

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



**Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
24 August 2020**

Overview

- The enhanced (suppressed) phase of the MJO propagated east over the Western (Eastern) Hemisphere during mid to late August.
- Although dynamical model forecasts are beginning to diverge on the strength of the MJO during the next two weeks, a continued eastward propagation of the MJO to the Indian Ocean is favored during week-1.
- The ongoing MJO, low-frequency base state, and climatology support tropical cyclone development across the main development region of the Atlantic basin into early September.
- A tropical cyclone is likely to form east of the Philippines during the next week and it may eventually recurve over the North Pacific, which could affect the longwave pattern downstream across North America during early September.

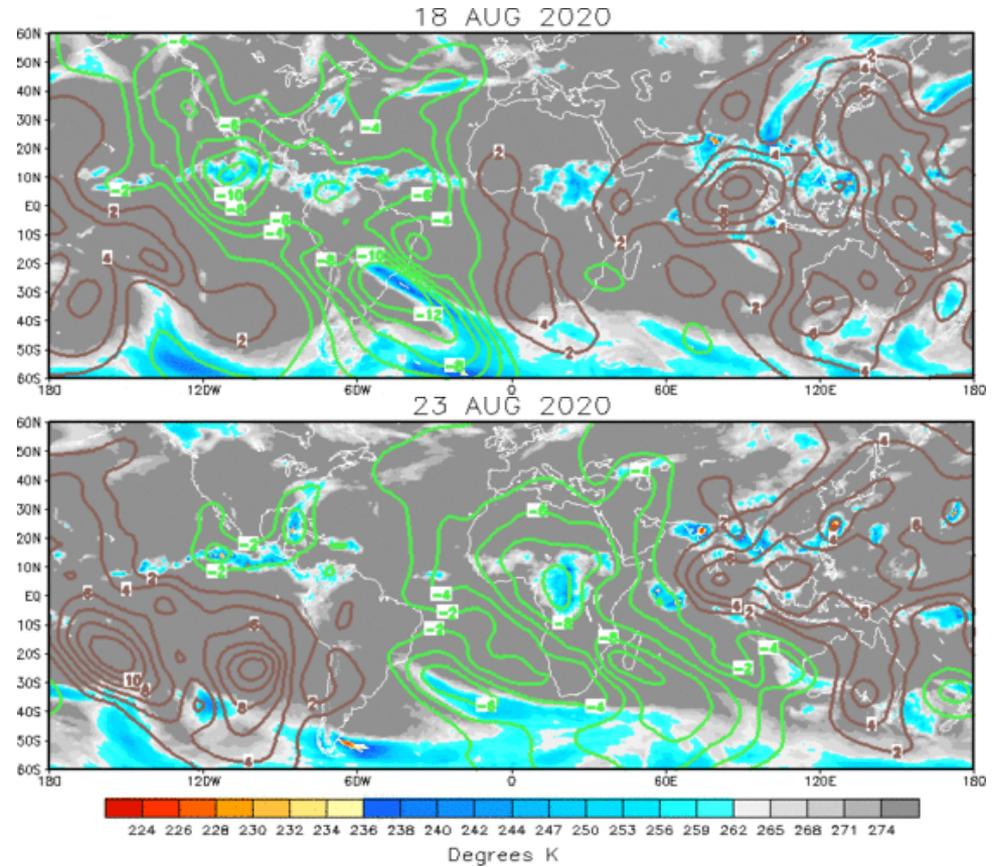
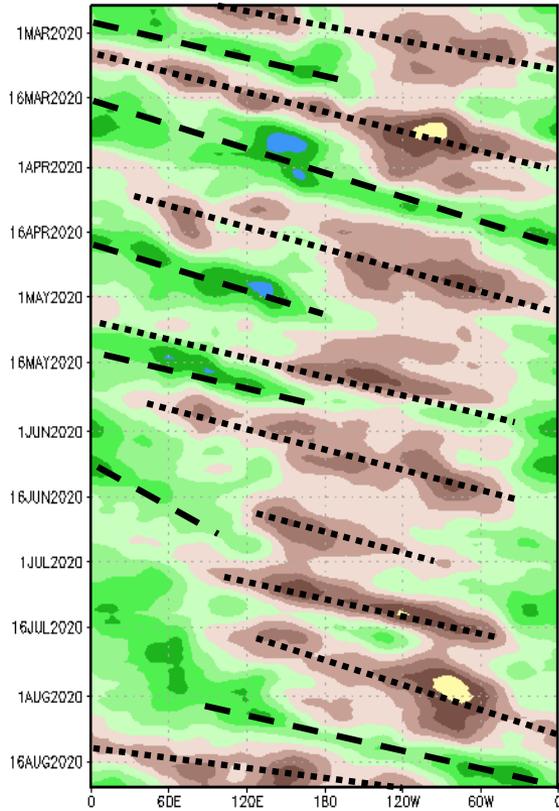
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

