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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
8 July 2019

Overview

- The MJO weakened during the past week.

- Equatorial Rossby wave activity caused the RMM index to strengthen in Phase 1 during the past several days, but this is unlikely to be tied to a bona-fide MJO event.

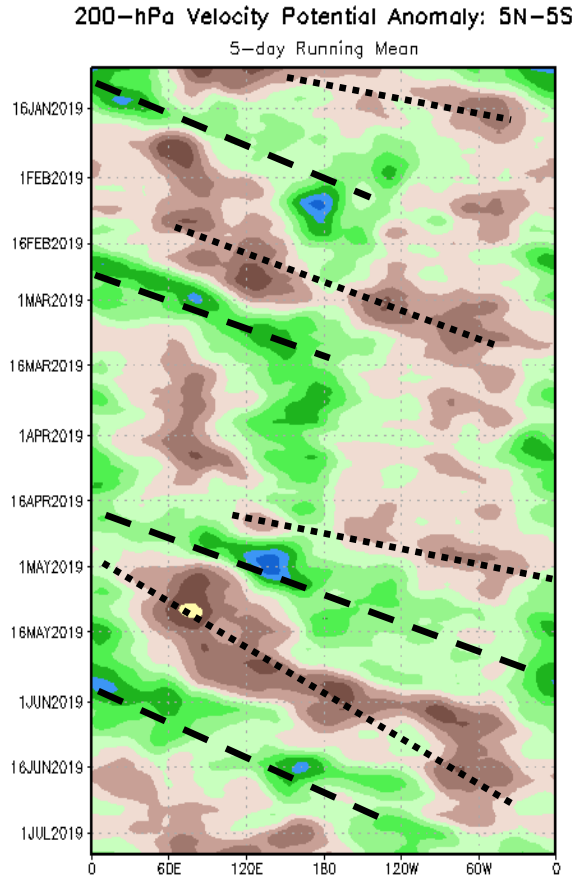
- Dynamical guidance suggests that as the RMM index will once again weaken as the ER wave moves westward.

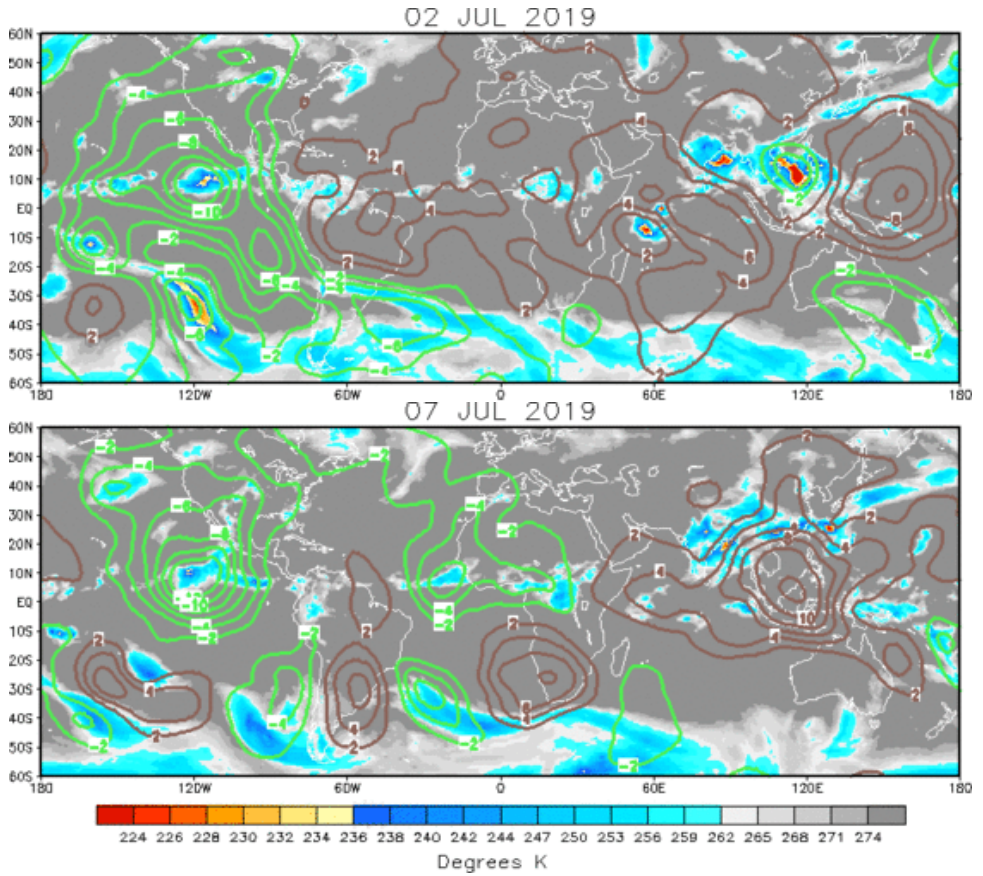
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

