

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



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

Overview

- The MJO signal became incoherent over the past week.
- The signal broke down into a slow-moving enhanced signal persisting over Africa and the western Indian Ocean and a robust convectively coupled Kelvin wave over the Pacific.
- Dynamical models remain mixed regarding future evolution of the MJO signal.
- A Pacific Kelvin wave may open a period of increased favorability for tropical cyclogenesis over both the East Pacific and western Atlantic basins.

A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:

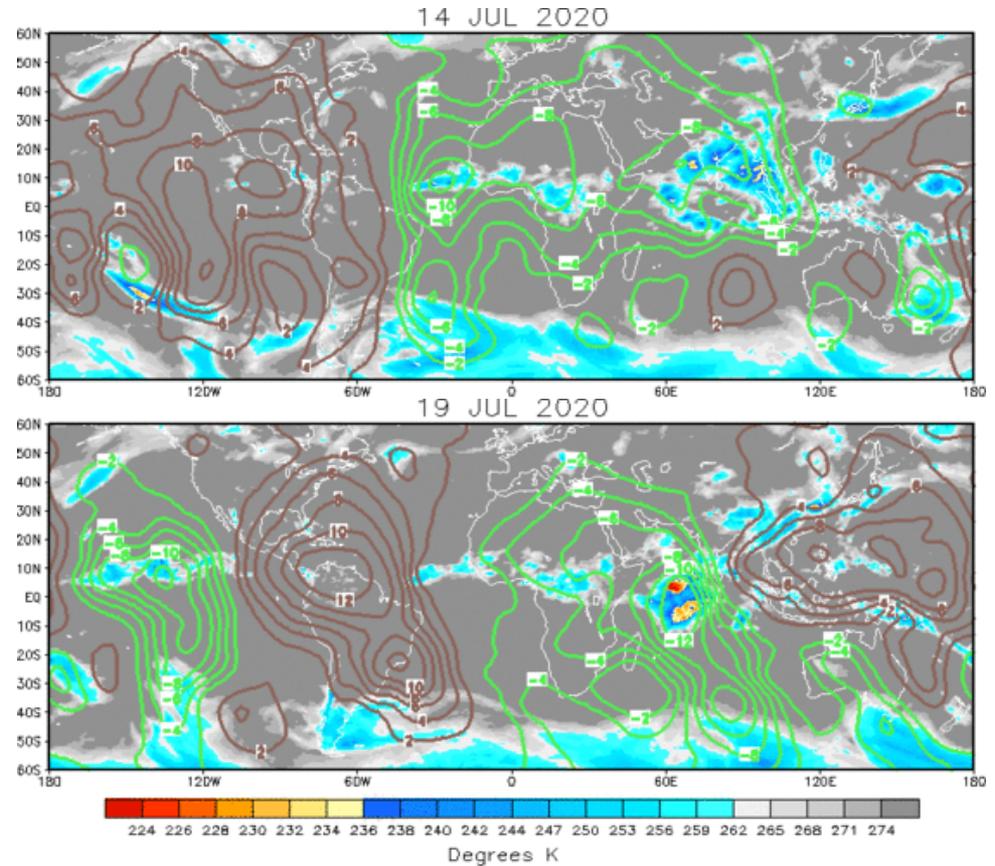
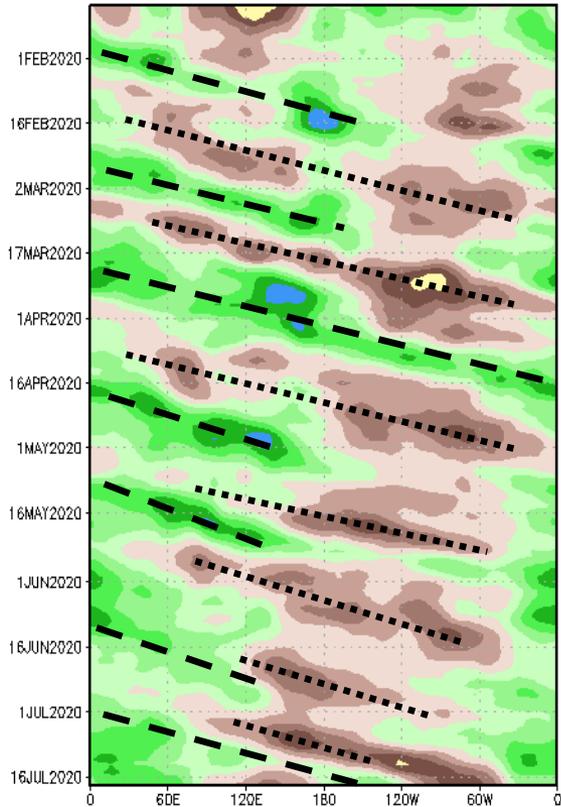
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