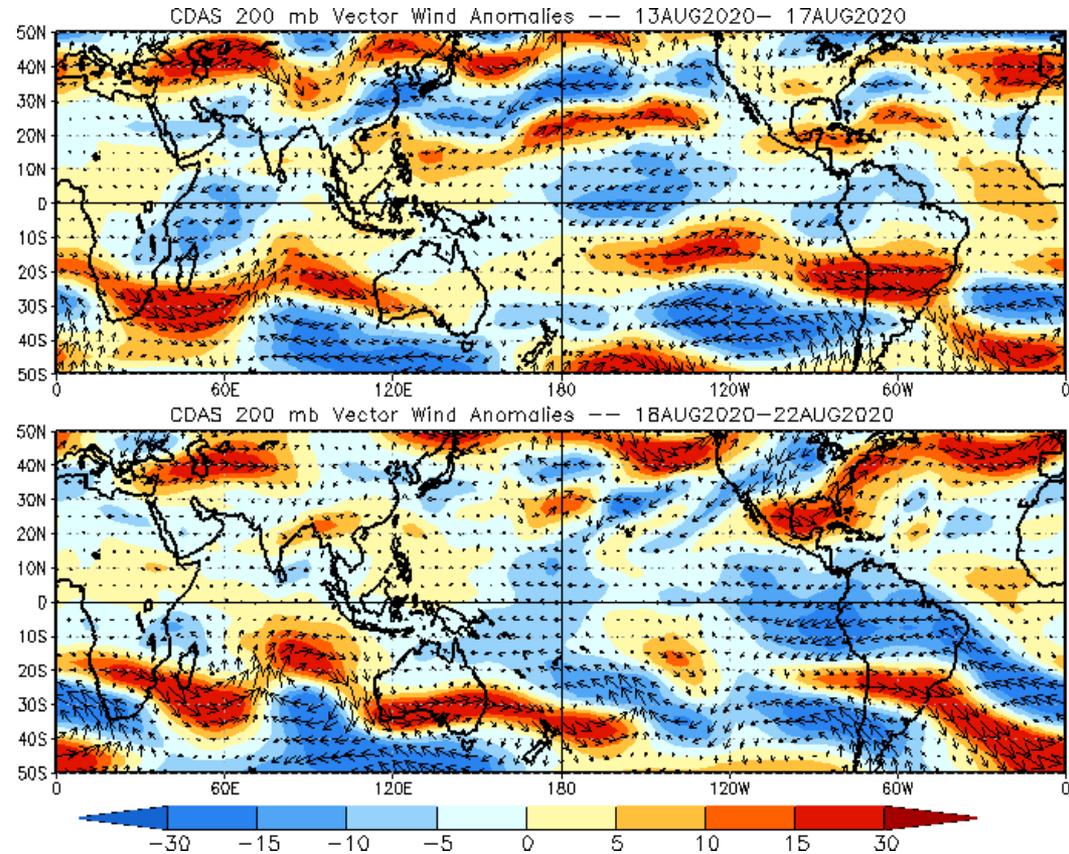
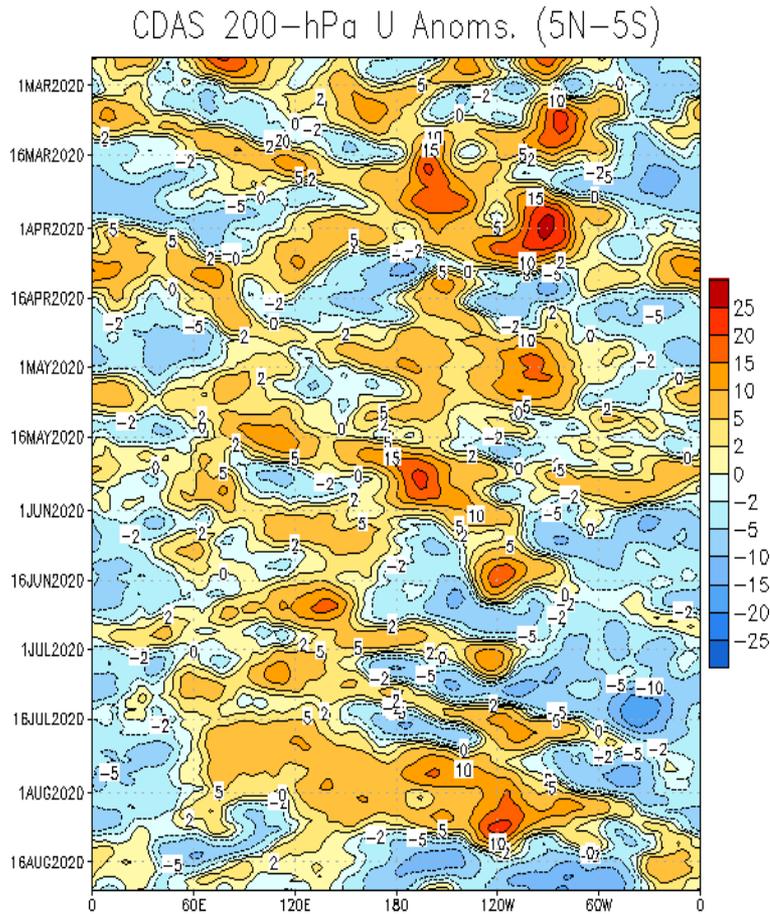
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- Throughout 2020, the base state has seen a westward shift of suppressed convection across the central Pacific. This has been interspersed with periodic intraseasonal activity.
- During mid-August, the anomalous upper-level divergence shifted east from the Americas to the tropical Atlantic and Africa.

