

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



Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
18 November 2019

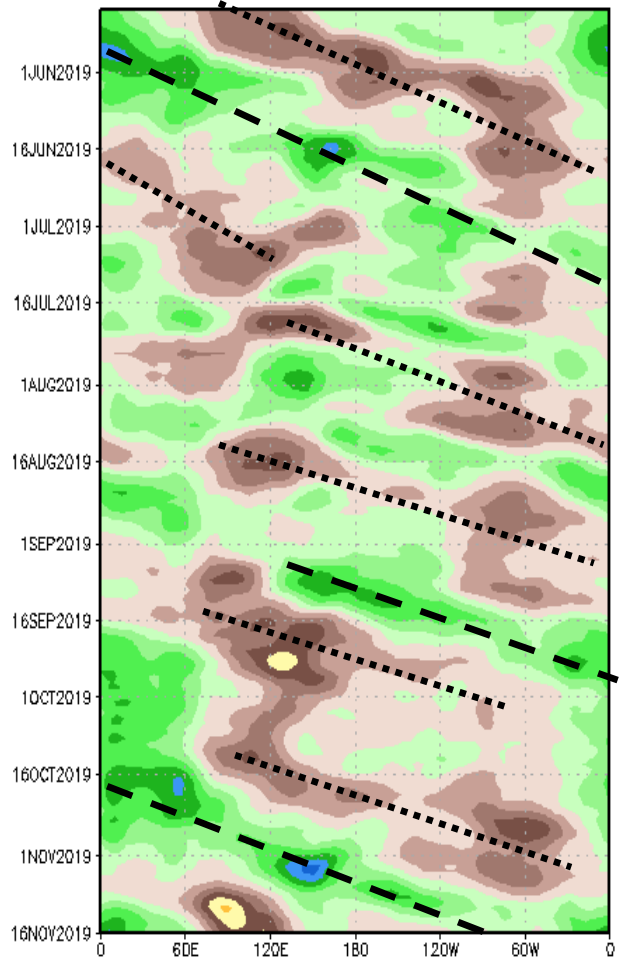
Overview

- The MJO remains active, with the enhanced phase now over the Western Hemisphere.
- Dynamical model MJO index forecasts depict a weakening signal as the low frequency atmospheric response to the ongoing positive Indian Ocean Dipole (IOD) event restrengthens.
- Although recent MJO activity was considerably faster than usual, there is some evidence of a midlatitude atmospheric response, most notably an extension of the East Asian Jet over the central Pacific.
- Based on recent observations and the dynamical model forecasts, lagged responses to the recent MJO event may continue over the next week or two, but continued MJO influence on the midlatitudes is less likely.

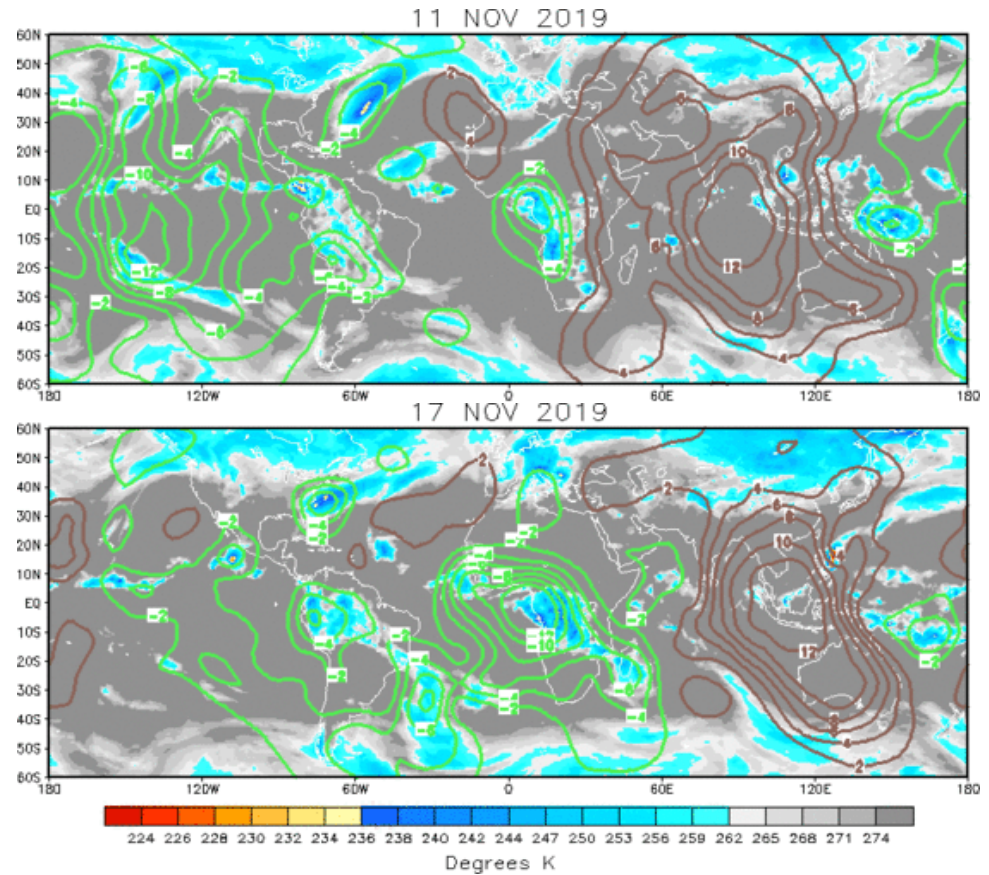
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

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



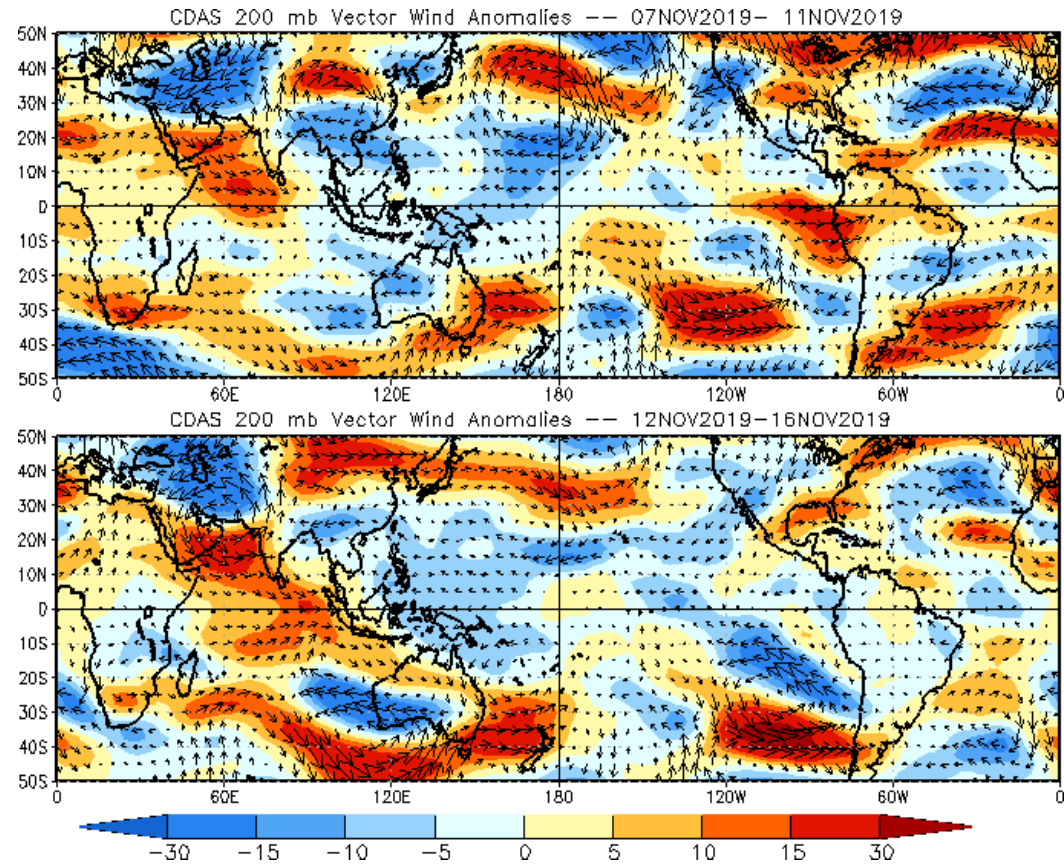
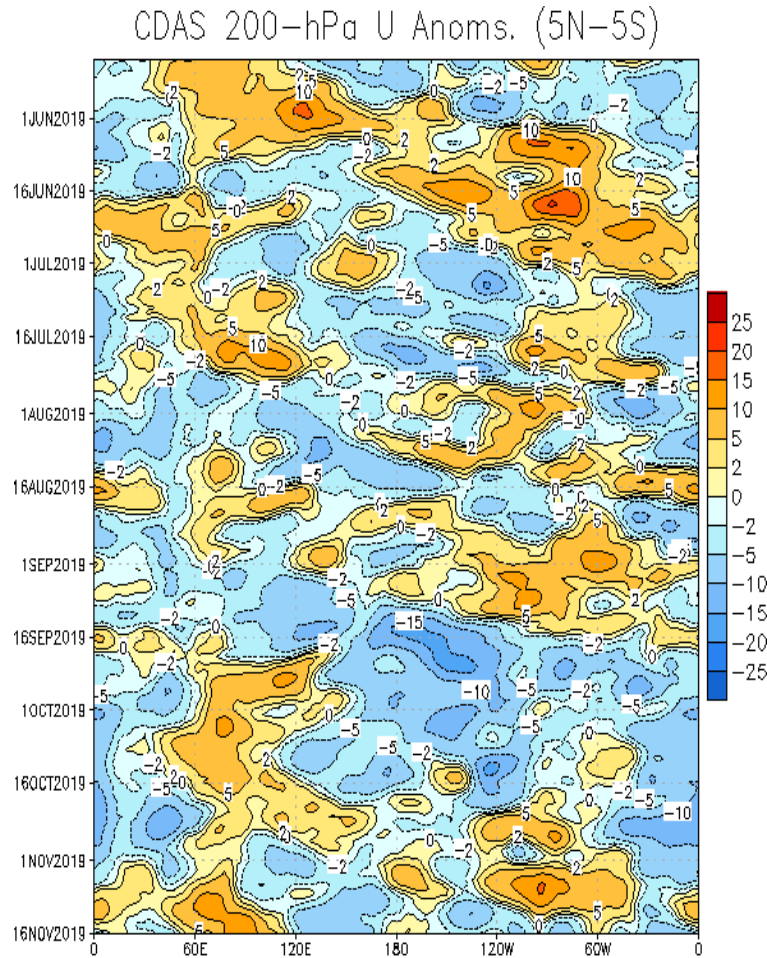
Green shades: Anomalous divergence (favorable for precipitation).
Brown shades: Anomalous convergence (unfavorable for precipitation).



- The upper-level velocity potential field continues to reflect an eastward propagating MJO event.
- The strength of the anomaly field over Africa reflects constructive interference between the subseasonal MJO signal and the low frequency Indian Ocean Dipole (IOD).

200-hPa Wind Anomalies

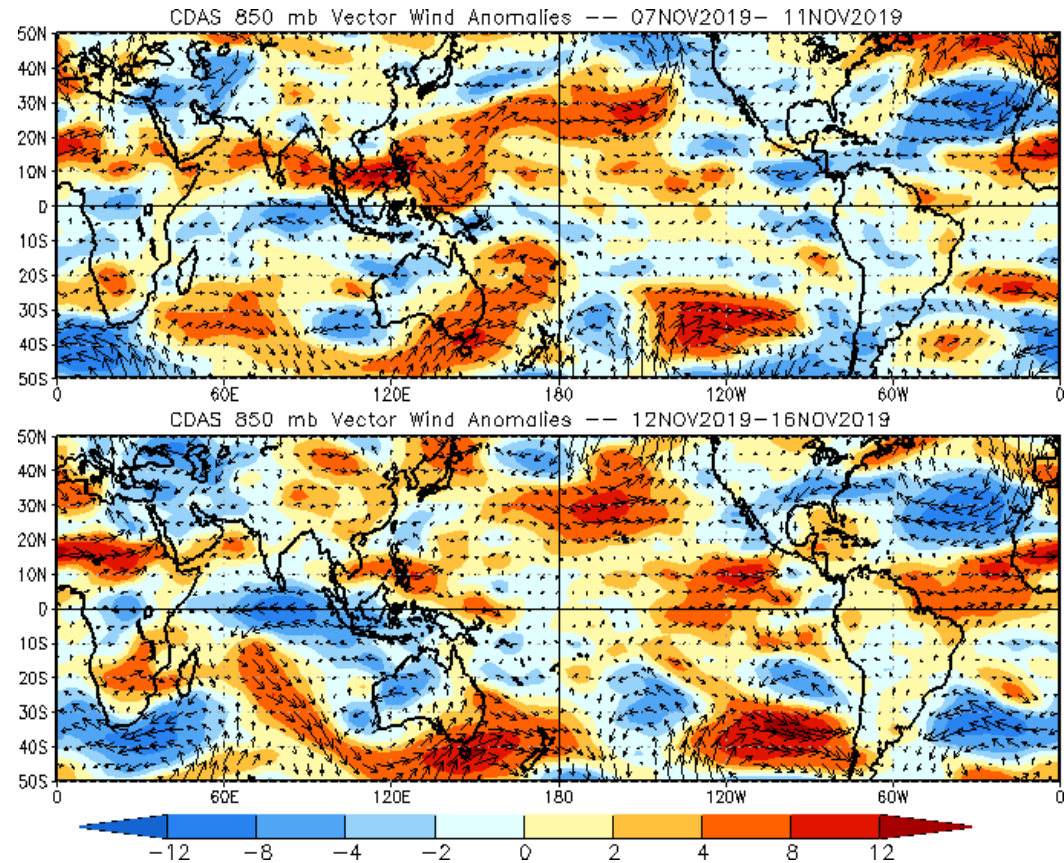
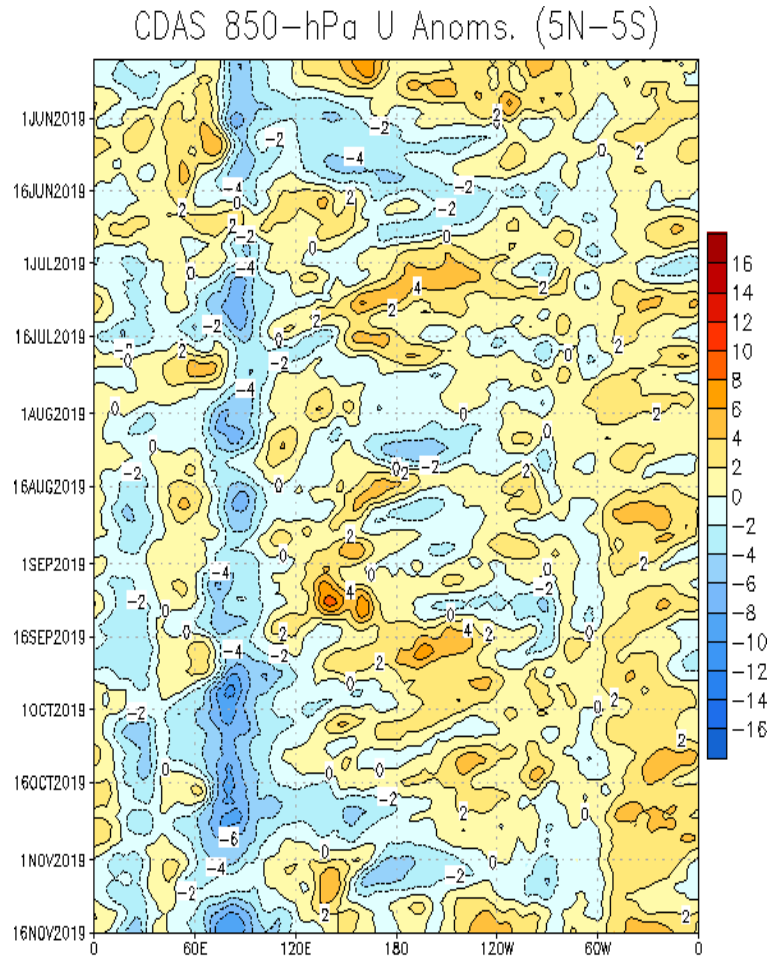
Shading denotes the zonal wind anomaly. **Blue shades: Anomalous easterlies.** **Red shades: Anomalous westerlies.**



- An East Asian jet extension is evident, which is consistent with a recent Pacific MJO event, but the teleconnection with the tropics is less clear.
- The upper-level wind field in the tropics is generally weak, but strong convergence over the Maritime Continent is consistent with an atmospheric response to the low frequency state.

850-hPa Wind Anomalies

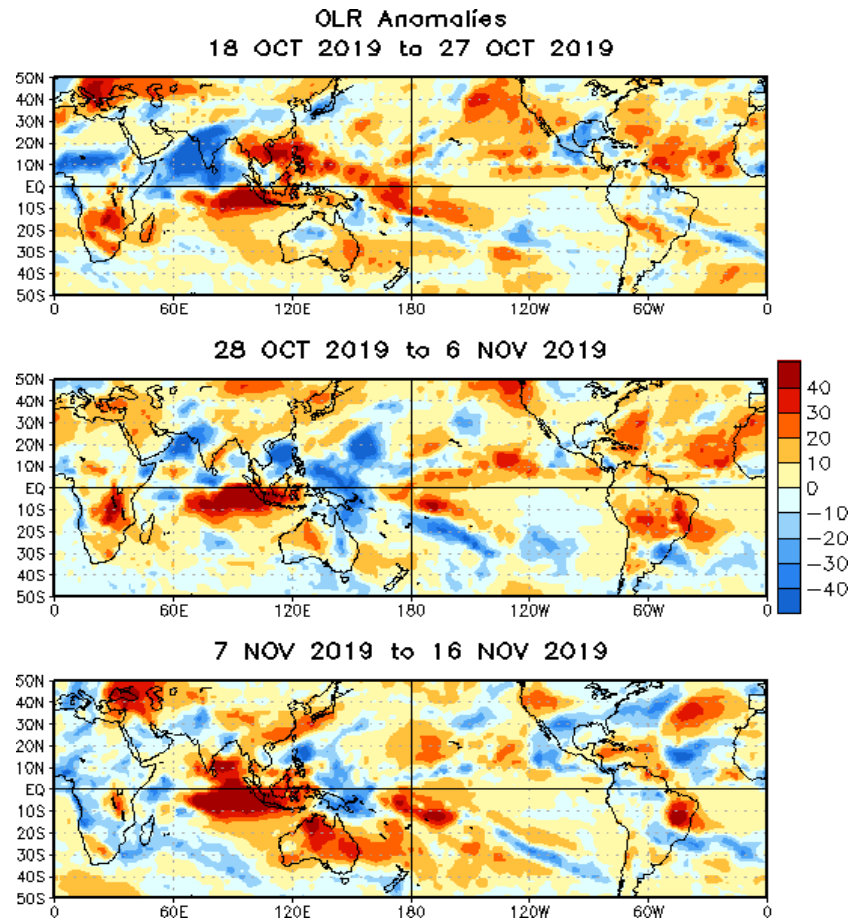
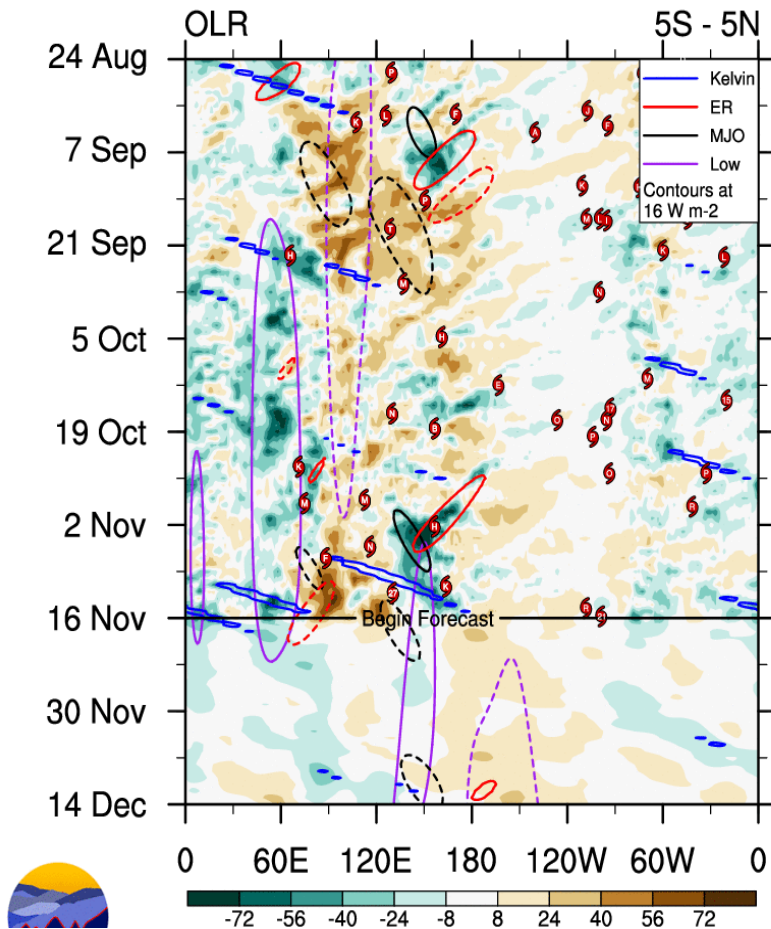
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Westerly anomalies increased over the East Pacific and Atlantic, consistent with the MJO.
- Easterly anomalies strengthened over the central Indian Ocean as destructive interference between the MJO and the IOD waned.

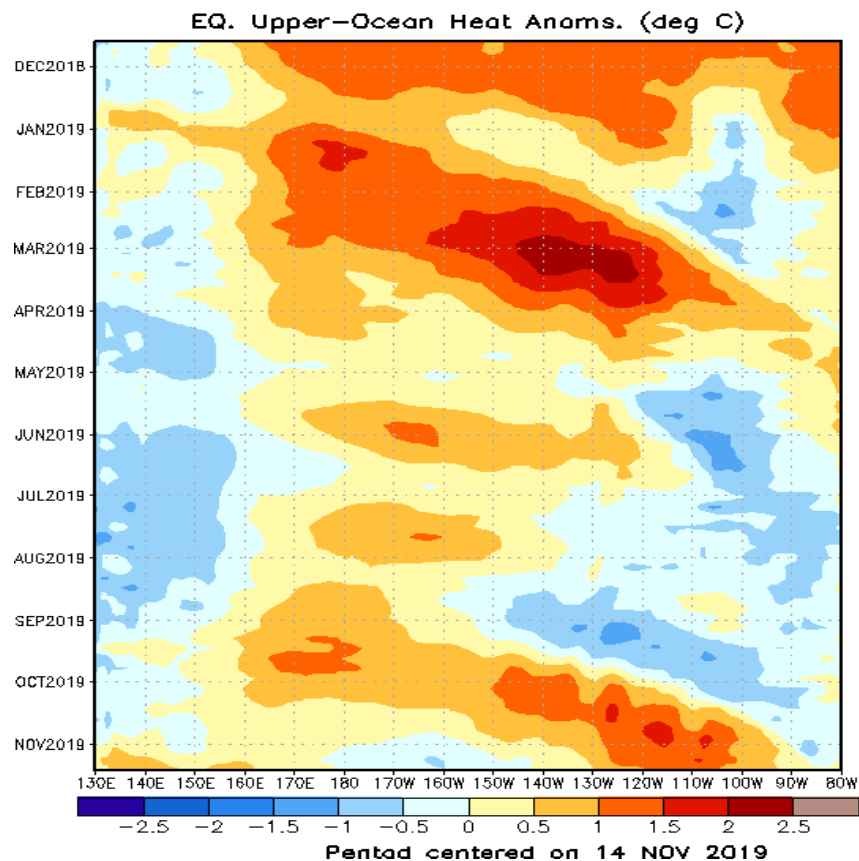
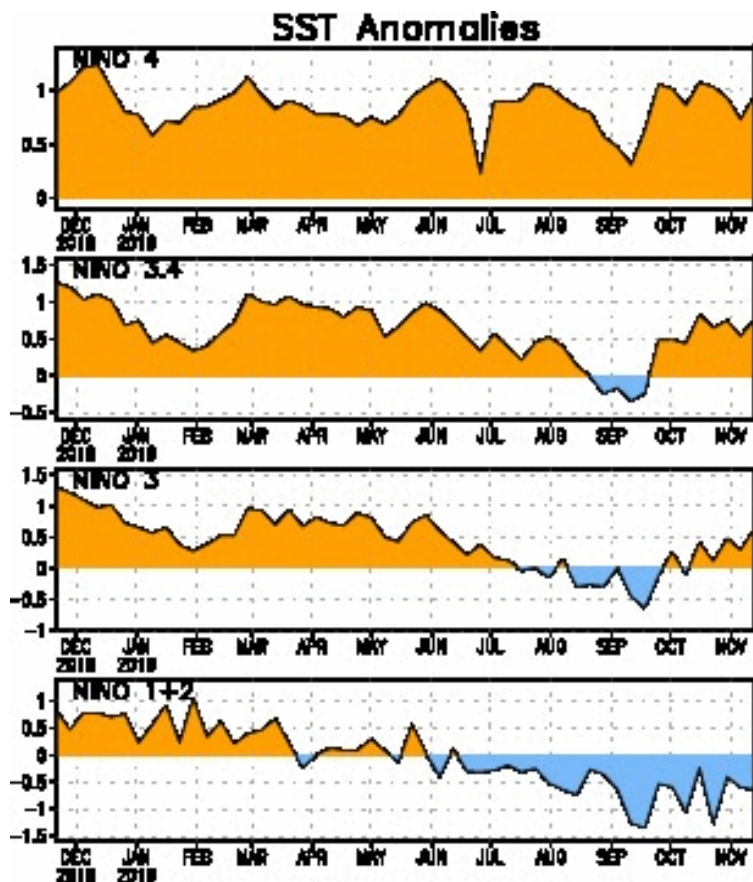
Outgoing Longwave Radiation (OLR) Anomalies

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



- Despite the rapid MJO propagation across the Maritime Continent in late October and early November, there was little convective response due to destructive interference with the positive IOD.
- Enhanced convection did overspread the West Pacific in early November, and the MJO may have contributed to late-season tropical cyclone formation over the East Pacific.

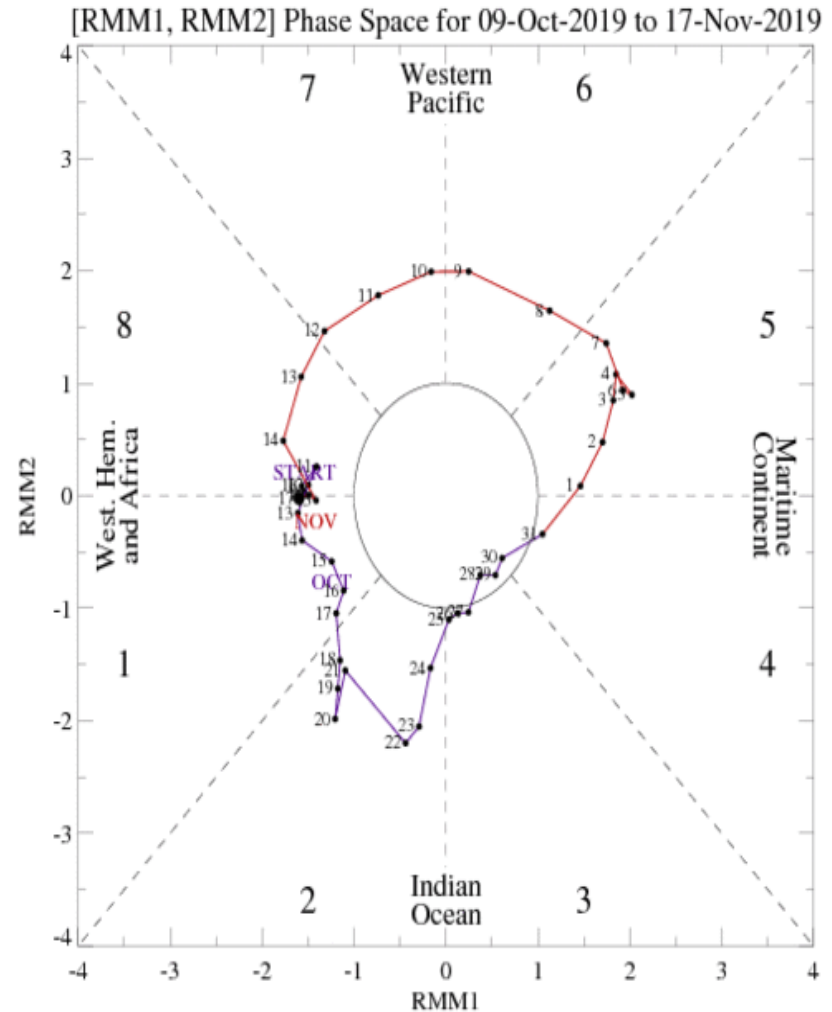
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- SSTs in the East Pacific and Pacific Niño 3.4 regions remain above normal following a downwelling Kelvin wave event that initiated in September.
- An upwelling event may be occurring over the central Pacific, but heat content anomalies remain weak, and the West Pacific is warming.

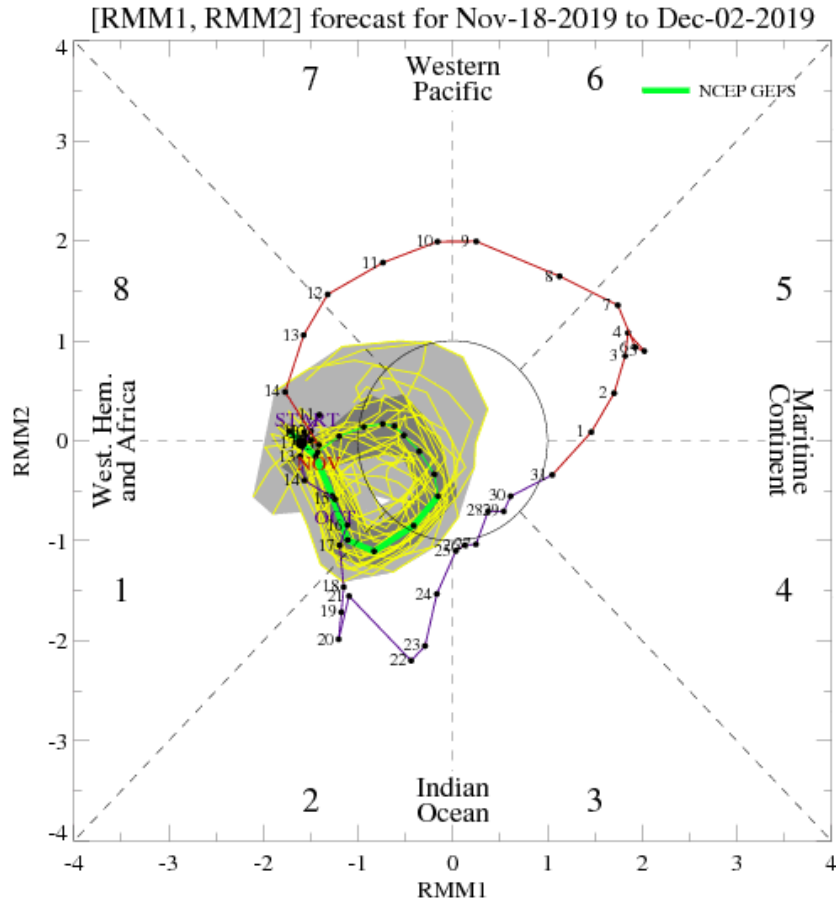
MJO Index: Recent Evolution

- The RMM index places the MJO over the Western Hemisphere.
- The MJO propagated very rapidly across the West Pacific, with a phase speed more consistent with Kelvin wave activity.

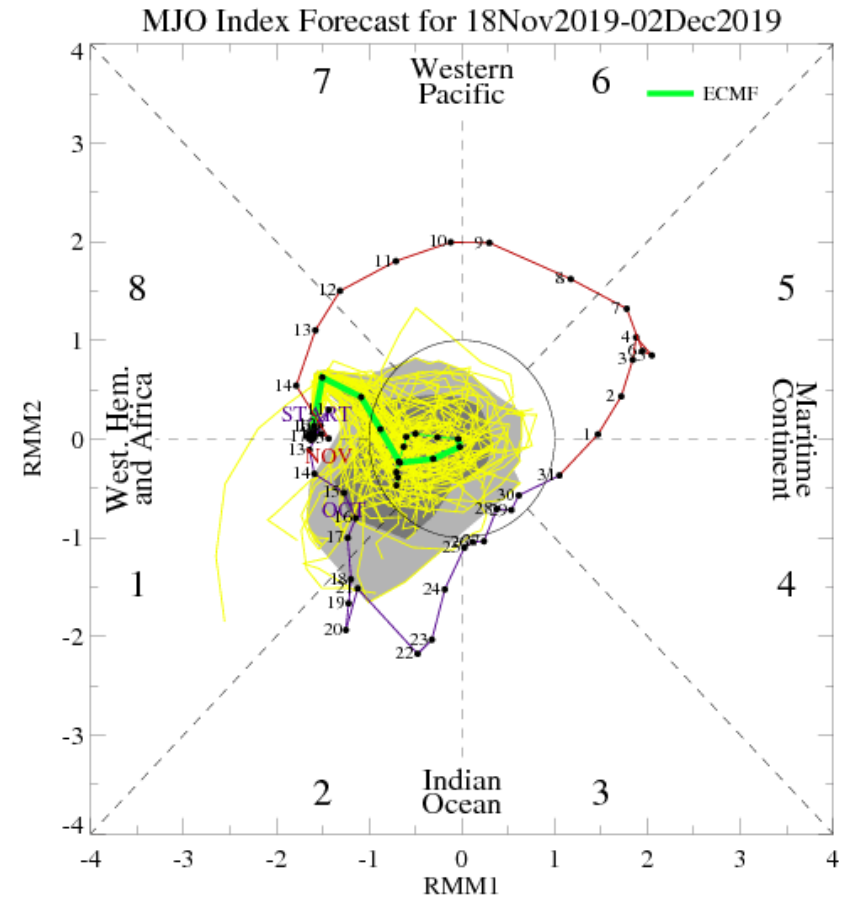


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



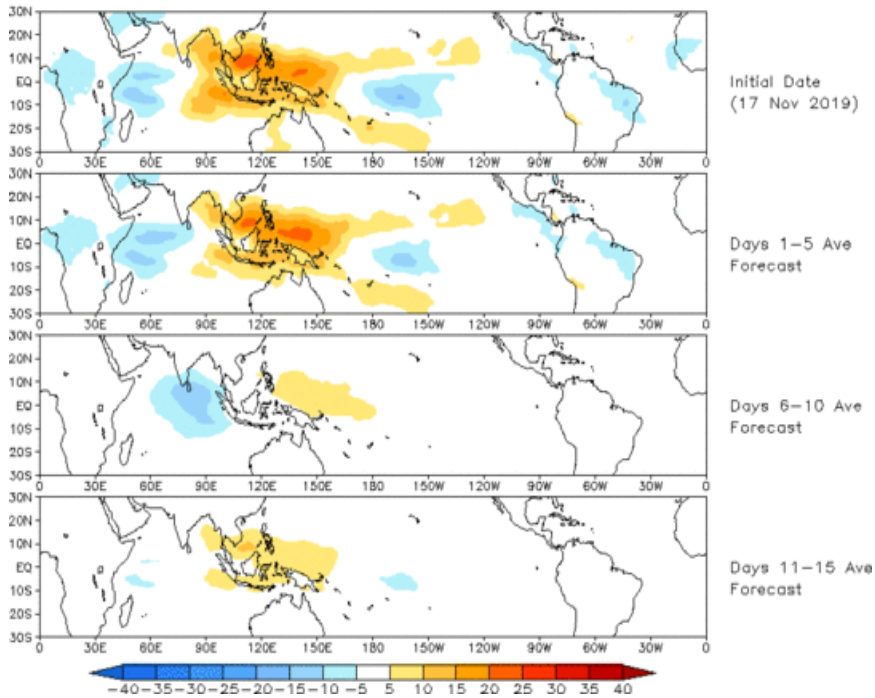
ECMWF Forecast

- Dynamical model MJO index forecasts show a weakening MJO signal, with no ensemble members from either the GEFS or ECMWF depicting the enhanced phase reaching the eastern Indian Ocean.
- A strengthening of the low frequency IOD may be pulling the index back towards Phase-1, destructively interfering with the MJO signal.

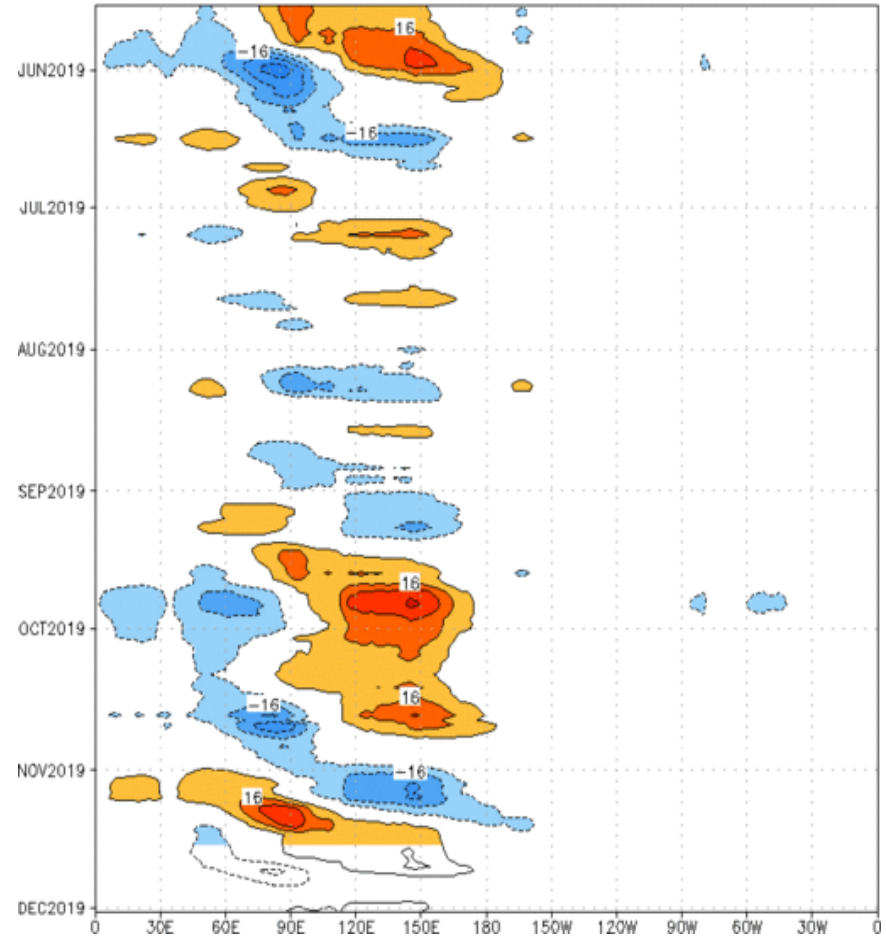
MJO: GEFS Forecast Evolution

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.)

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 17 Nov 2019
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:18-May-2019 to 17-Nov-2019
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

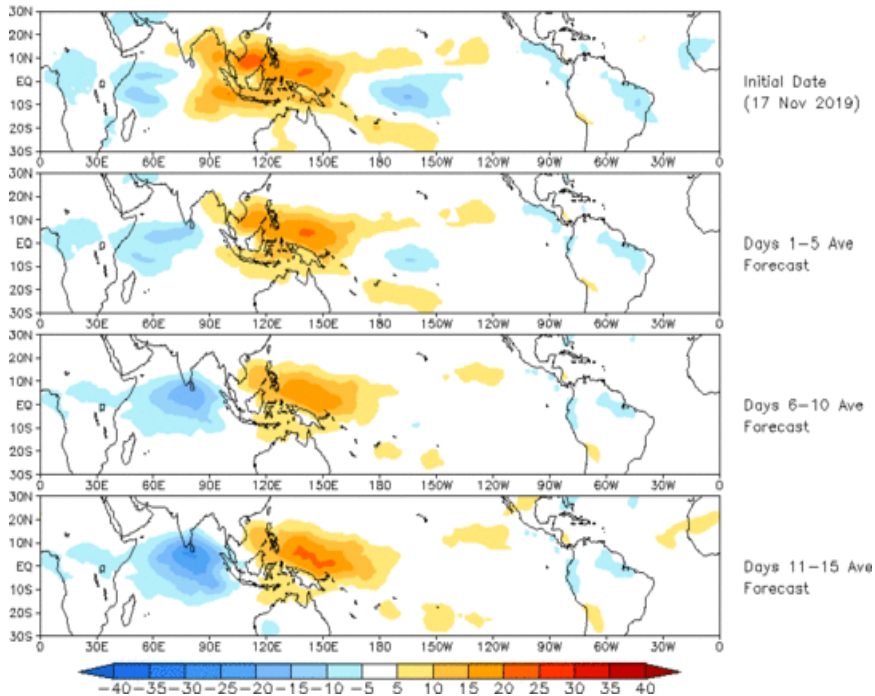


- The GEFS RMM-based OLR anomaly forecast shows a stationary and weakening signal.

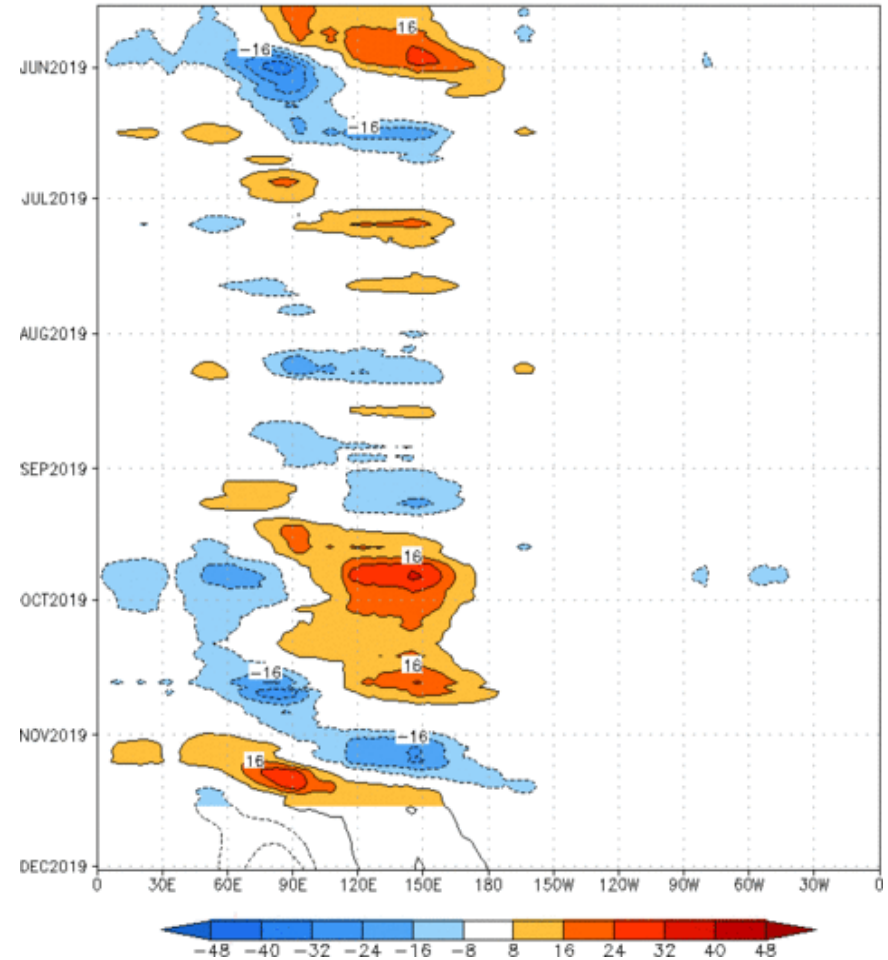
MJO: Constructed Analog Forecast Evolution

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.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (17 Nov 2019)



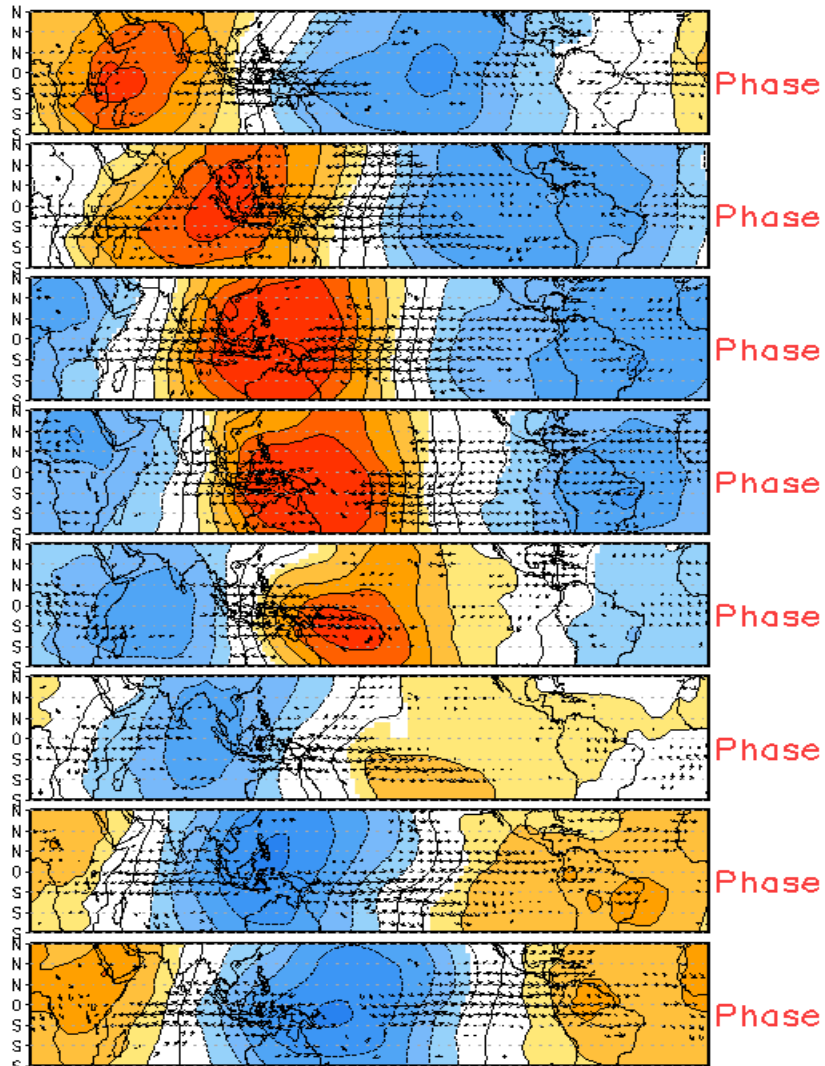
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cont:4Wm⁻²) Period:18-May-2019 to 17-Nov-2019
The unfilled contours are CA forecast reconstructed anomaly for 15 days



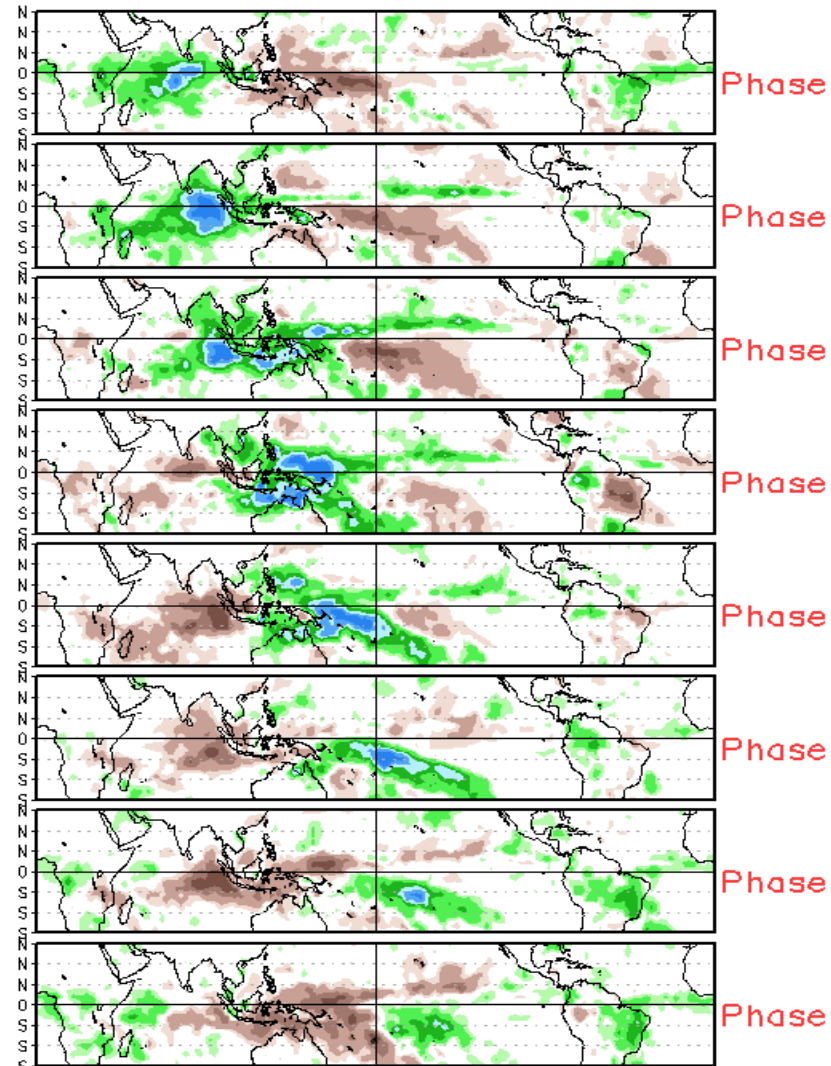
- The constructed analog shows a slow and robust new Indian Ocean MJO event.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



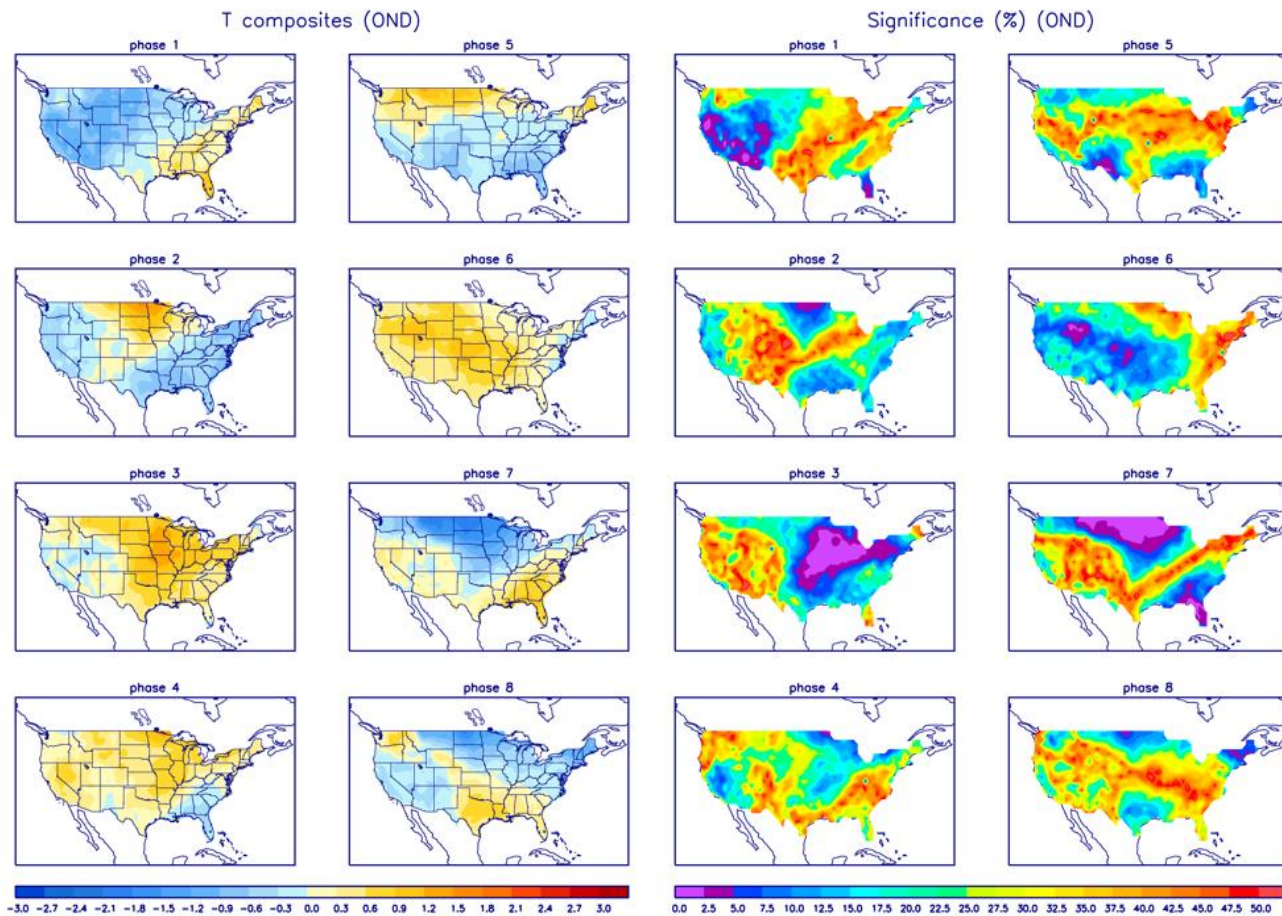
Precipitation Anomalies



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.