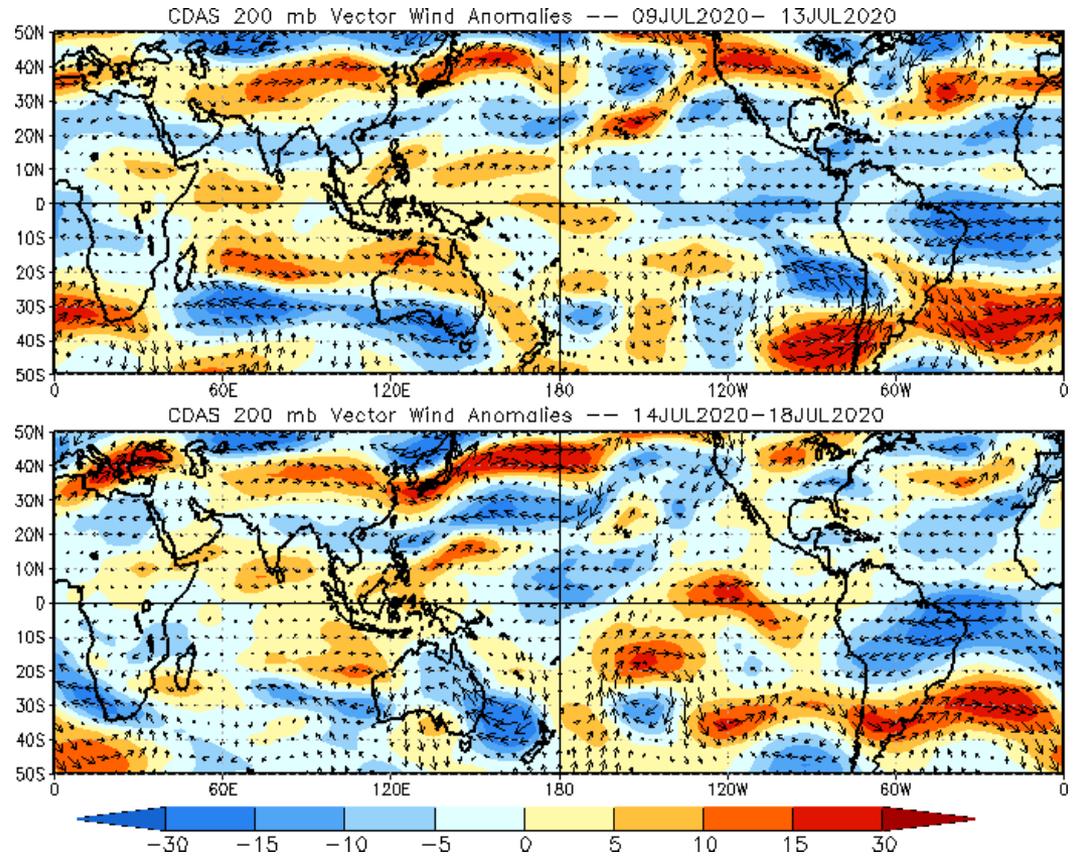
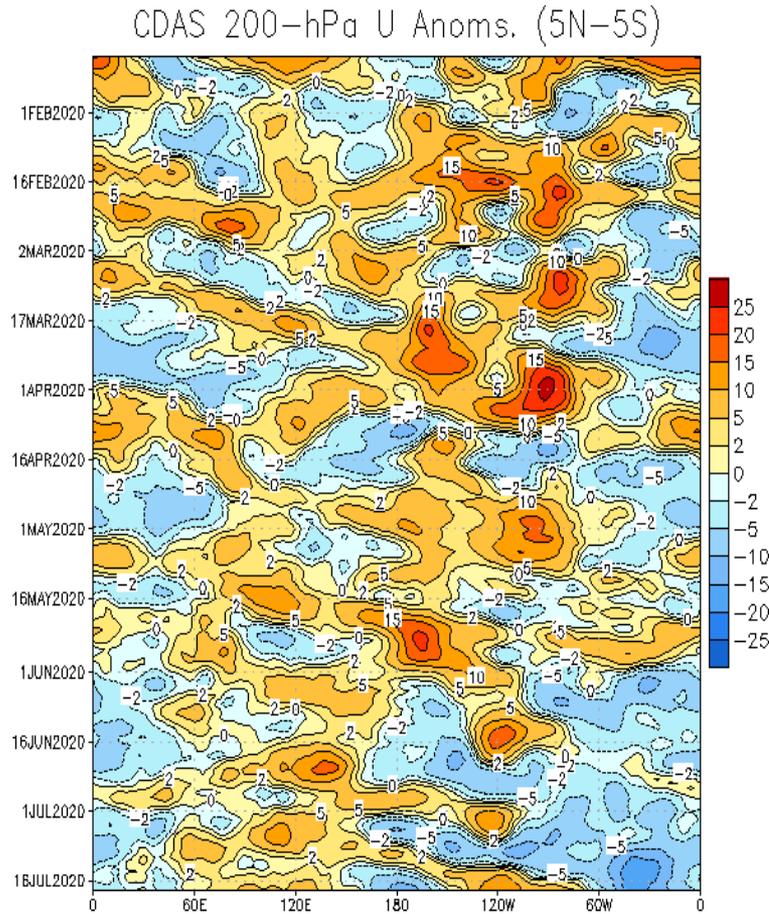
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- An organized upper-level Wave-1 pattern in mid-July quickly broke down into a Wave-2 asymmetry
- There appear to be two competing signals: A robust convectively coupled Kelvin wave over the Pacific, and a slower-moving signal over Africa and the western Indian Ocean.
- A low-frequency suppressed signal has moved slowly westward across the Pacific since the Boreal Spring.

