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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
28 October 2019

Overview

- The RMM signal that grew over the month of October has now rapidly weakened over the past week while traversing Phase 2. Convection remains mostly over the Indian Ocean, likely supported by the strong IOD.

- Signal strength of the MJO is likely to remain weak over the next week, with a possible surge in strength in week-2. Continued eastward propagation is forecast by most of the models however.

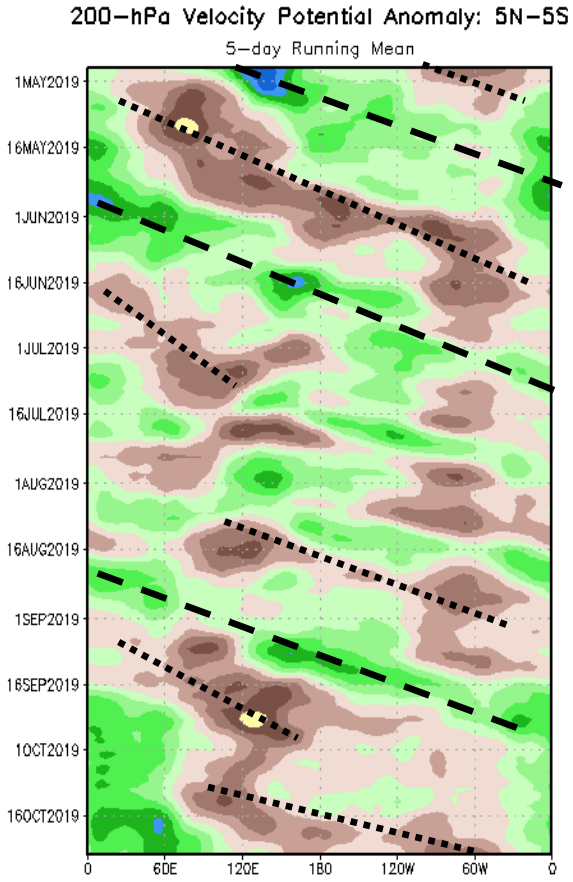
- Chances for tropical cyclone activity over the eastern Pacific and Atlantic basins continue to be low as we move into November and out of the peak period of activity in the Atlantic.

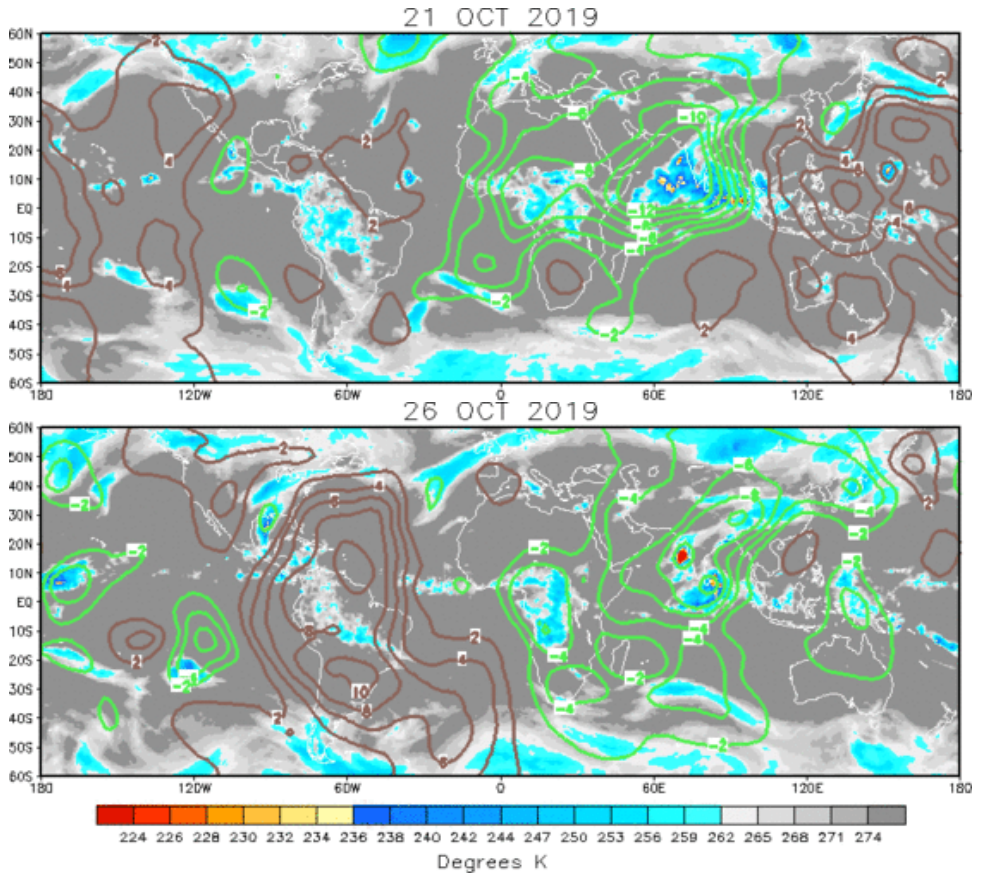
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

