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

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

Overview

- A developing MJO has shifted east from Africa to the western Indian Ocean during mid-October, which is constructively interfering with the positive phase Indian Ocean Dipole (IOD) event.

- Although the MJO is likely to weaken during Week-2 as it crosses the Maritime Continent, its remnant enhanced phase is expected to emerge over the West Pacific by the beginning of November.

- The predicted MJO evolution favors one or two tropical cyclones forming over the Arabian Sea during the next two weeks.

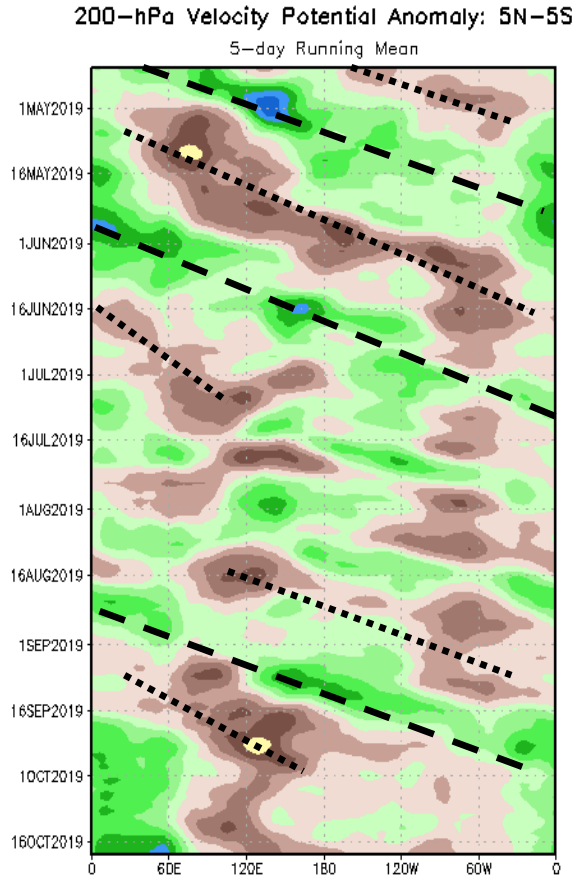
- An early end to the tropical cyclone season is becoming more likely across the East Pacific and Atlantic basins.

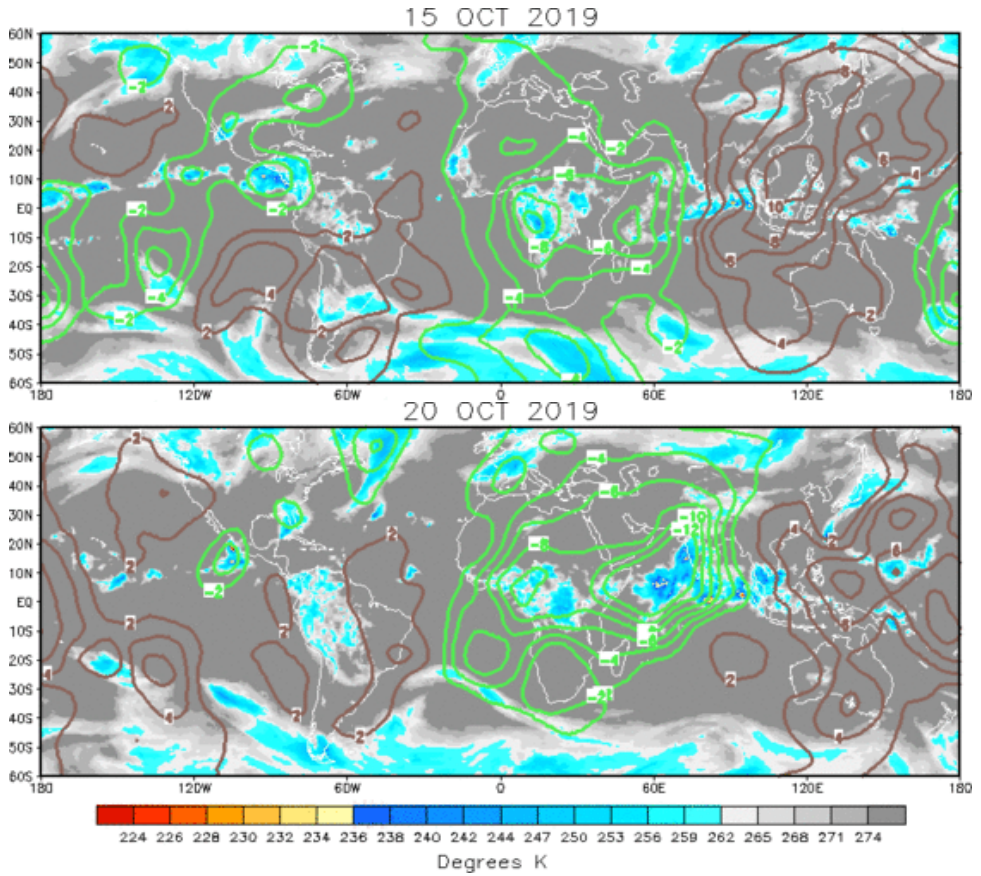
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