200-hPa Wind Anomalies

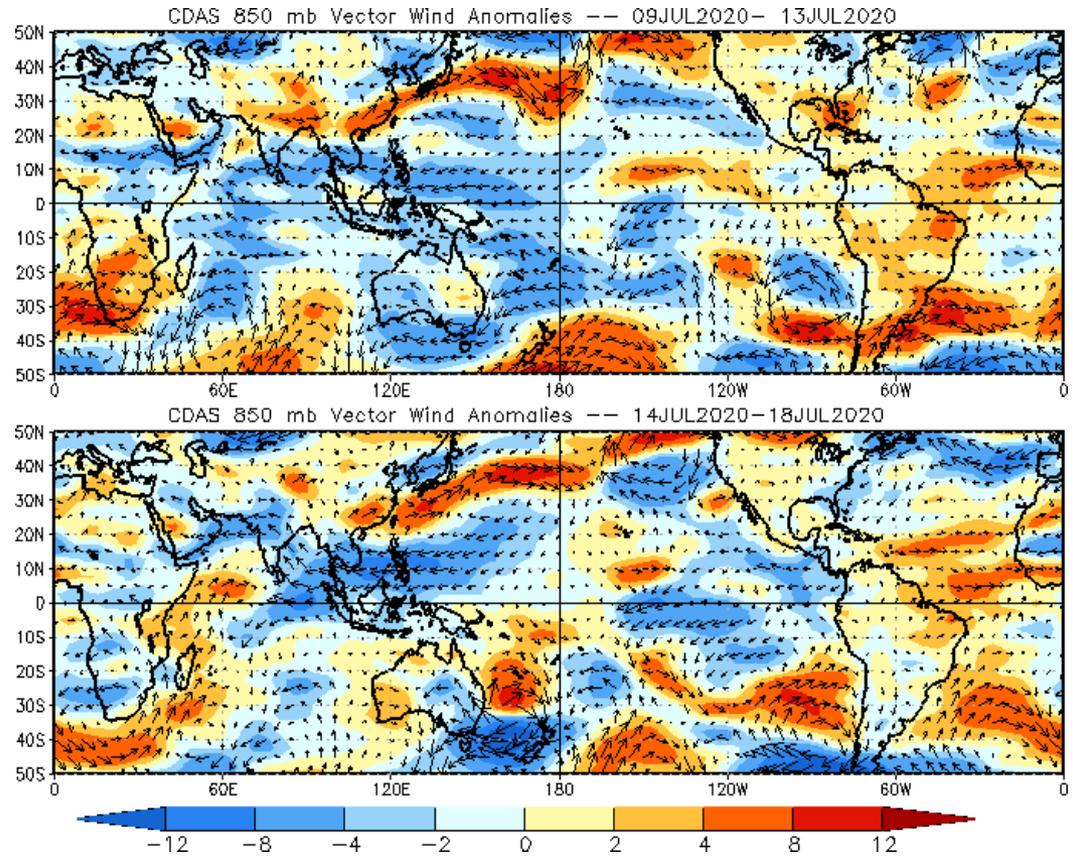
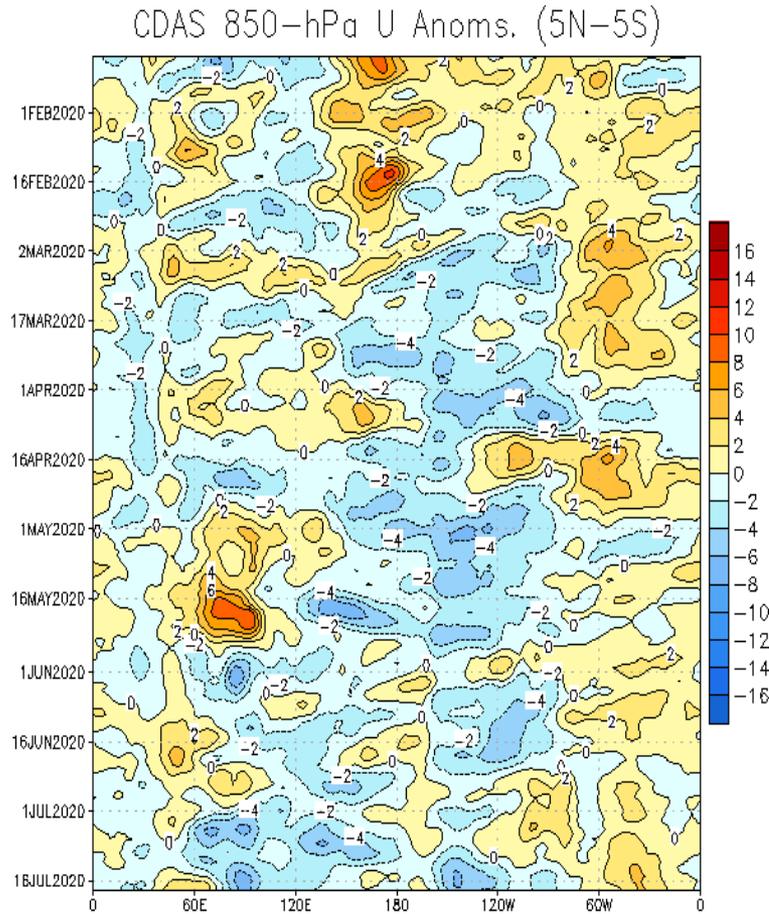
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Westerlies (easterlies) have persisted over the Indian Ocean and Maritime Continent (South America and tropical Atlantic).
- Kelvin wave activity is evident over the east-central Pacific.