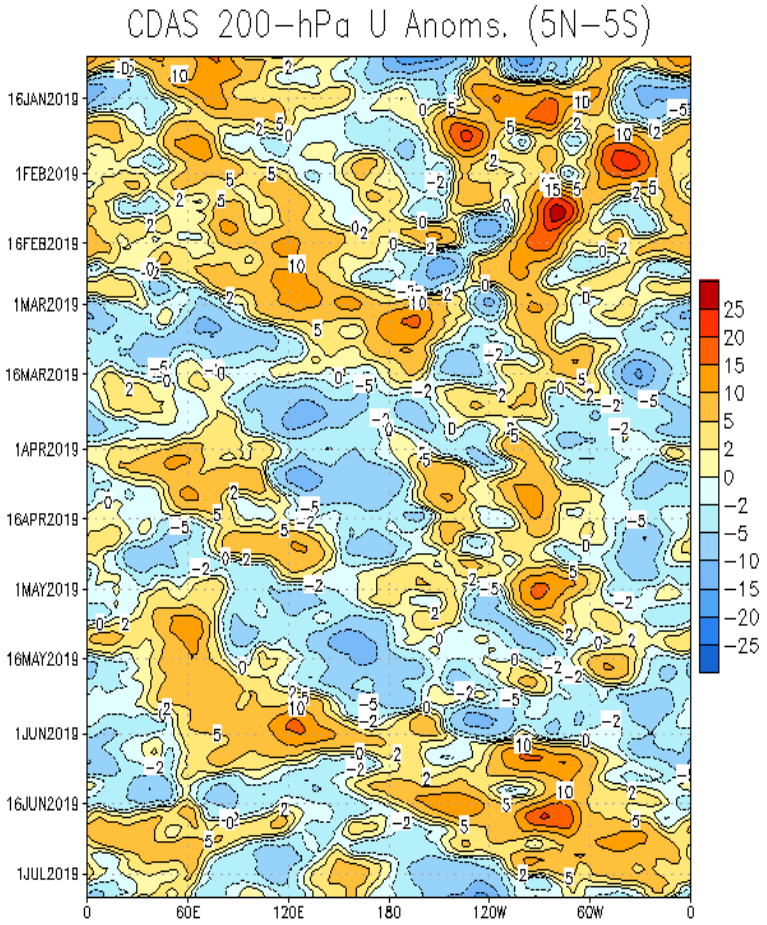


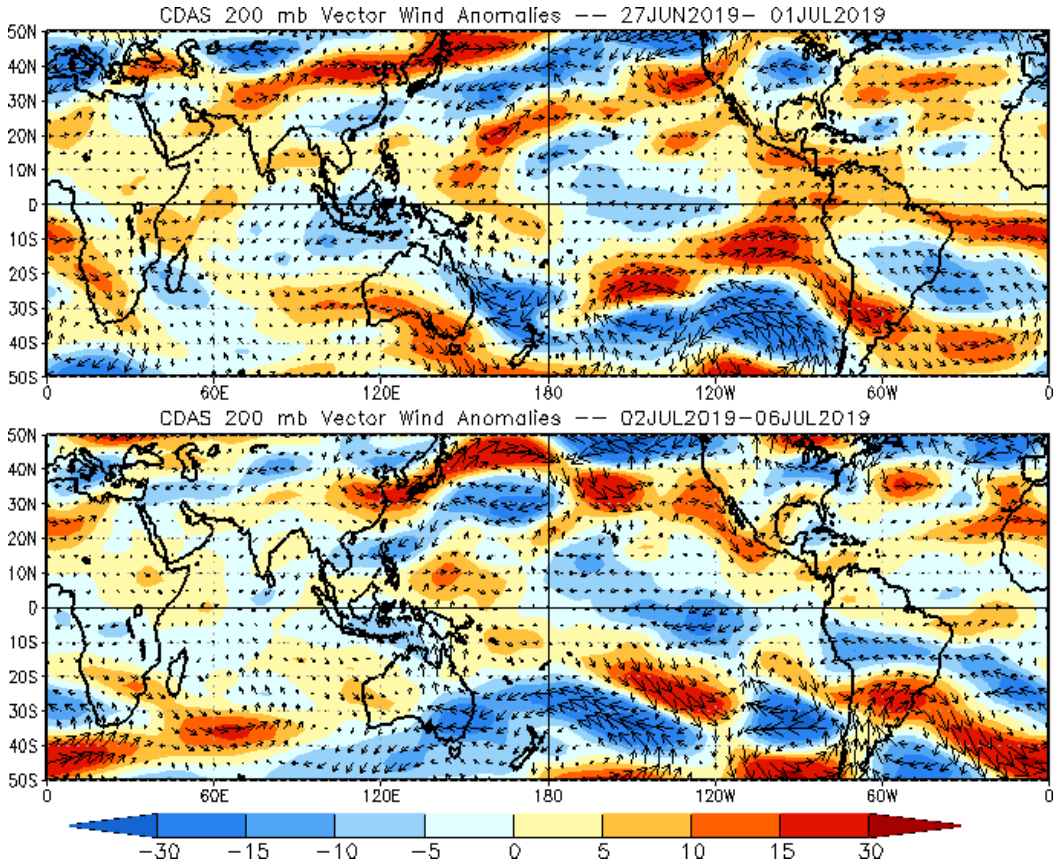


- The MJO has been active since December except for a 1.5 month pause during March and early April.
- The latest MJO event began in mid-April and was influenced by westward moving features over the Indian Ocean in early June before returning to the Maritime Continent and West Pacific.
- The MJO weakened during the past week which led to a noisier upper-level velocity potential pattern.