200-hPa Wind Anomalies

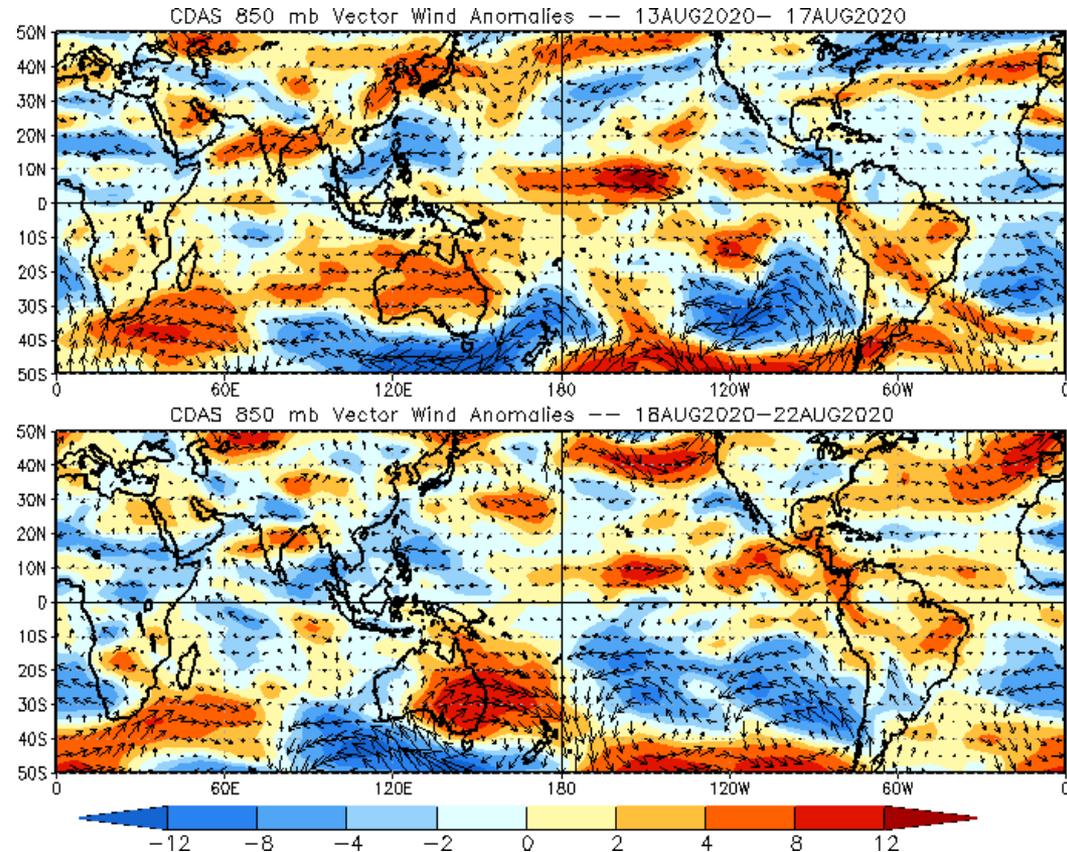
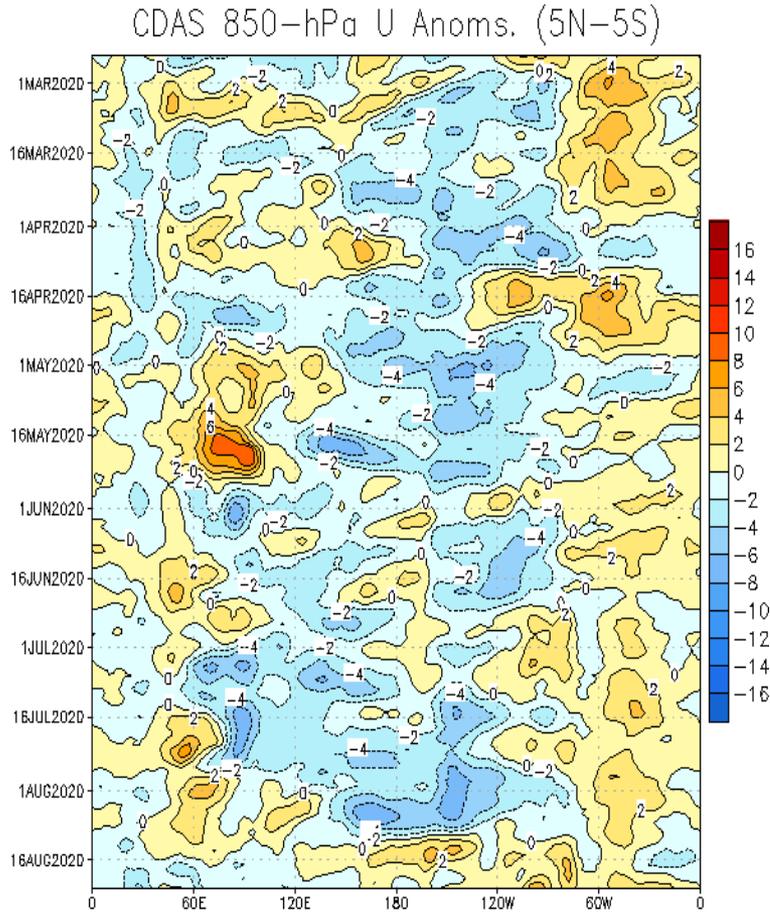
Shading denotes the zonal wind anomaly. **Blue shades: Anomalous easterlies.** **Red shades: Anomalous westerlies.**



- Anomalous upper-level easterlies expanded from the central Pacific to northern South America during the past ten days, which is a major change from earlier this month and consistent with the ongoing MJO.

