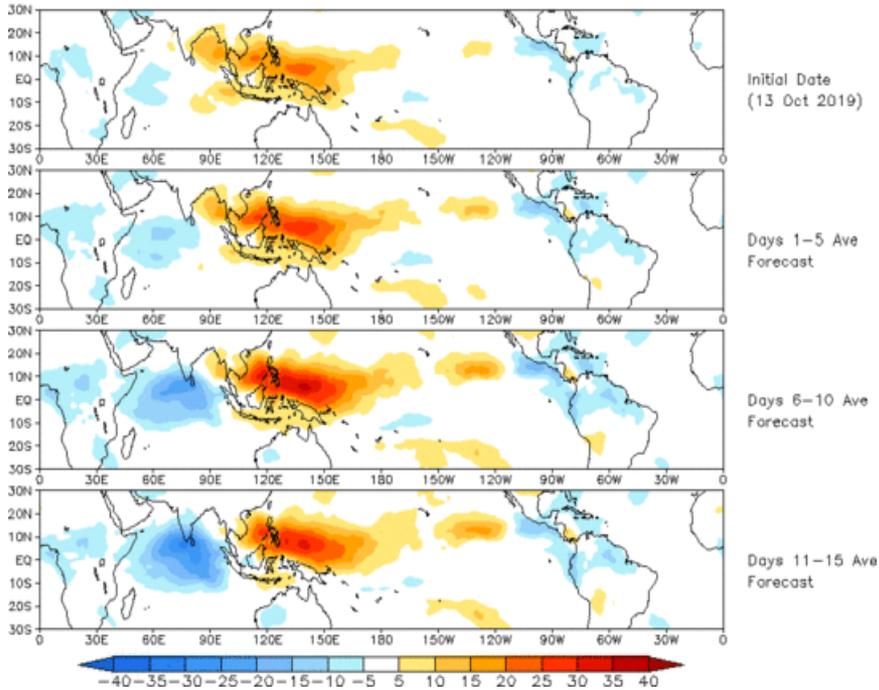
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [$7.5^{\circ}\text{S}, 7.5^{\circ}\text{N}$] (cont: 4Wm^{-2}) Period: 13-Apr-2019 to 13-Oct-2019
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days



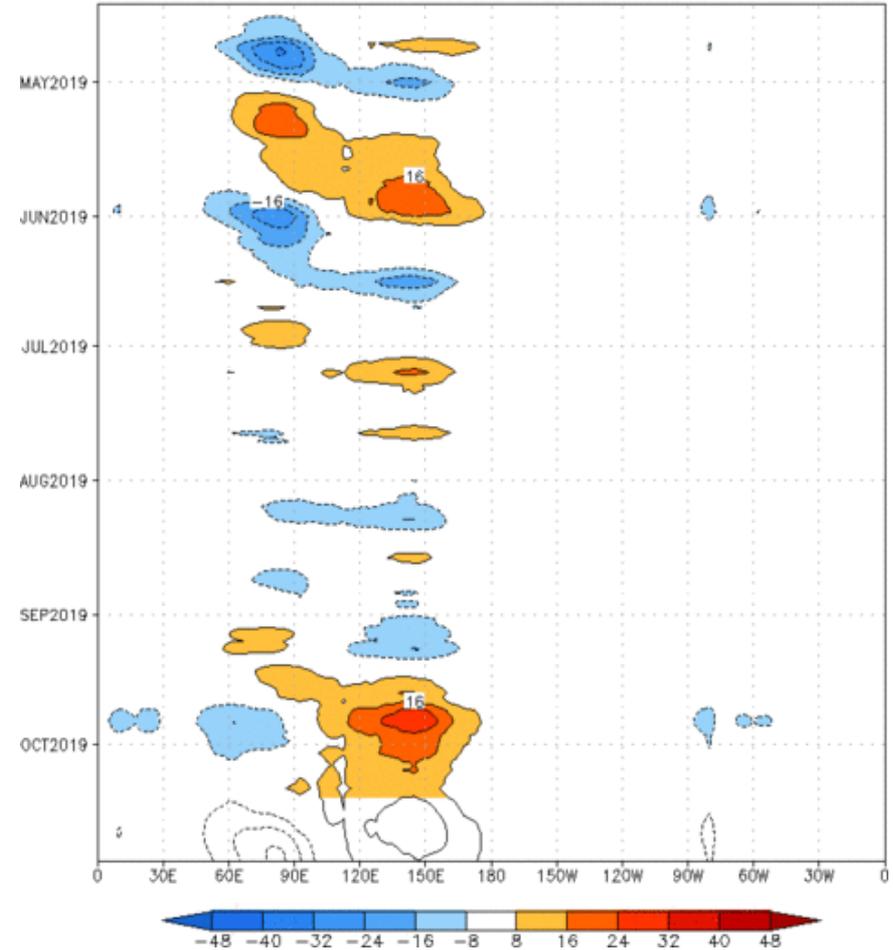
MJO: Constructed Analog Forecast Evolution

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 (13 Oct 2019)