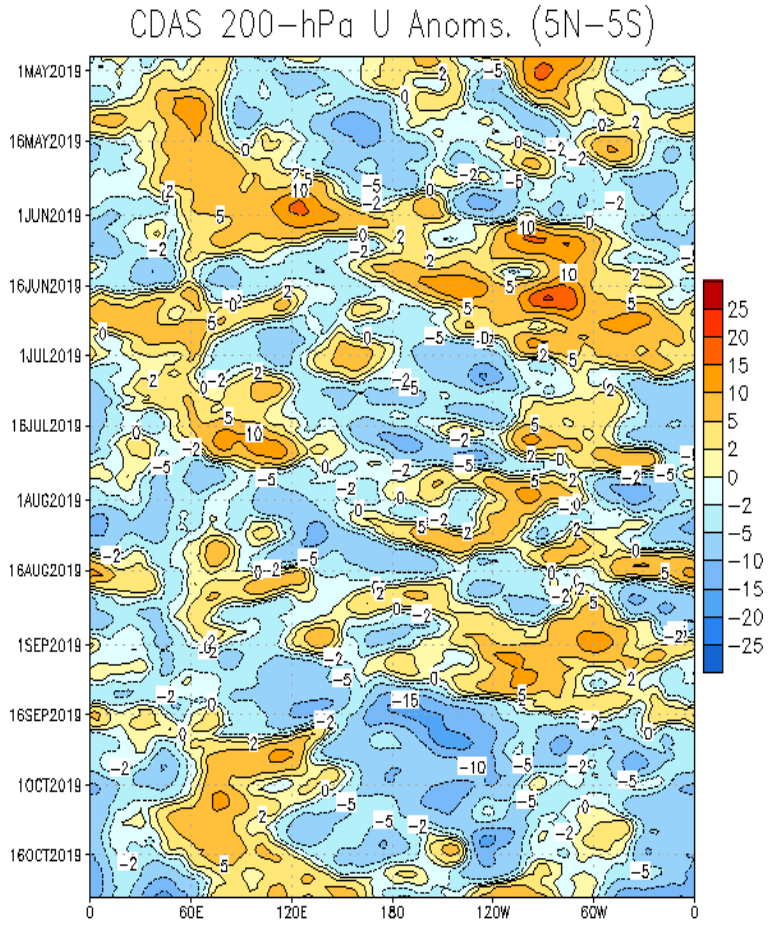


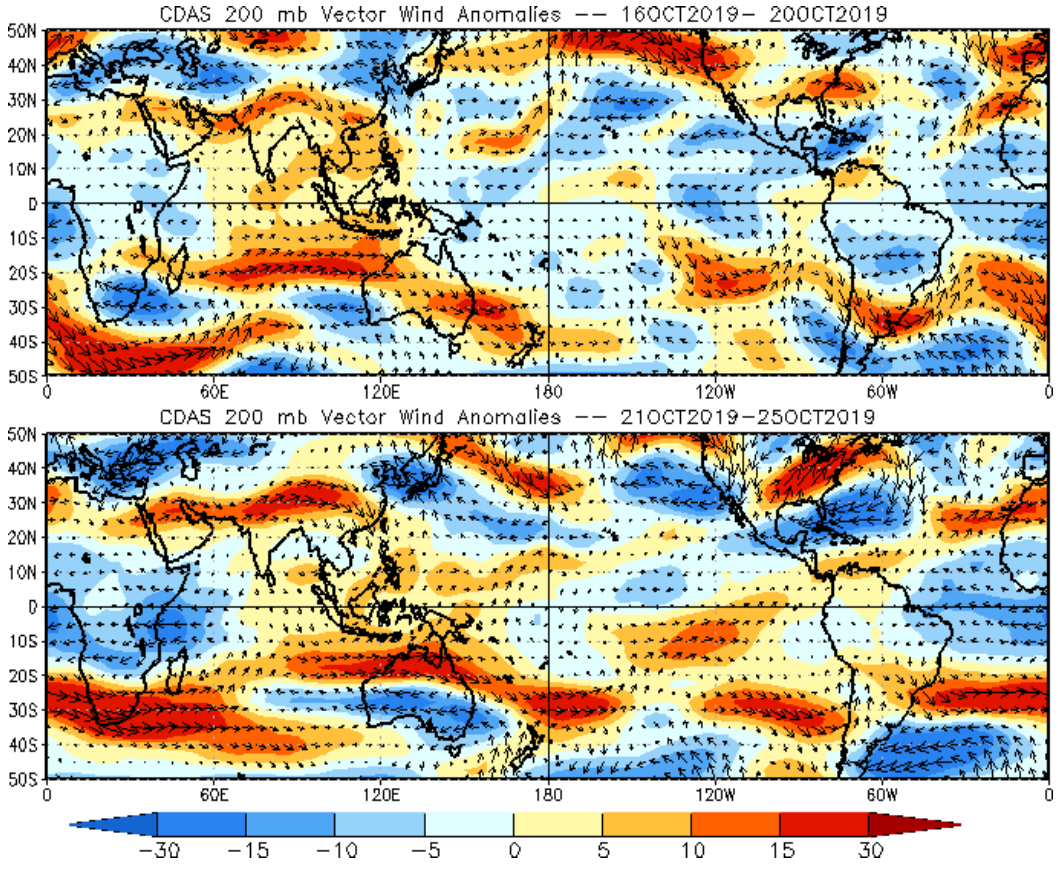


- Over the past month, the MJO signal remained mostly stationary, constructively interfering with the robust positive phase of the Indian Ocean Dipole (IOD) and resulting in strong upper-level divergence over the Indian Ocean.
- The suppressed envelope of the MJO has begun to propagate eastward since mid-October. Upper-level divergence has now shifted east over the Americas.