200-hPa Wind Anomalies

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

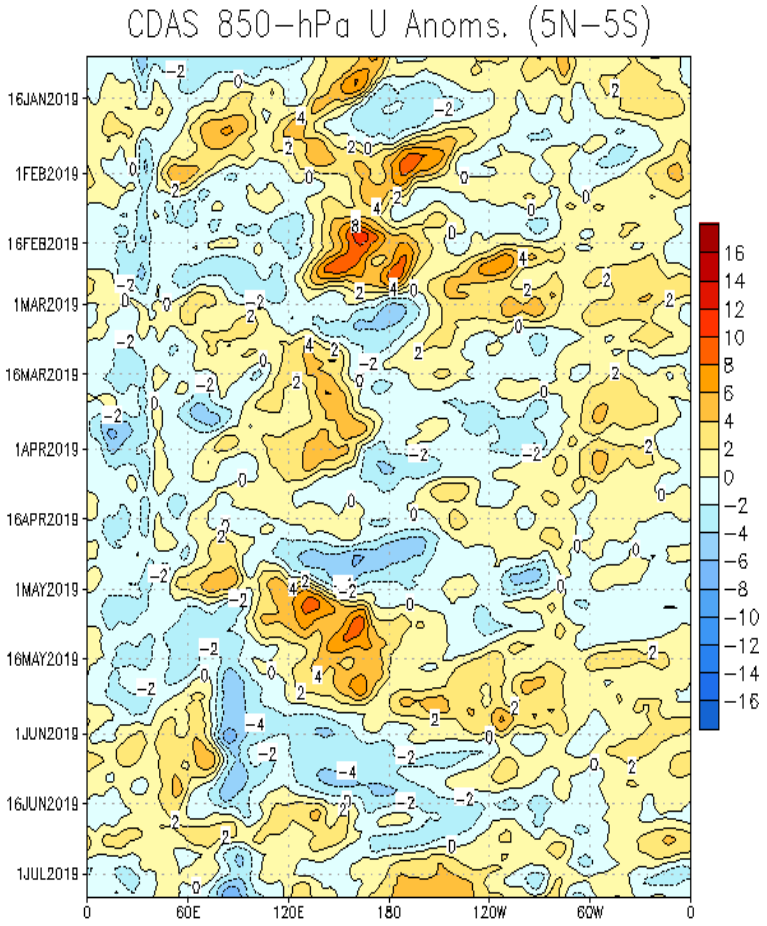


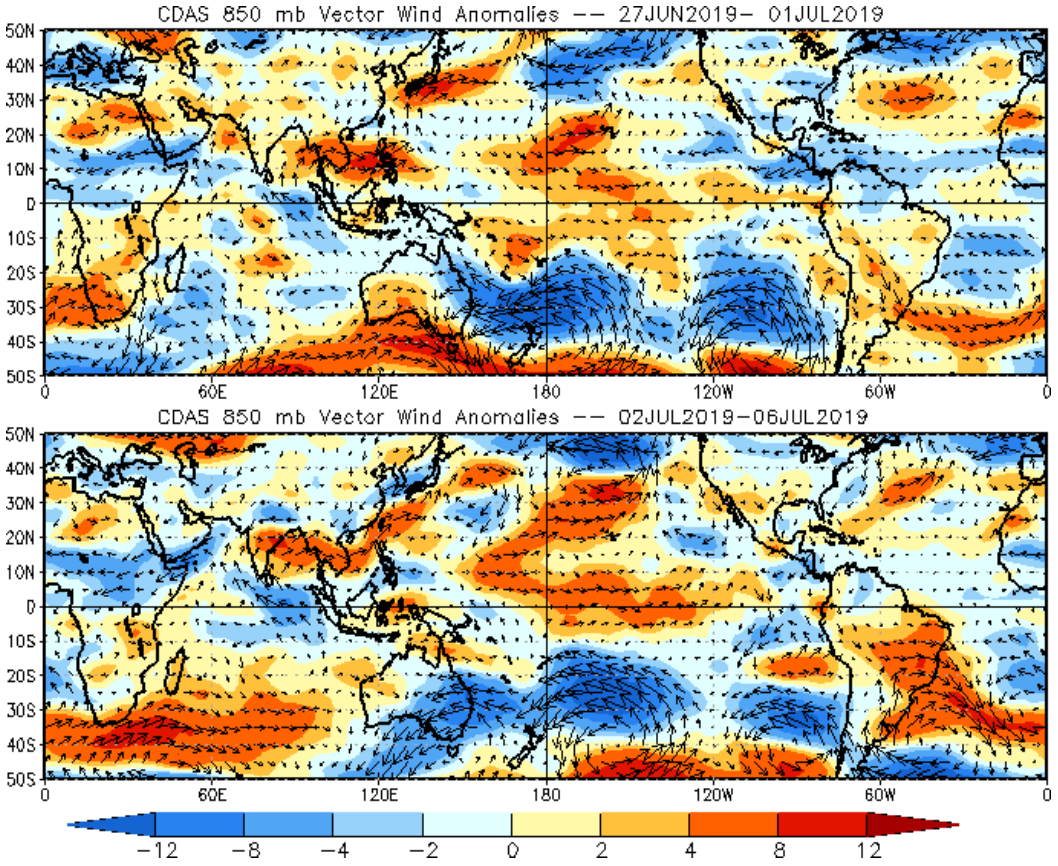


- An envelope of westerly anomalies associated with the MJO continued propagating eastward across the Pacific to the Atlantic during late June.
- Anomalous upper-level easterlies have propagated eastward through the Pacific during the past several weeks.
- There is evidence of upper-level mid-latitude Rossby wave breaking just east of the Date Line during the past week.

850-hPa Wind Anomalies

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

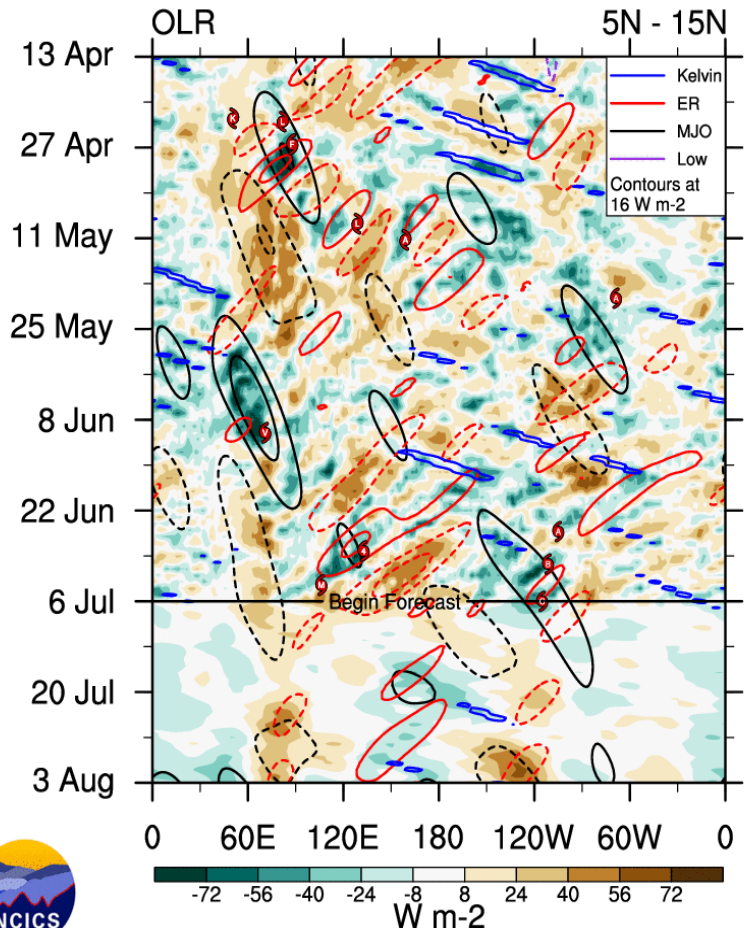


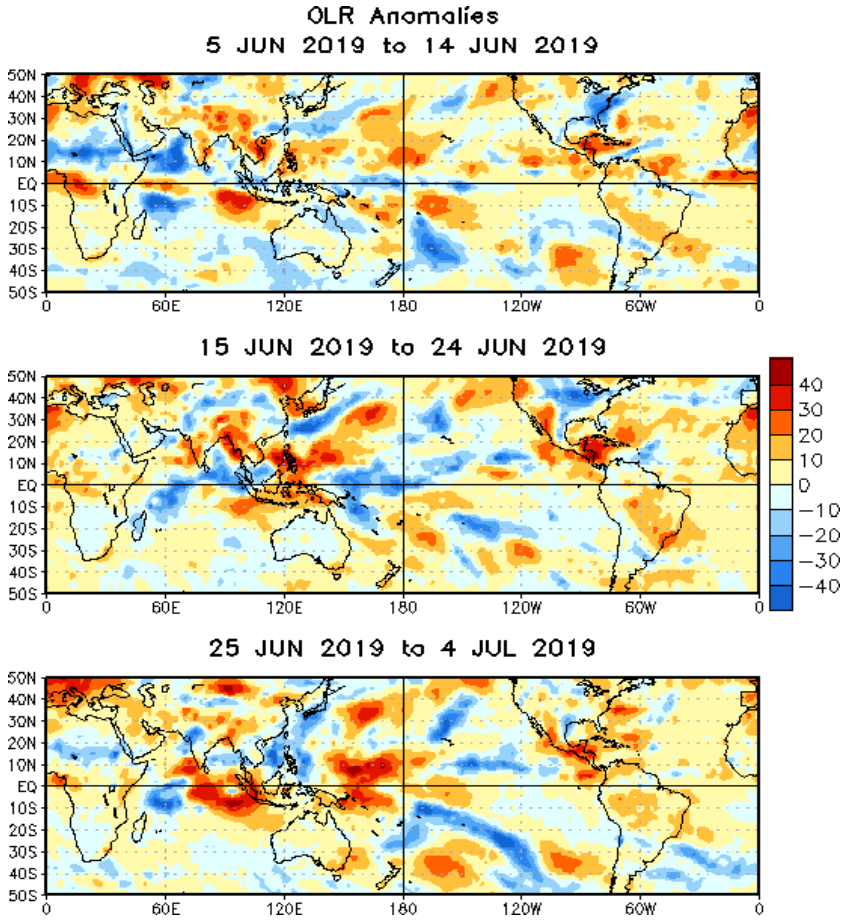


- There was no strong westerly wind burst signal associated with the most recent MJO event.
- Anomalous low-level westerlies have gotten stronger along, and just north of, the equator during the past week.