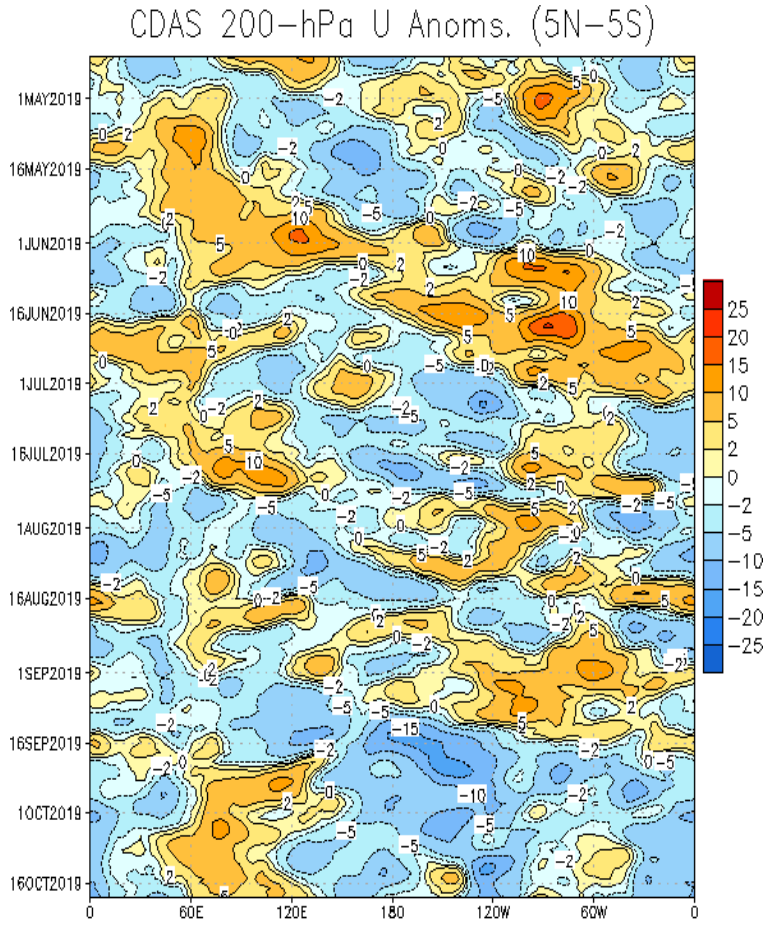


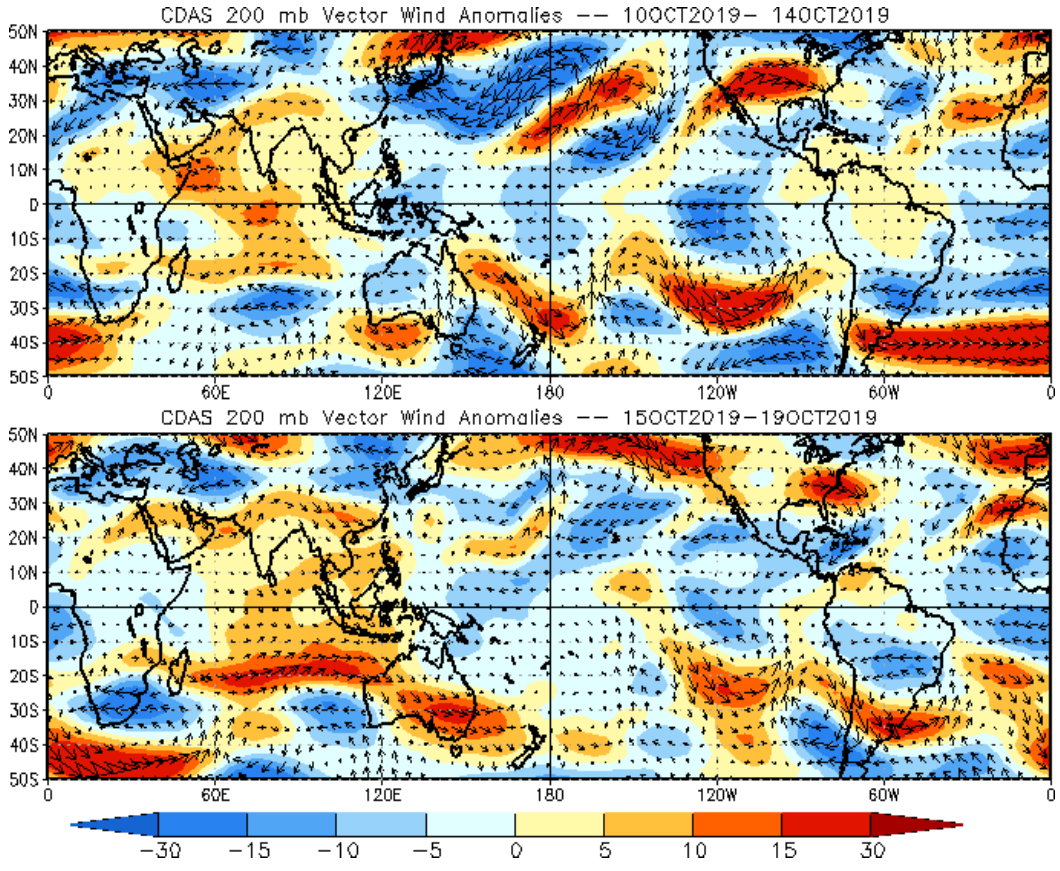
- Following a persistent pattern of 200-hPa Velocity Potential anomalies over the Eastern Hemisphere, a slight eastward shift in anomalous upper-level convergence (divergence) is noted over the West Pacific (Indian Ocean) during mid-October.