850-hPa Wind Anomalies

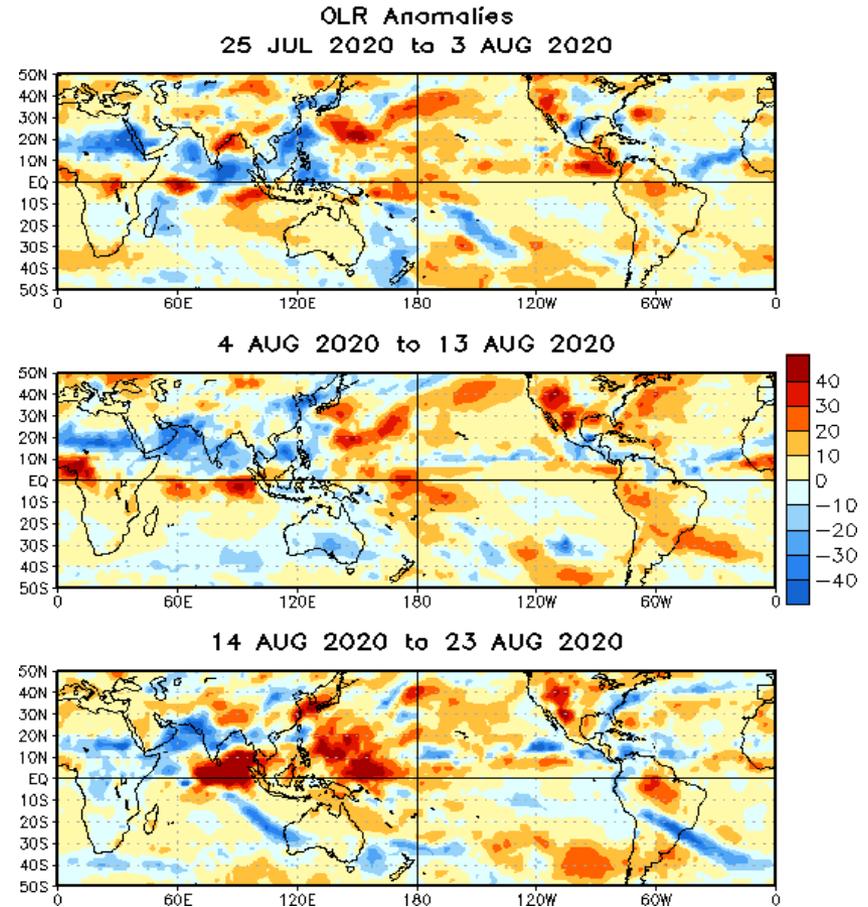
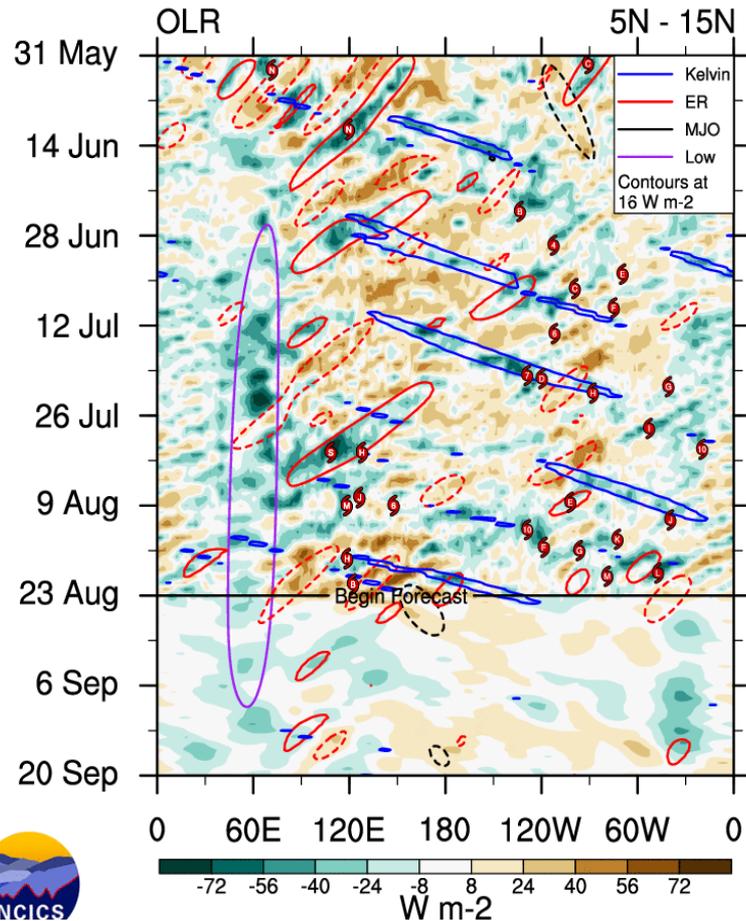
Shading denotes the zonal wind anomaly. **Blue shades: Anomalous easterlies.** **Red shades: Anomalous westerlies.**



- Anomalous low-level easterlies switched sign throughout the equatorial central and eastern Pacific with the passage of an active MJO during early August.
- As the MJO propagated eastward, anomalous low-level westerlies overspread the Caribbean Sea and tropical Atlantic which reduced vertical wind shear over the Atlantic basin.

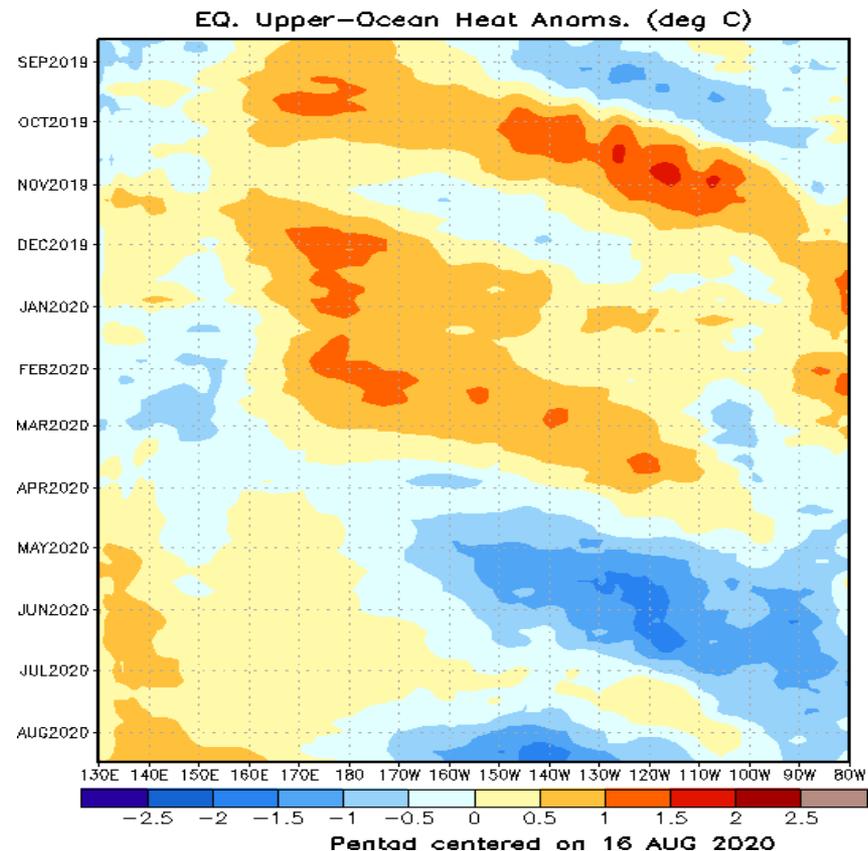
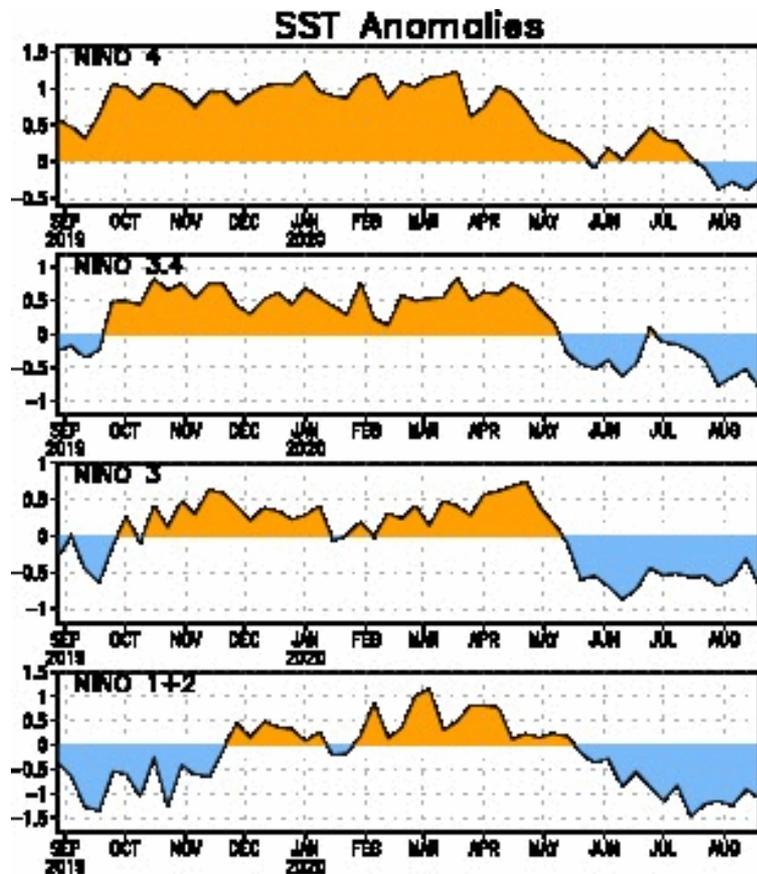
Outgoing Longwave Radiation (OLR) Anomalies

