

Madden-Julian Oscillation:

Recent Evolution, Current Status and Predictions



Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
27 July 2020

Overview

- The MJO is beginning to show signs of strengthening with enhanced convection overspreading the eastern Indian Ocean.
- A robust convectively-coupled Kelvin wave has propagated eastward from the East Pacific to the western Caribbean Sea.
- Dynamical models depict a developing MJO shifting eastward from the Indian Ocean to the Maritime Continent during the next two weeks.
- If a MJO continues eastward propagation, then conditions would become more (less) favorable for tropical cyclone development across the West (East) Pacific during early August.

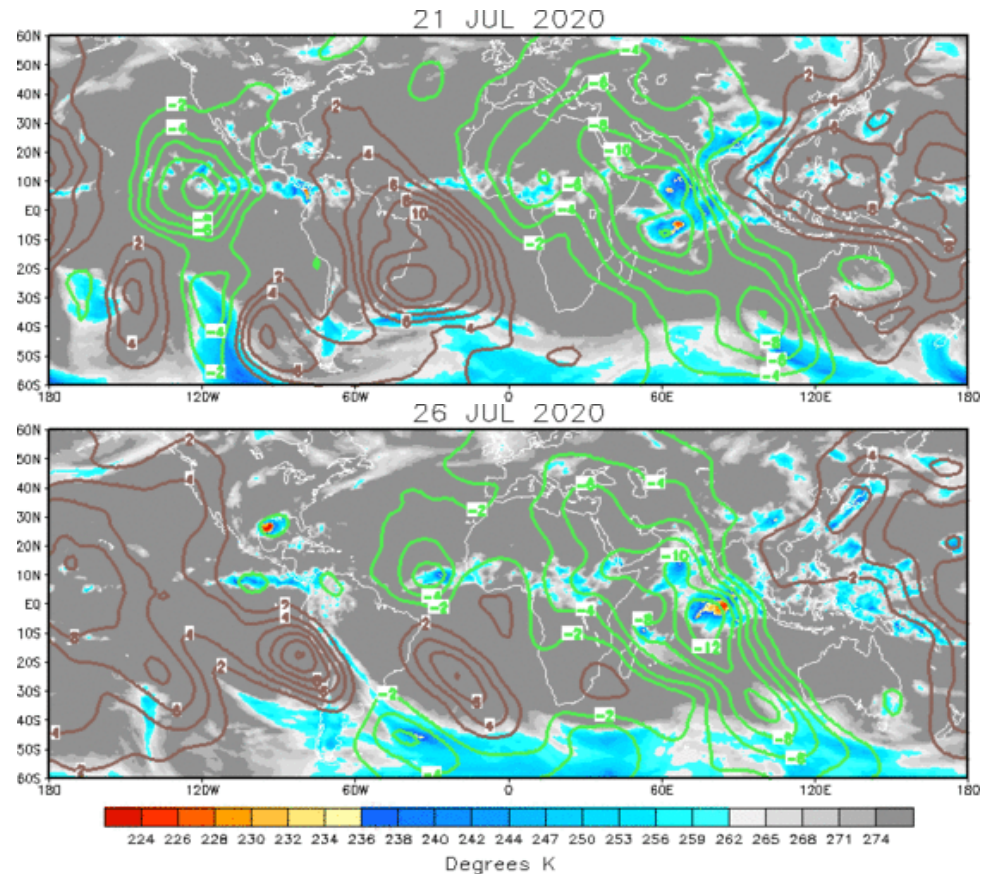
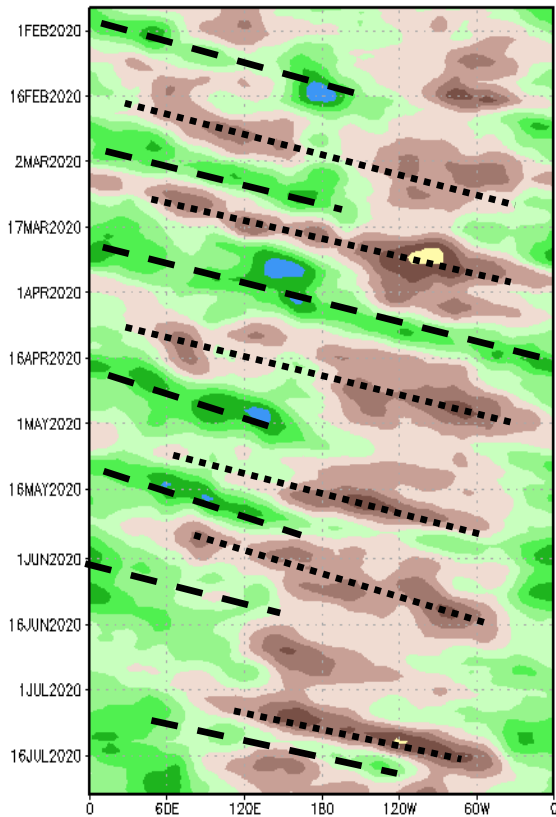
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

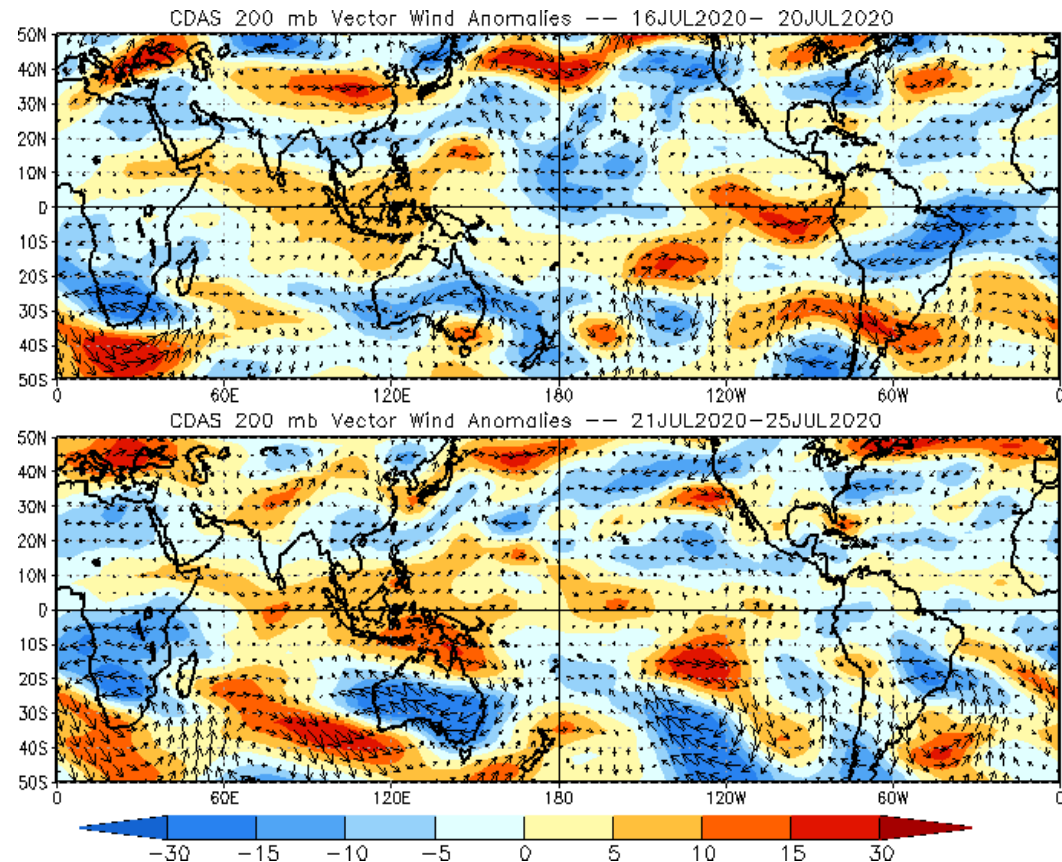
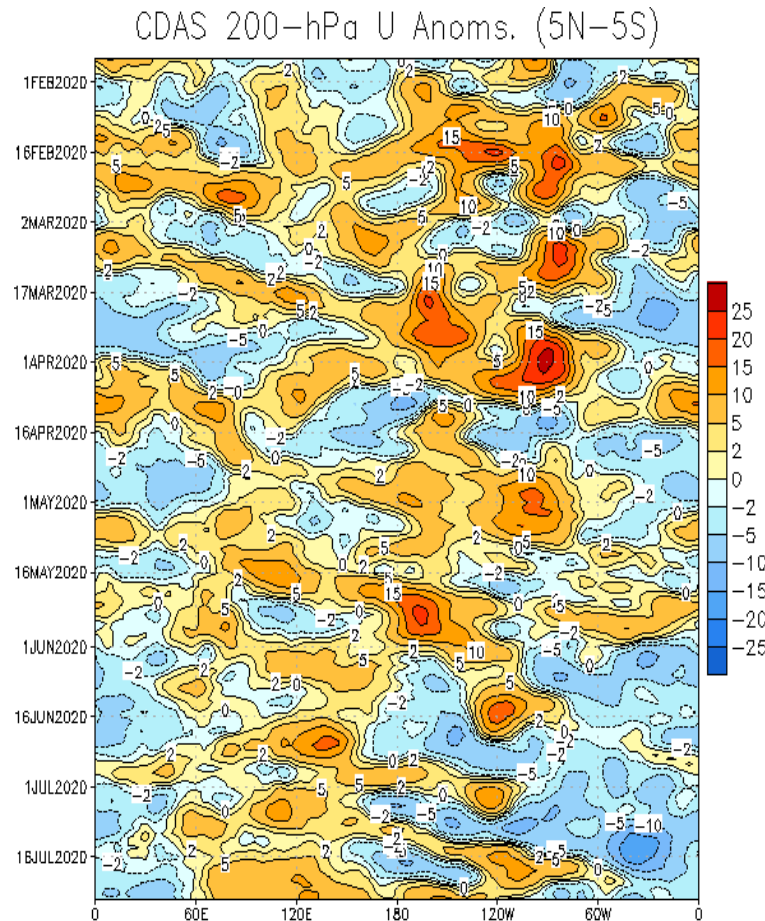
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- A low-frequency suppressed signal has moved slowly westward across the Pacific since the Boreal Spring.
- A robust convectively-coupled Kelvin wave has been crossing the Western Hemisphere since mid-July, while an enhanced area of upper-level divergence is showing signs of propagating eastward over the Indian Ocean.

200-hPa Wind Anomalies

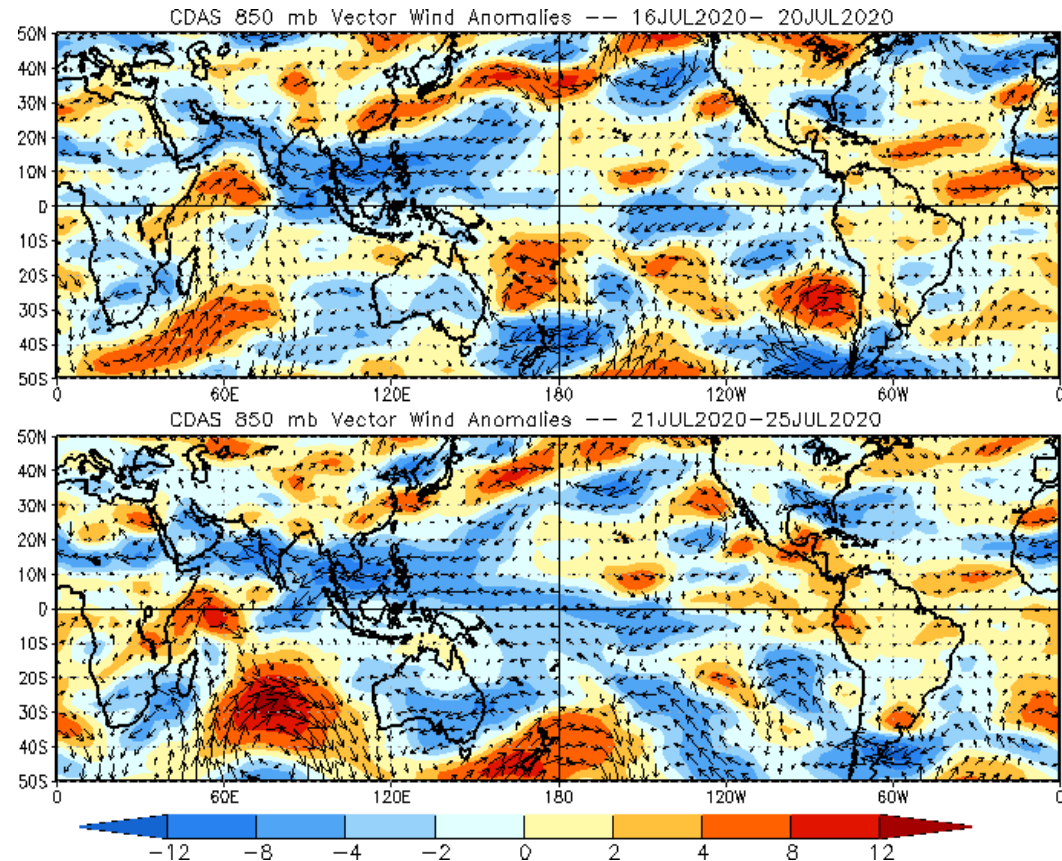
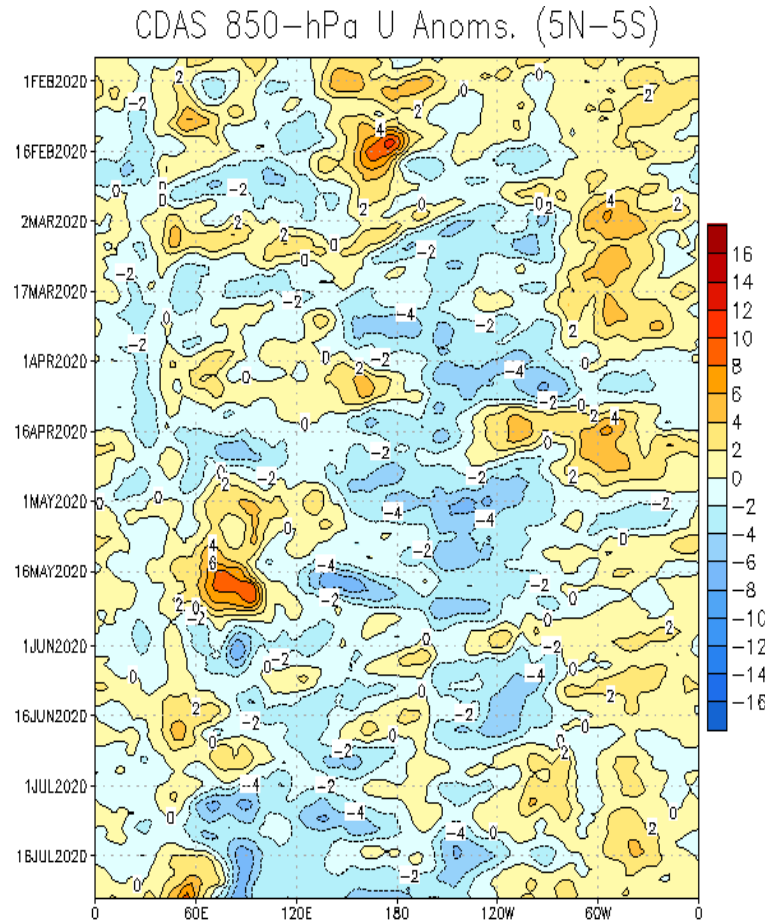
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Westerly (easterly) anomalies have persisted over the eastern Indian Ocean and Maritime Continent (South America to Africa).
- The easterly 200-hPa anomalies over Africa coupled with the westerly anomalies farther to the east continue to enhance convection across the western Indian Ocean.

850-hPa Wind Anomalies

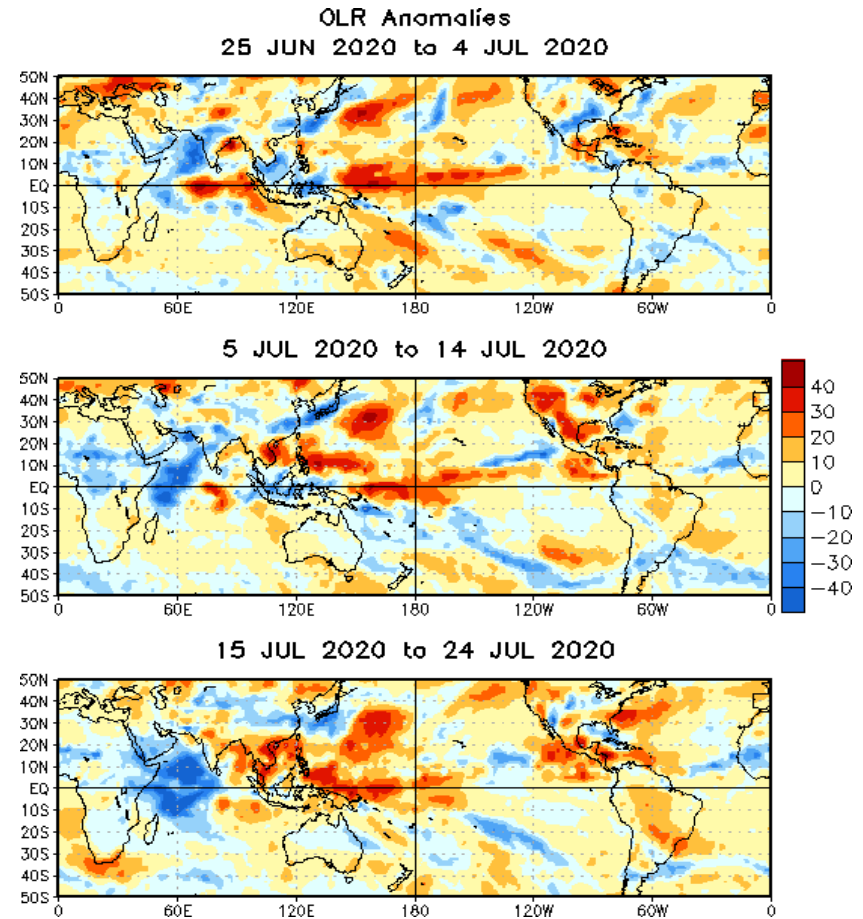
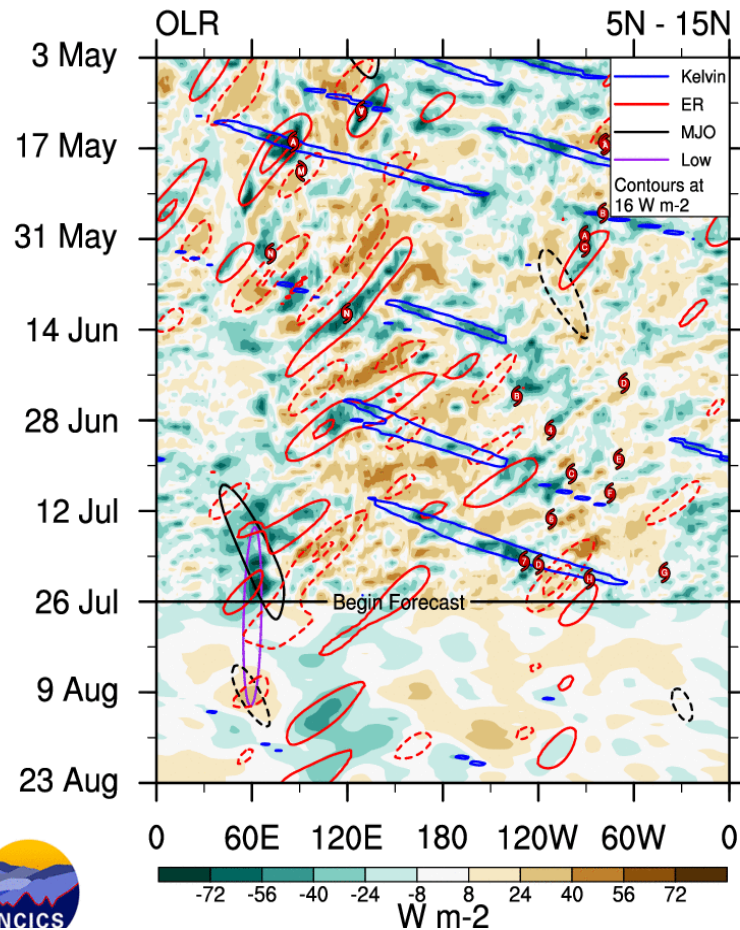
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Robust easterly anomalies persist over the Northwest Pacific and the monsoon areas of South and Southeast Asia.
- A Kelvin wave has recently shifted eastward to Central America.

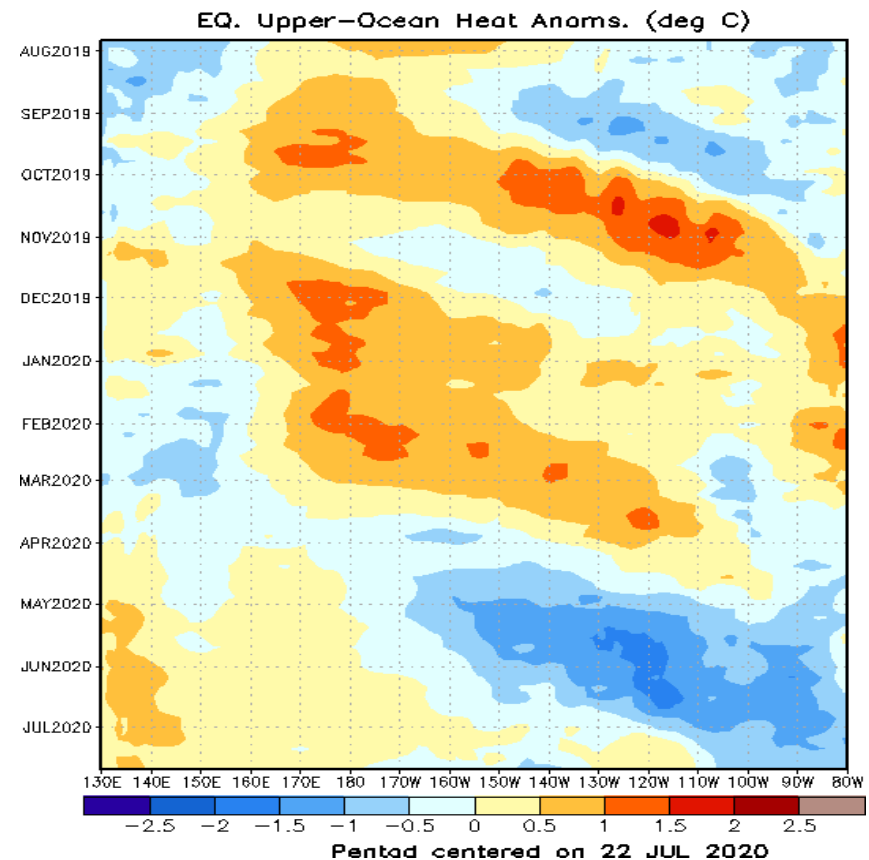
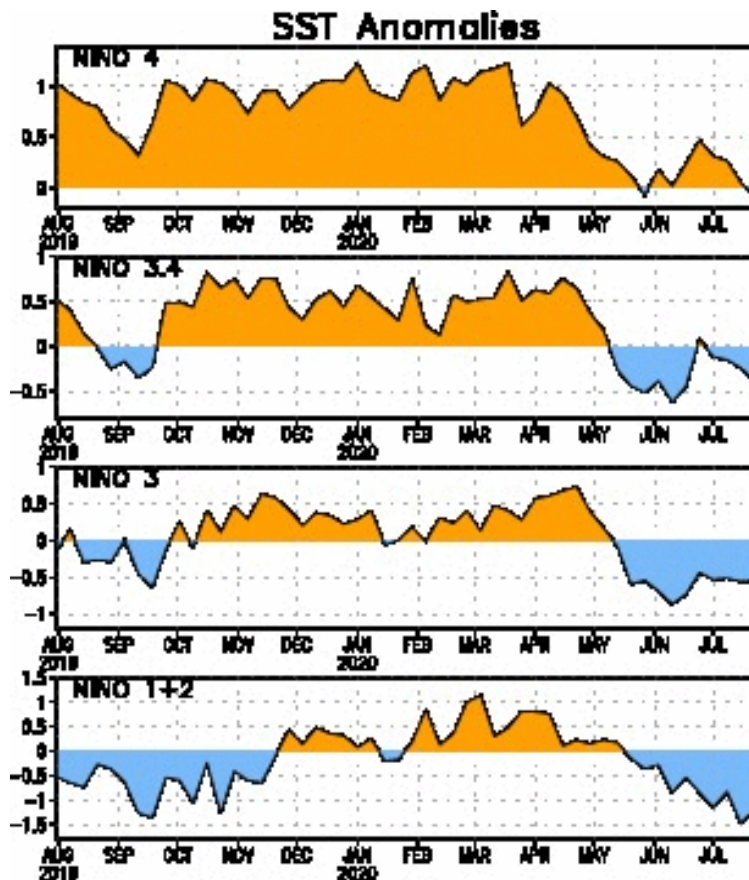
Outgoing Longwave Radiation (OLR) Anomalies

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



- The slow-moving enhanced convective signal over Africa and the western Indian Ocean and the Pacific Kelvin wave are evident in the OLR field.
- A suppressed convective regime continues over the West and Central Pacific.

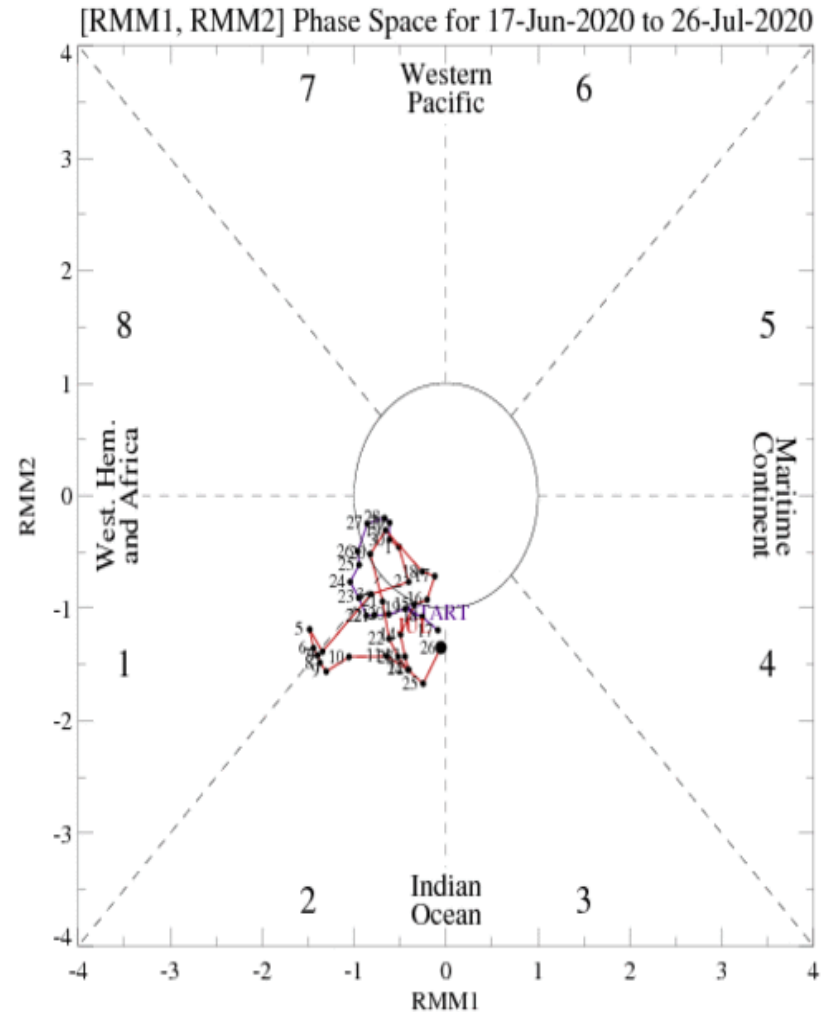
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- A La Niña Watch was issued by CPC earlier during July.
- SST anomalies in the three easternmost Niño regions have been mostly negative since mid-May.
- Upper-Ocean heat content anomalies have weakened over the central and eastern Pacific in recent weeks following the robust upwelling phase of a Kelvin wave that moved during May and June.

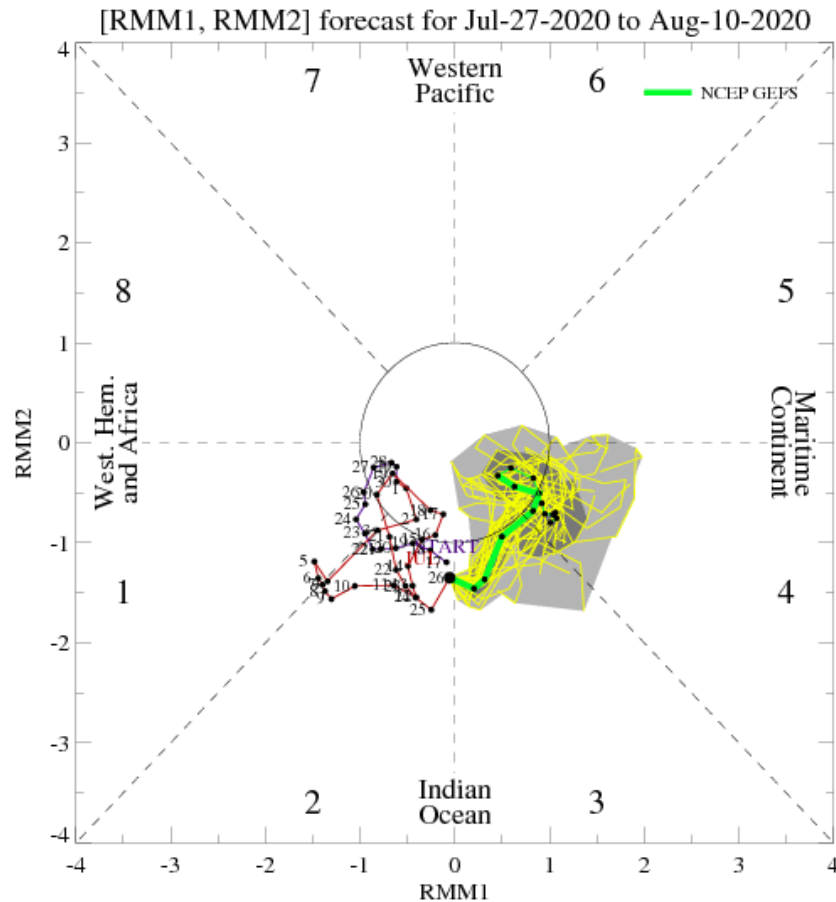
MJO Index: Recent Evolution

- The RMM index depicts the absence of a MJO this summer but there is recently slight eastward propagation of a signal.

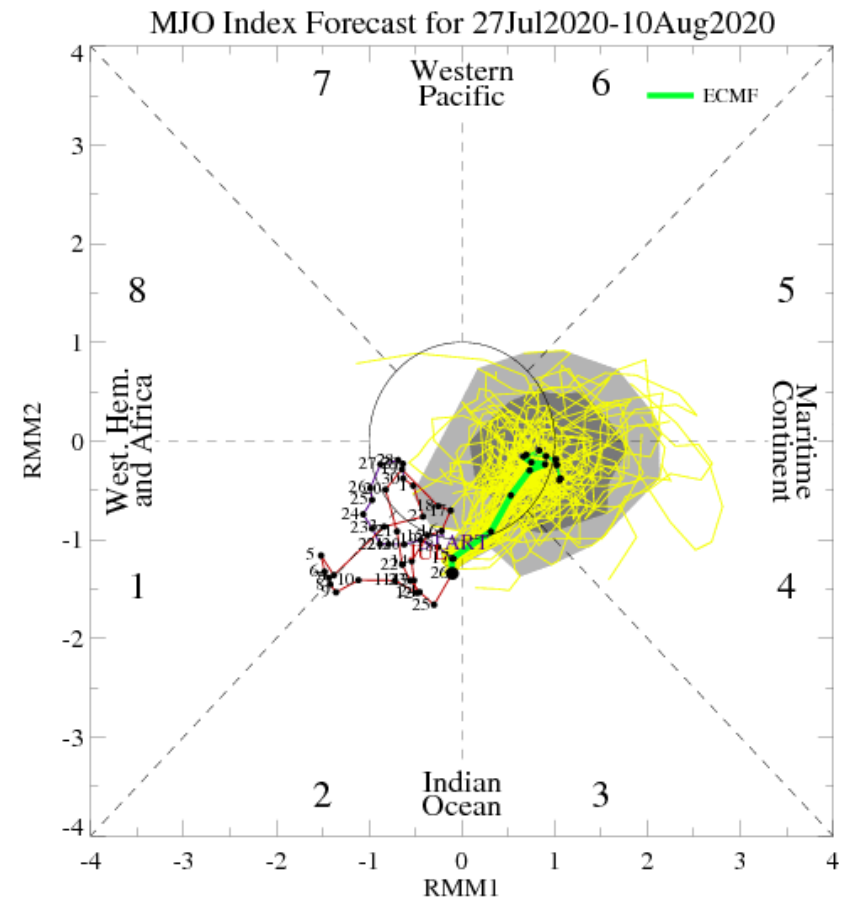


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



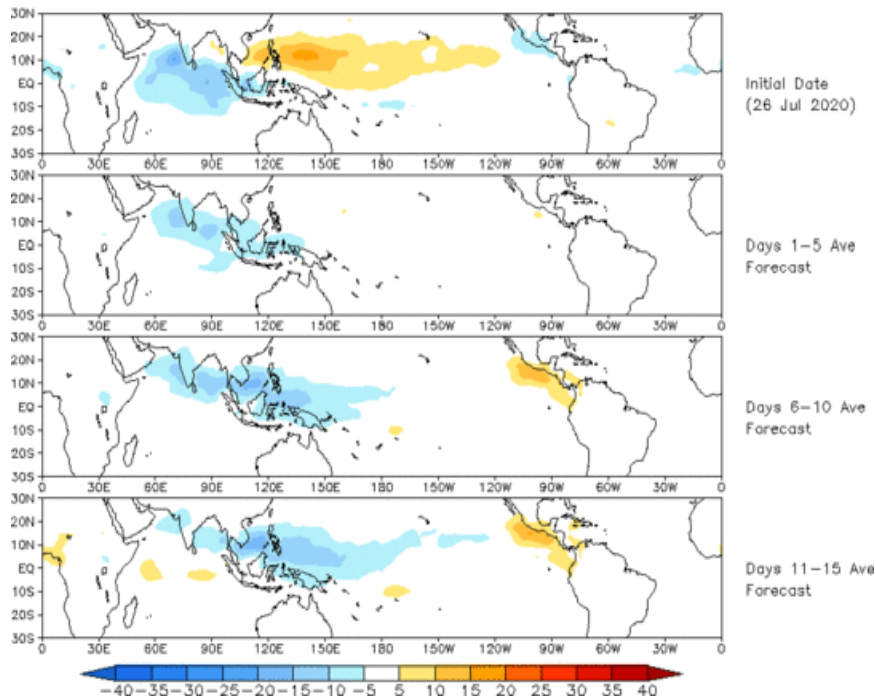
ECMWF Forecast

- The GFS and ECMWF ensemble means feature eastward propagation of a MJO from the Indian Ocean to the Maritime Continent during the next two weeks.
- However, past model solutions have struggled recently with a developing MJO.

MJO: Constructed Analog Forecast Evolution

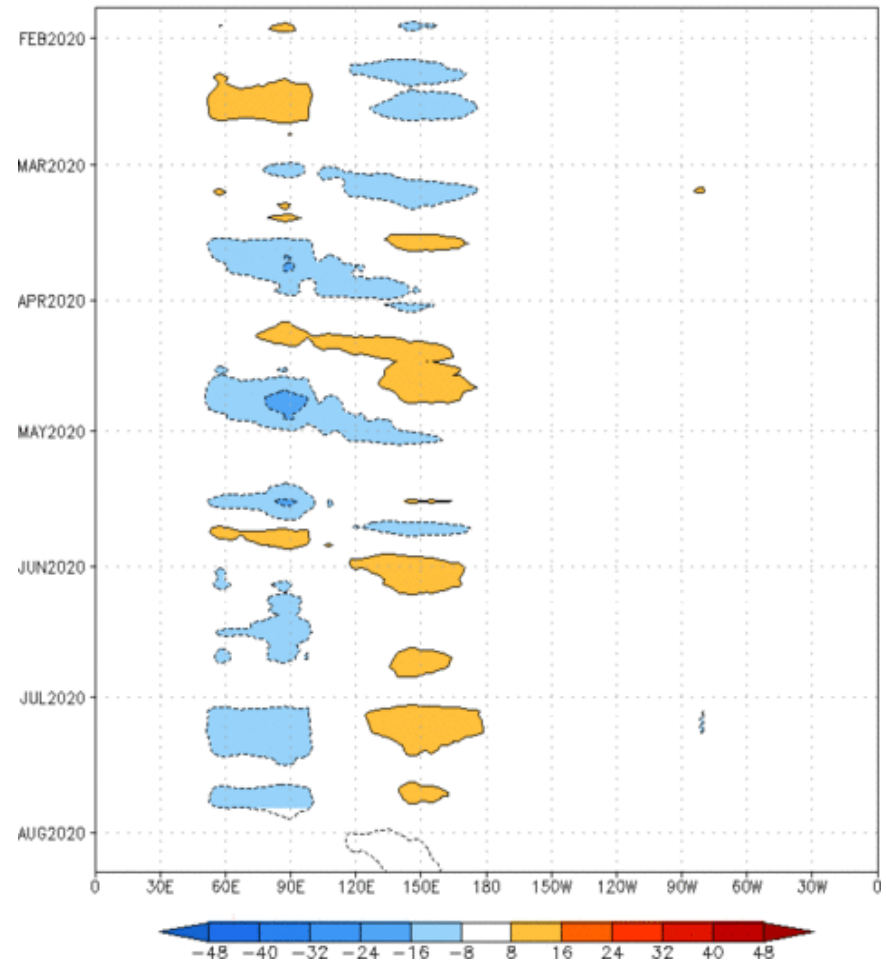
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (26 Jul 2020)



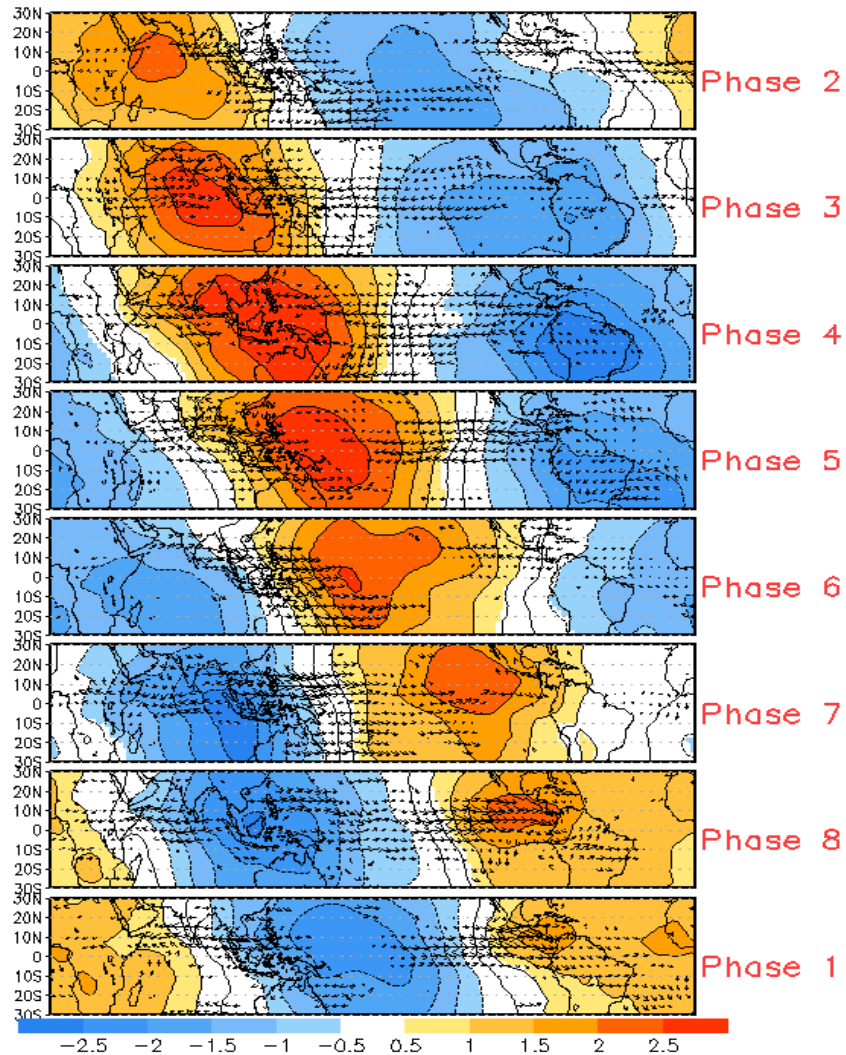
- The constructed analog model depicts enhanced convection shifting eastward over the Maritime Continent and West Pacific. Suppressed convection is forecast to develop across the East Pacific, Central America, and Caribbean Sea.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:25-Jan-2020 to 26-Jul-2020
The unfilled contours are CA forecast reconstructed anomaly for 15 days

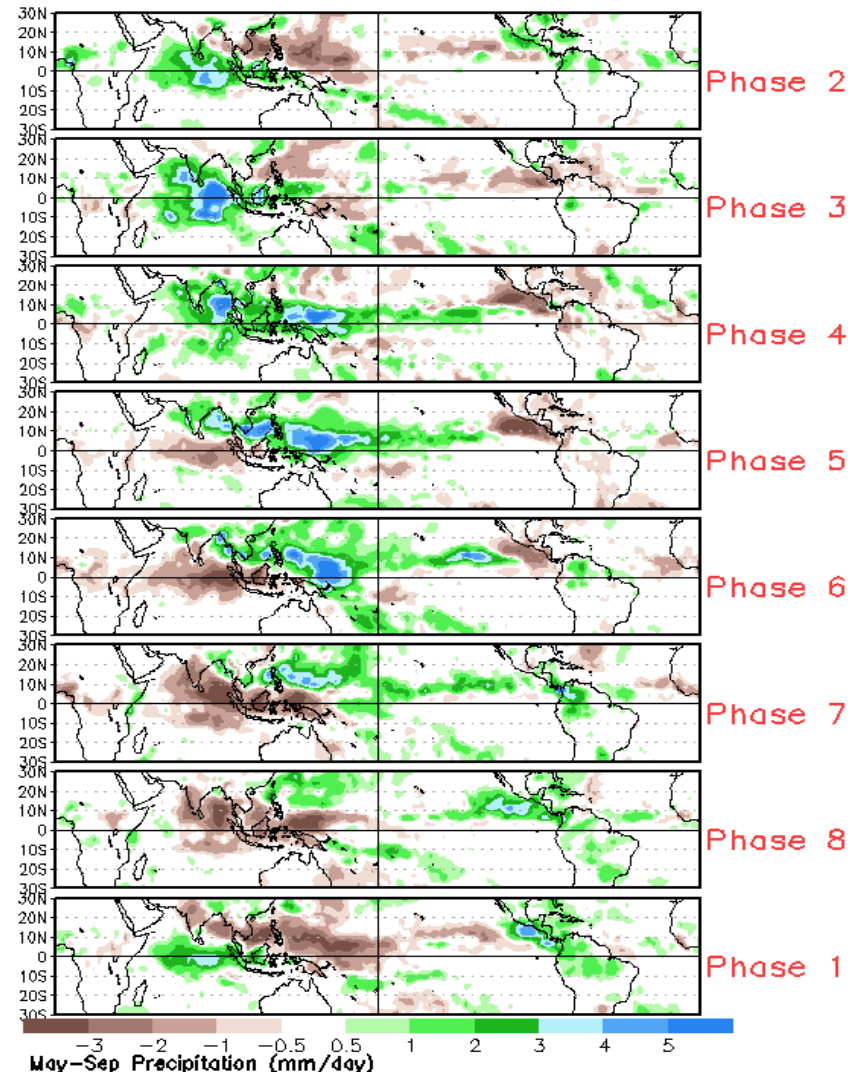


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and
Wind Anomalies



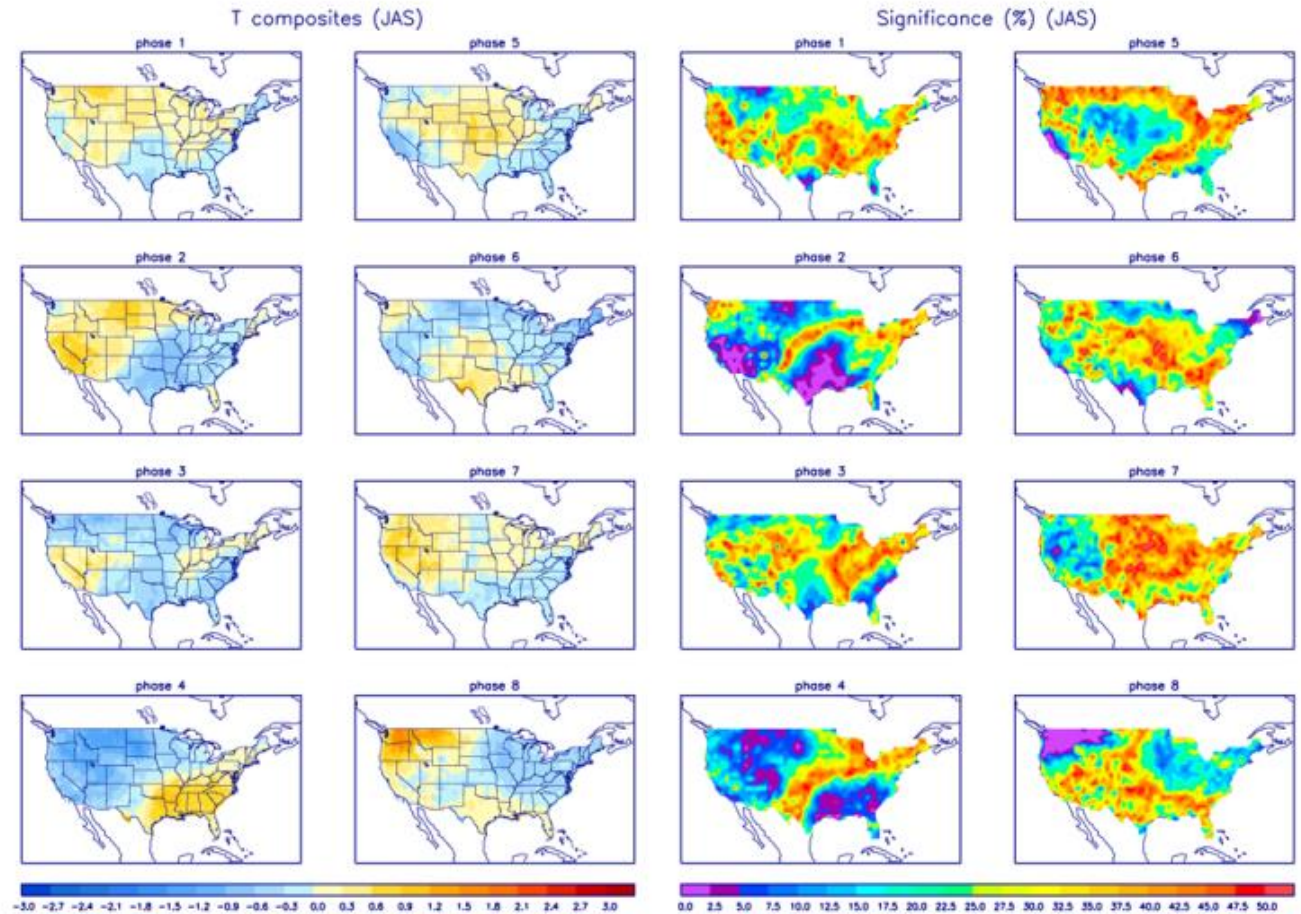
Precipitation Anomalies



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.