Outgoing Longwave Radiation (OLR) Anomalies

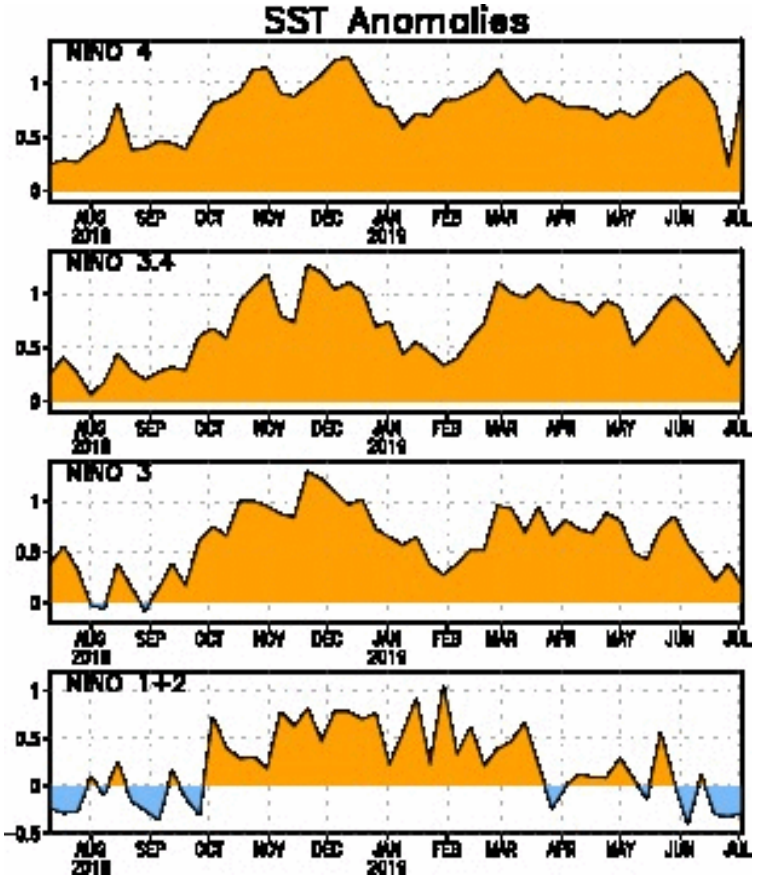
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

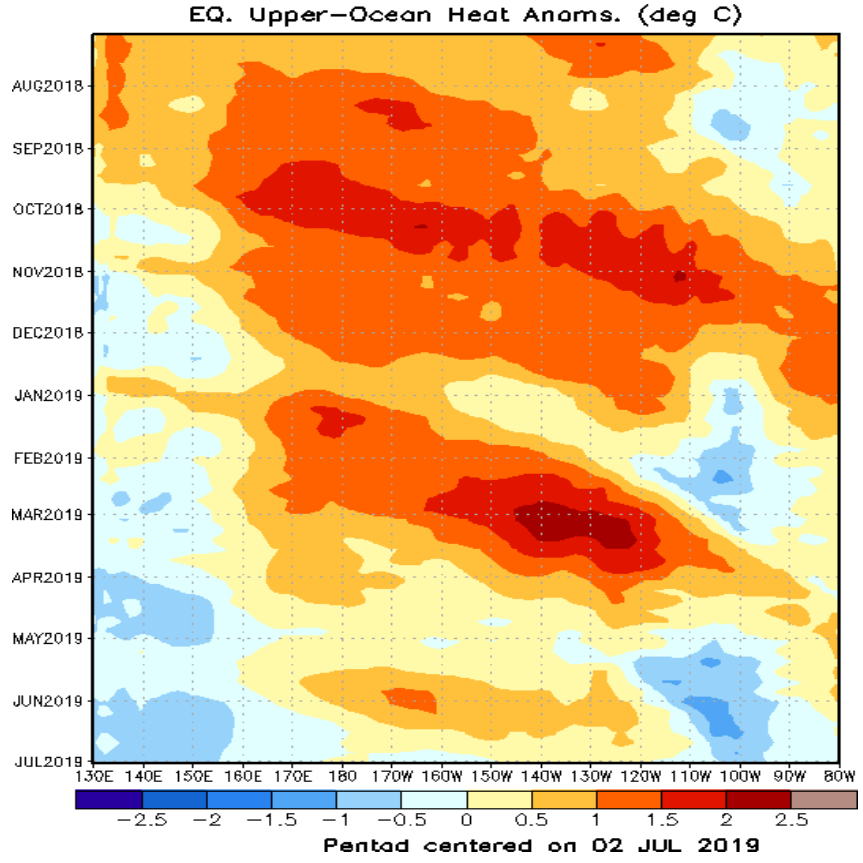




- Any MJO-related convective signal is difficult to detect, as areas of anomalous convection are dominated by Kelvin and Rossby wave activity.
- Recent drying over the central Pacific appears most closely tied to the suppressed phase of an equatorial Rossby wave.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

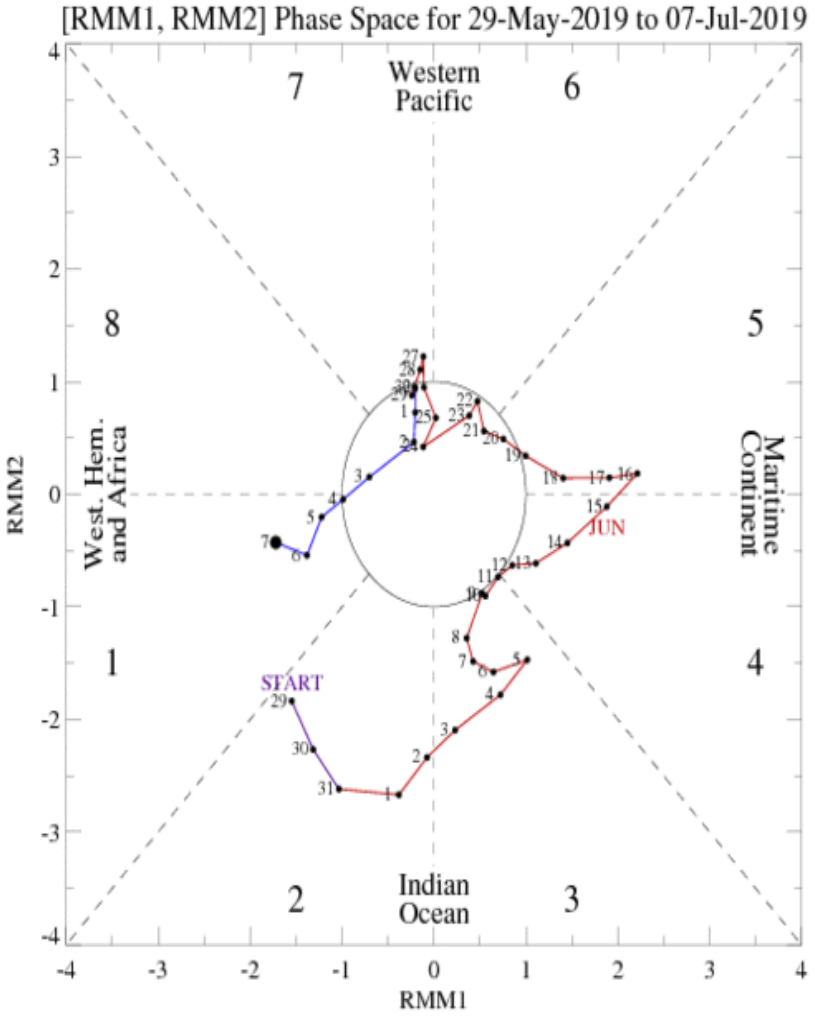




- Low amplitude SST anomalies remain above climatology across much of the equatorial Central and East Pacific, consistent with the ongoing El Niño event.
- A downwelling Kelvin wave event is evident over the central and eastern Pacific since mid-May, but its amplitude is weaker than what was observed in previous events. Overall, upper-ocean heat content has been on a steady decline over the past several months.