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



- Enhanced convection, associated with the MJO, shifted east across the Indian Ocean and Maritime Continent during late July and early August.
- As the MJO continued its eastward propagation, convection became enhanced along the ITCZ at 10N in the East Pacific.

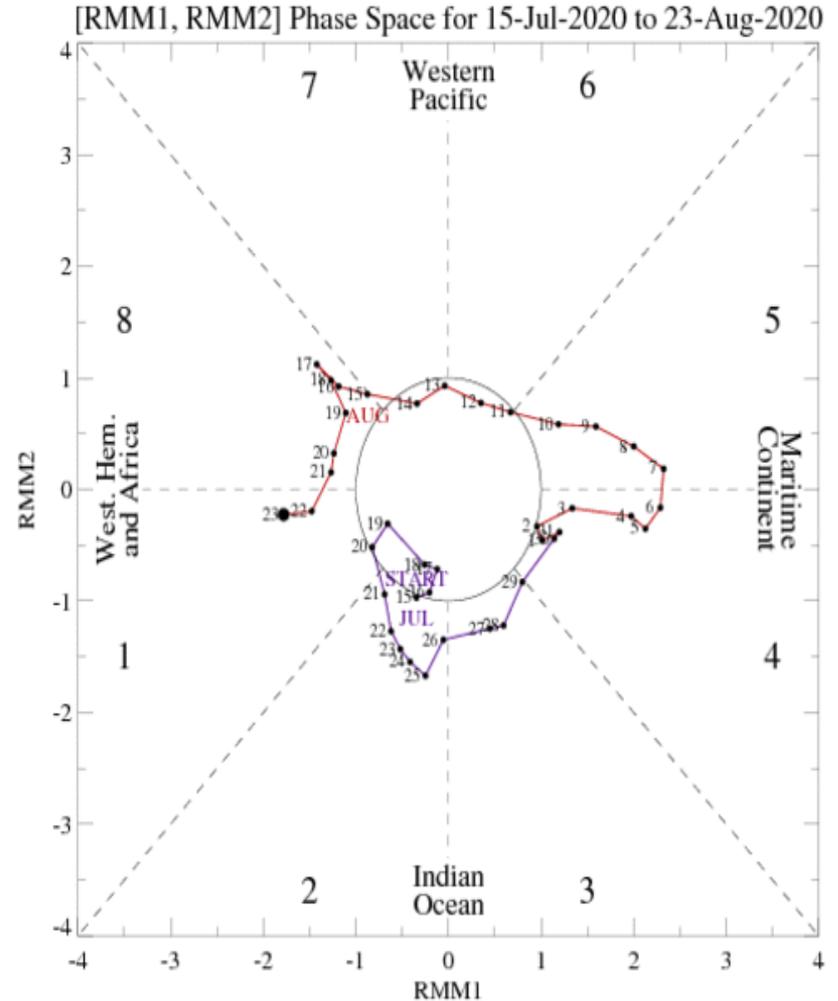
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- A La Niña Watch remains in effect from CPC.
- SST anomalies in the three easternmost Niño regions have been mostly negative since mid-May, with the Niño 4 SST anomalies turning negative in mid-July.
- High frequency variations in the SST time series are mostly attributed to MJO, Kelvin wave, and TC activity.

