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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
28 September 2020

Overview

- The strongest MJO signal is found in the upper-level velocity potential field, but is especially weak in the OLR and low-level circulation fields.

- None of our dynamical or statistical models predict a particularly strong MJO event in the next couple of weeks. We therefore expect most of the tropical pattern to be driven by isolated tropical cyclone activity in the West Pacific and Kelvin wave activity throughout the Tropics.

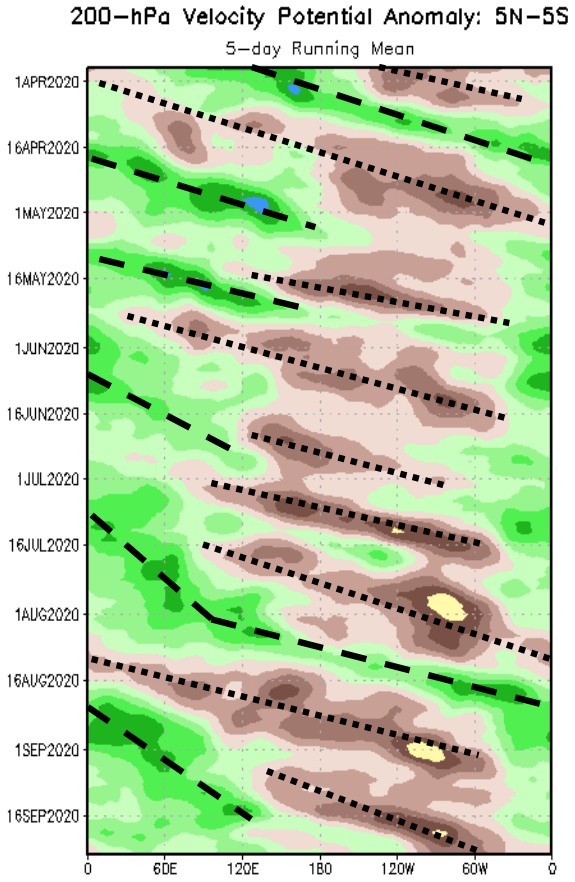
- Consistent with the current La Niña conditions, SST anomalies in the eastern Pacific are negative and the associated upper-level component of the Walker Circulation is apparent.

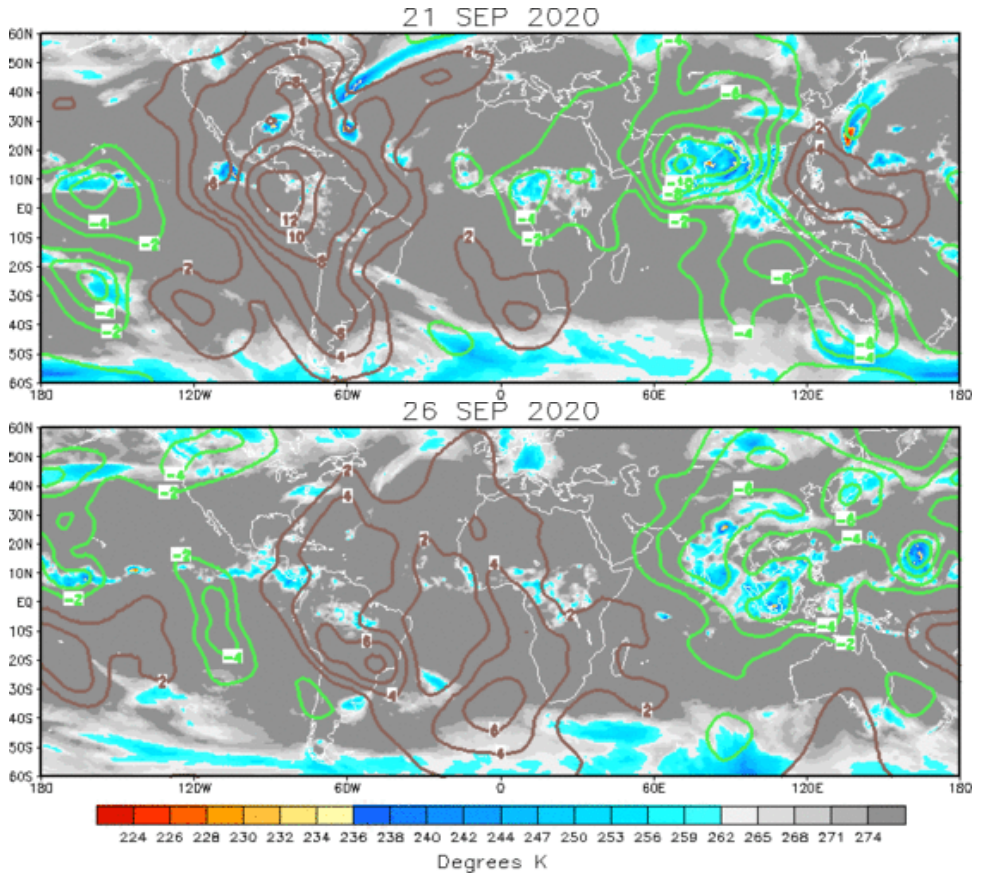
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