200-hPa Wind Anomalies

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

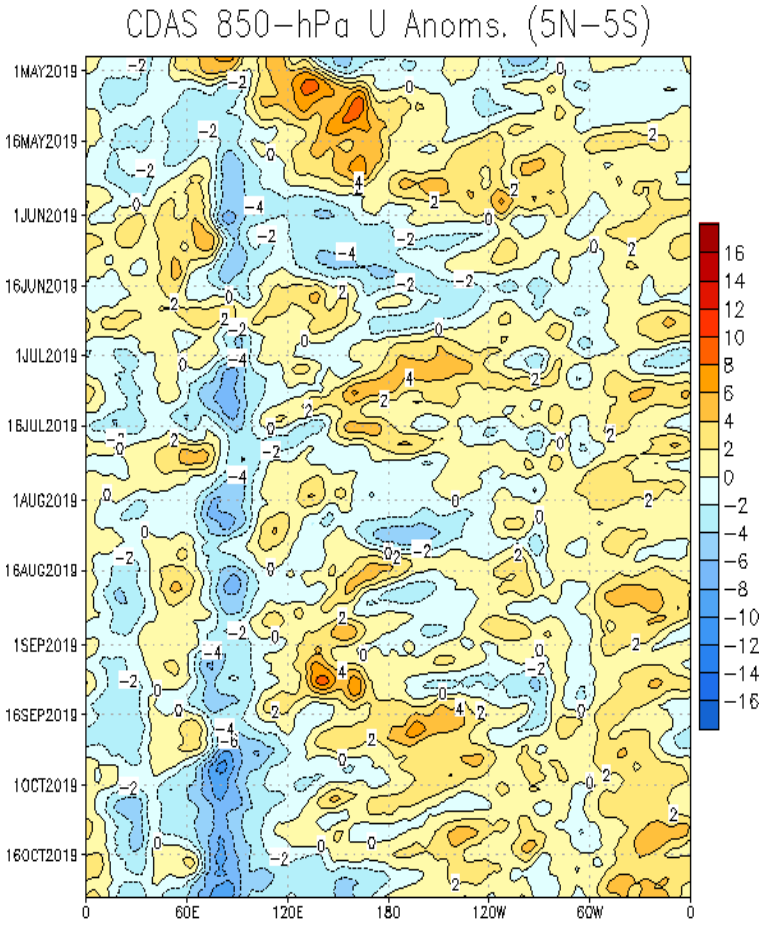


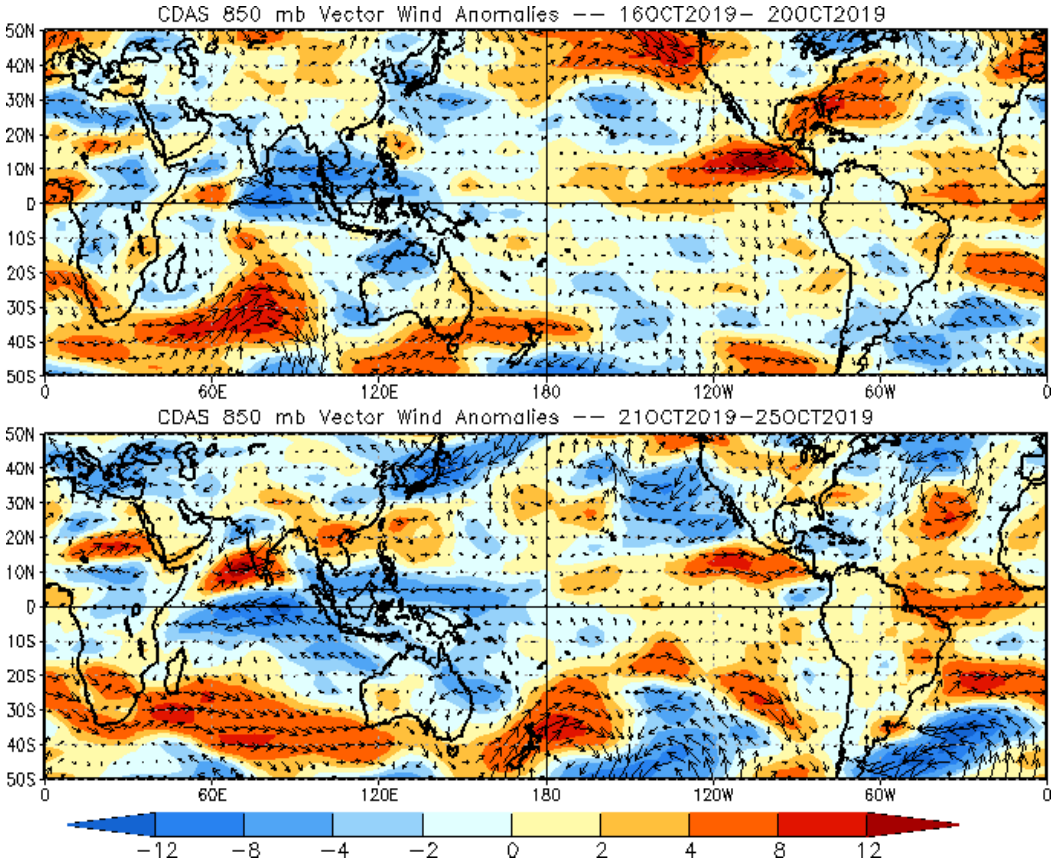


- Upper-level westerlies, over the tropical Atlantic during early to mid-October, contributed toward a decrease in tropical cyclogenesis across the Main Development Region.
- Anomalous upper-level easterlies have grown over Africa and the eastern Indian Ocean. Anticyclonic flow off of the eastern Seaboard is propagating anomalous easterlies over the central Pacific. Subtropical flow has become enhanced over the past week in the Northern Hemisphere.

850-hPa Wind Anomalies

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

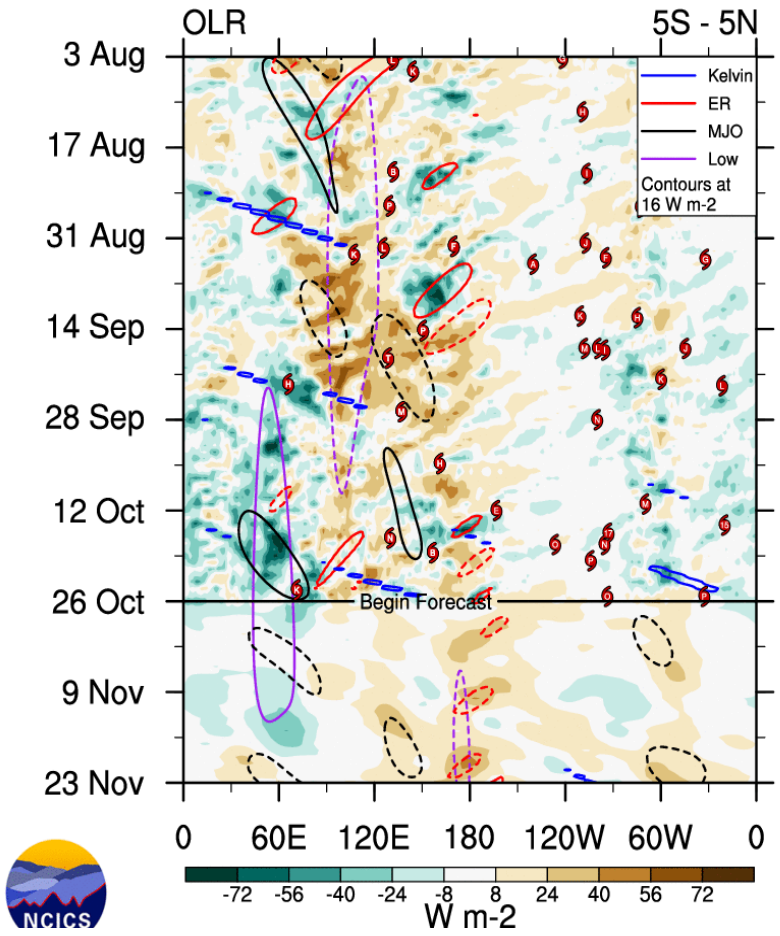


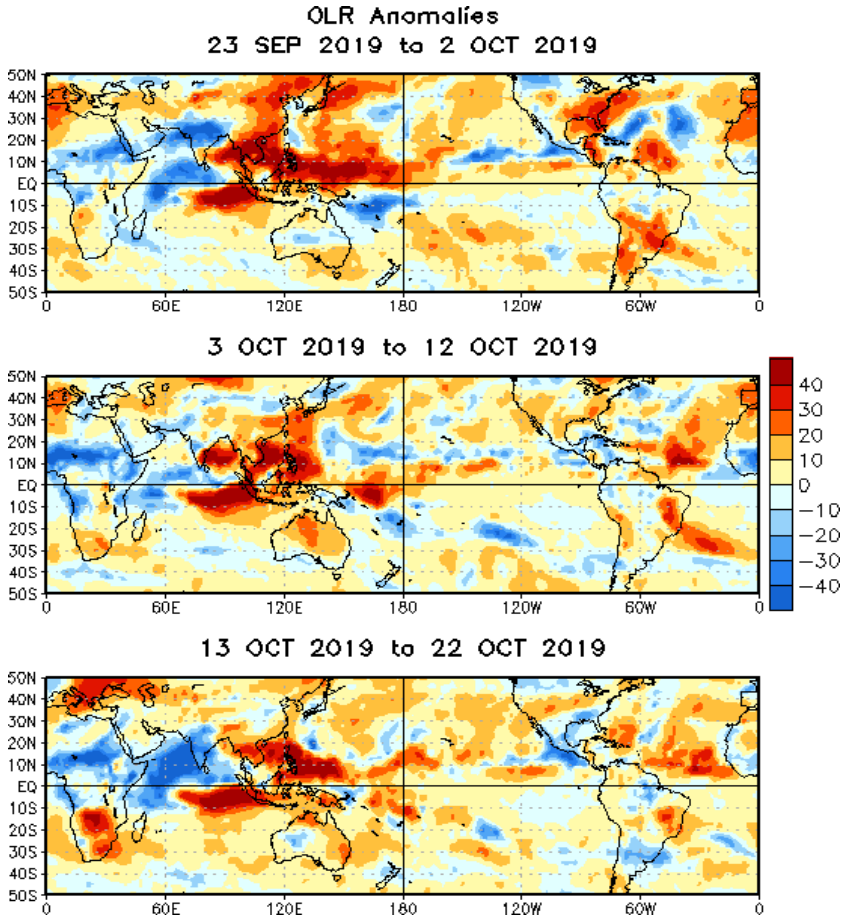


- Unlike the upper-level observations, a MJO signal is not as apparent with anomalous low-level easterlies persisting across the Indian Ocean. The footprint of TC Kyarr is evident near the Indian Peninsula.
- Anomalous easterlies along the western coast of the US have strengthened over the past week.

Outgoing Longwave Radiation (OLR) Anomalies

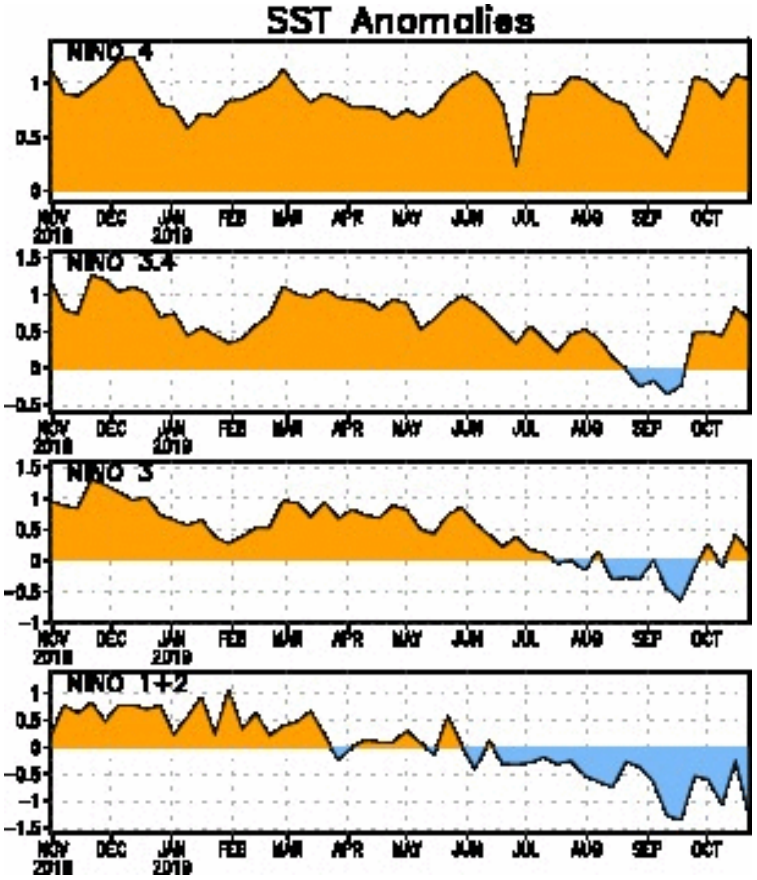
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

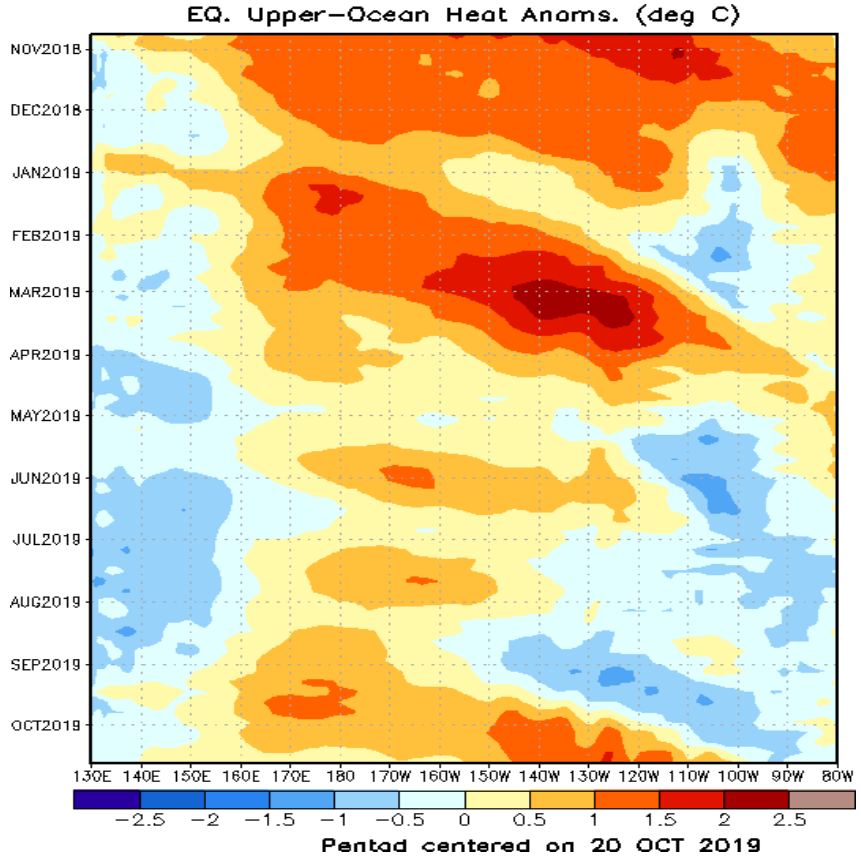




- The anomalous dipole of convection across much of the Indian Ocean and Maritime Continent tied to the ongoing positive IOD event persists and has strengthened over the past week.
- Suppressed convection over the Atlantic MDR has remained consistent over the past month.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



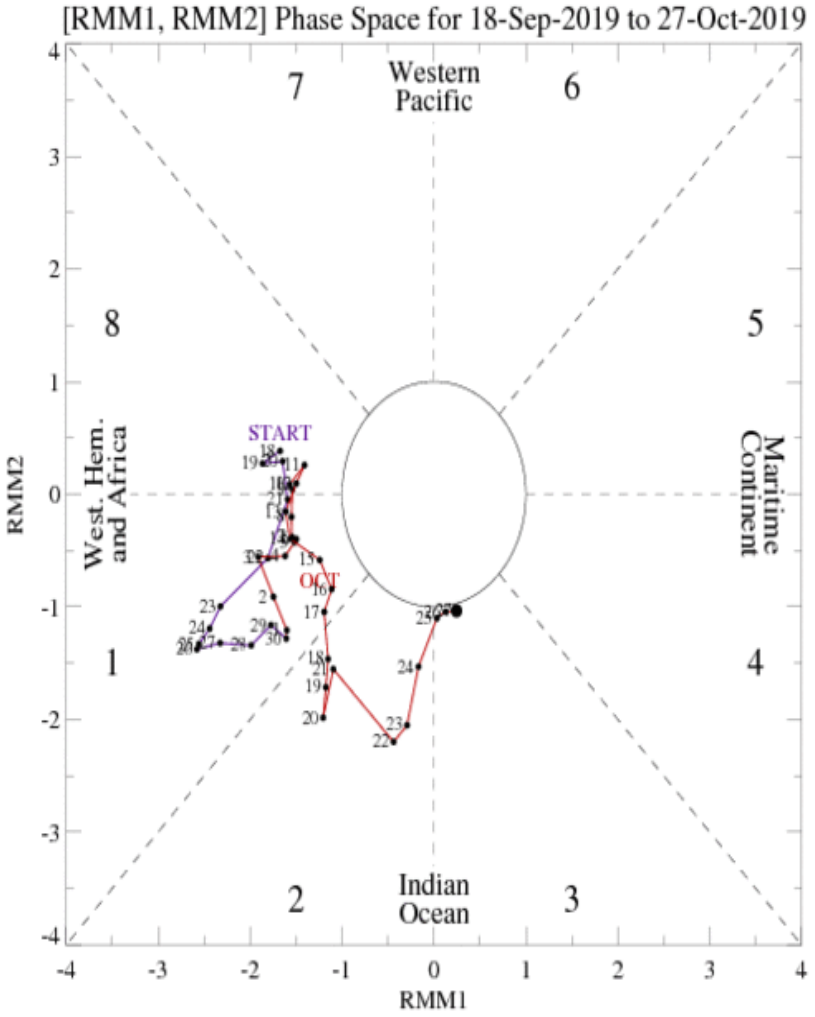


- Negative anomalies associated with the upwelling phase of an oceanic Kelvin wave decreased over the East Pacific.

- Upper-oceanic heat content increased across the central equatorial Pacific since mid-September.

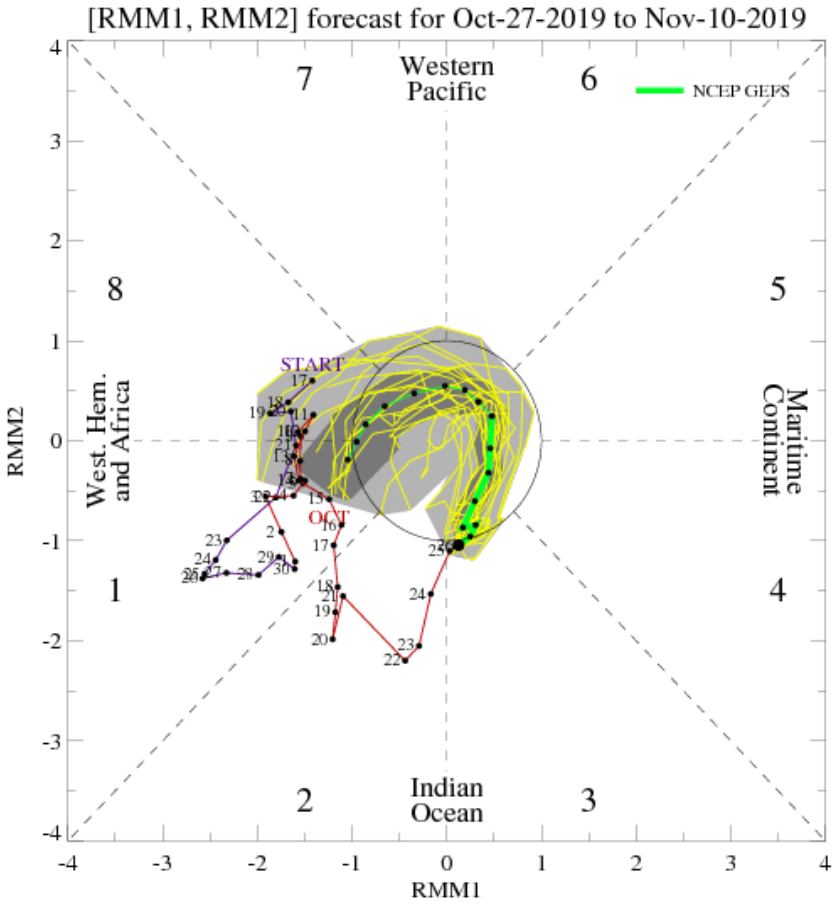
MJO Index: Recent Evolution

- The RMM index indicates some eastward propagation of the signal since mid-October; however, since last week, eastward propagation has dramatically slowed, with the signal diving back toward the unit circle.

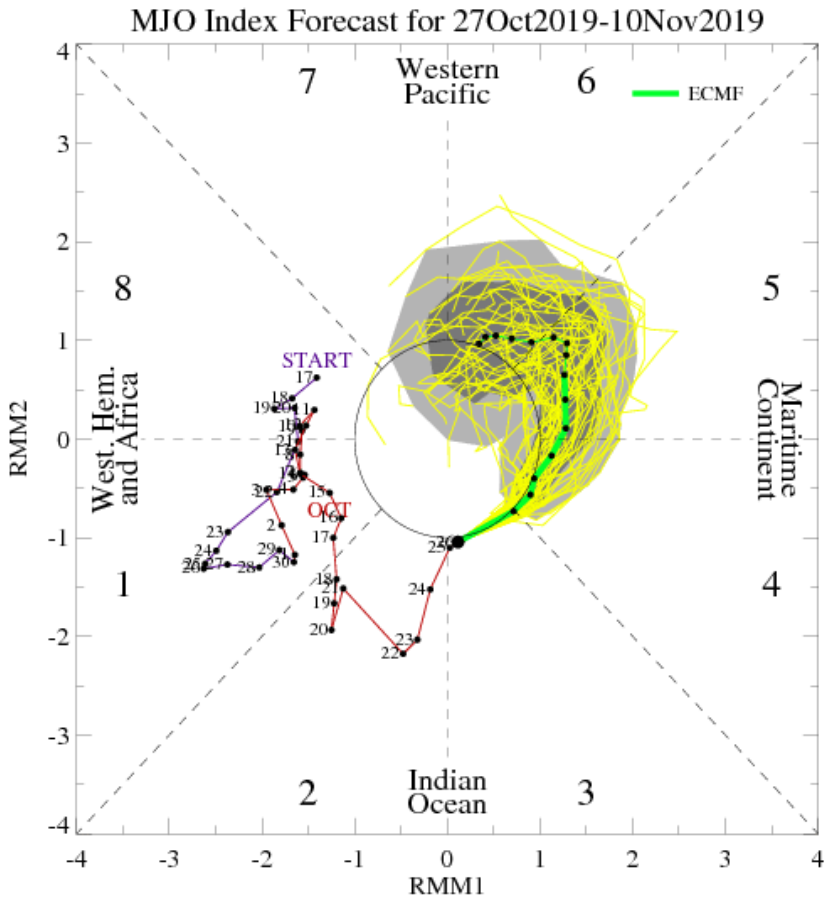


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

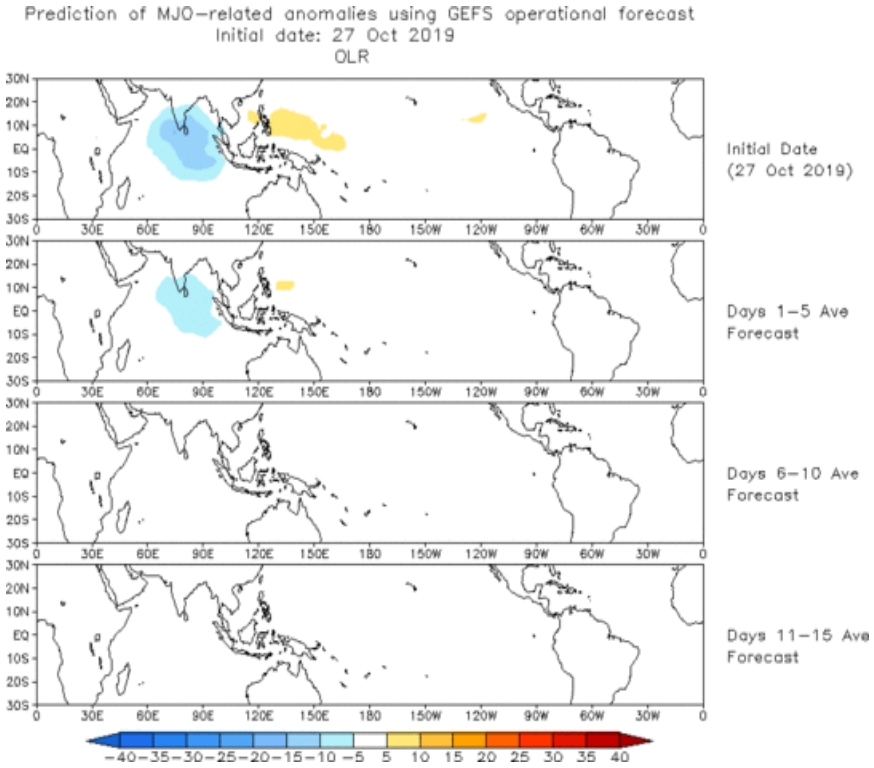


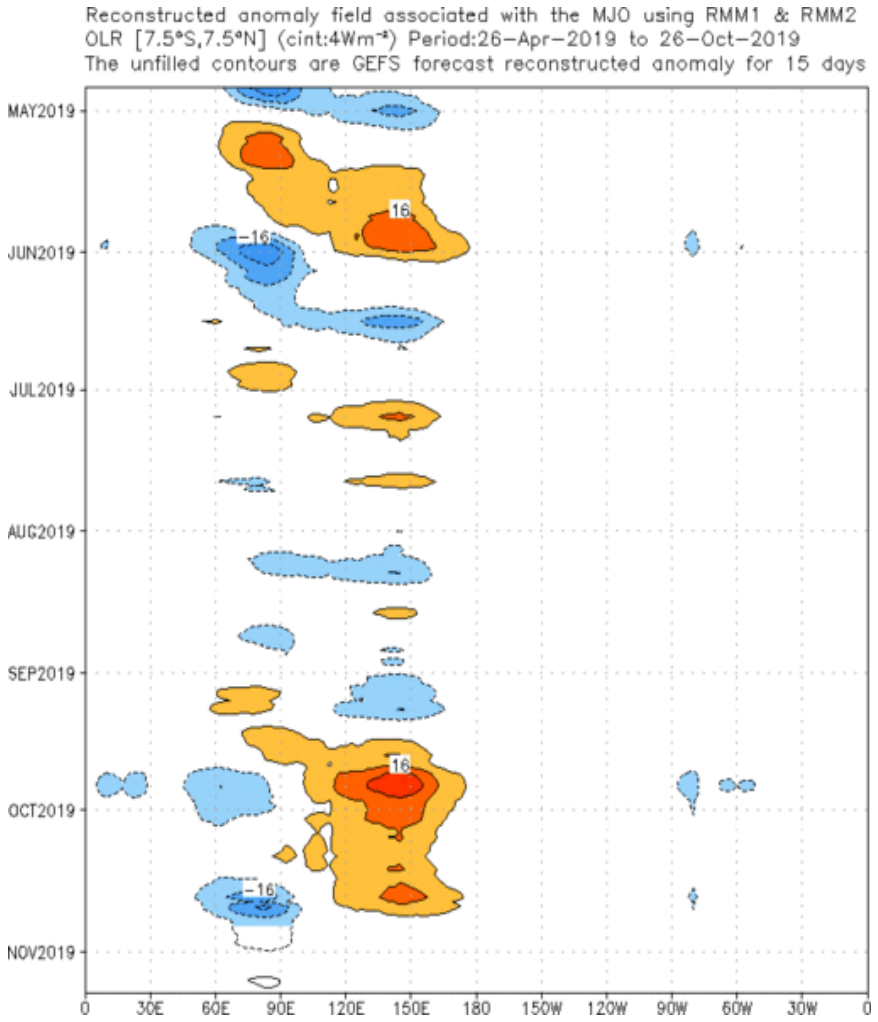
ECMWF Forecast

- The ECMWF mean continues eastward propagation of the MJO through the next two weeks, with the signal seeing an uptick in strength toward the end of week-1, as it reaches the Western Pacific. Spread between the members remains fairly wide, with some falling within the unit circle and others rapidly strengthening the signal.
- Although the GFS model maintains eastward propagation during the next week, the signal remains weak as the MJO destructively interferences with continued strong IOD signal through week-1.

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.)

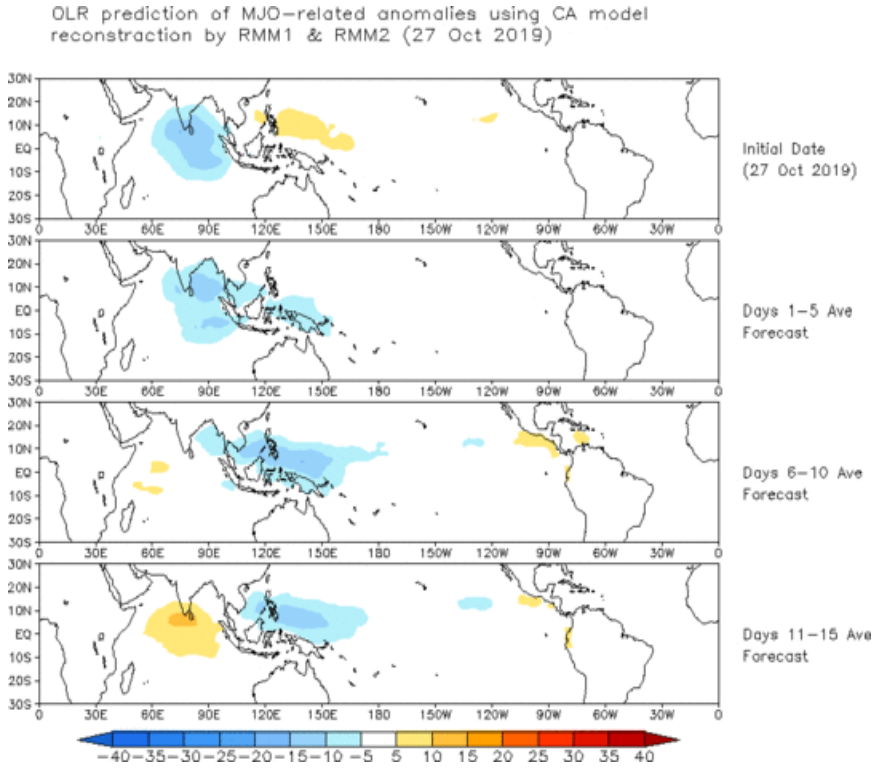


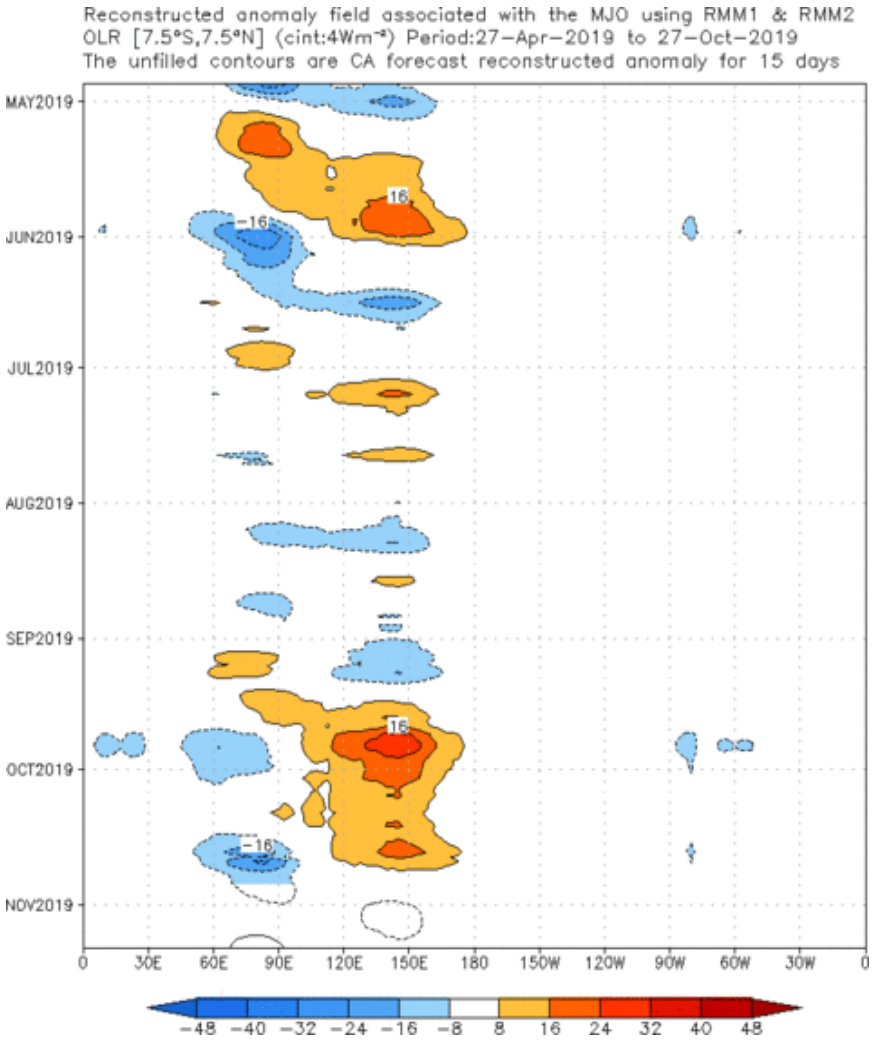


- The GEFS indicates OLR anomalies diminishing rapidly, with no anomalies present by the end of week-1.