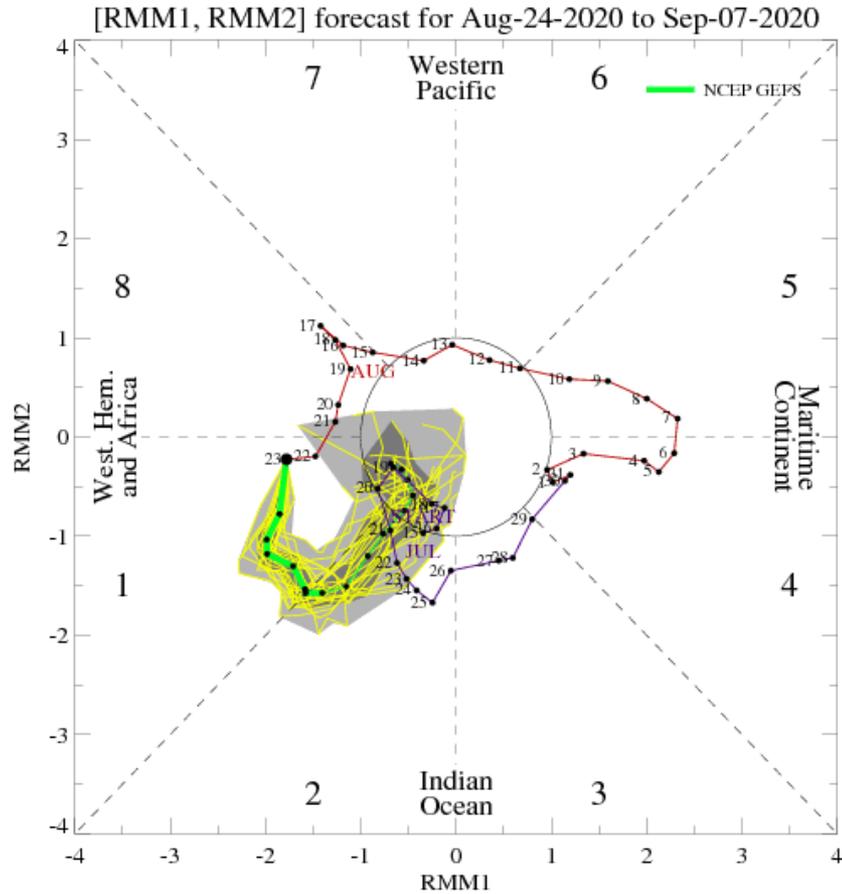
MJO Index: Recent Evolution

- The RMM index depicts the MJO emerging over the Indian Ocean during late July with eastward propagation over the Western Hemisphere during mid-August.

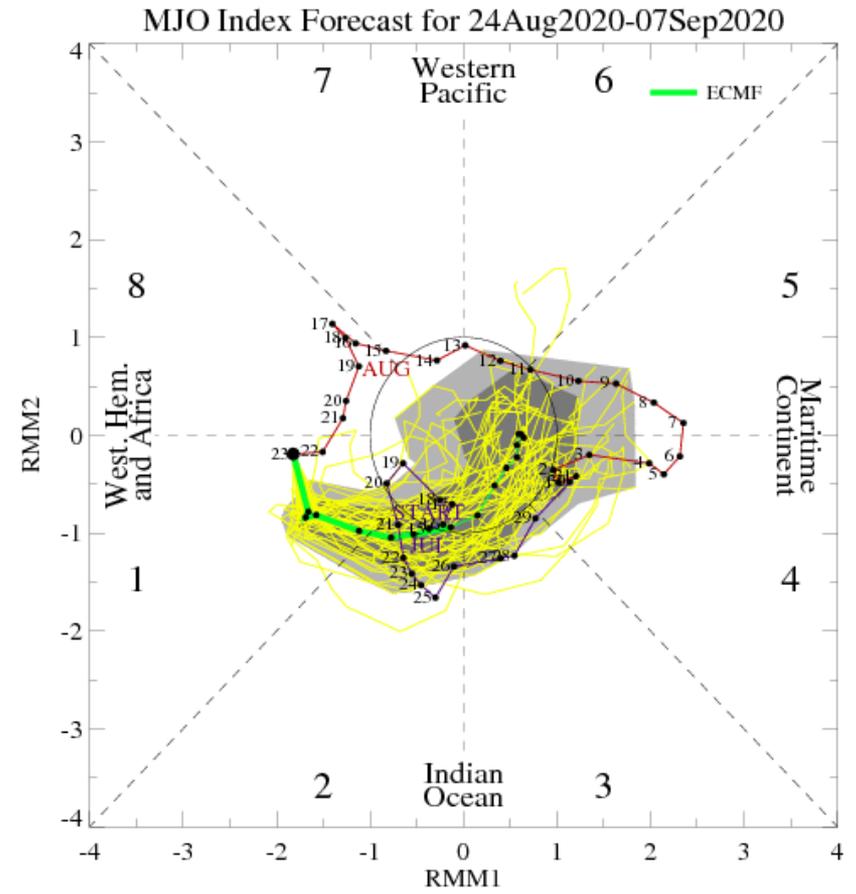


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



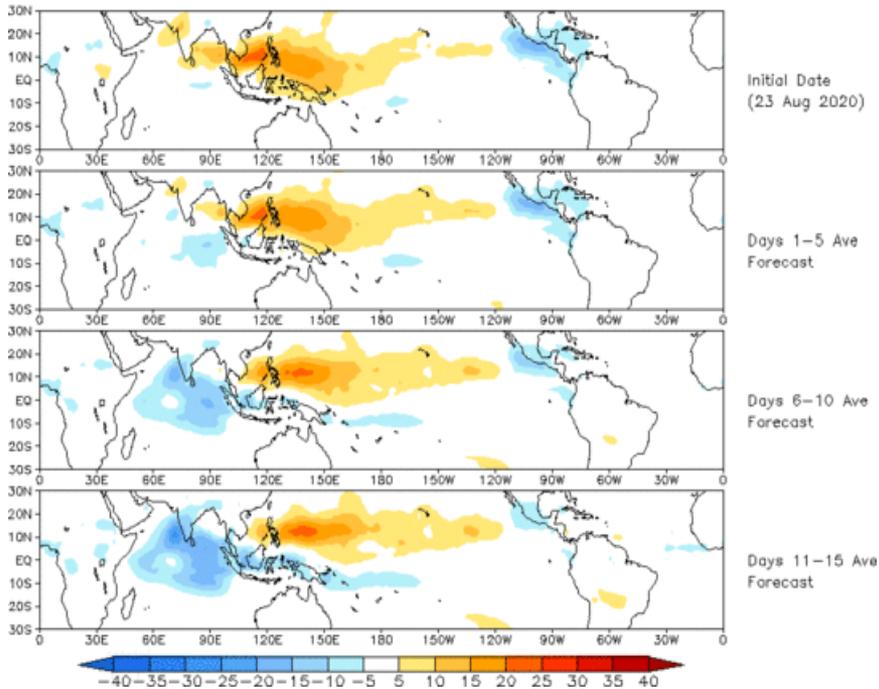
ECMWF Forecast

- Although the GEFS indicates a weakening MJO during the next two weeks, the ECMWF ensemble mean features a continued MJO signal propagating east over the Indian Ocean.