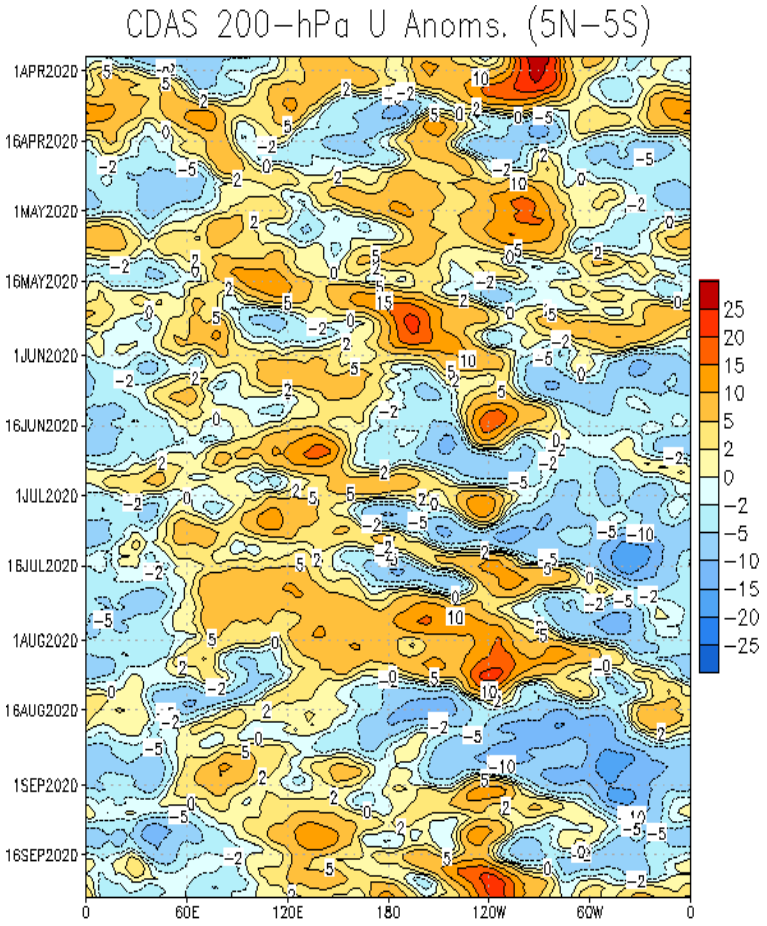


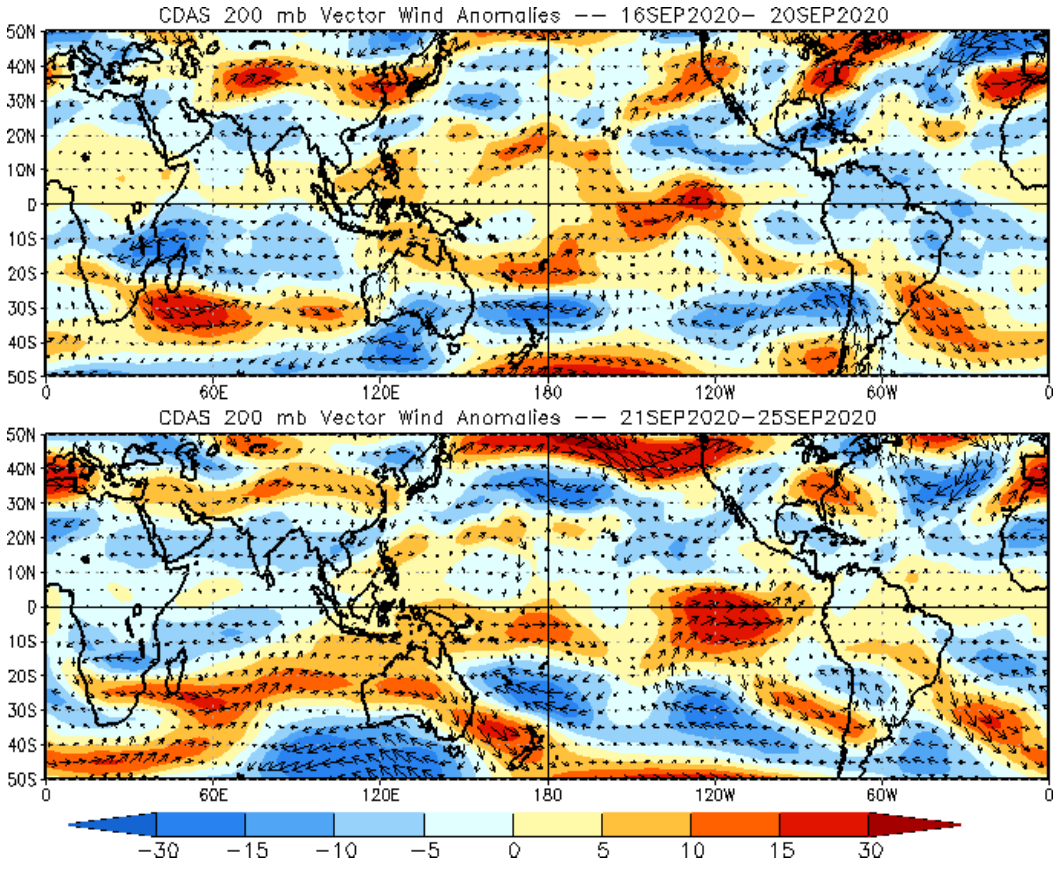


- Convection over the Pacific has shifted slowly westward during the past several months.
- MJO activity was robust during much of July and August, but has weakened a bit during September.
- A general Wave-1 pattern continues to dominate the global flow pattern. However, its amplitude has decreased substantially compared to last week.