850-hPa Wind Anomalies

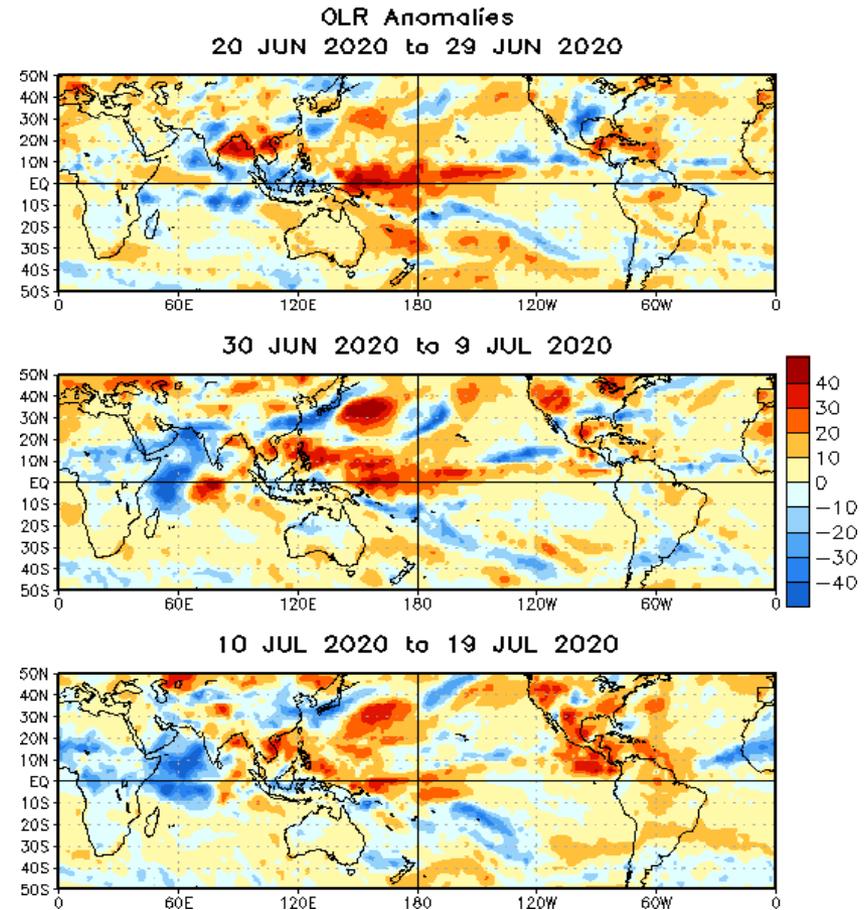
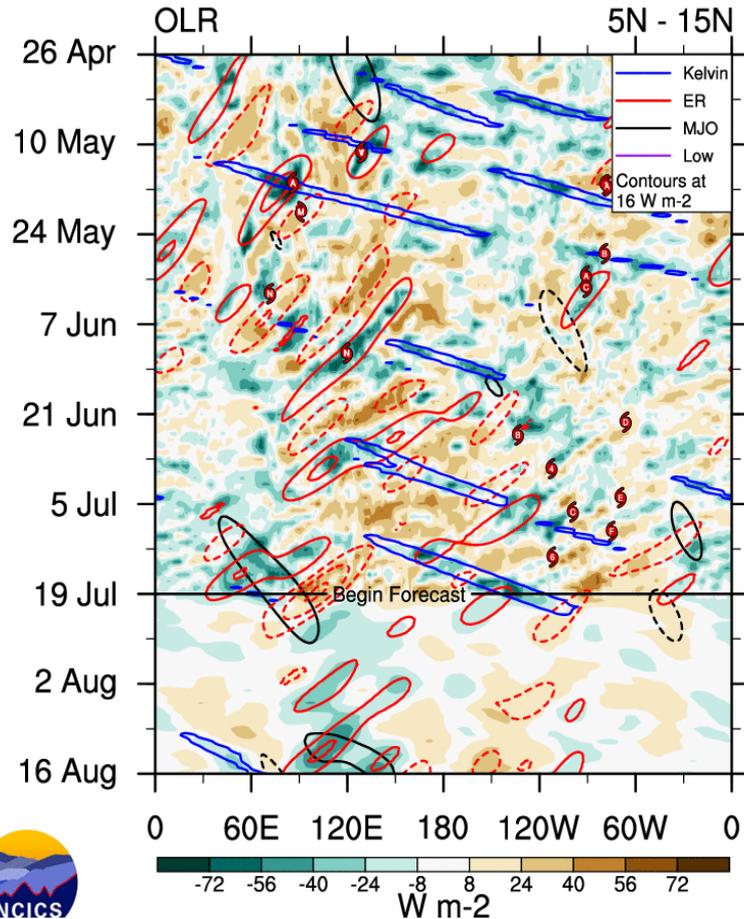
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Robust easterly anomalies persist over the Northwest Pacific and the Monsoon areas of South and Southeast Asia.
- The Kelvin wave over the Pacific is less evident at the lower levels of the atmosphere, with enhanced trades persisting over the eastern Pacific.