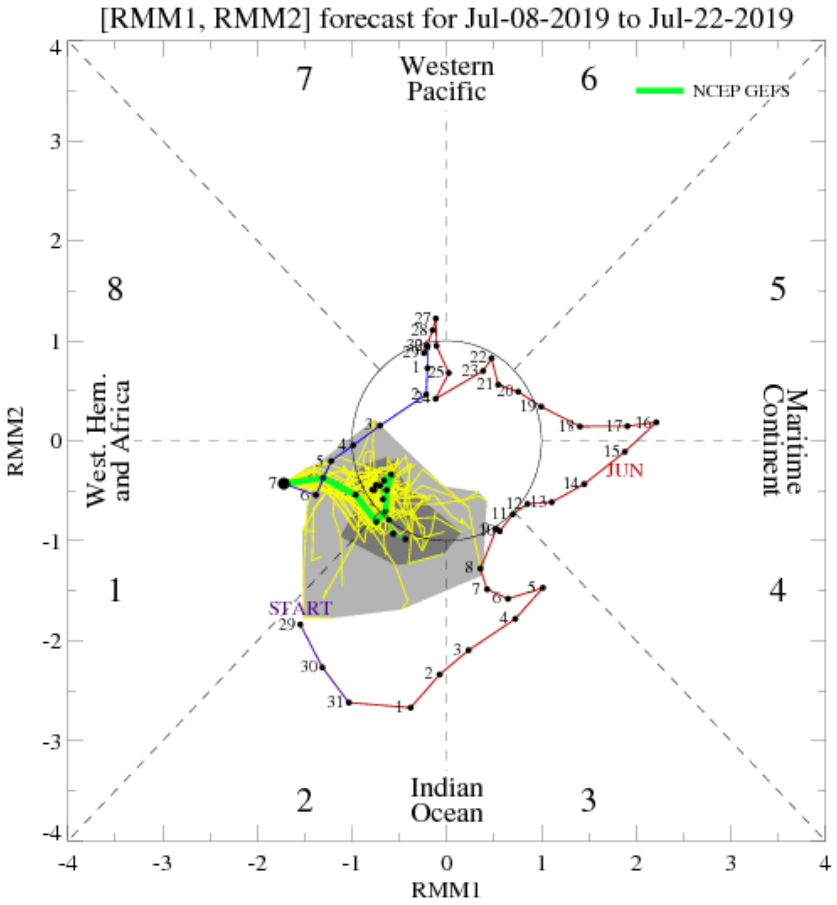
MJO Index: Recent Evolution

- The MJO weakened early last week but has begun to strengthen again, in an RMM sense.
- The RMM index places the MJO in Phase 1, but this is likely due to Rossby wave intereference.