200-hPa Wind Anomalies

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

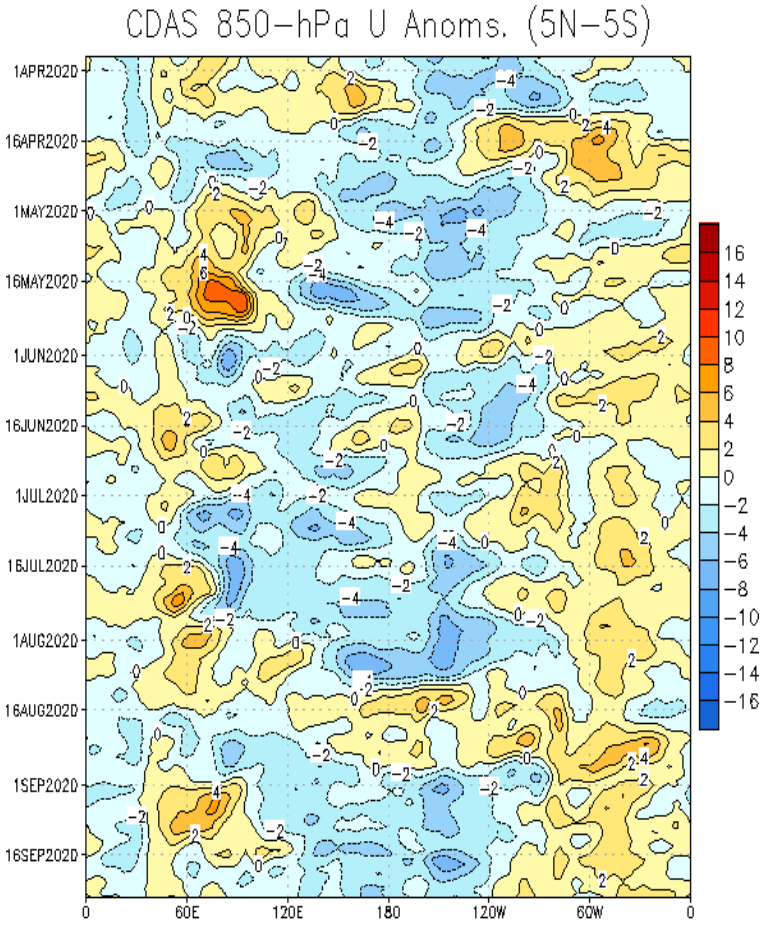


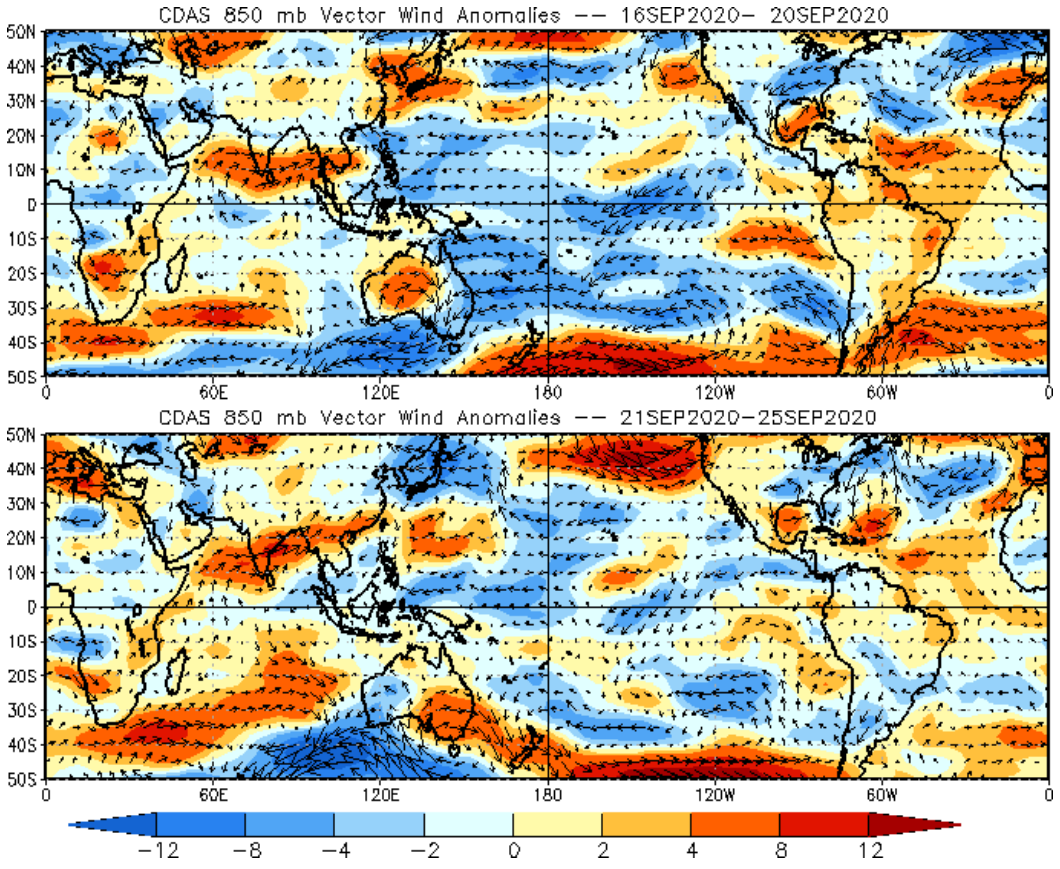


- Active wave breaking is evident over the central North Pacific, which is common during this time of the year as the Polar jet speeds up.
- A large area of anomalous westerlies has developed over the eastern Pacific, consistent with a shifted Walker Circulation that characterizes the atmospheric response to oceanic La Niña conditions.

850-hPa Wind Anomalies

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



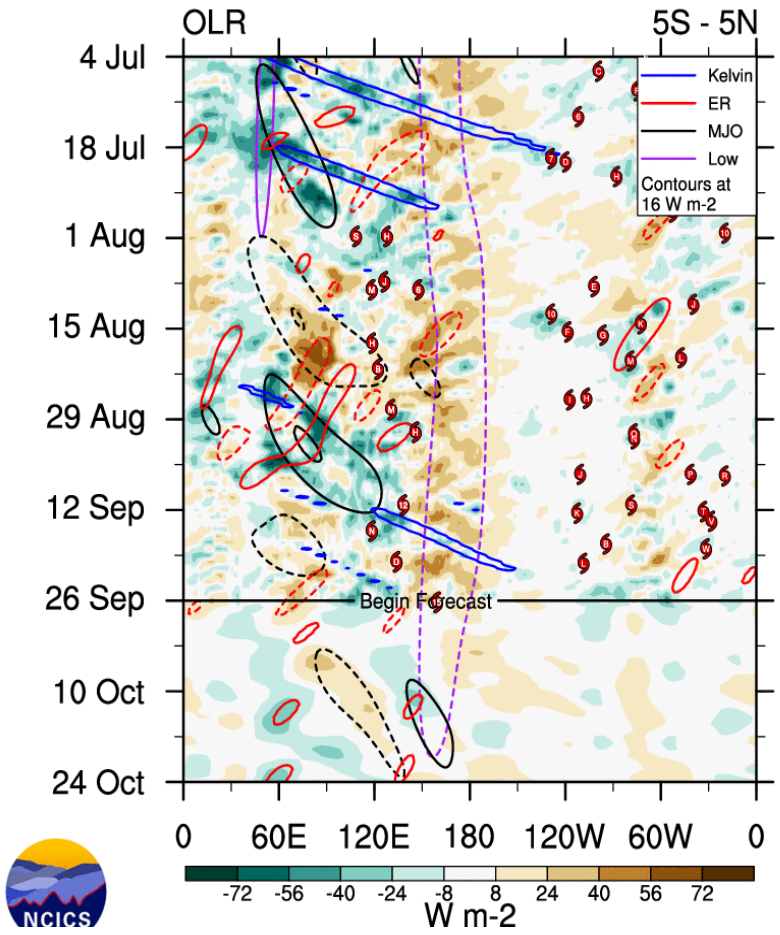


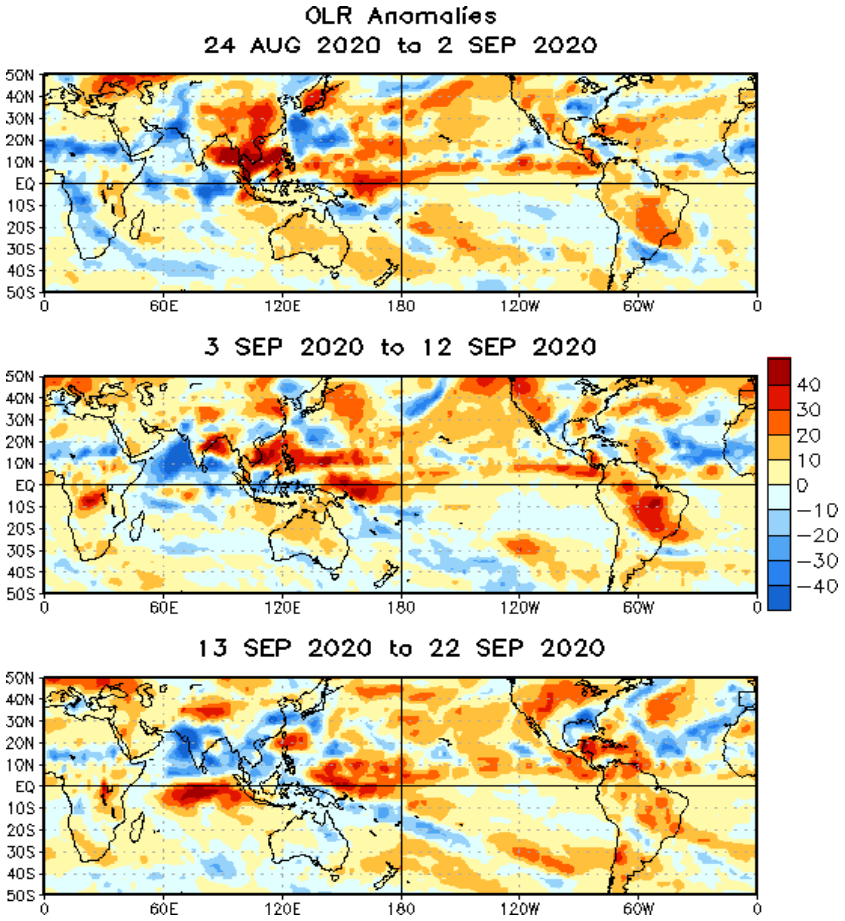
- The aforementioned shift in the Walker Circulation is weaker in the lower levels of the atmosphere, but is still evident through the enhanced trades east of the Dateline.

- Westerly anomalies remain in place over the tropical Atlantic main development region, tied to anomalous cyclonic flow between 10-20˚N.