- This more coherent MJO is constructively interfering with the robust positive phase of the Indian Ocean Dipole (IOD), resulting in strong upper-level divergence over the Indian Ocean.

200-hPa Wind Anomalies

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



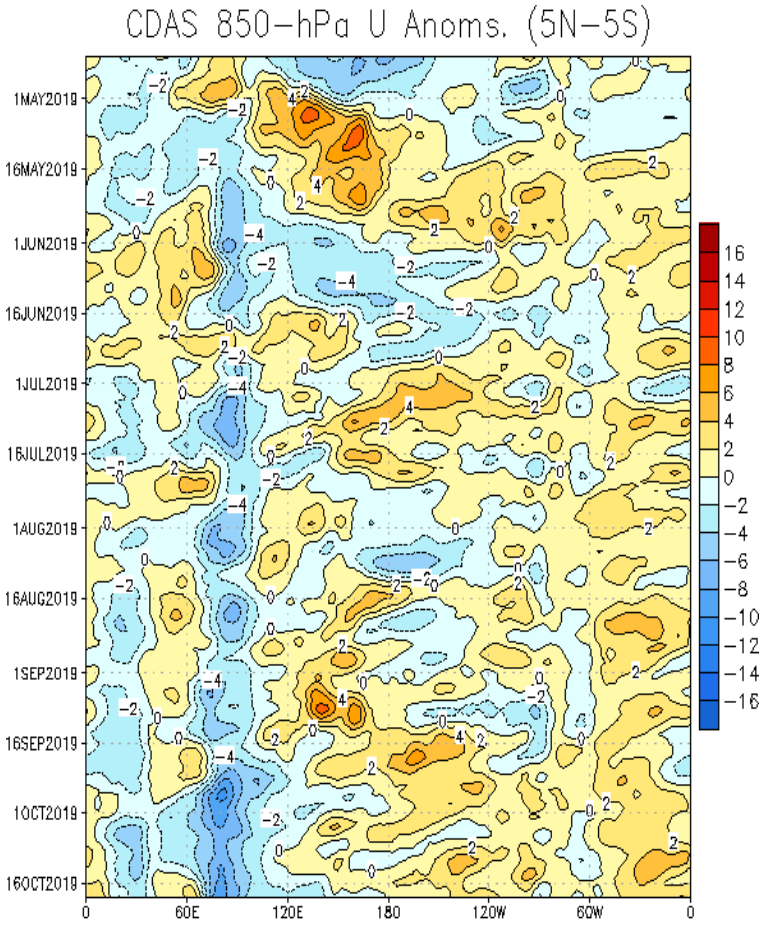


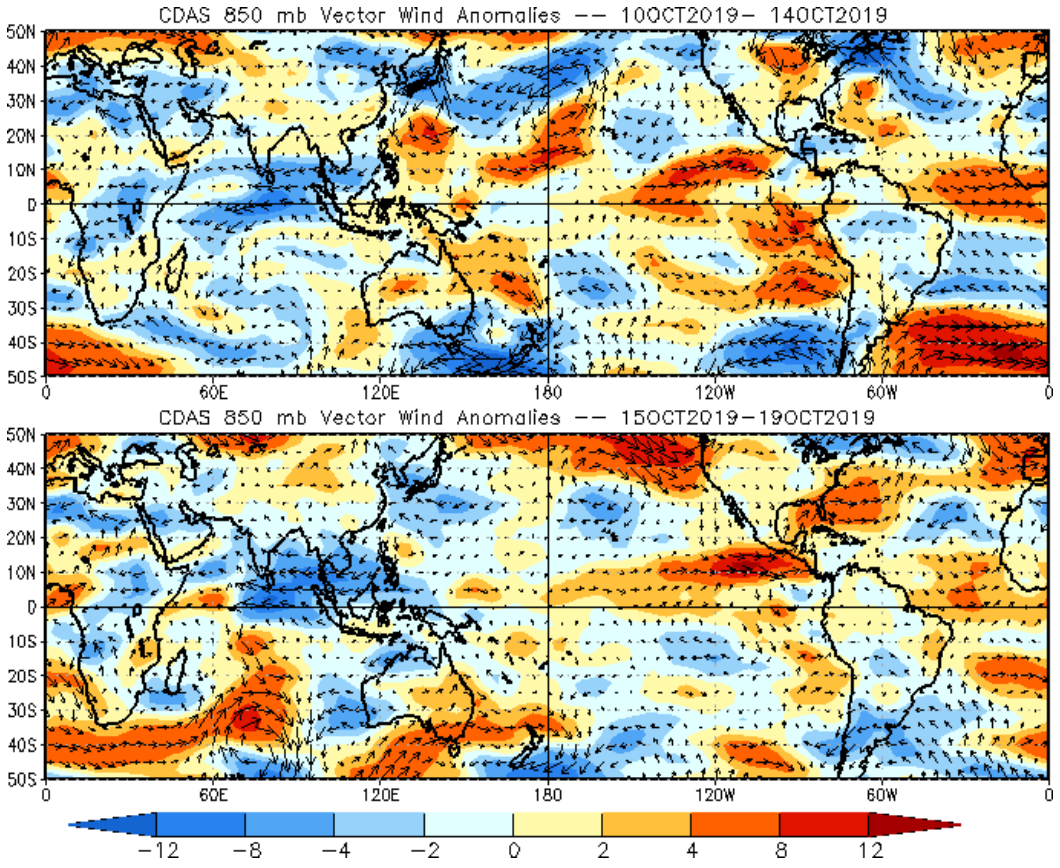
- Upper-level westerlies, over the tropical Atlantic during early to mid-October, contributed toward a decrease in tropical cyclogenesis across the Main Development Region.

- Anomalous upper-level westerlies expanded east from the Indian Ocean to the Maritime Continent during the past five days.

850-hPa Wind Anomalies

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



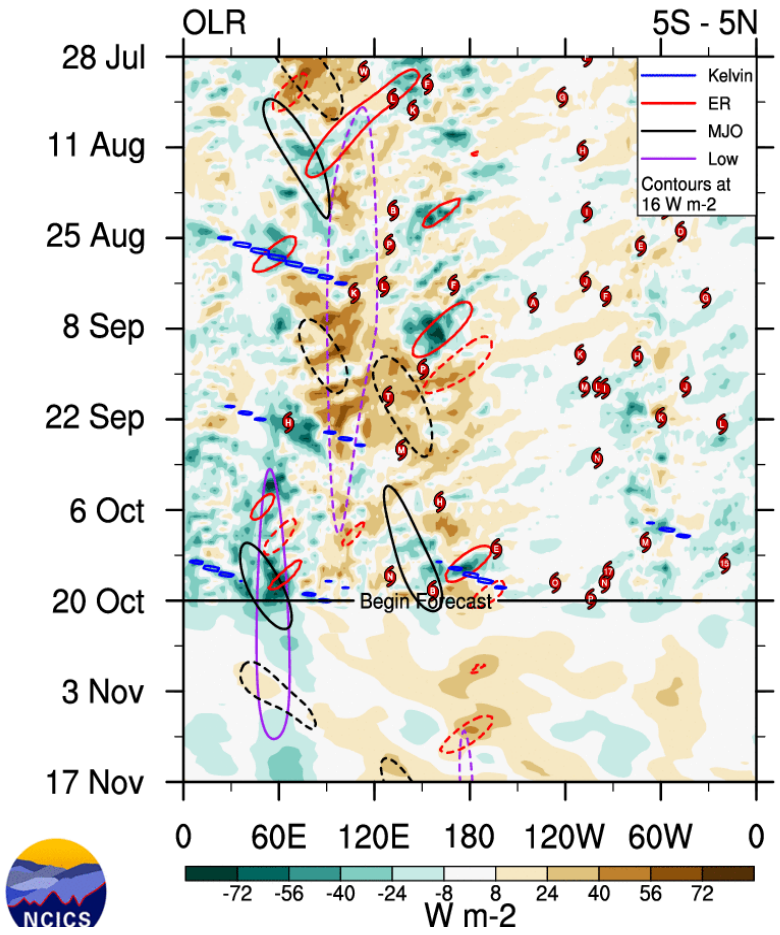


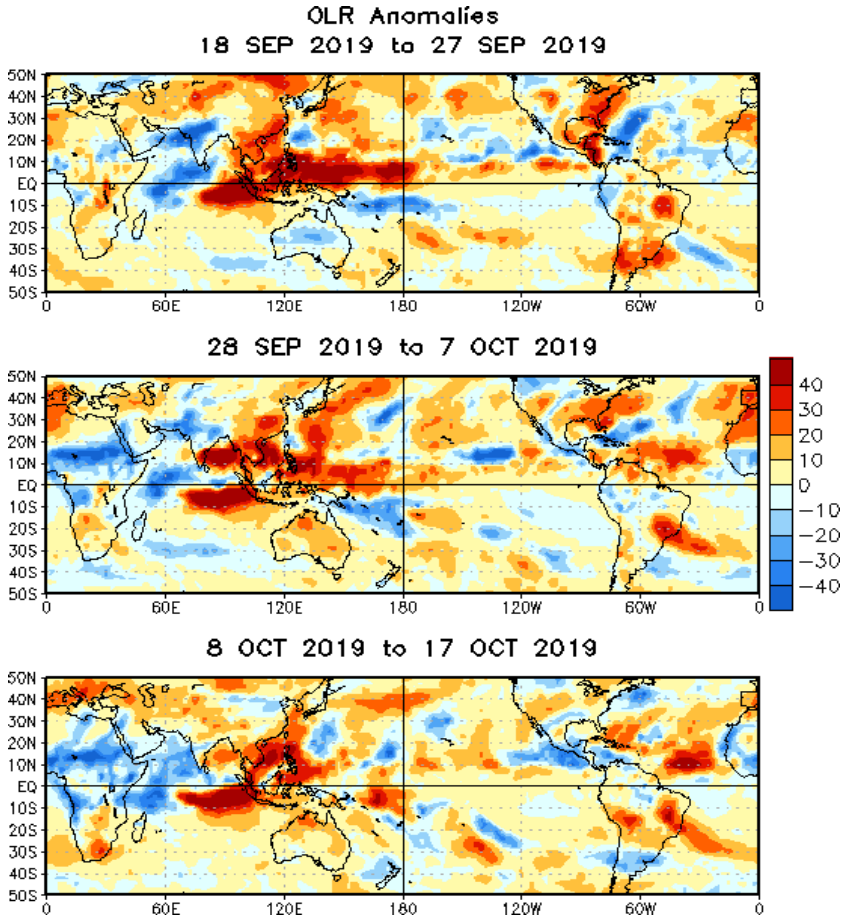
- Unlike the upper-level observations, a MJO signal is not as apparent with anomalous low-level easterlies persisting across the Indian Ocean.

- Anomalous westerlies across the East Pacific aided the development of two tropical cyclones (Octave and Priscilla) during the past week.

Outgoing Longwave Radiation (OLR) Anomalies

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

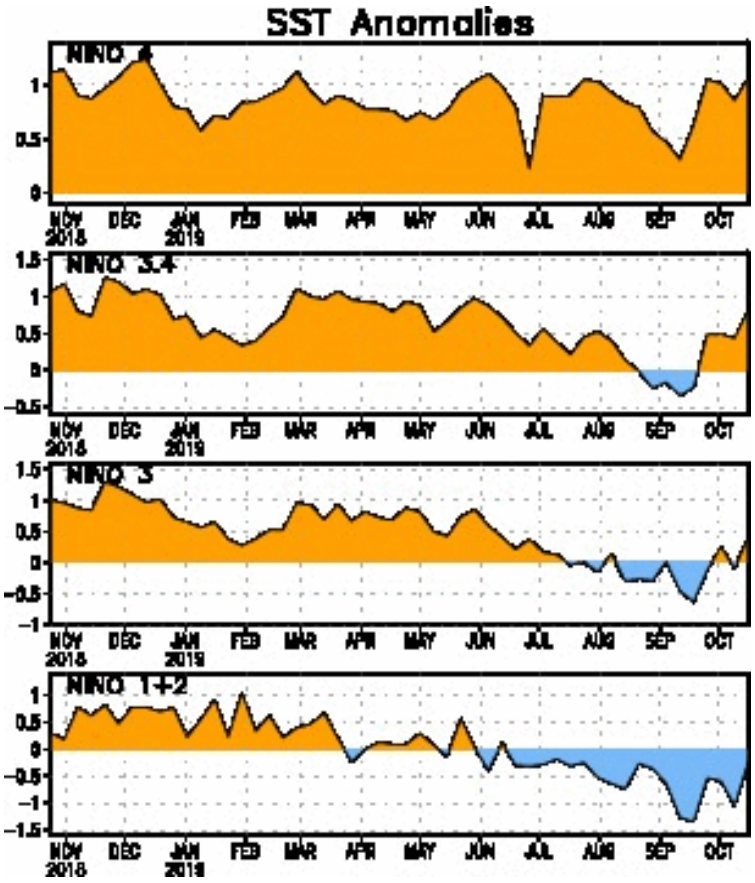


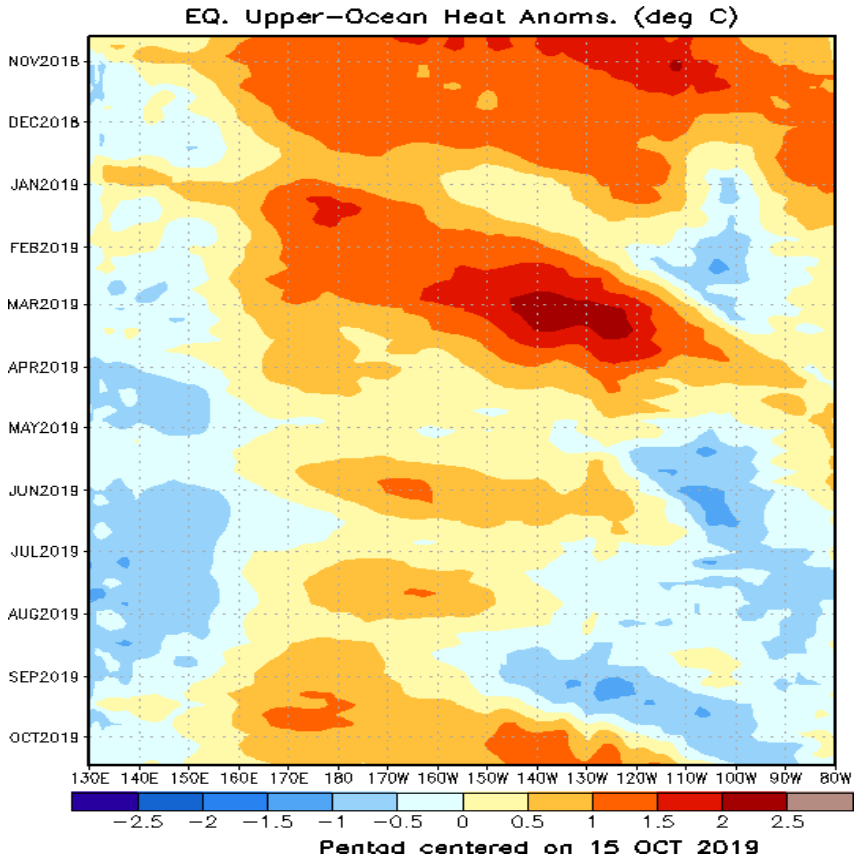


- The anomalous dipole of convection across much of the Indian Ocean and Maritime Continent tied to the ongoing positive IOD event persists.

- Enhanced convection continued across parts of the East Pacific through early to mid-October.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



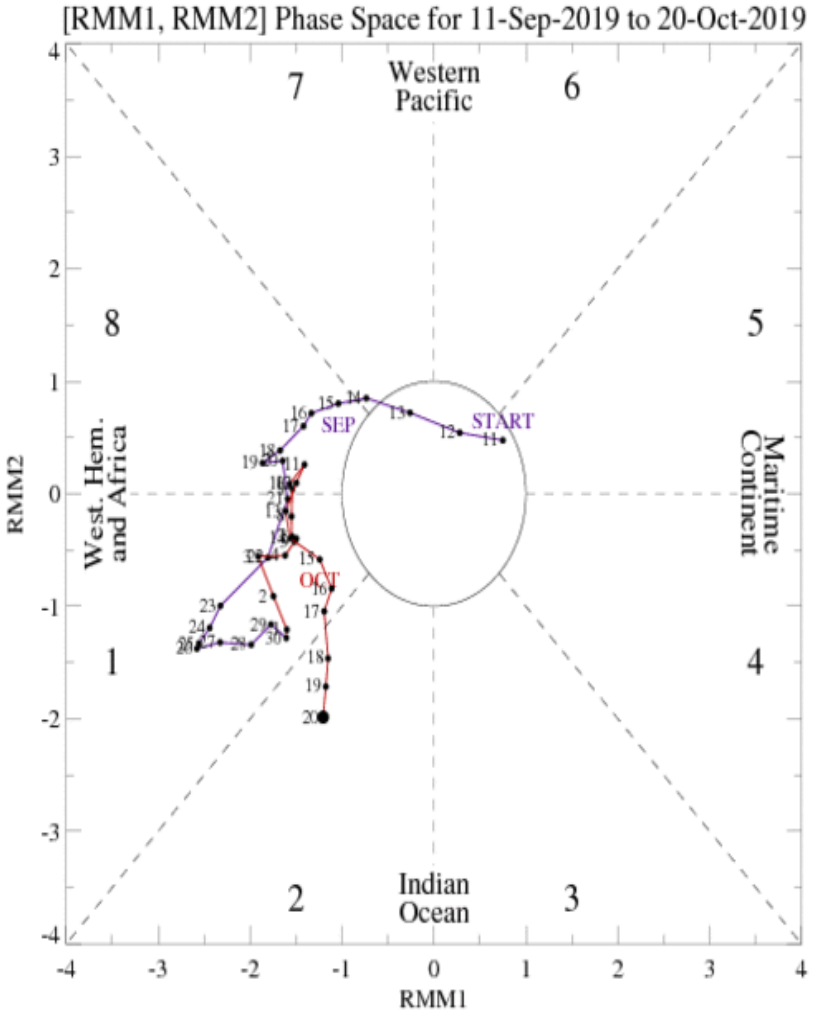


- Negative anomalies associated with the upwelling phase of an oceanic Kelvin wave increased over the East Pacific, resulting in negative SST anomalies offshore of South America.

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

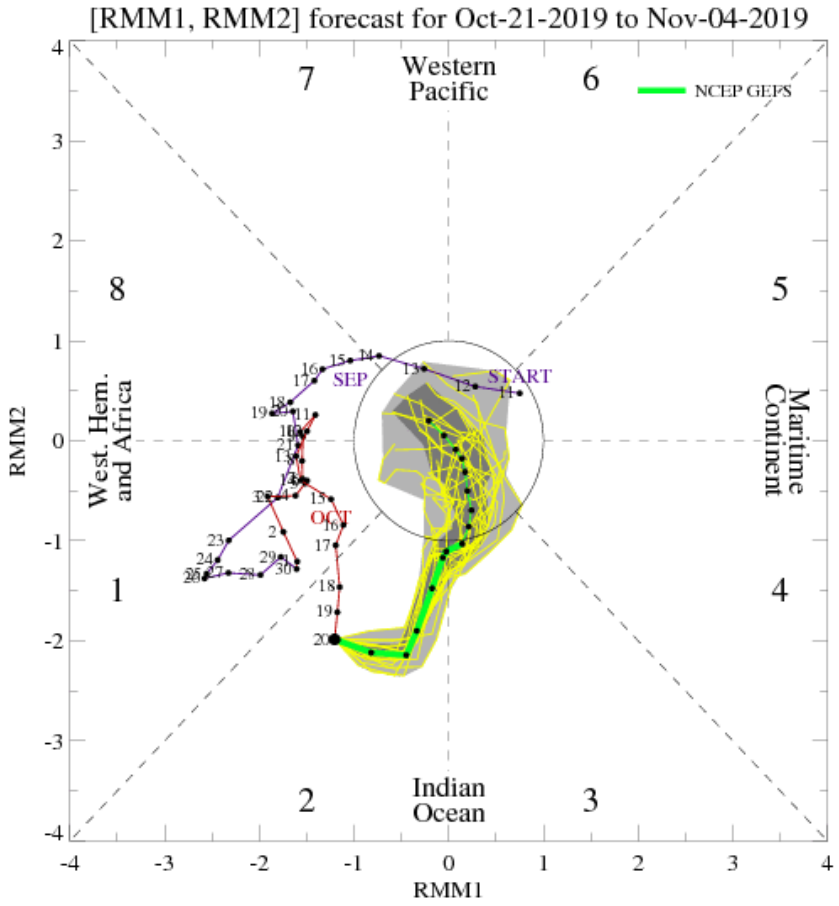
MJO Index: Recent Evolution

- The RMM index indicates eastward propagation of a developing MJO with its enhanced phase shifting east over Africa and the western Indian Ocean. The increase in amplitude is associated with constructive interference with the positive IOD.