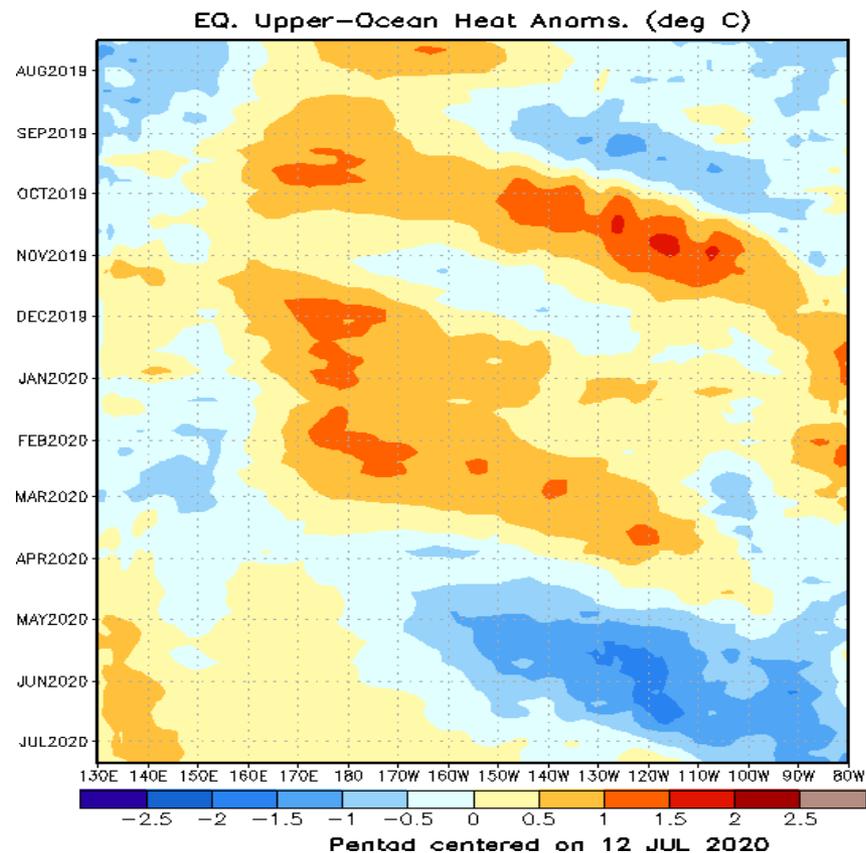
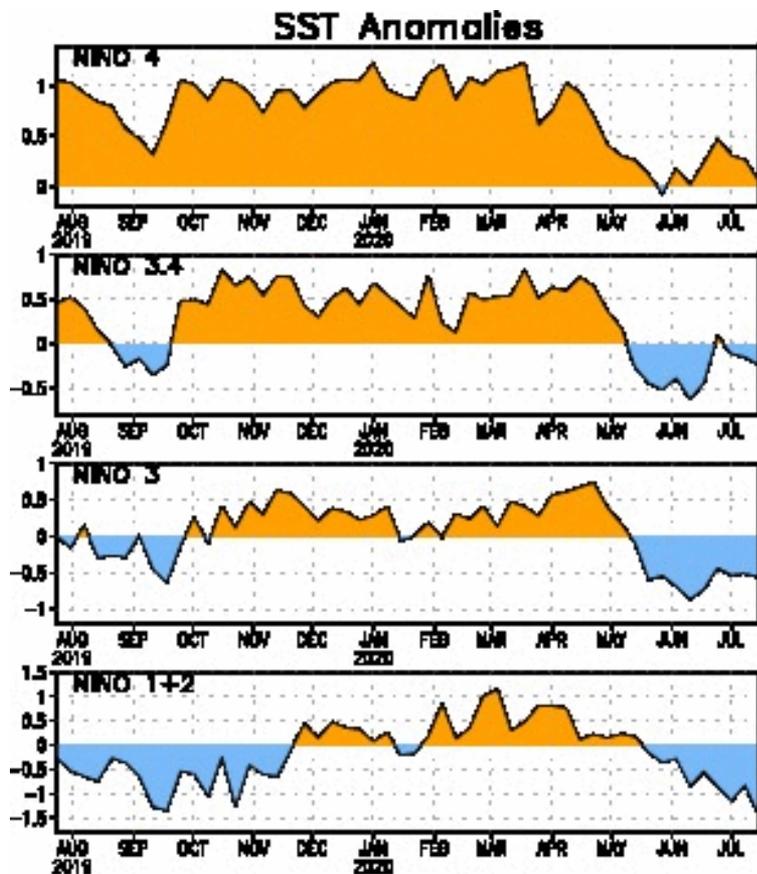
Outgoing Longwave Radiation (OLR) Anomalies

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 Pacific.

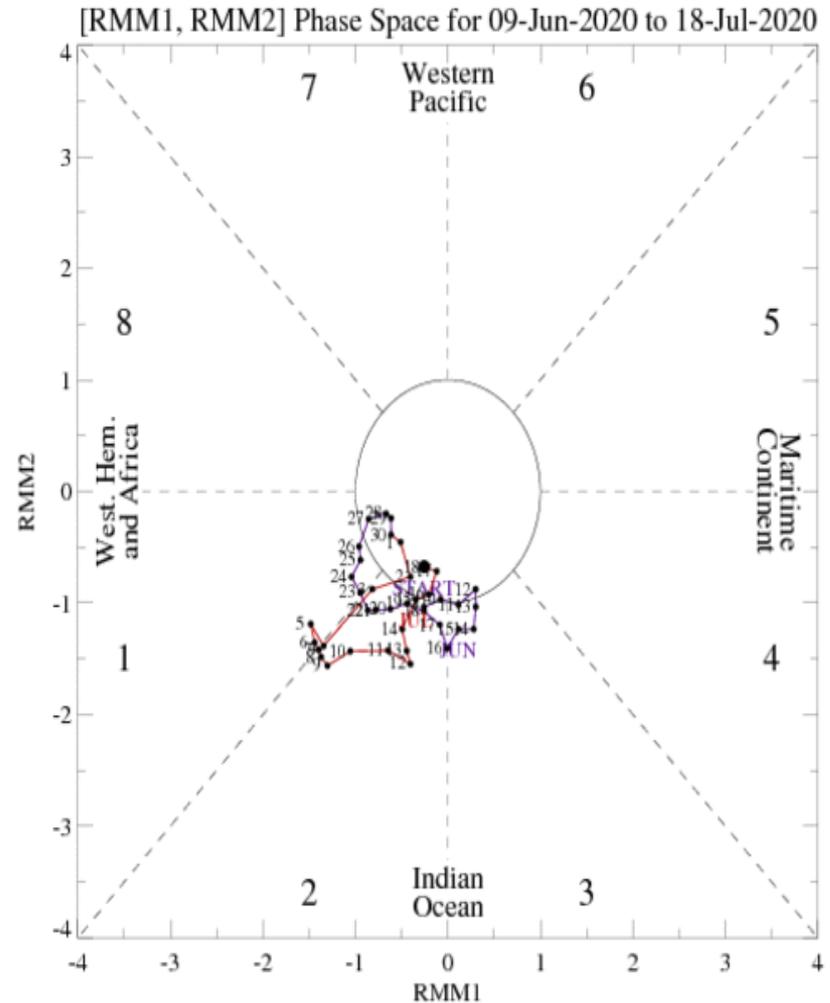
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- La Nina Watch issued by CPC last week.
- SST anomalies in the three easternmost Niño regions have been 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