MJO: Constructed Analog Forecast Evolution

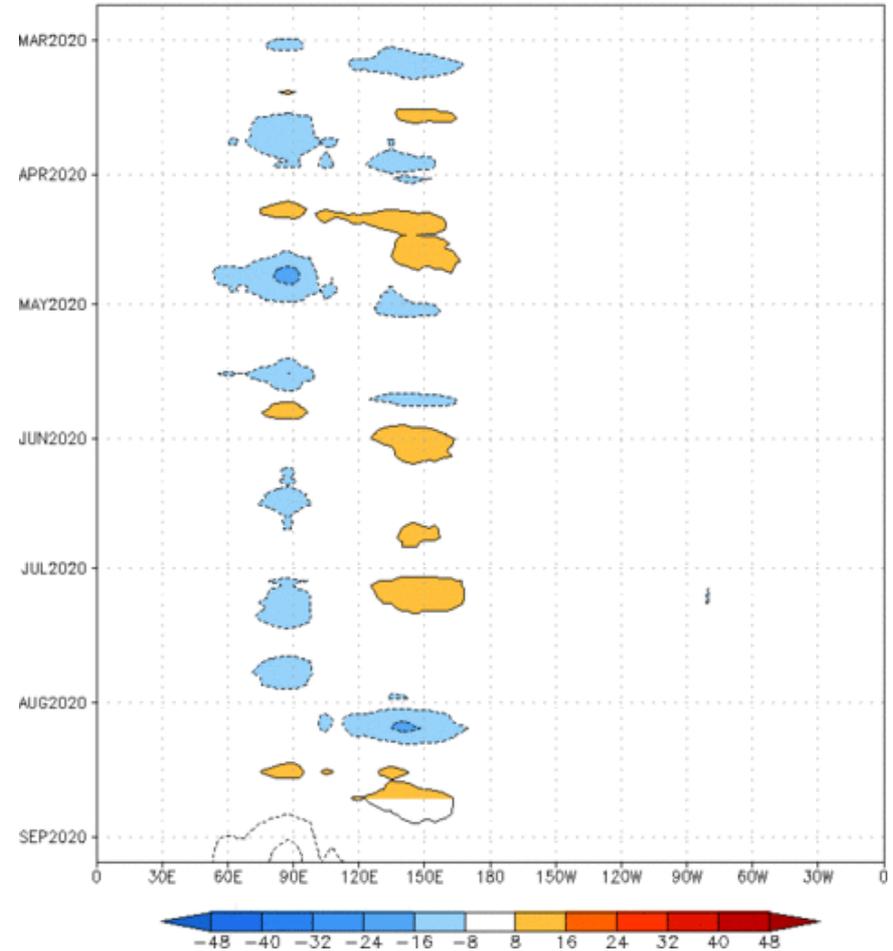
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (23 Aug 2020)



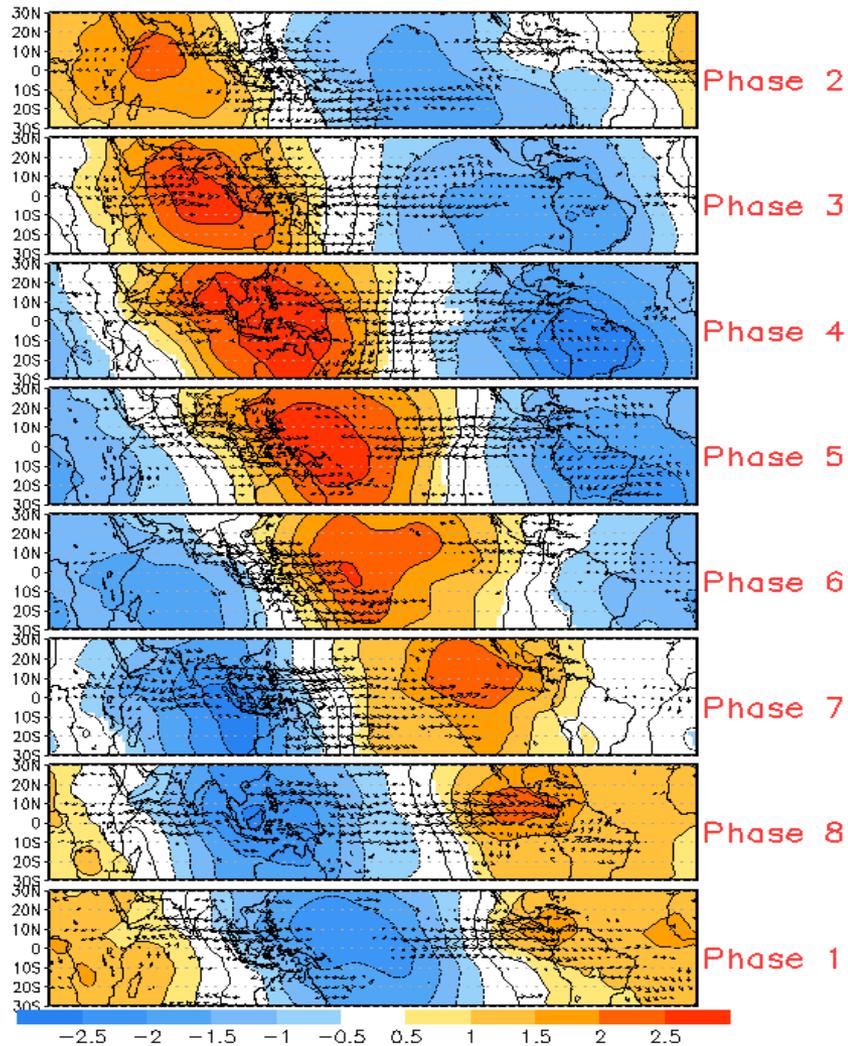
- The constructed analog model depicts an increase in enhanced convection over the Indian Ocean.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cont:4Wm²) Period:22-Feb-2020 to 23-Aug-2020
The unfilled contours are CA forecast reconstructed anomaly for 15 days