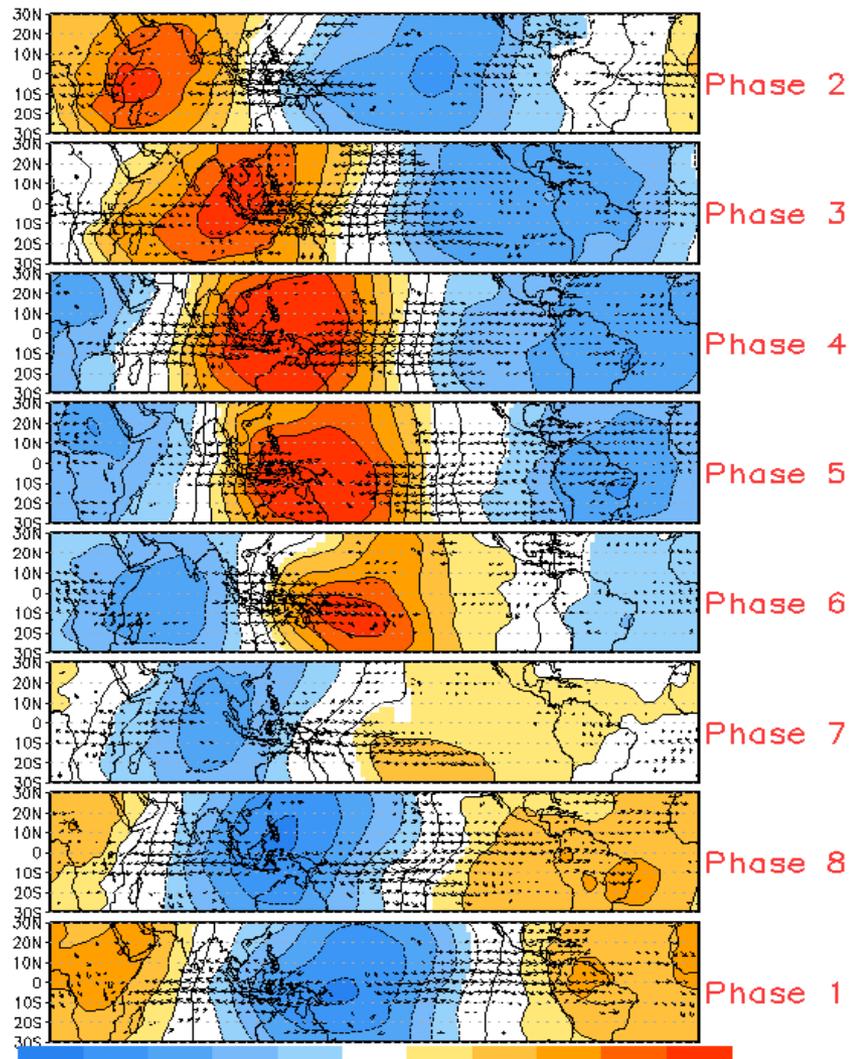
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] ($\text{cont:}4\text{Wm}^{-2}$) Period:13-Apr-2019 to 13-Oct-2019
The unfilled contours are CA forecast reconstructed anomaly for 15 days



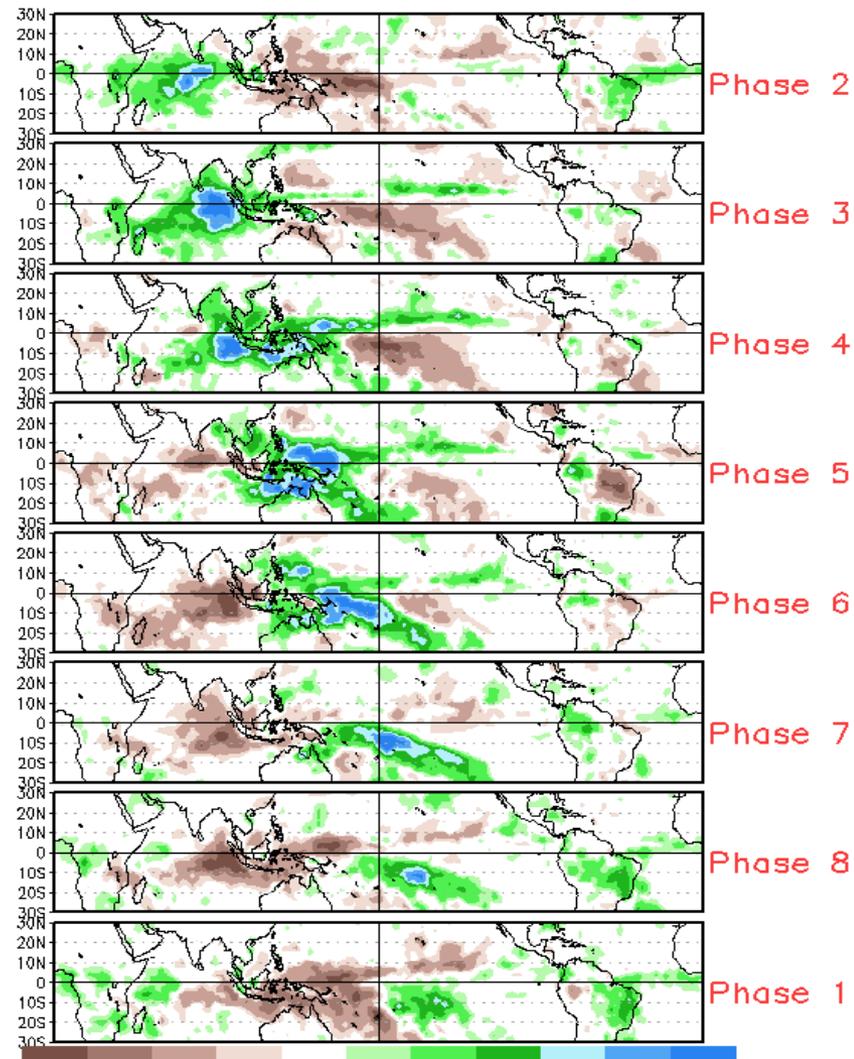
- The constructed analog forecast is slightly more progressive in propagating the convective dipole across the Eastern Hemisphere, while growing its amplitude with time. This would be more supportive of a robust subseasonal influence as opposed to the lower frequency perspective of the GEFs.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