Outgoing Longwave Radiation (OLR) Anomalies

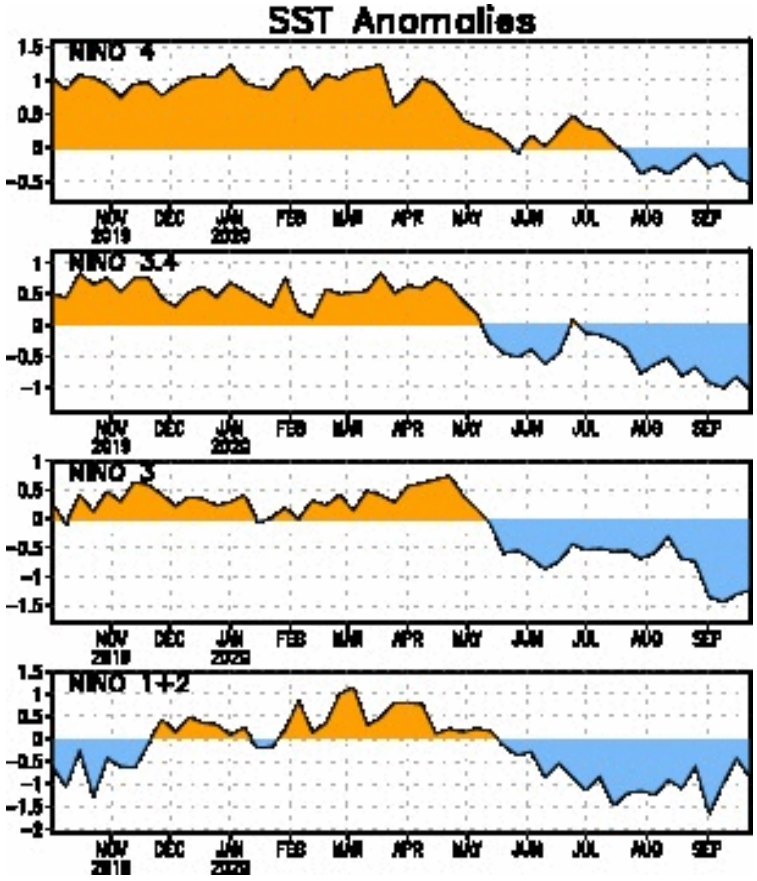
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

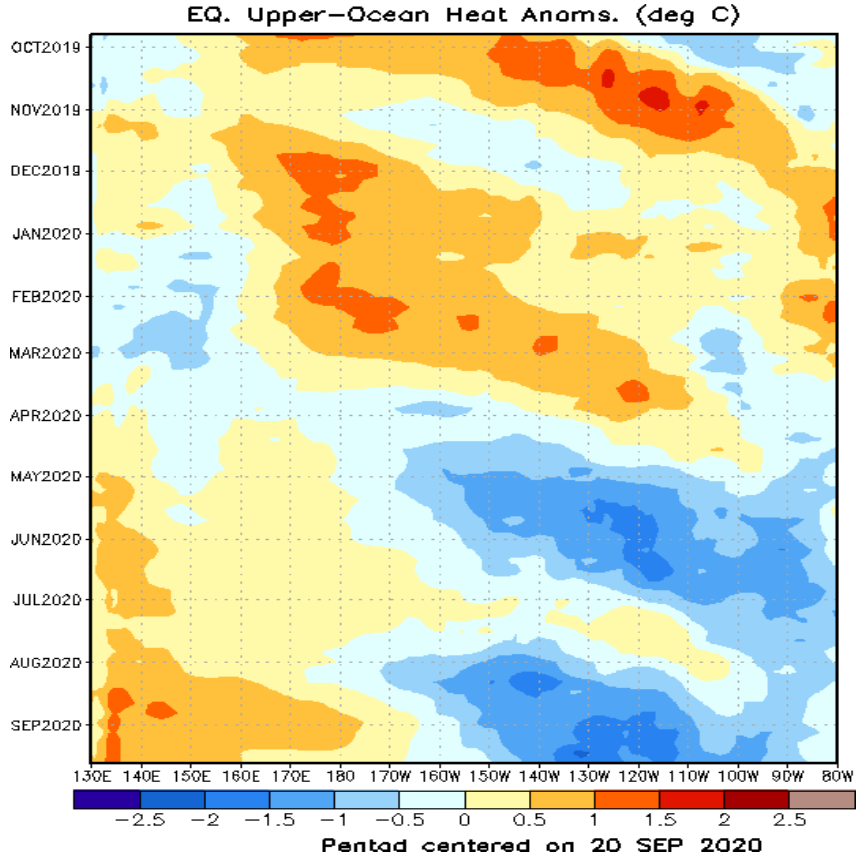




- The OLR field is weak throughout the Tropics.
- Active Rossby wave and MJO activity are indicated east of the Dateline in 250-hPa zonal wind and velocity potential charts, but the convective signatures associated with these modes are generally weak.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

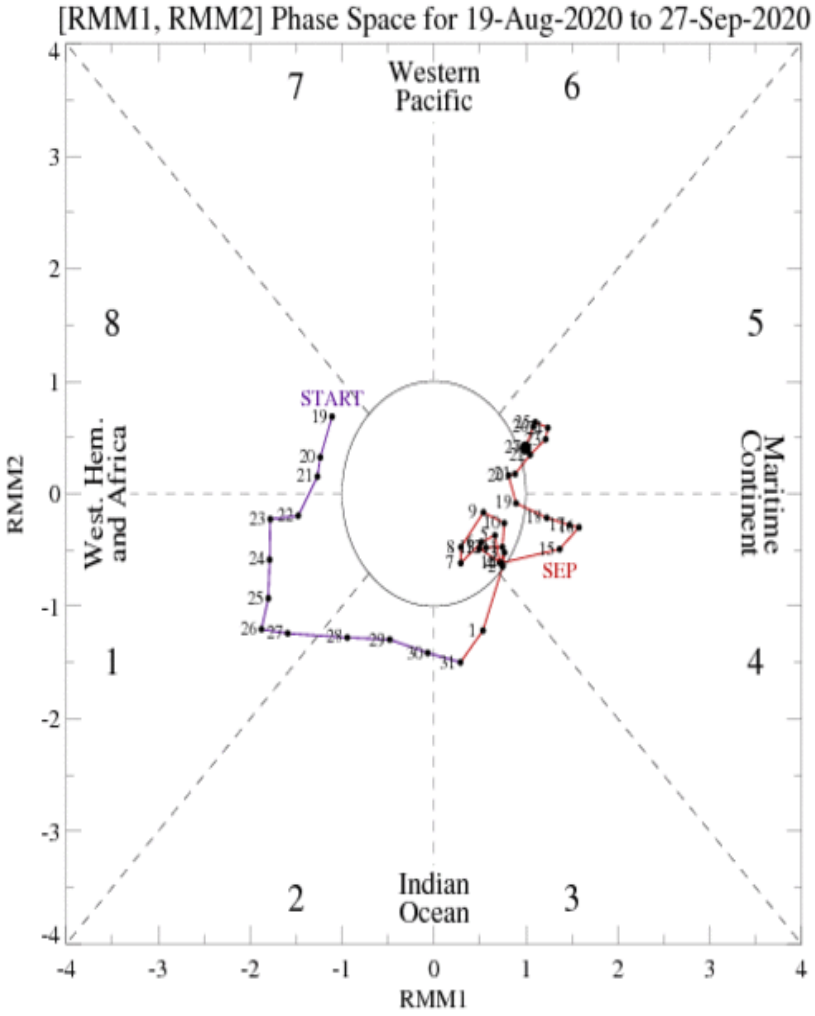




- Following destructive interference with the base state by a downwelling Kelvin wave, the subsequent upwelling phase has pushed the Pacific into La Niña conditions.
- Heat content anomalies in the Niño 3.4 region have become strongly negative since July.
- A second downwelling Kelvin wave is evident over the central Pacific.