- Following several days of eastward propagation, the RMM index weakened last week due to interference from Kelvin wave activity over the Pacific.

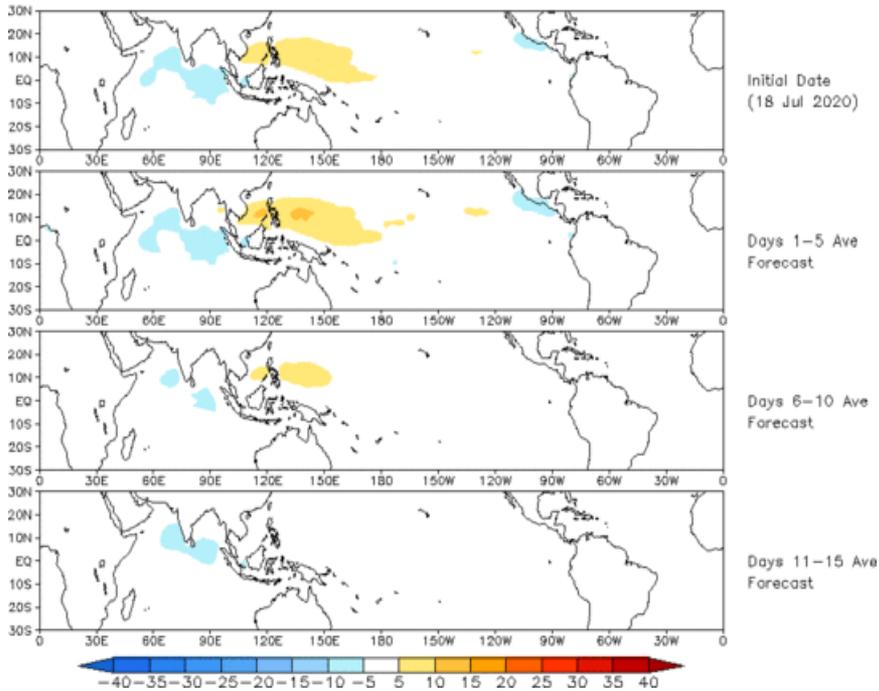


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO: Constructed Analog Forecast Evolution

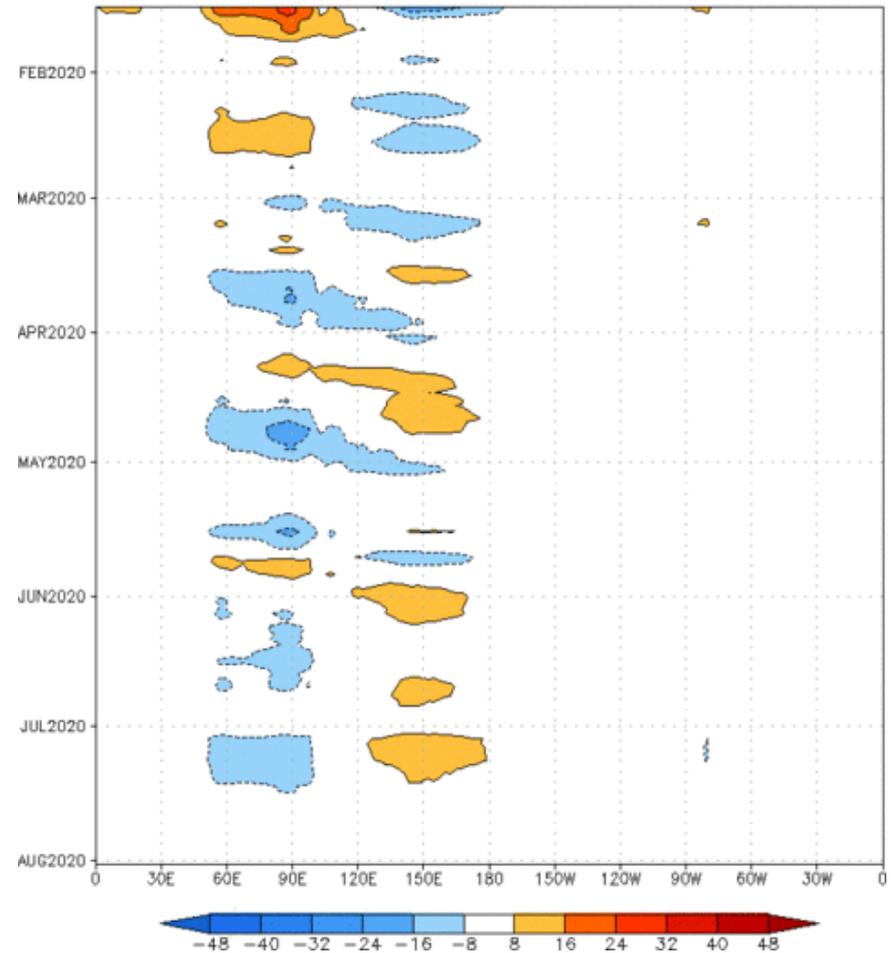
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (18 Jul 2020)