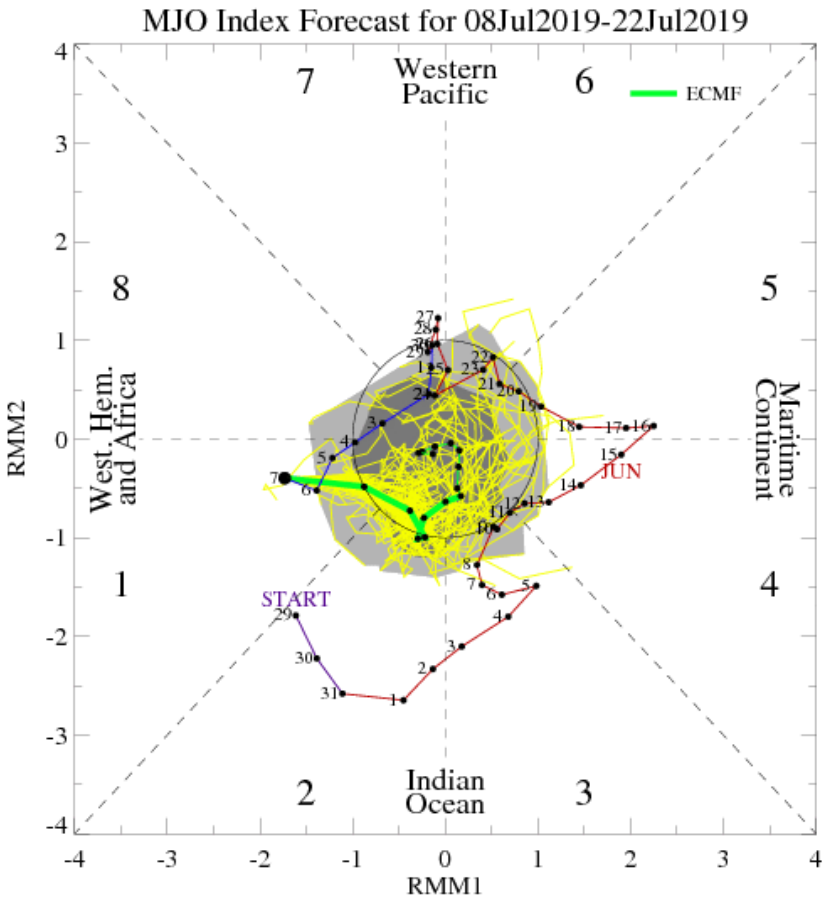


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

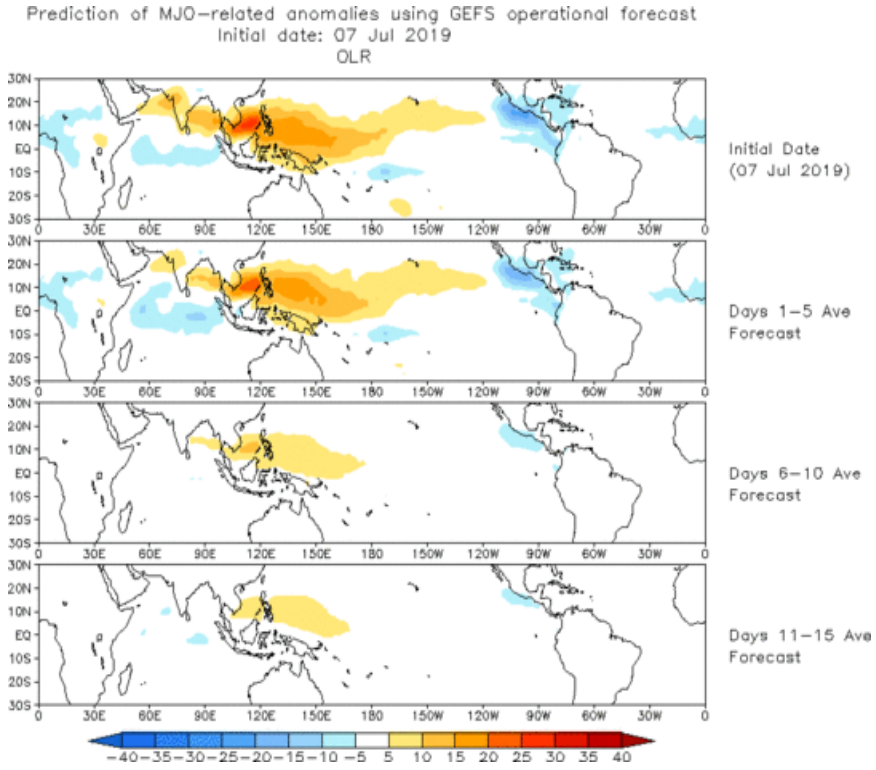


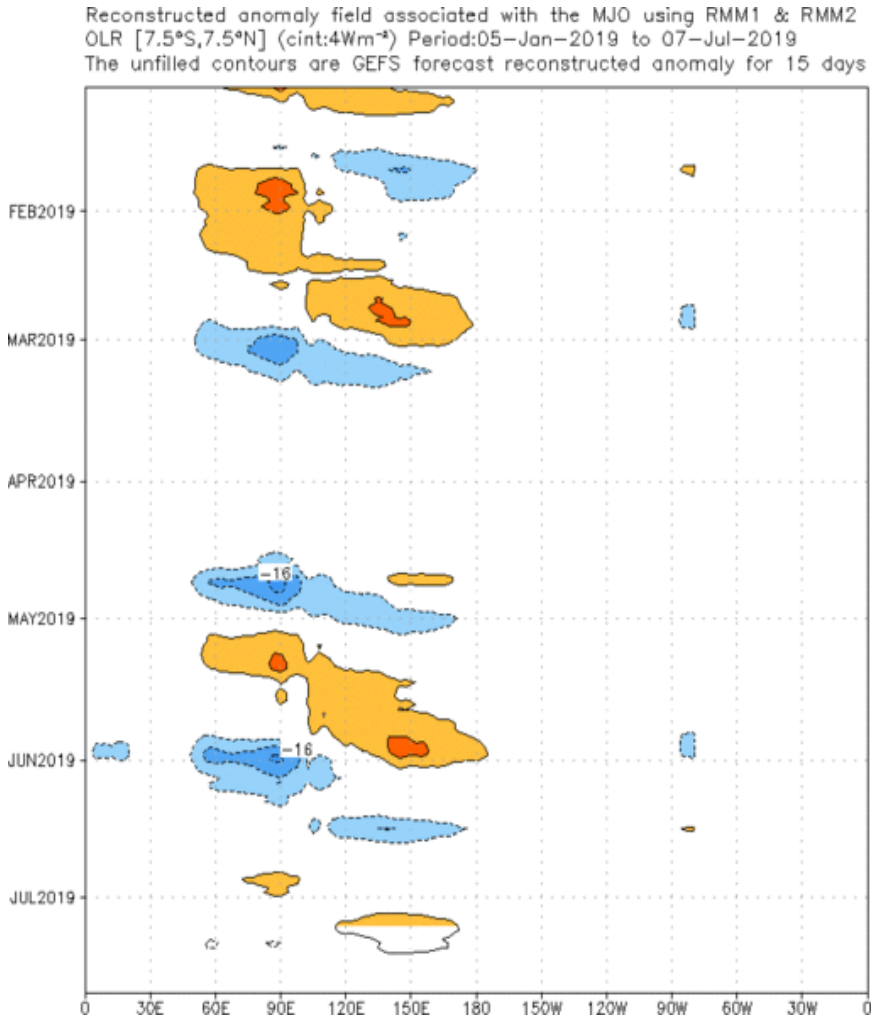
ECMWF Forecast

- The models agree that the RMM index will weaken once again, most likely because they are picking up on an equatorial Rossby wave that will propagate westward over the next several days.

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.)

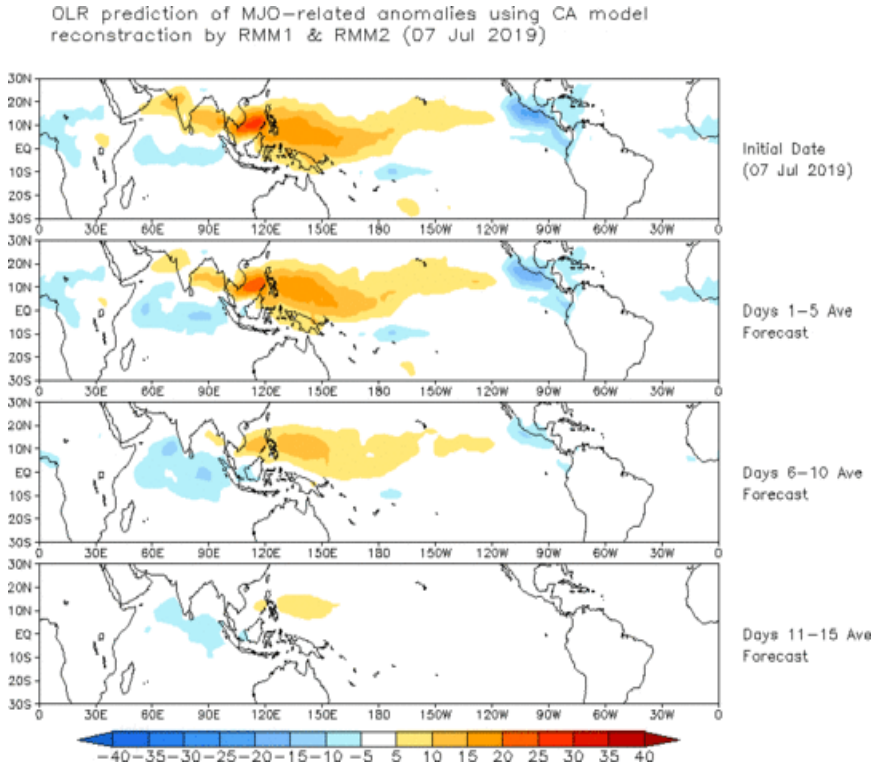


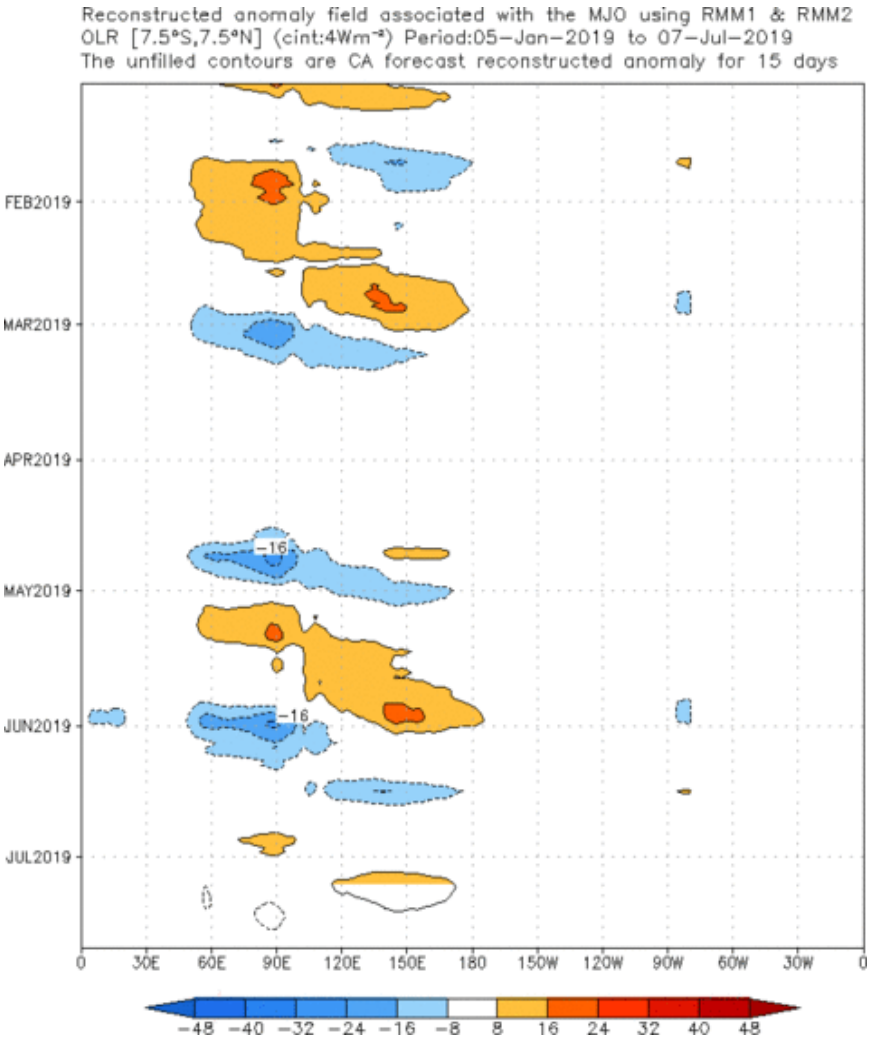


- The spatial depiction of the MJO within the GEFS model suggests that it will stay weak during the next two weeks.