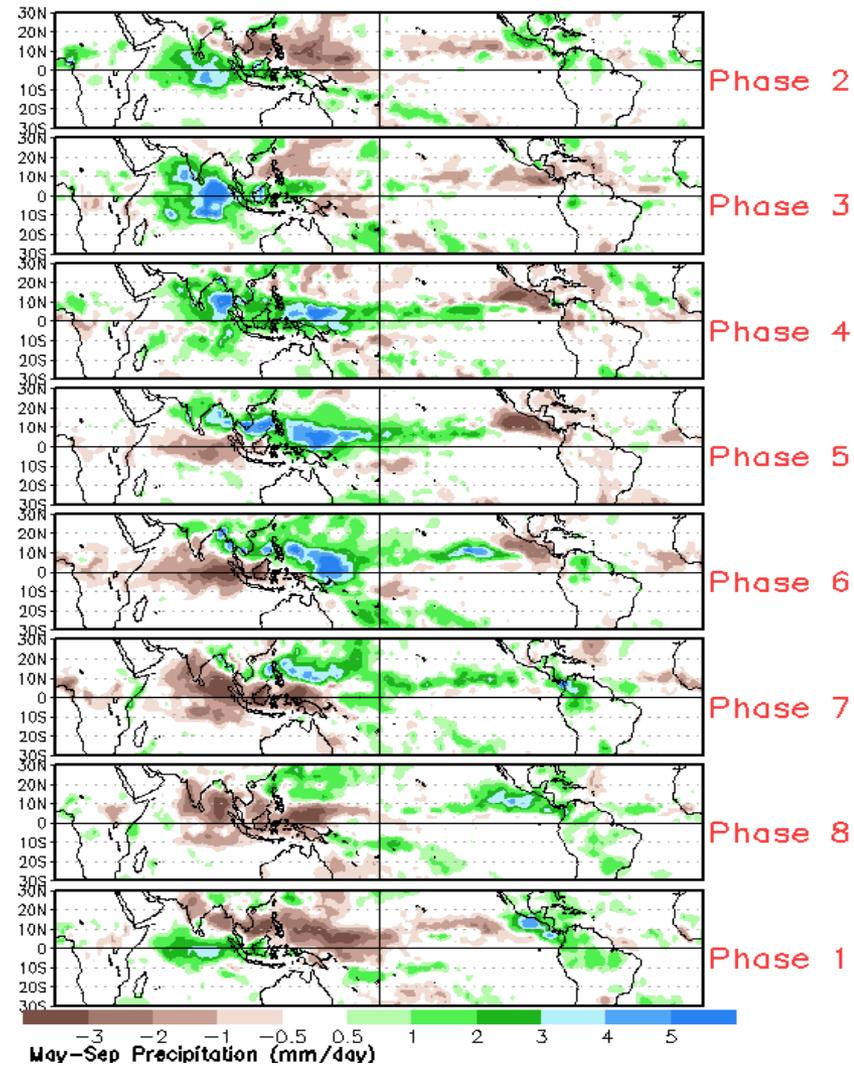


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



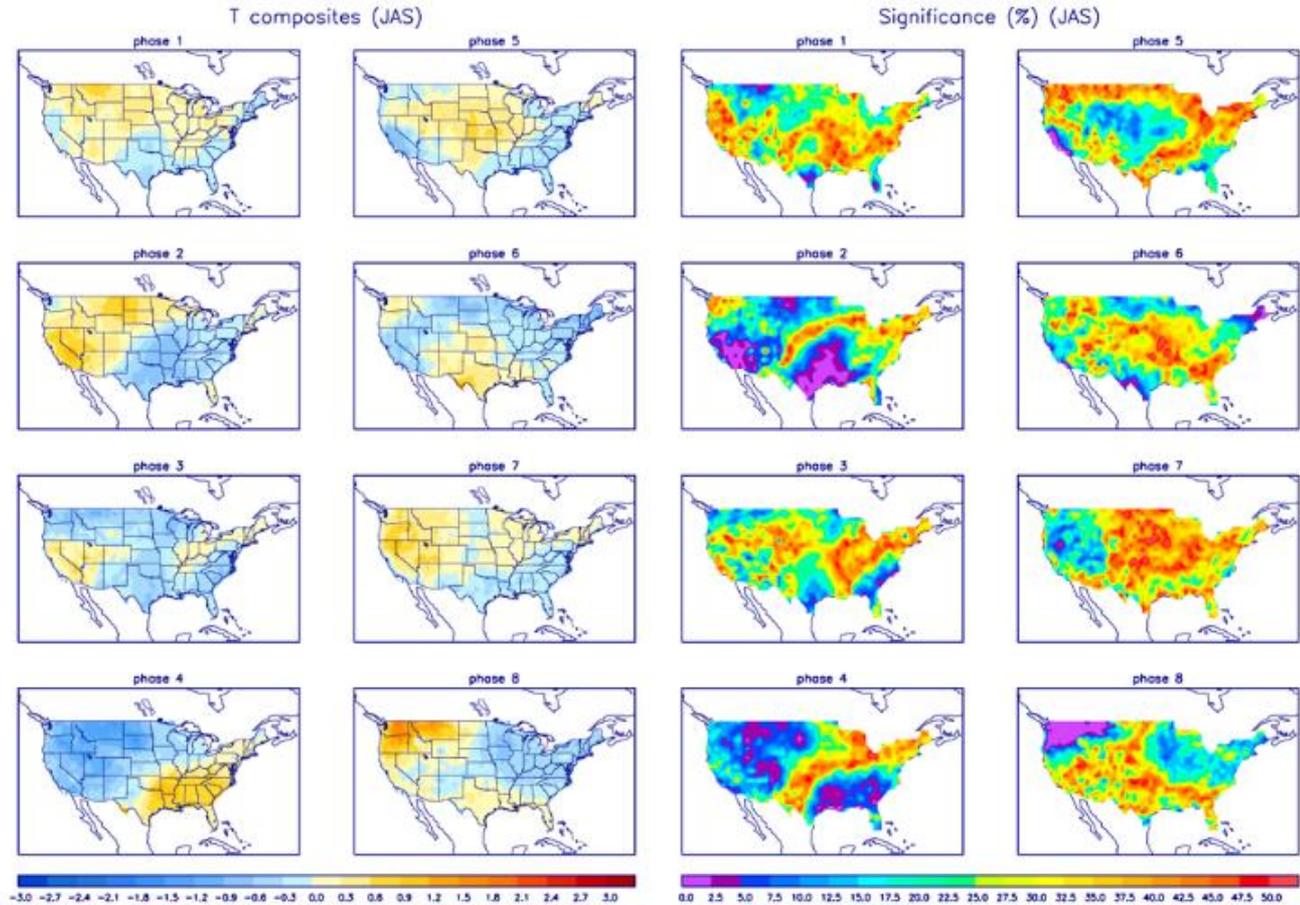
Precipitation Anomalies



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.