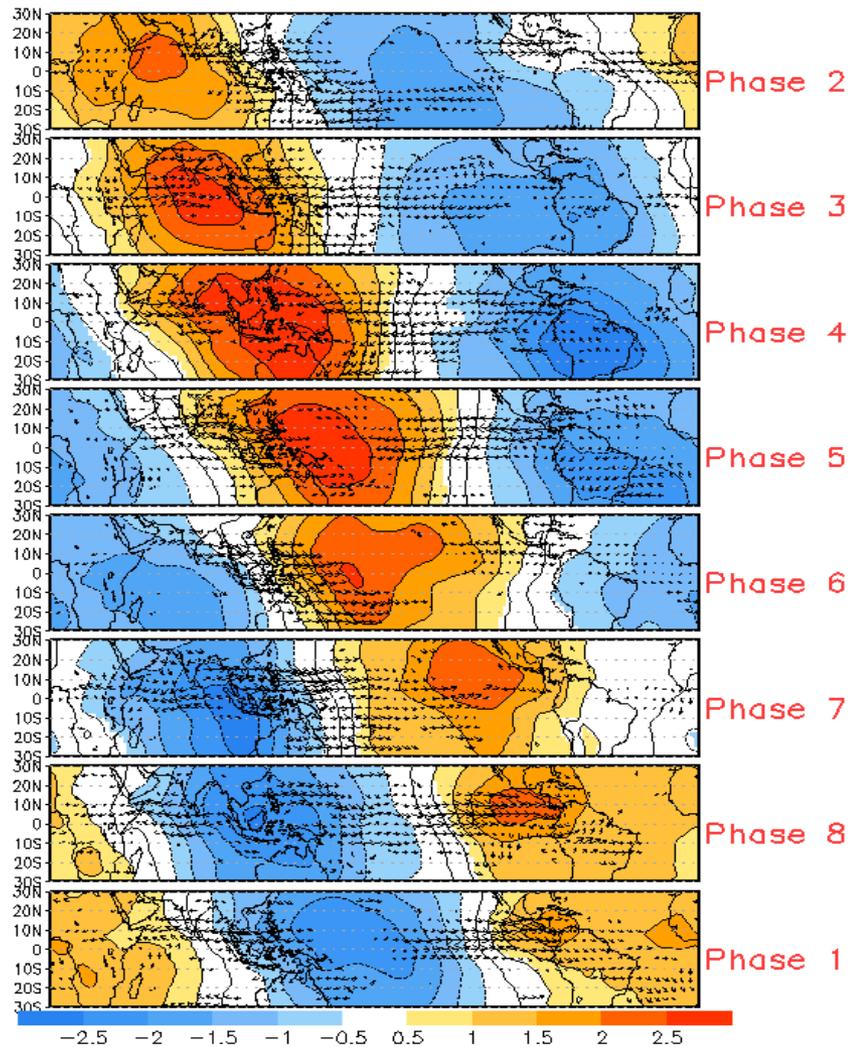
- The constructed analog model depicts little to no MJO-associated OLR anomalies over the next two weeks.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:17-Jan-2020 to 18-Jul-2020
The unfilled contours are CA forecast reconstructed anomaly for 15 days

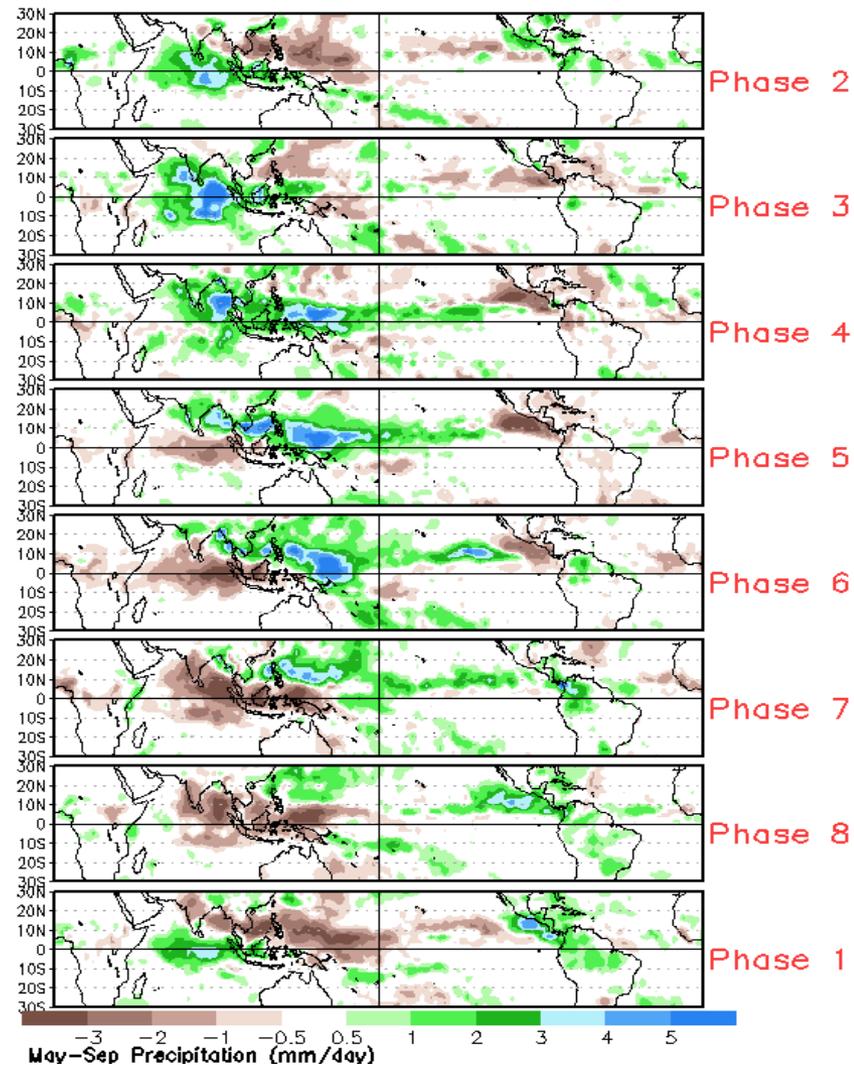


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



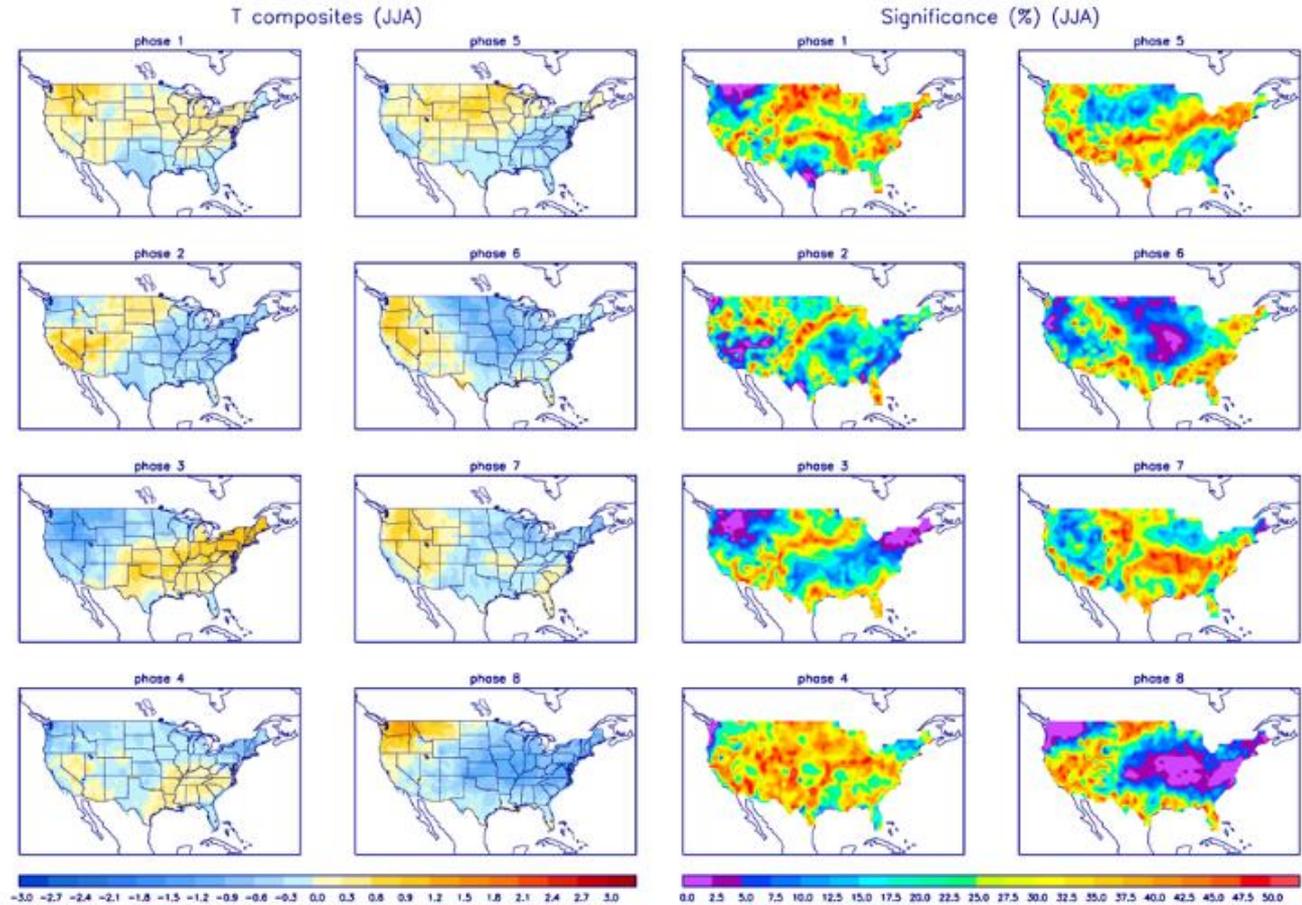
Precipitation Anomalies



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.