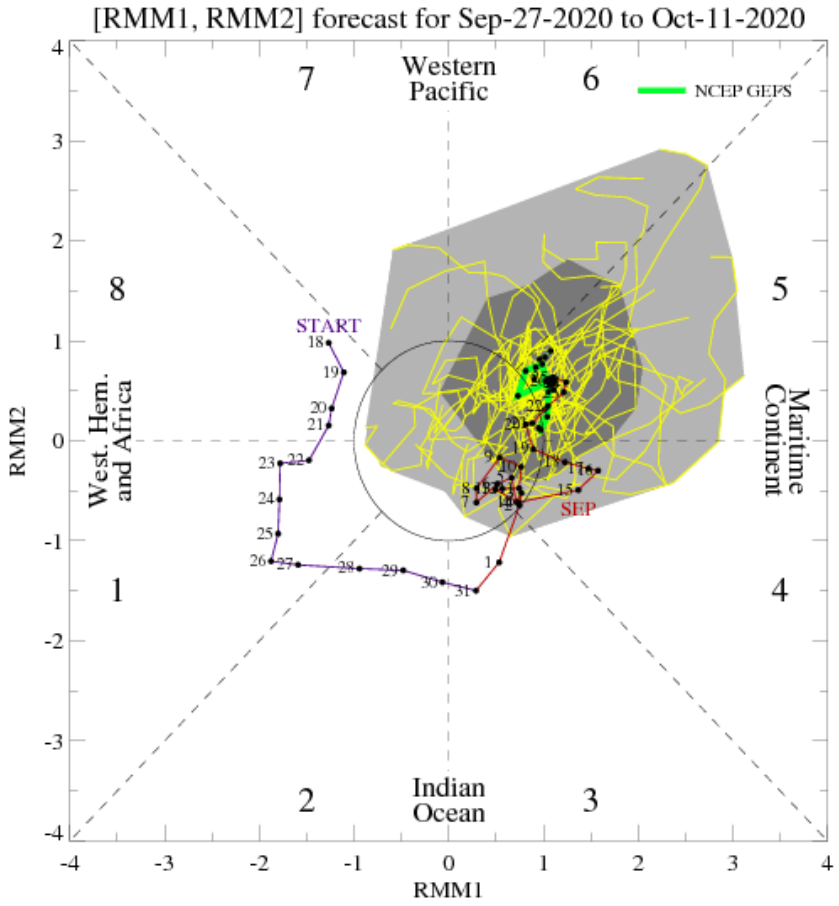
MJO Index: Recent Evolution

- The RMM index is just outside of the unit circle in Phase 5.