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.)

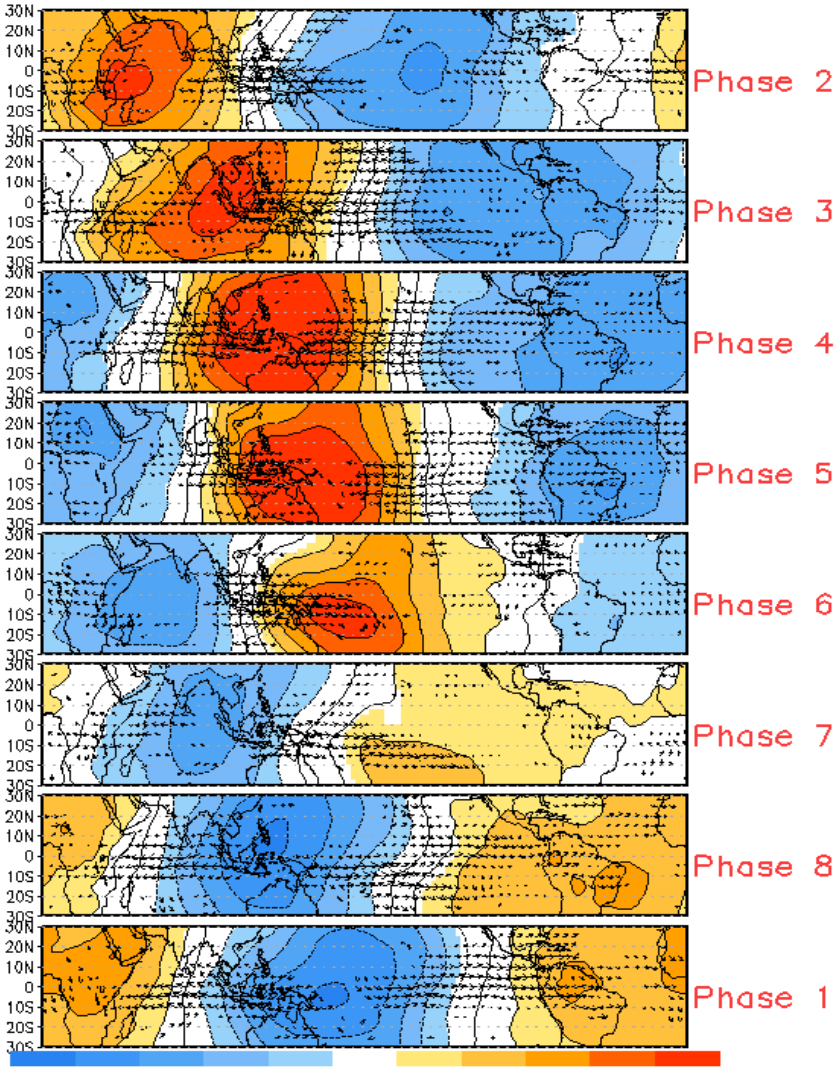




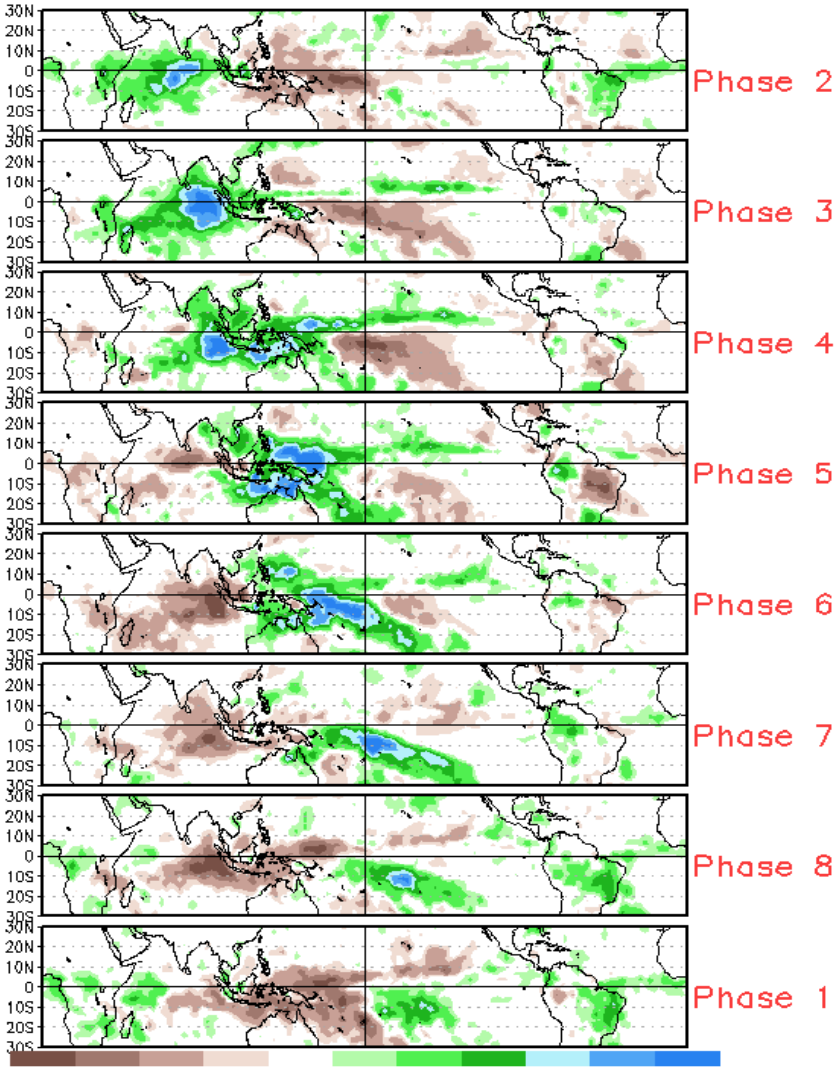
- The constructed analog forecast shows enhanced convection propagating eastward, reaching the western Pacific by week-2. Suppressed convection begins to grow in week-2 over the Indian Ocean.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



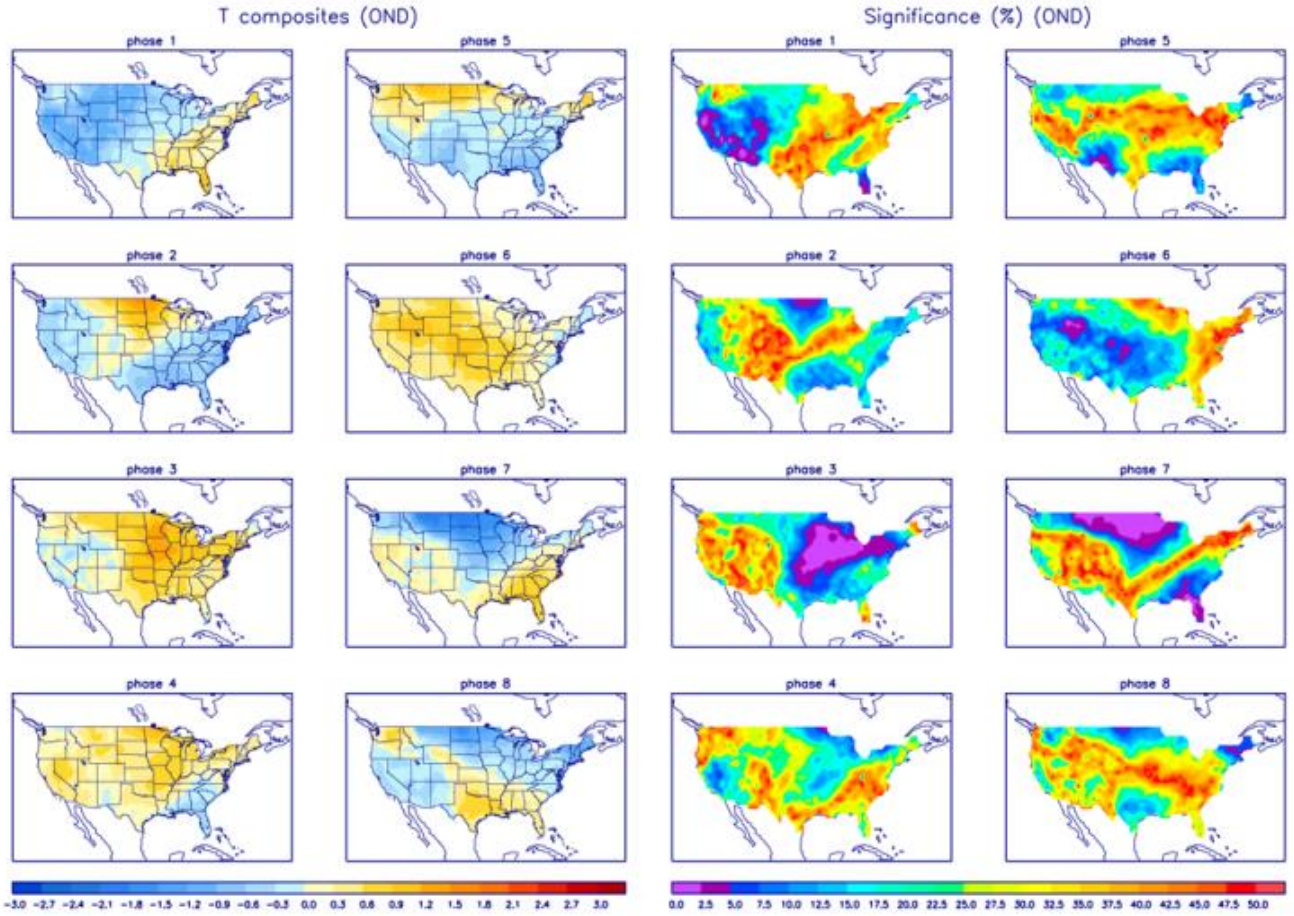
Precipitation Anomalies



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.

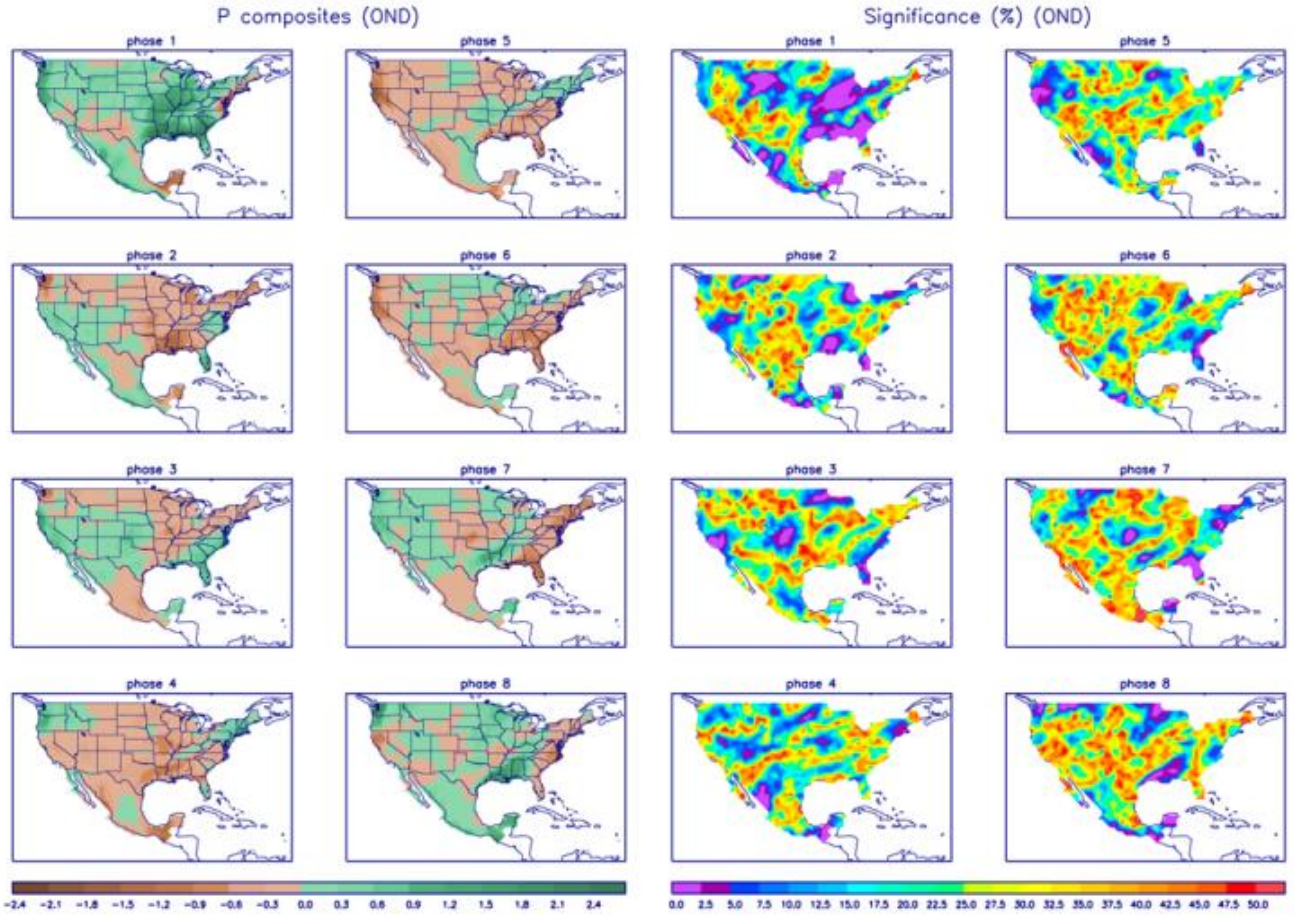


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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.



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