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.)

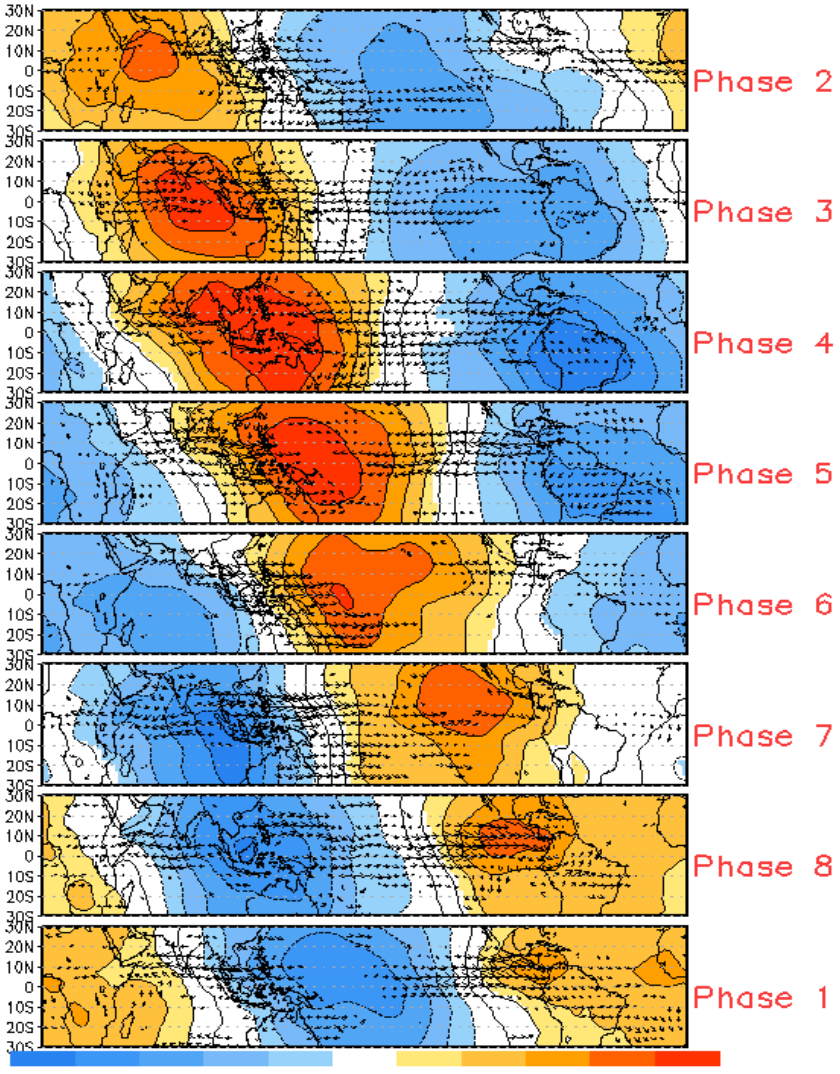




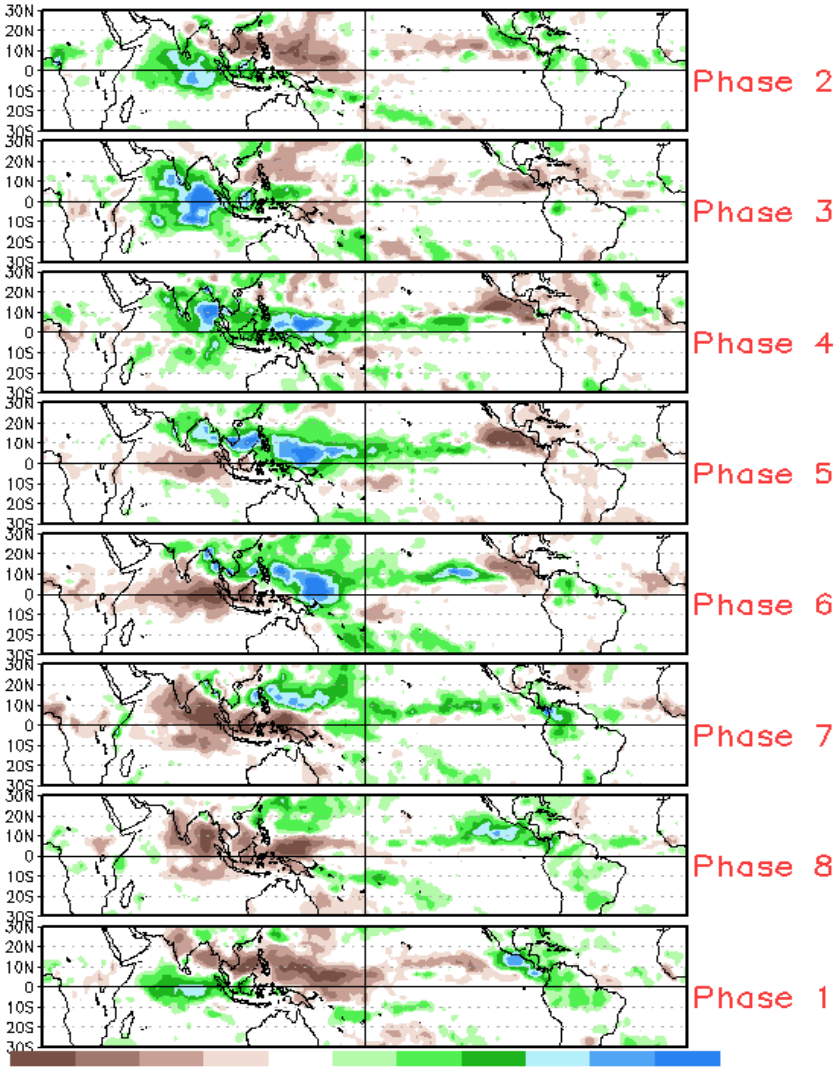
- The constructed analog forecast is very similar to the GEFS, suggesting a weak MJO signal over the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