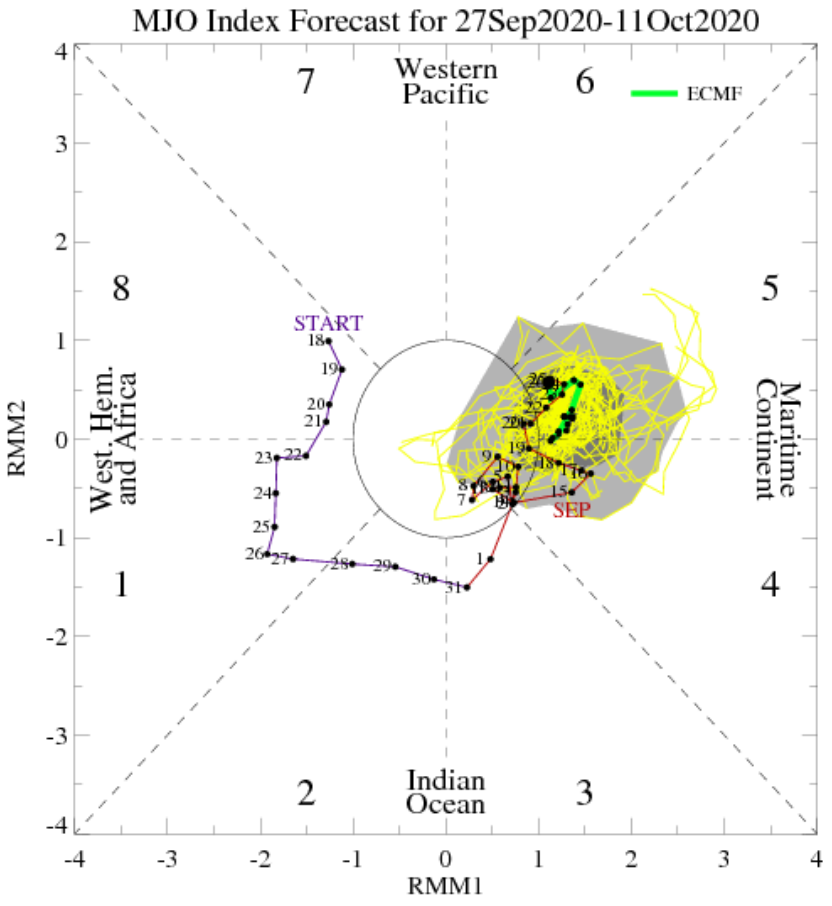


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

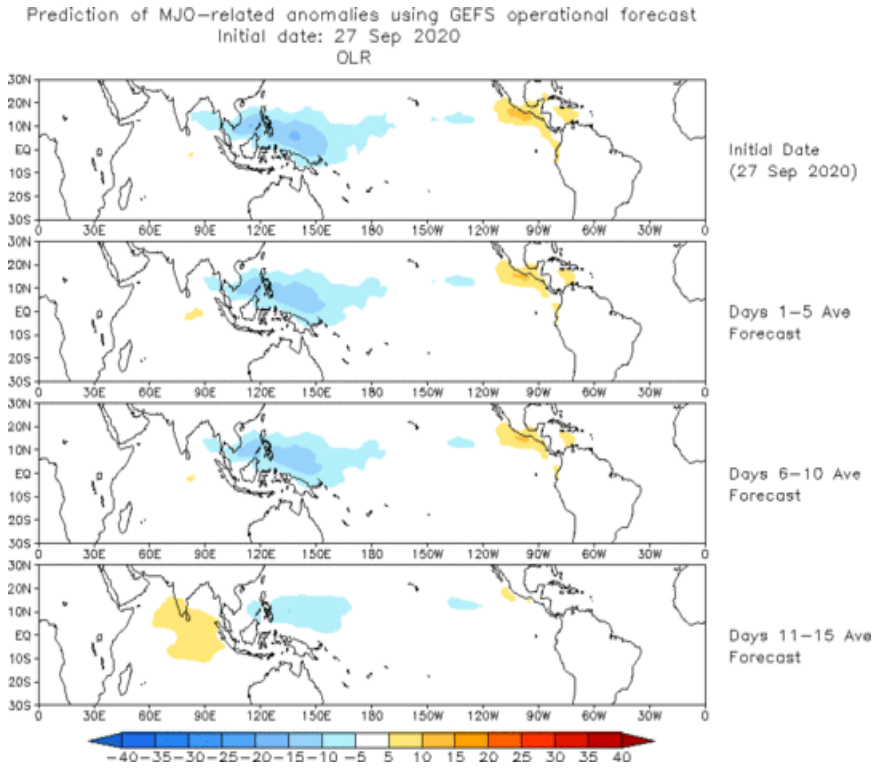


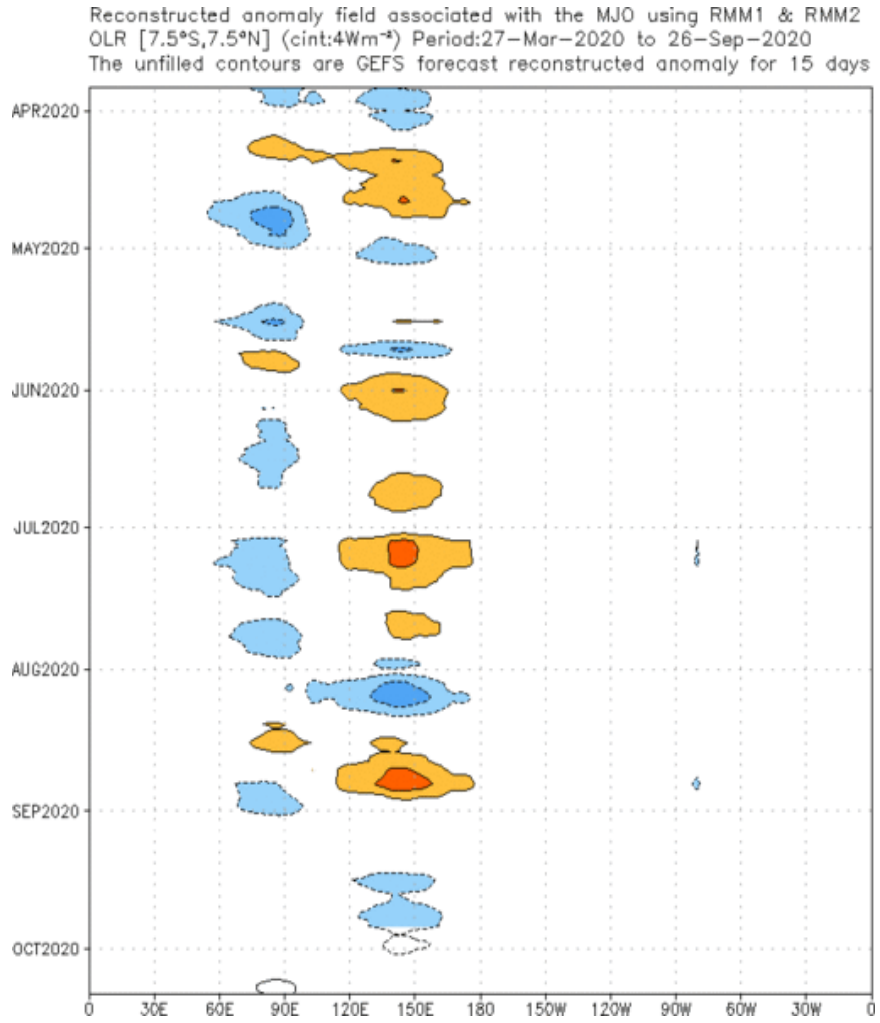
ECMWF Forecast

- Neither model has a confident MJO forecast, which is not surprising given the combination of weak tropical waves and low predictability associated with a developing La Niña and strengthening general circulation.

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.)

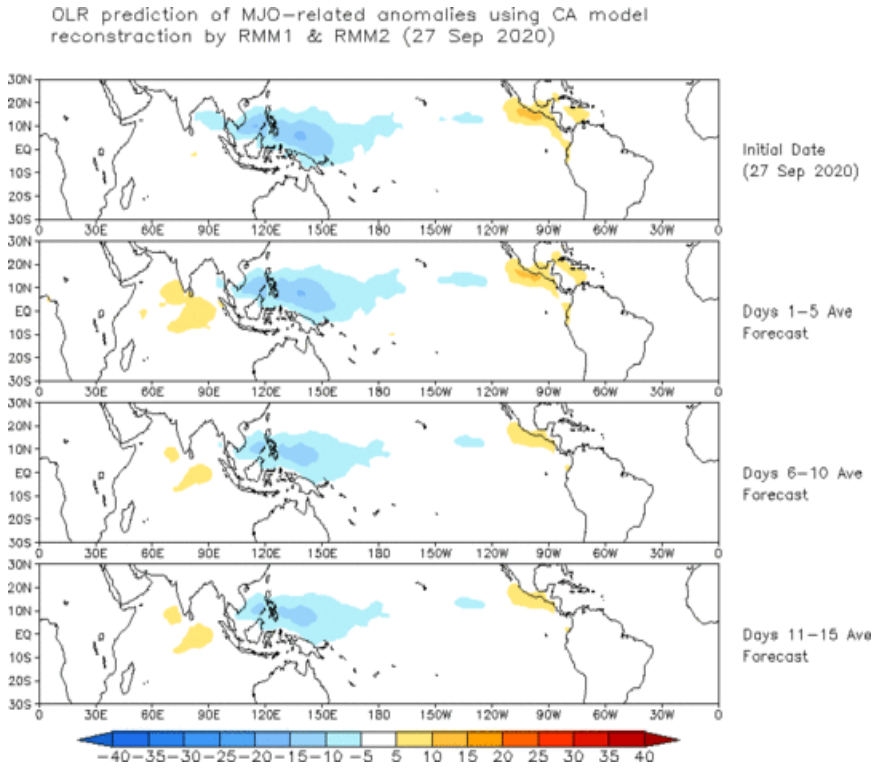


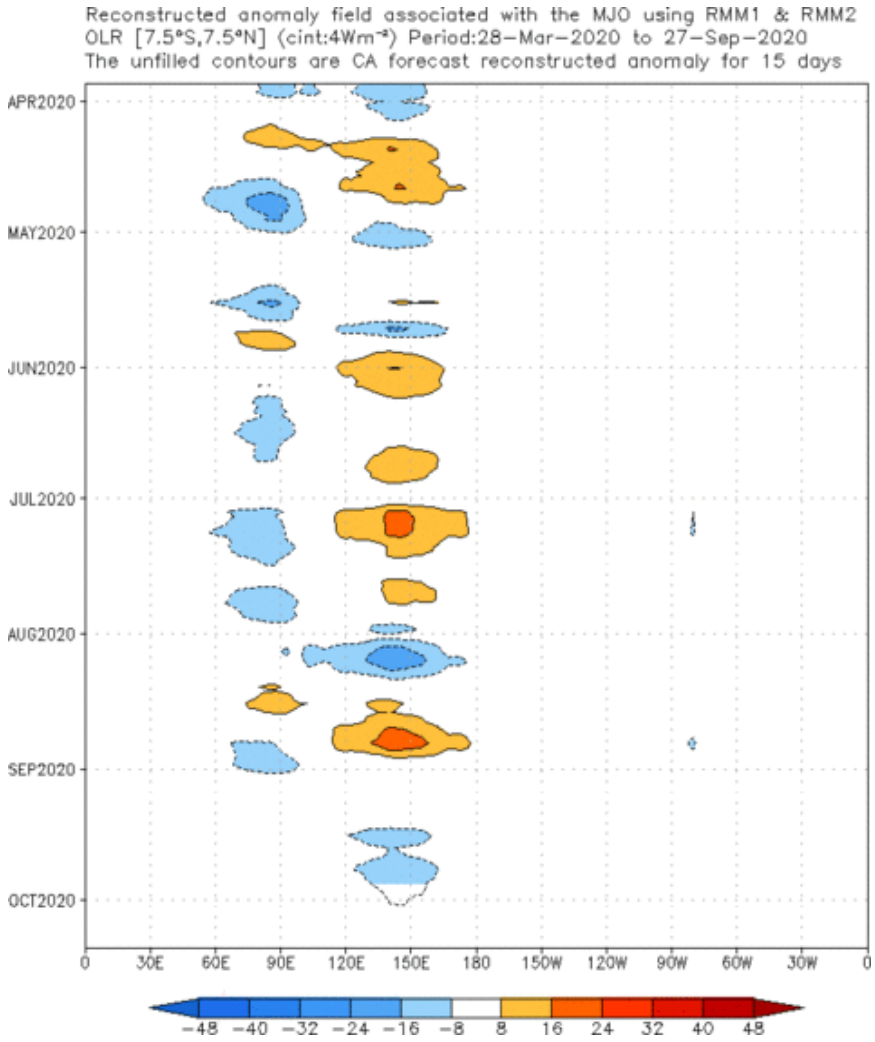


- The GEFS predicts a weak, stationary MJO signal.

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.)

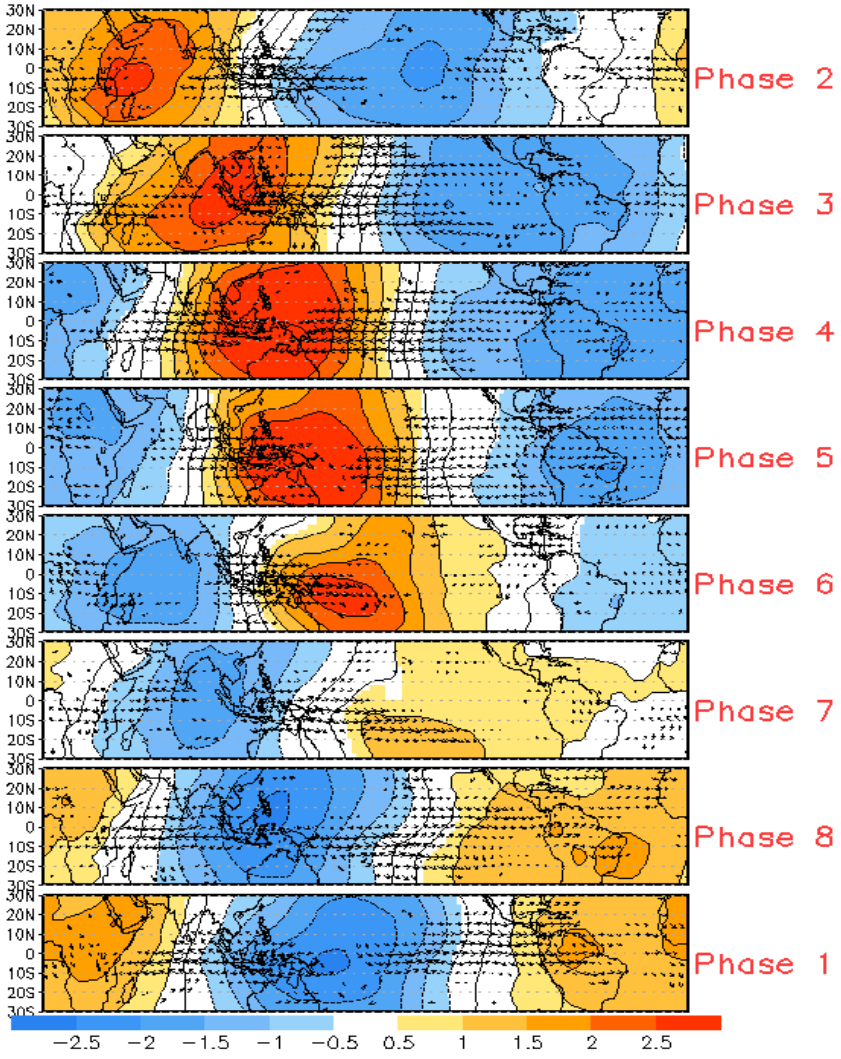




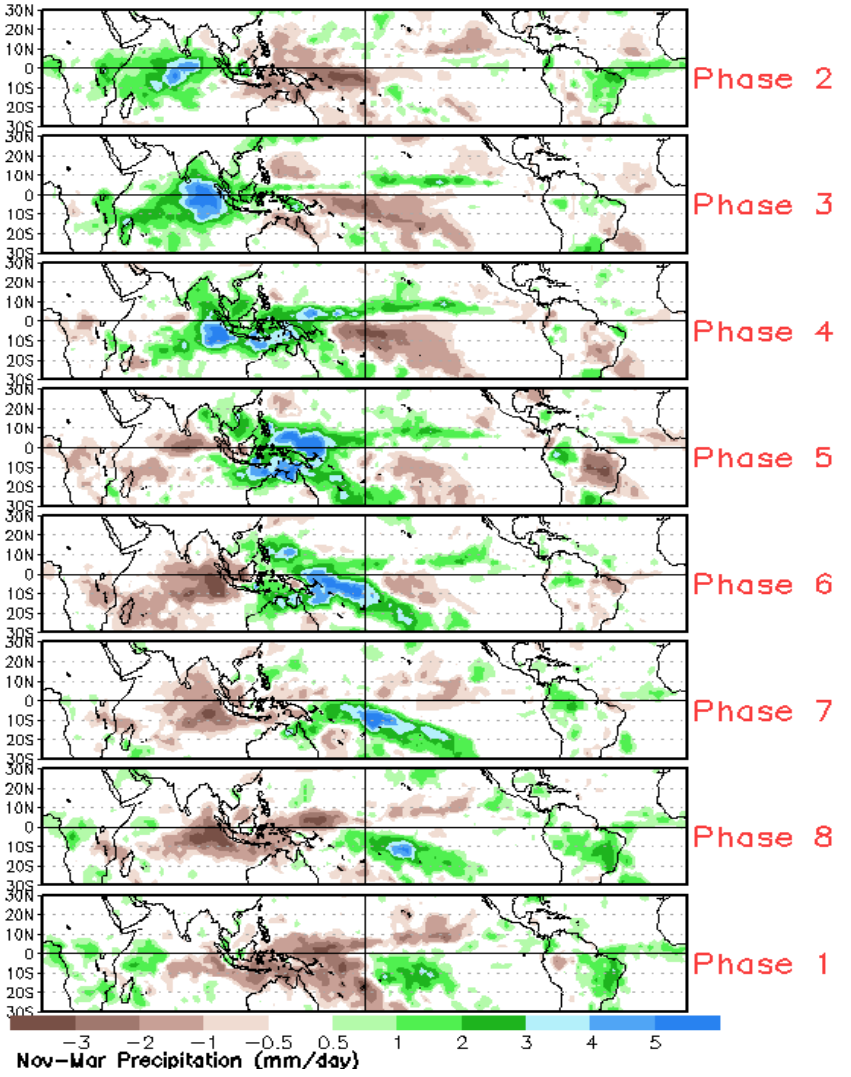
- The constructed analog model predicts a similarly weak pattern as the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



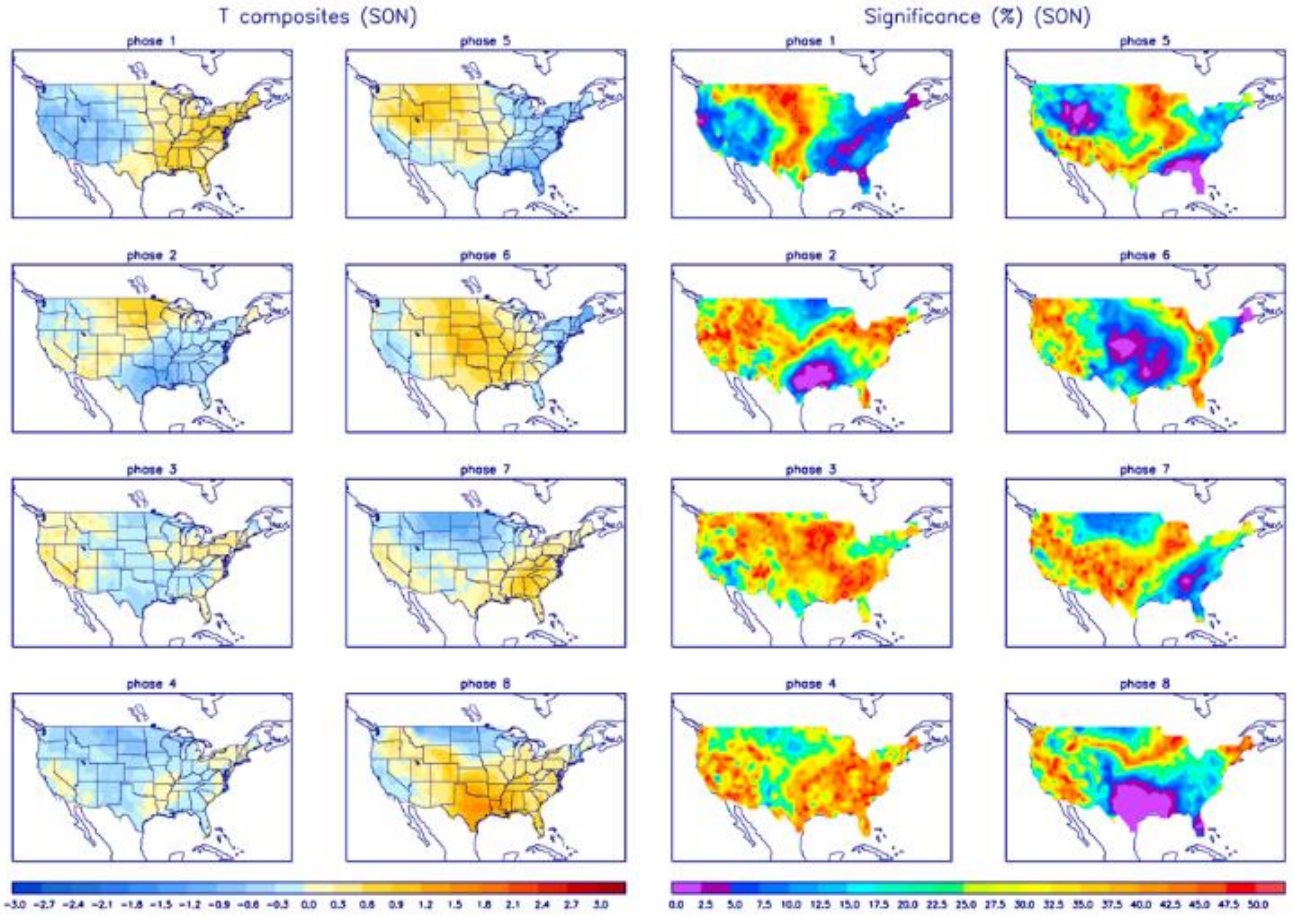
Precipitation Anomalies



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.

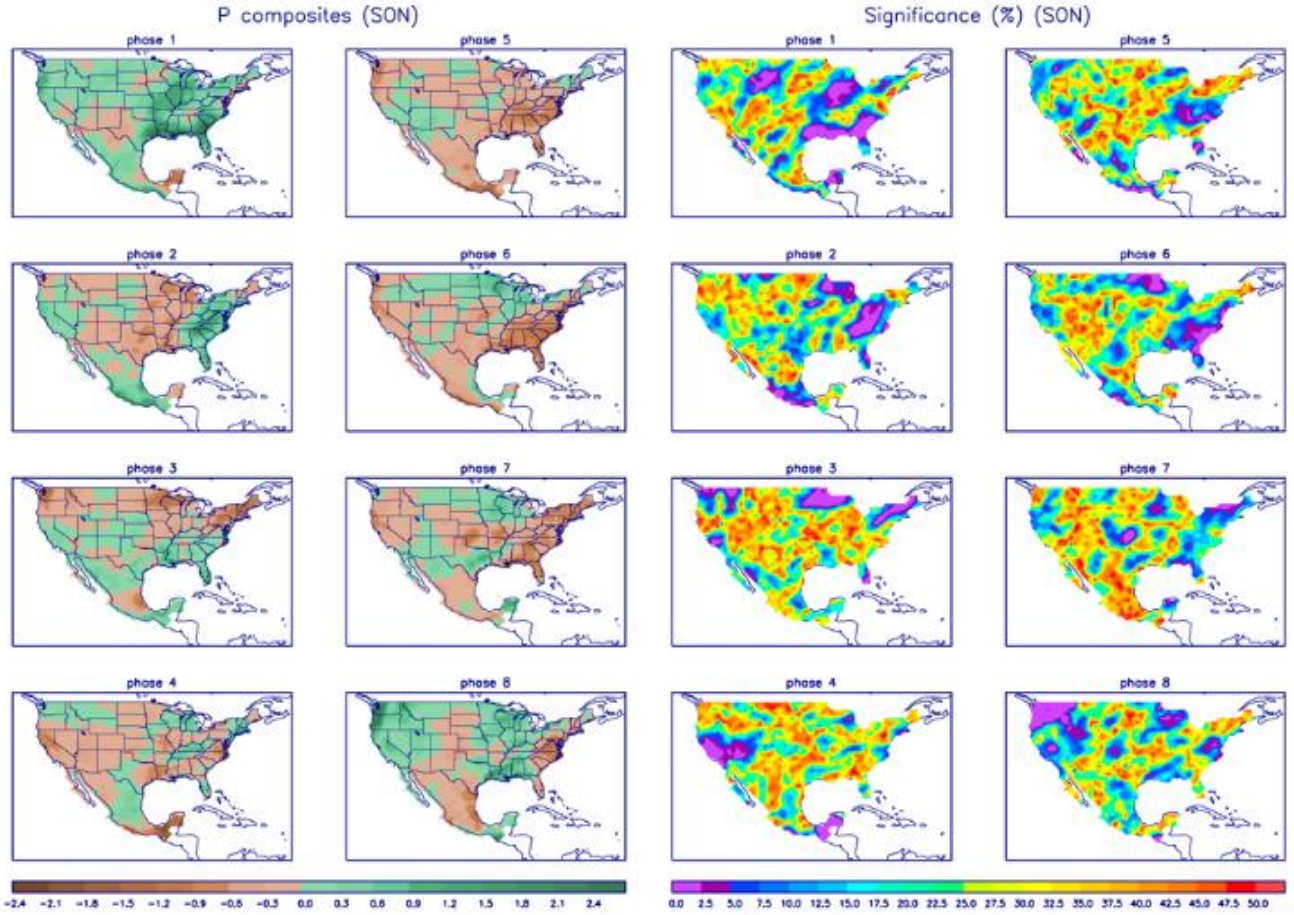


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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