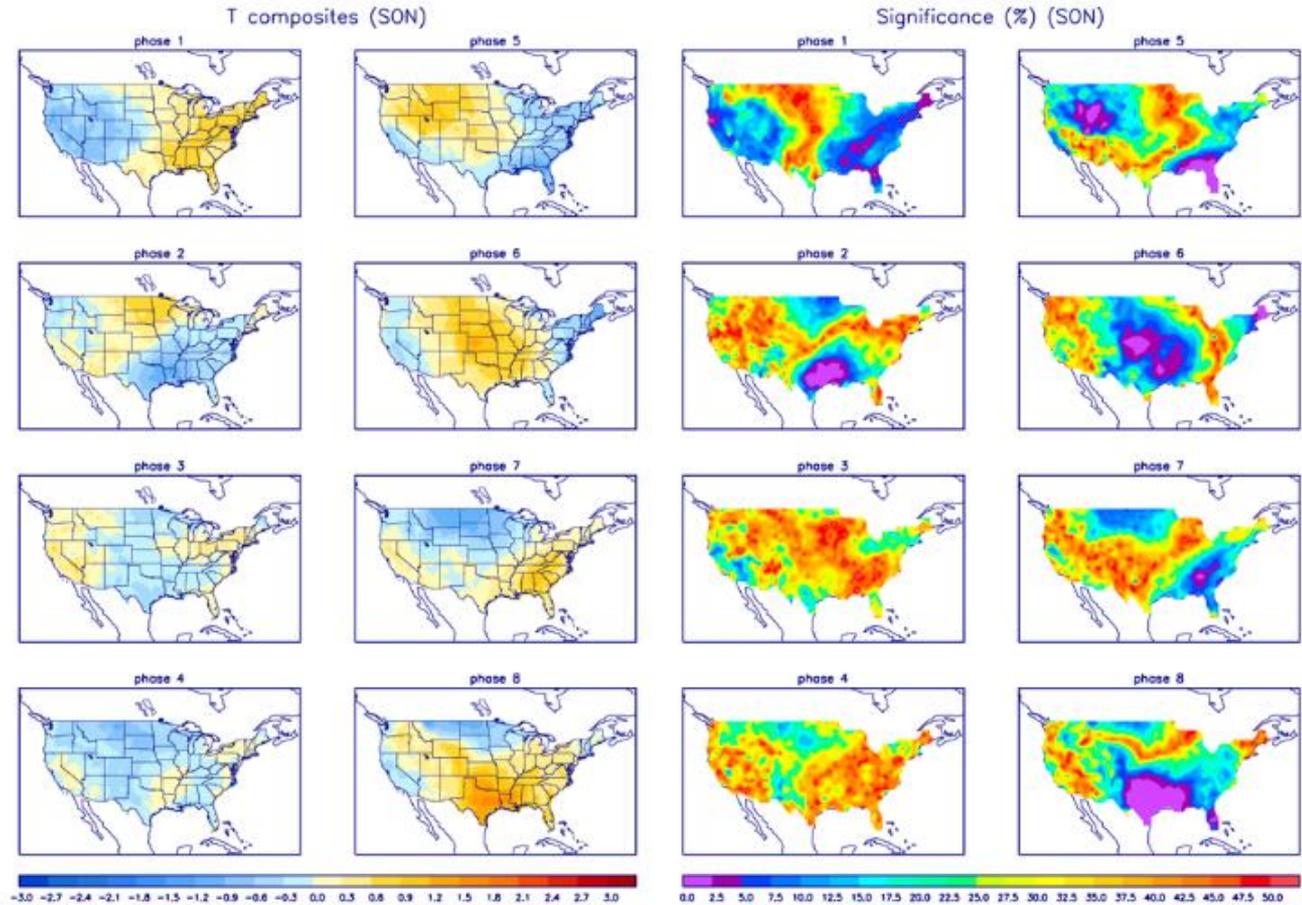
Precipitation Anomalies



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.