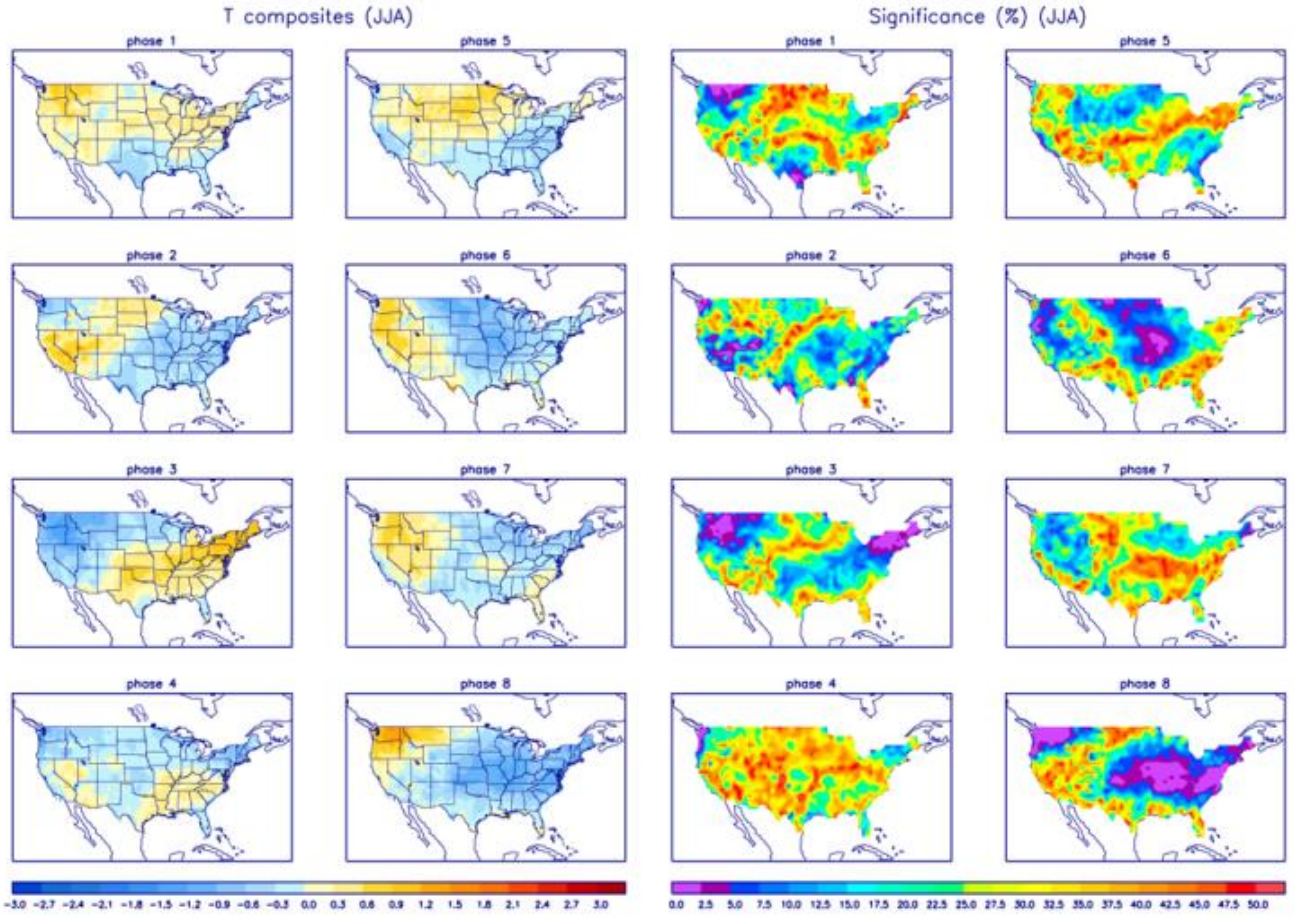
Precipitation Anomalies



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.

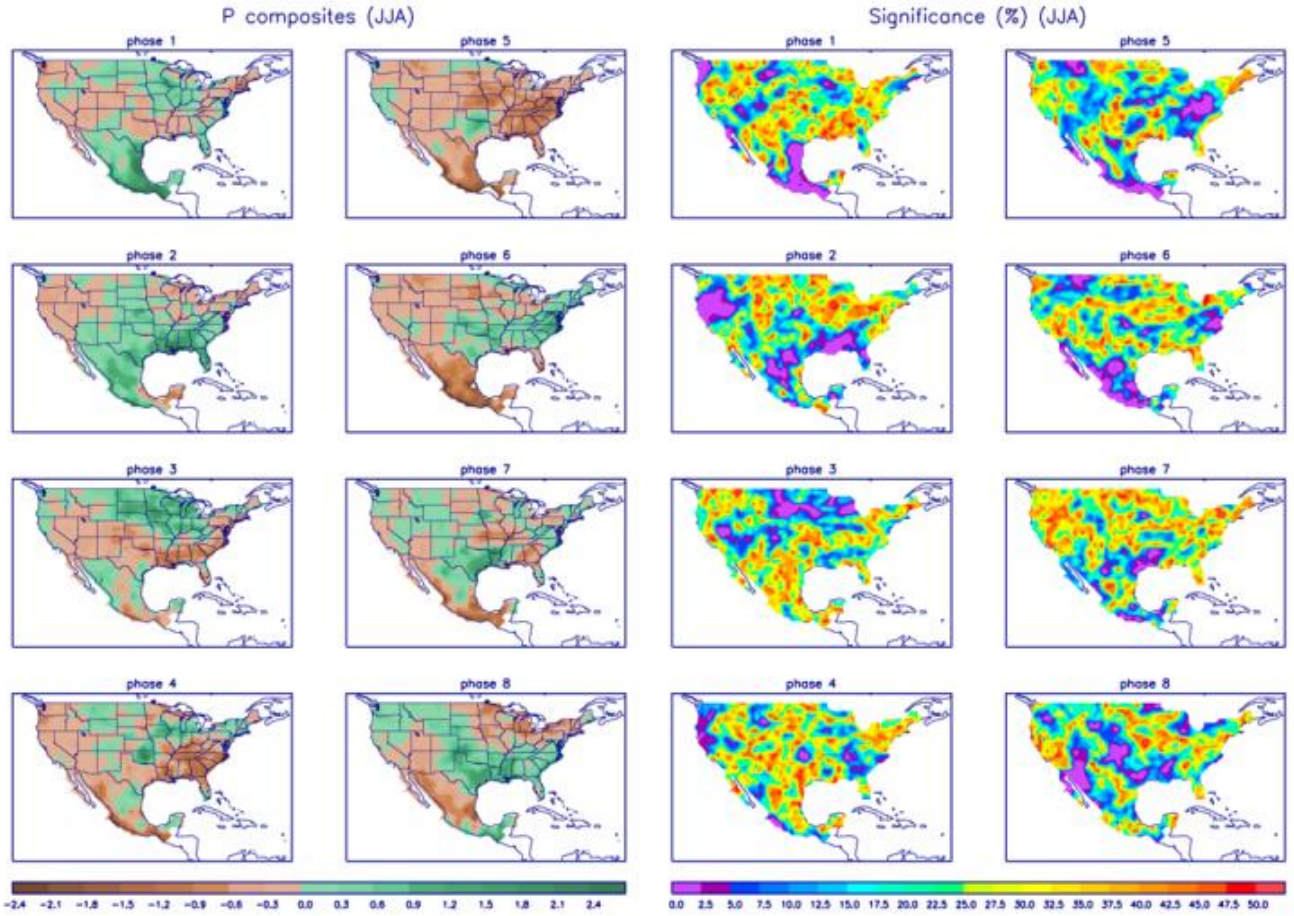


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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.



More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml