

Madden-Julian Oscillation:

Recent Evolution, Current Status and Predictions



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

Overview

- Recent observations depict a more organized wave-1 pattern, and some eastward propagation of the intraseasonal signal in phase 2.
- Most dynamical models forecast the intraseasonal signal to rapidly weaken during week-1 over the Indian Ocean and remain within the RMM unit circle during week-2.
- Tropical cyclogenesis remains favored over the Eastern Pacific during the next week. TC activity looks to be quiet in the Atlantic and the western Pacific.

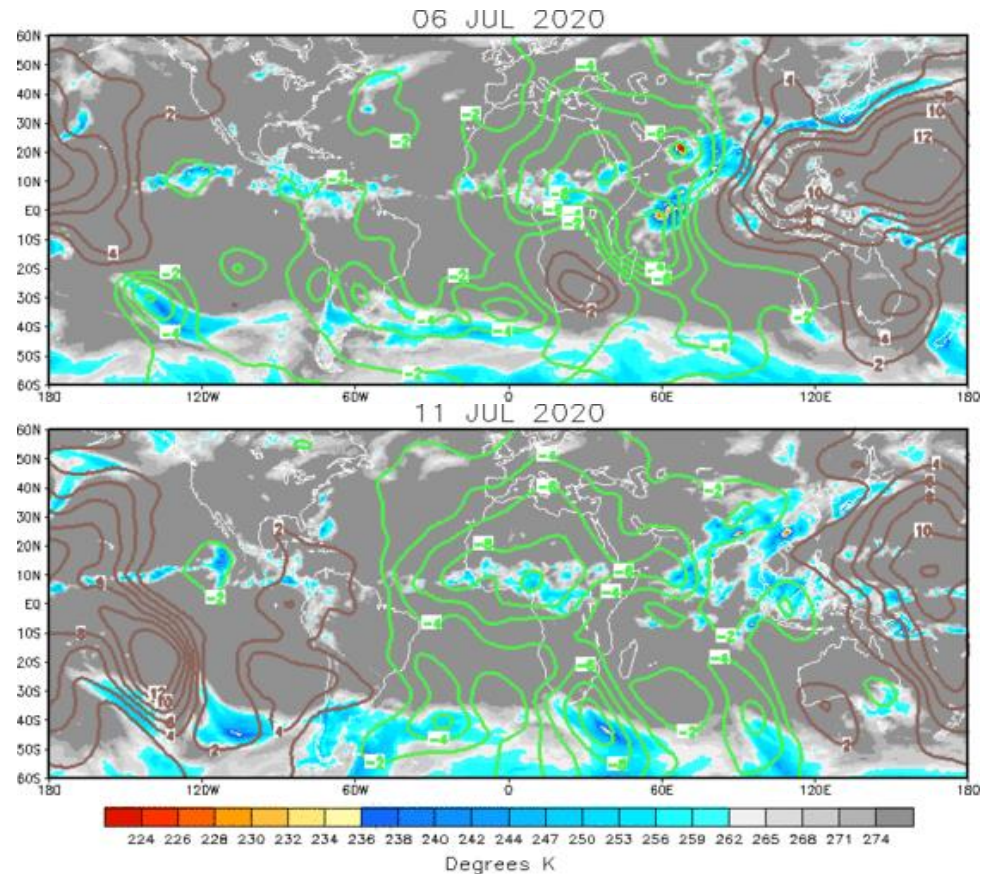
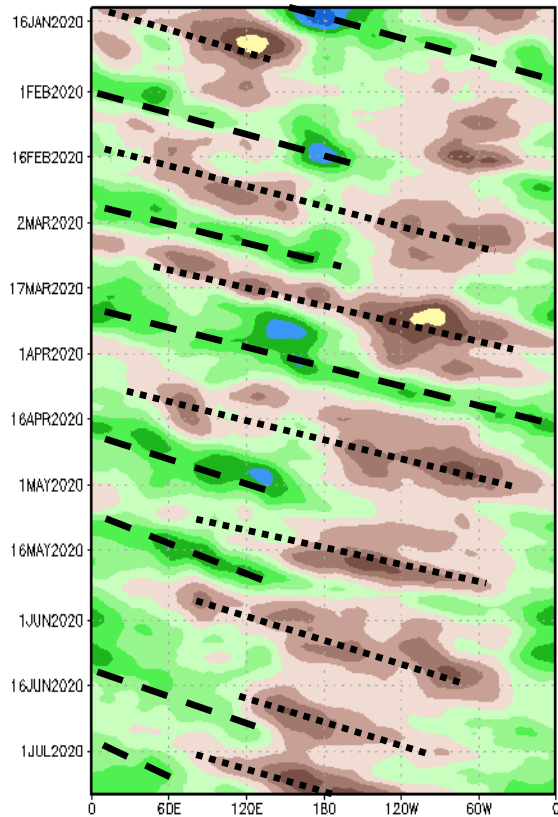
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

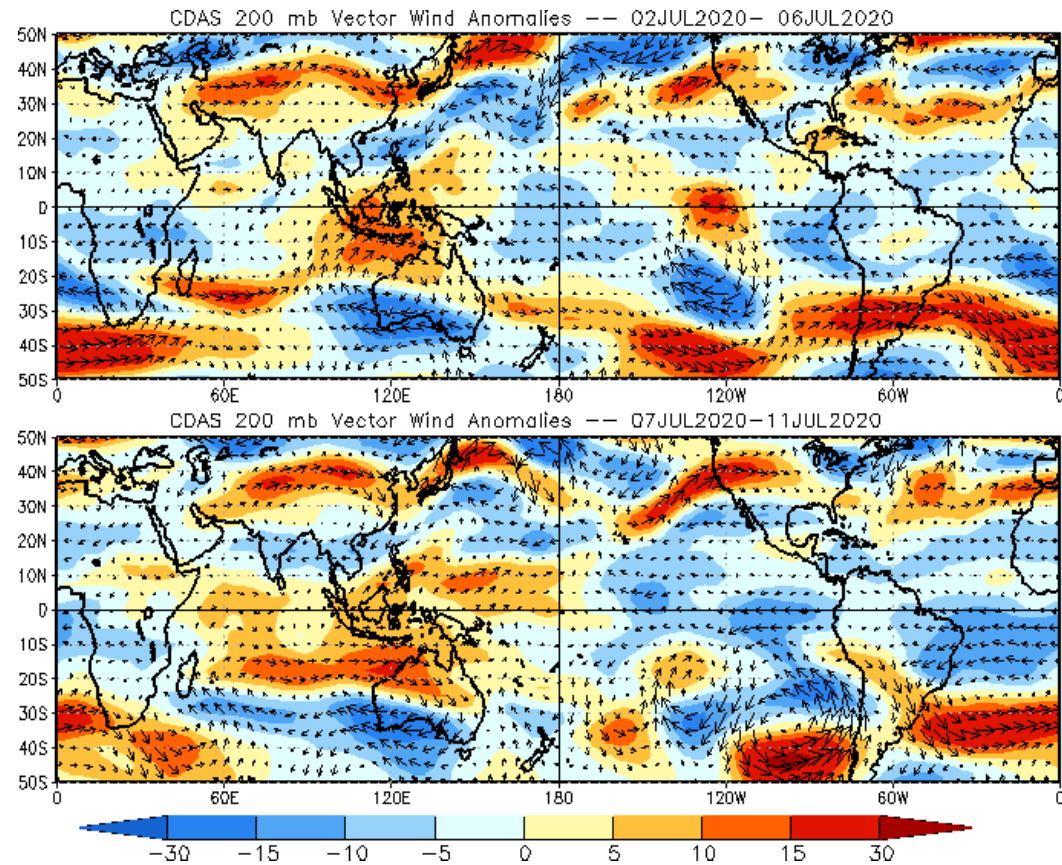
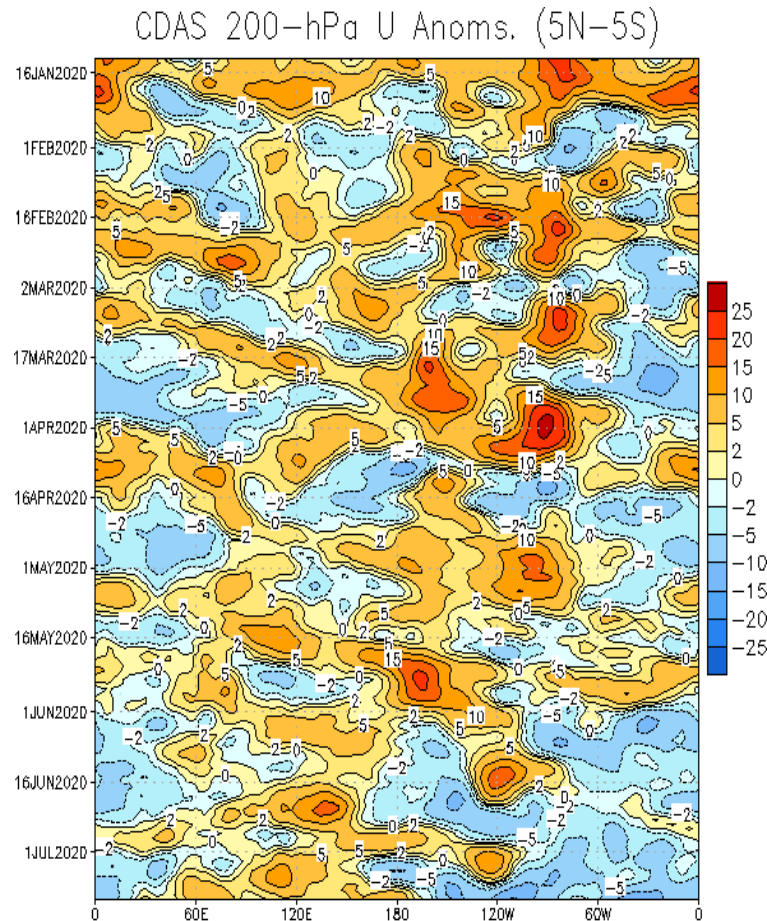
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- Compared to early July, there is better organization in the VP pattern (wave-1), with a broad enhanced envelope extending from the Atlantic to the Indian Ocean
- Enhanced convection over the East Pacific is associated with TC activity (Cristina).
- Since spring, there is a westward shift in the envelope of suppressed convection.

200-hPa Wind Anomalies

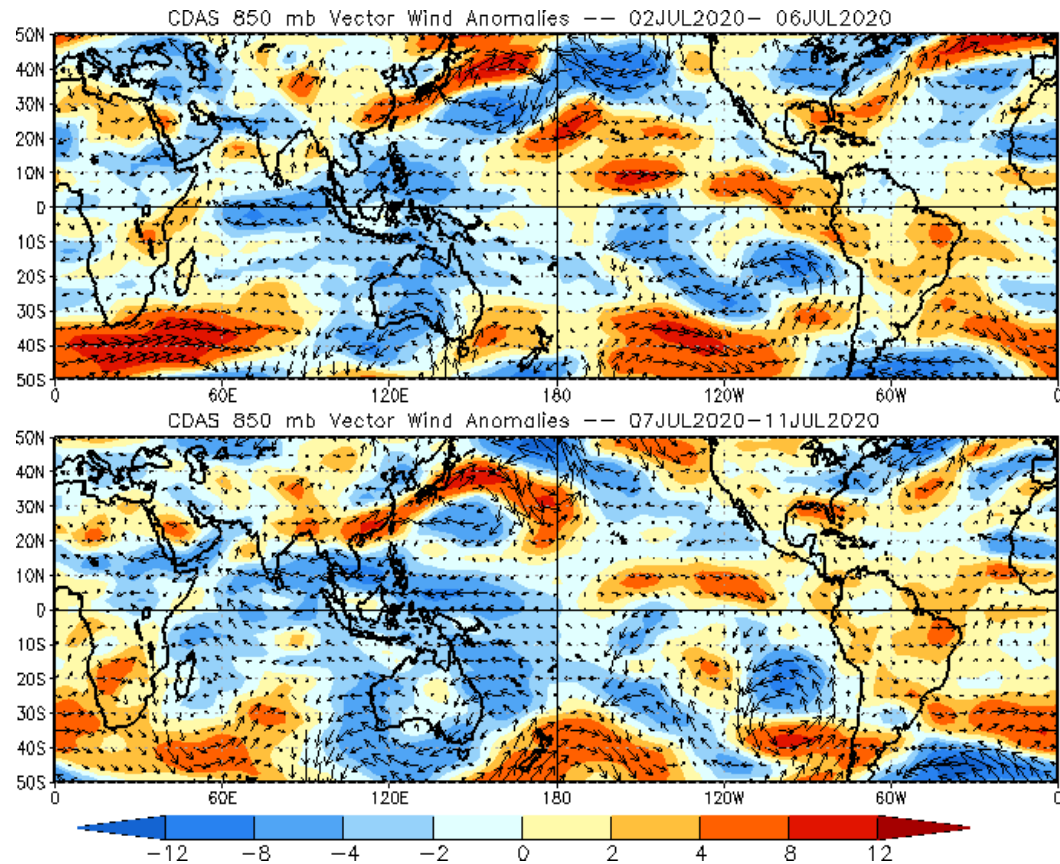
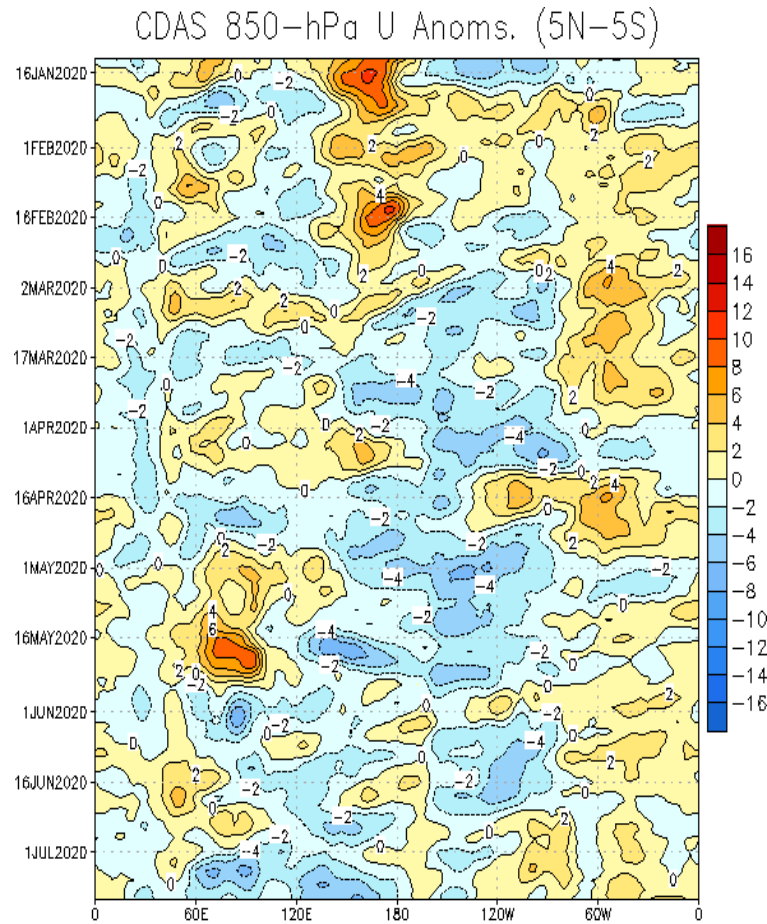
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- A region of divergence aloft has shifted westward over Africa during the past week. A band of anomalous easterly anomalies from ~110W to Africa that have prevailed since late-June.
- Synoptic scale wave breaking continues over the North Pacific with a cyclonic circulation persisting aloft near the Date Line.

850-hPa Wind Anomalies

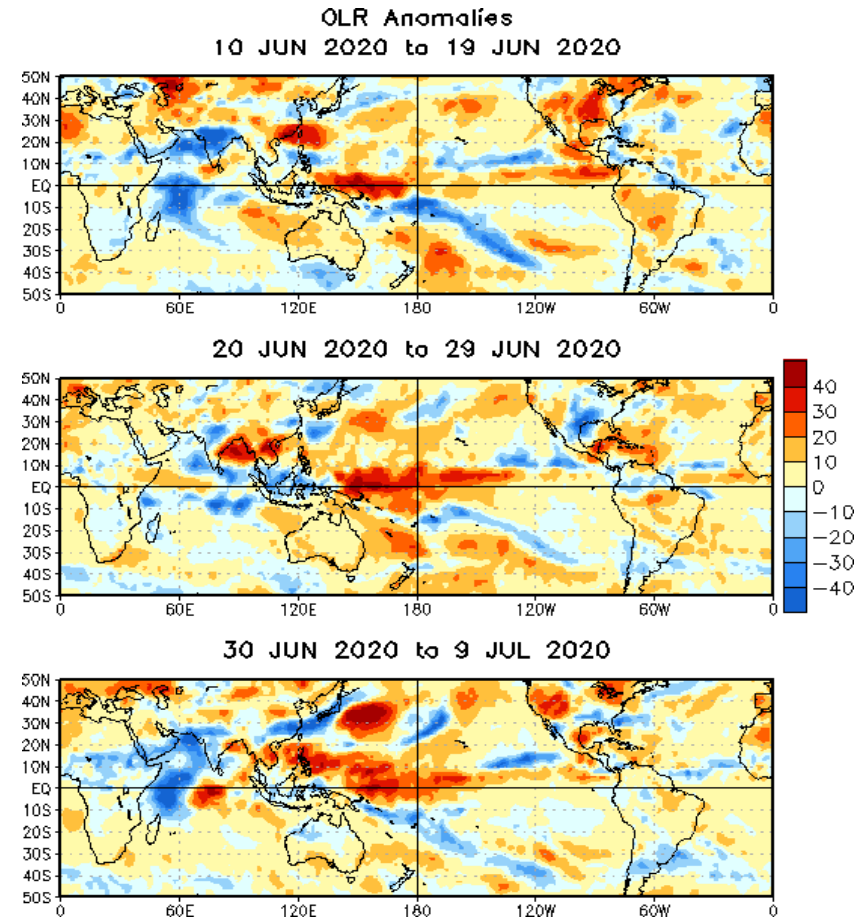
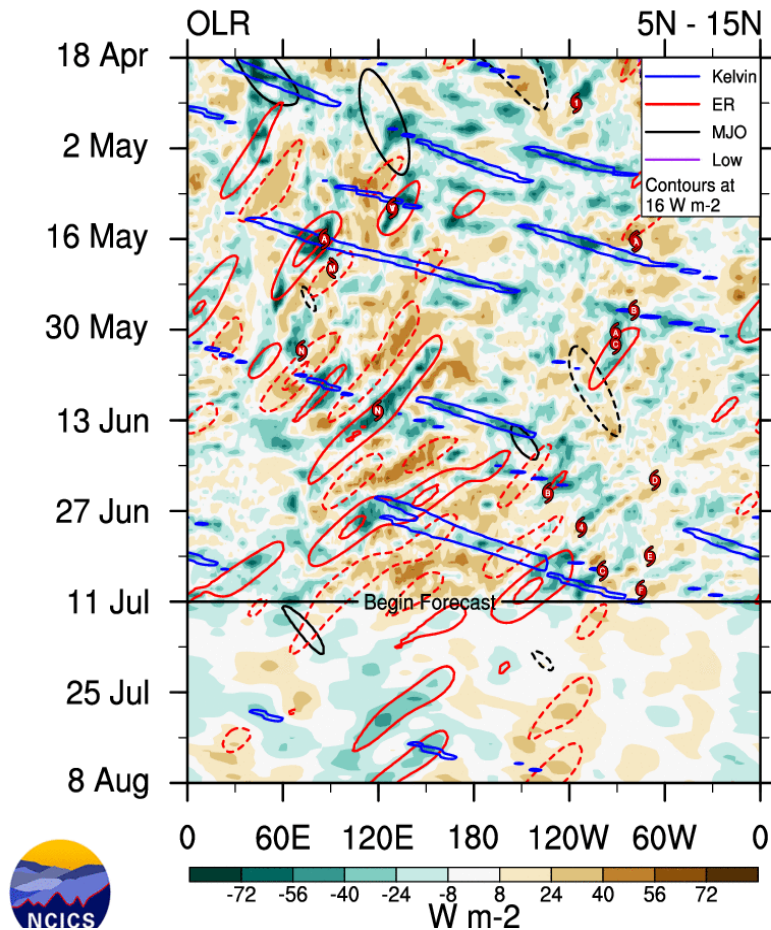
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- A strong elongated band of easterly anomalies have strengthened from the Indian Ocean to the Date Line, with lower-level divergence supportive of suppressed convection across the central Pacific.
- A band of westerlies remains over the eastern Pacific north of the equator.

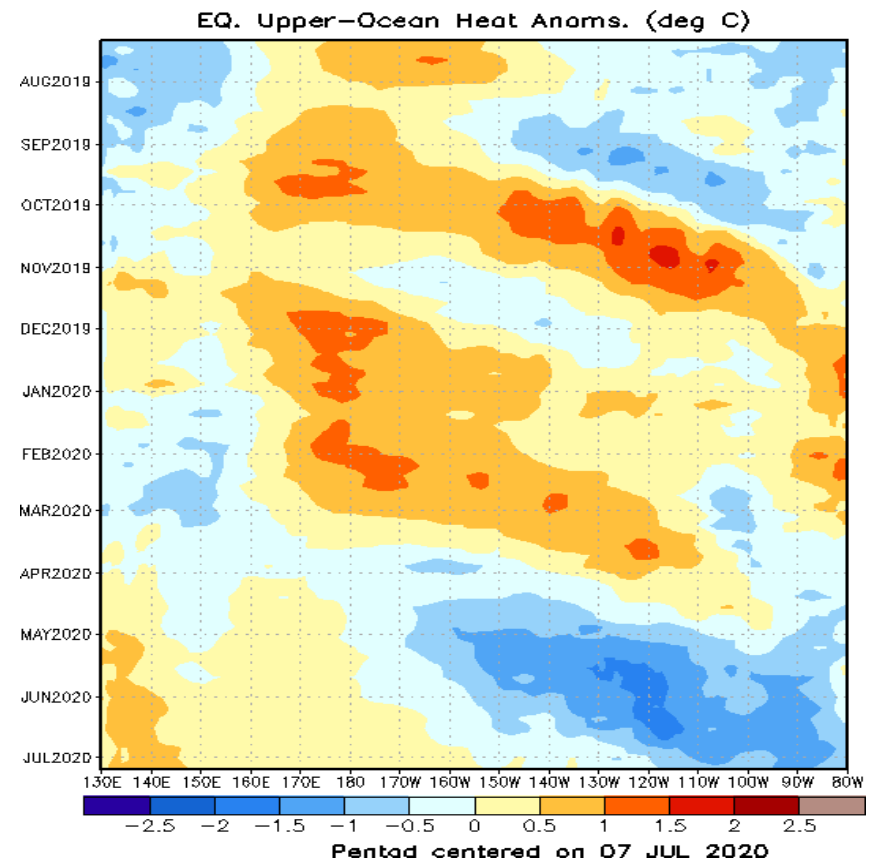
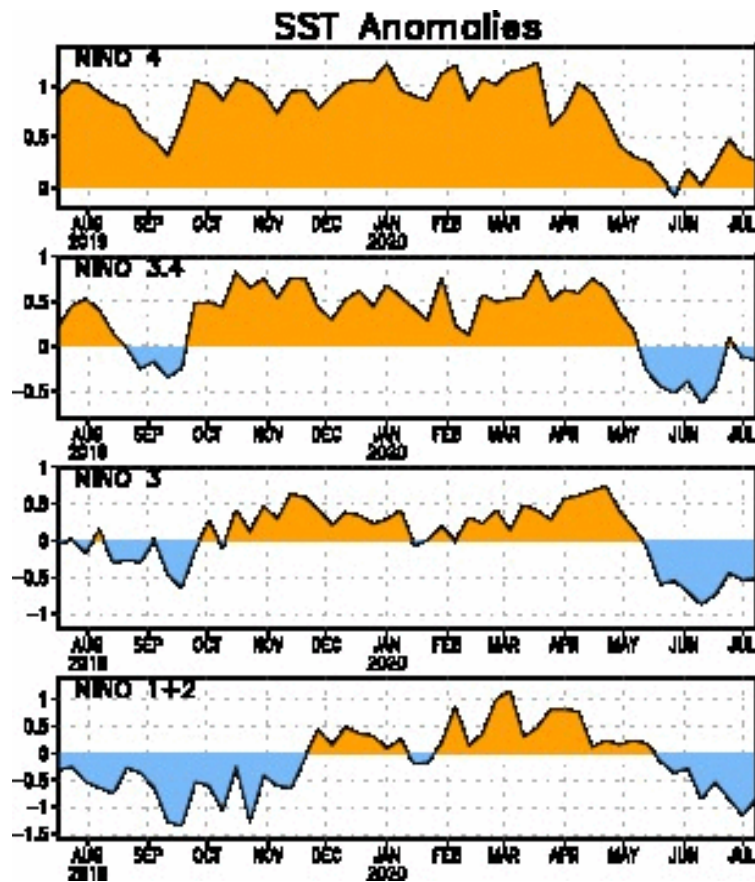
Outgoing Longwave Radiation (OLR) Anomalies

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



- Objective OLR filtering features Kelvin wave activity over the Pacific and into the western Atlantic
- Rossby wave activity and suppressed convection over the West Pacific has prevailed since mid-June.
- Enhanced convection has returned over the western Indian Ocean

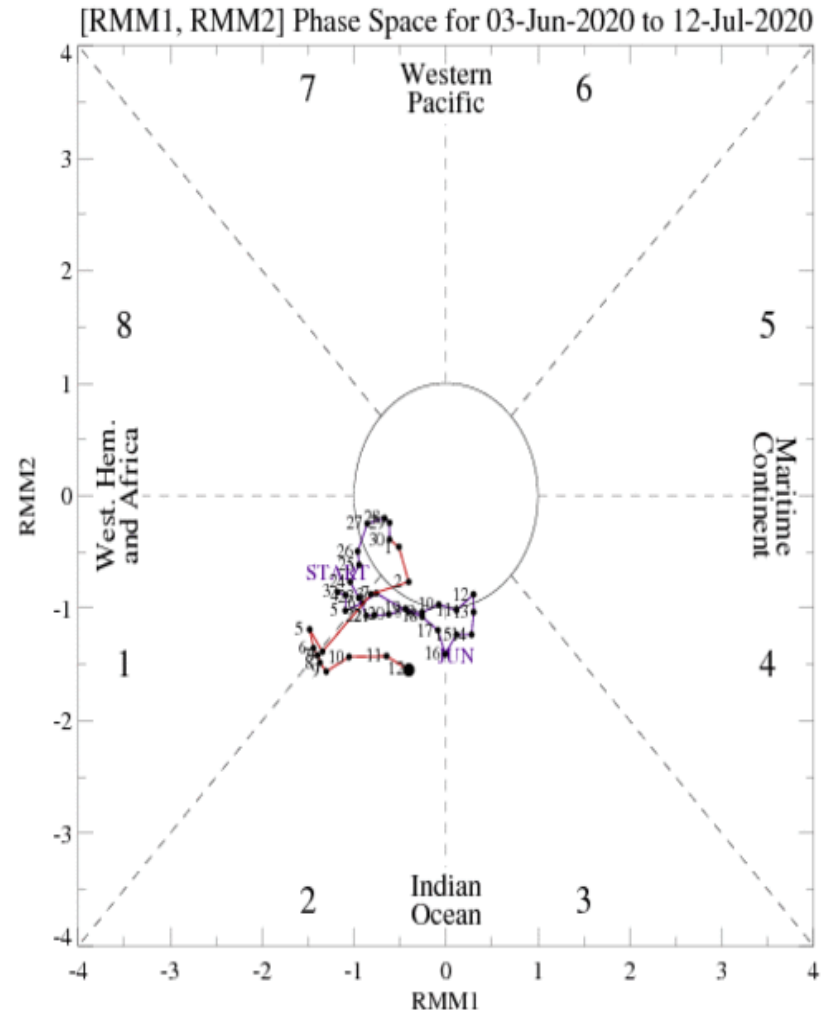
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- La Nina Watch issued by CPC last week.
- SST anomalies in the three easternmost Niño regions have been negative since mid-May.
- Upper-Ocean heat content anomalies have weakened over the eastern Pacific in recent weeks, with marginal positive anomalies continuing to extend further east of the Date Line.

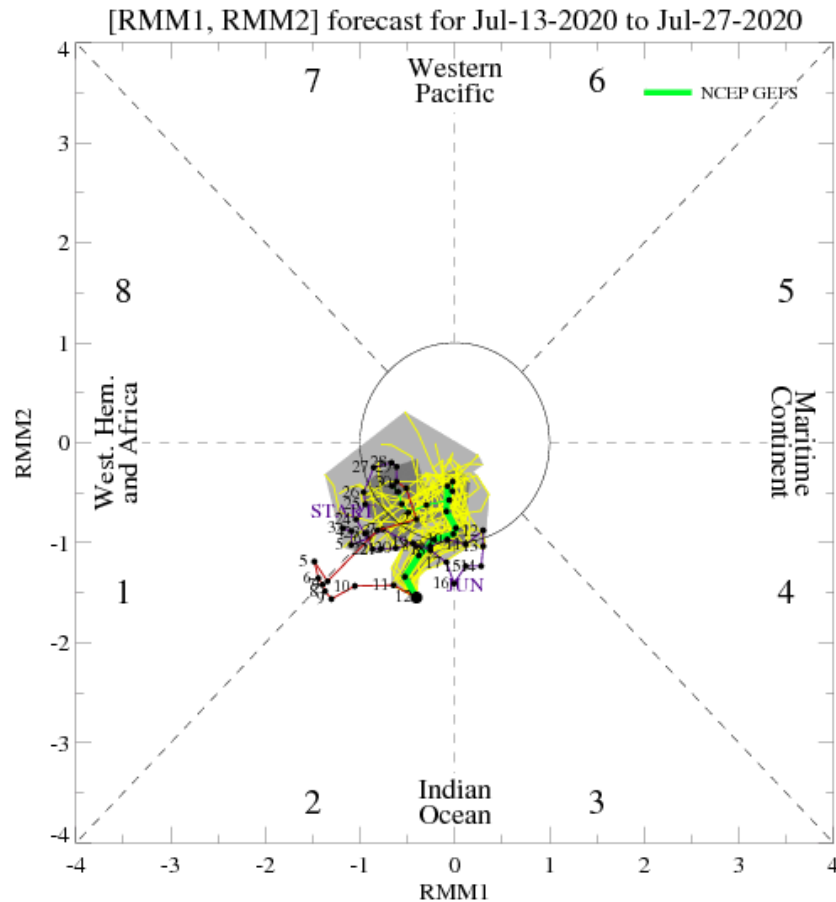
MJO Index: Recent Evolution

- Following a stationary increase in amplitude between phases 1 and 2 since early July, the RMM index indicates some eastward propagation of the intraseasonal signal in Phase 2 in recent days.

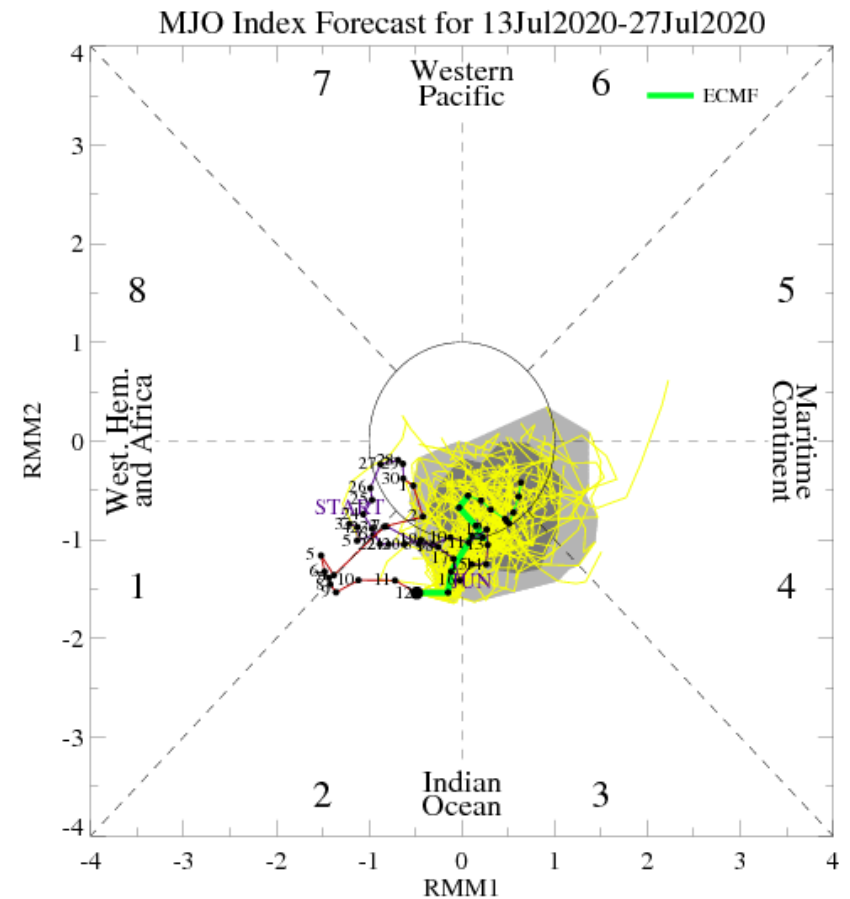


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



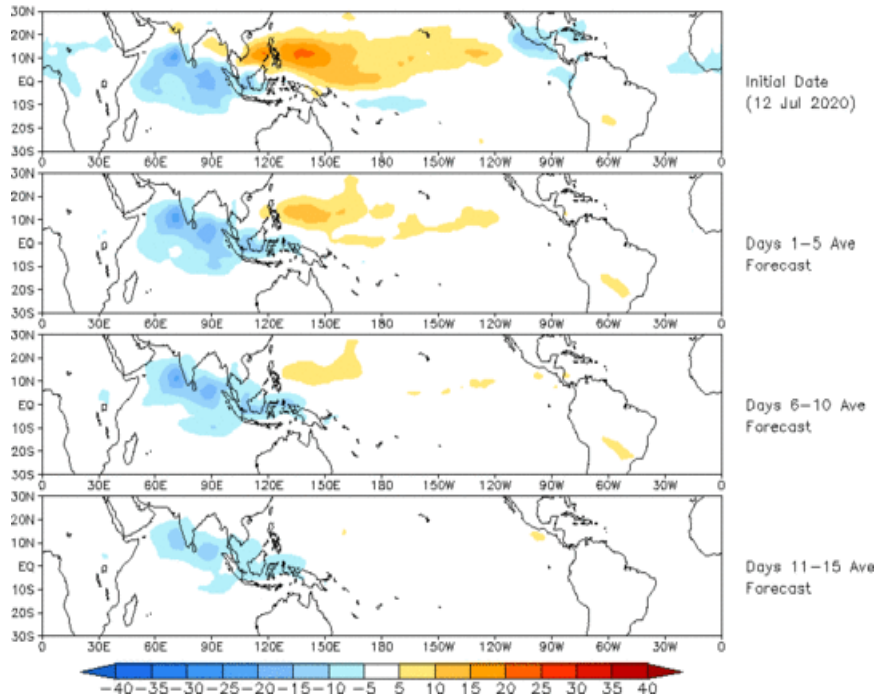
ECMWF Forecast

- Both the GEFS, CFS, and ECMWF ensemble mean forecasts favor a weakening of the signal, remaining in the RMM unit circle during late week-1 and throughout week-2.
- However, there are several ECMWF ensemble members suggesting some reemergence into phases 3 and 4 during week-2.

MJO: Constructed Analog Forecast Evolution

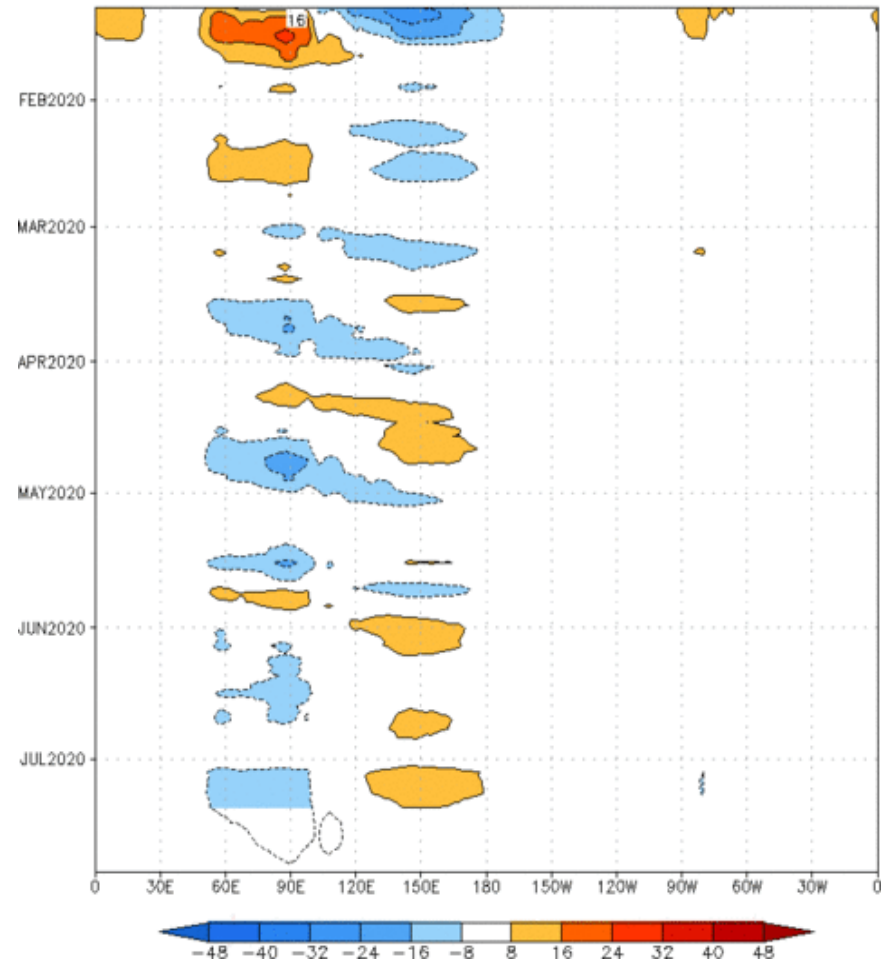
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (12 Jul 2020)



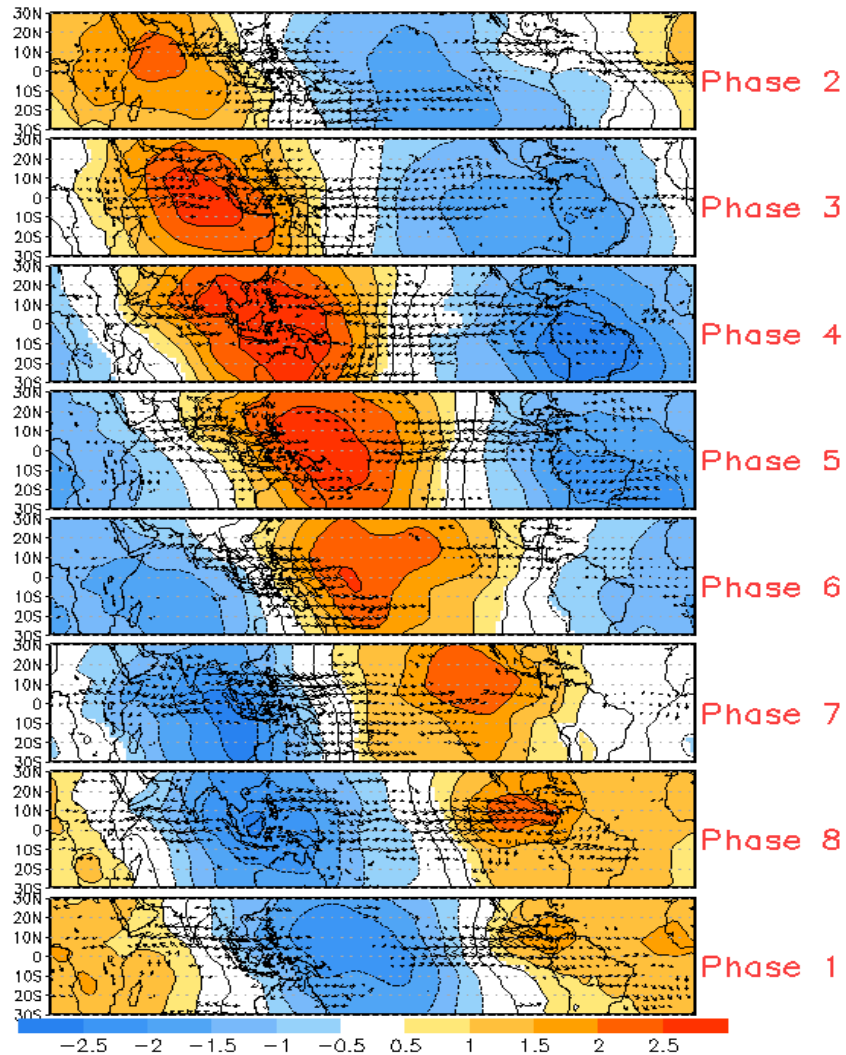
- The constructed analog model depicts a slow eastward propagation with weakening of the convective signal over the Indian Ocean. Little evidence of suppression in the forecast except over the eastern Pacific during week-2.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:11-Jan-2020 to 12-Jul-2020
The unfilled contours are CA forecast reconstructed anomaly for 15 days

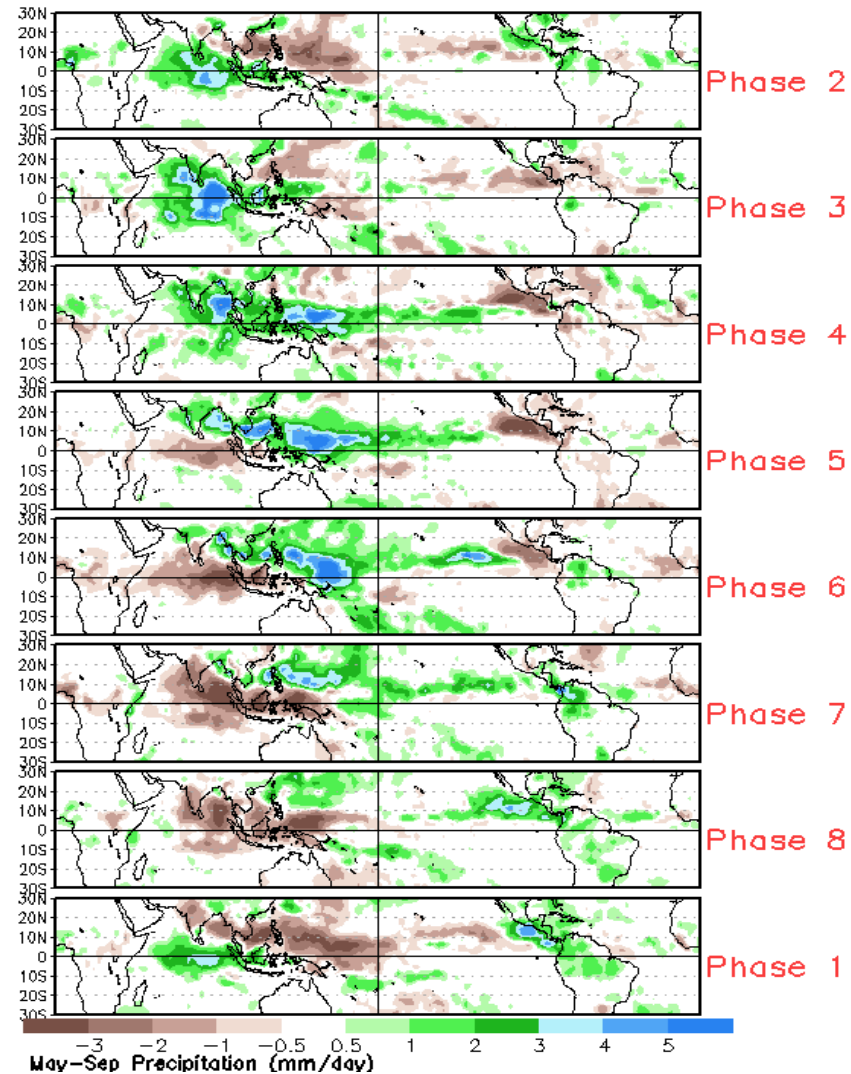


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and
Wind Anomalies



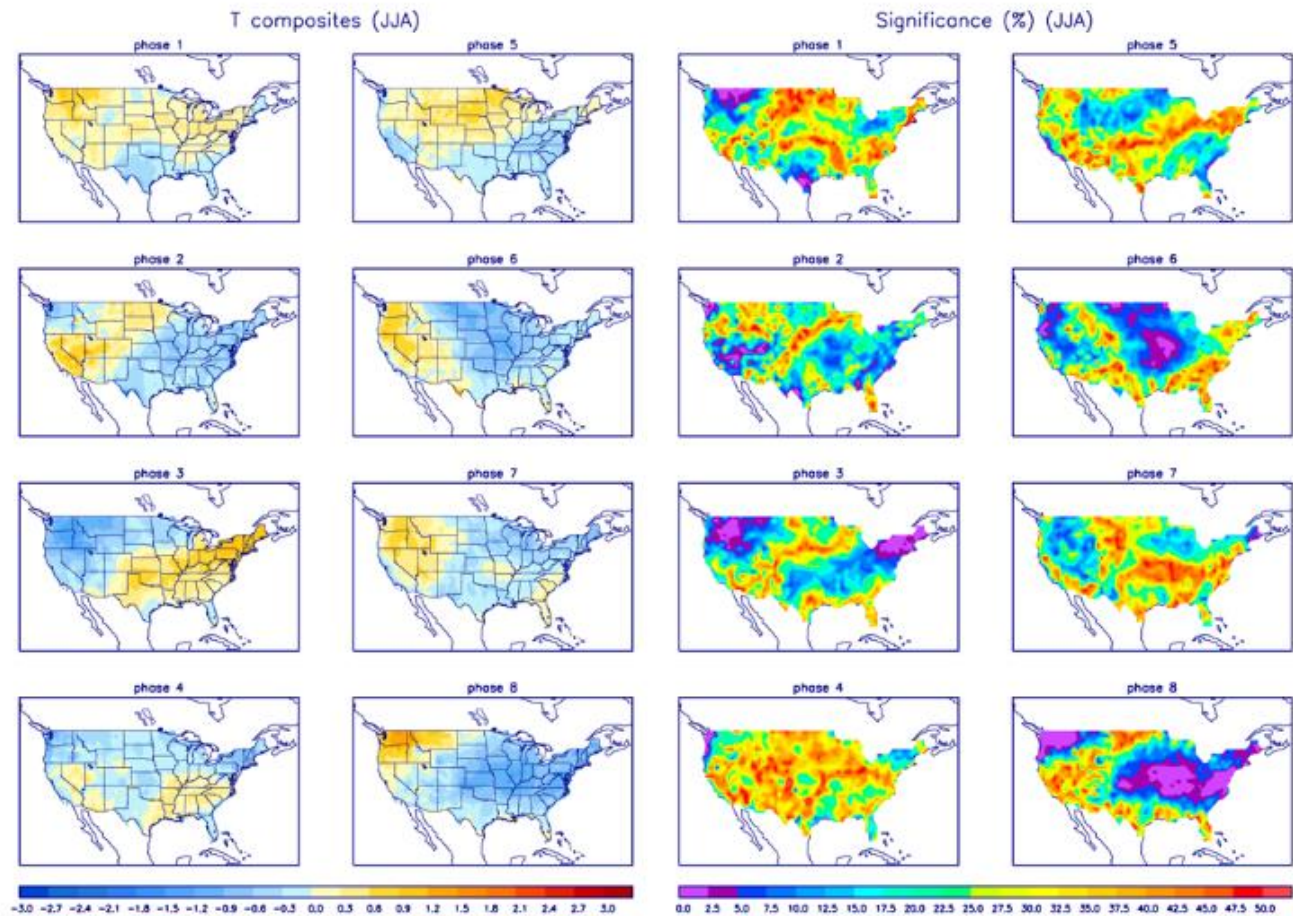
Precipitation Anomalies



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.