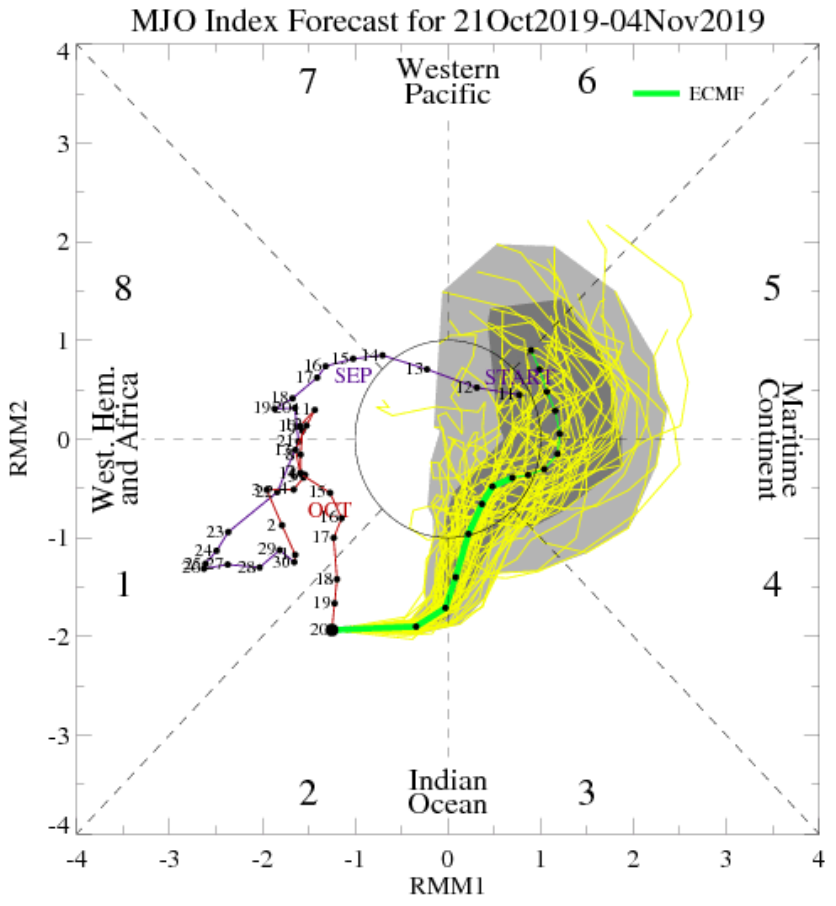


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



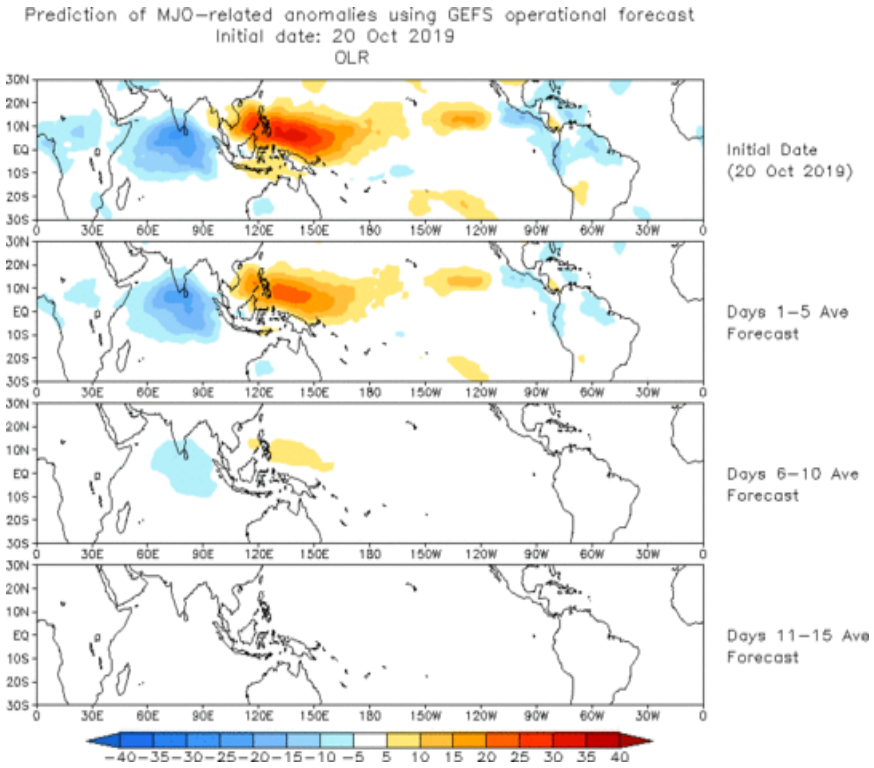
ECMWF Forecast

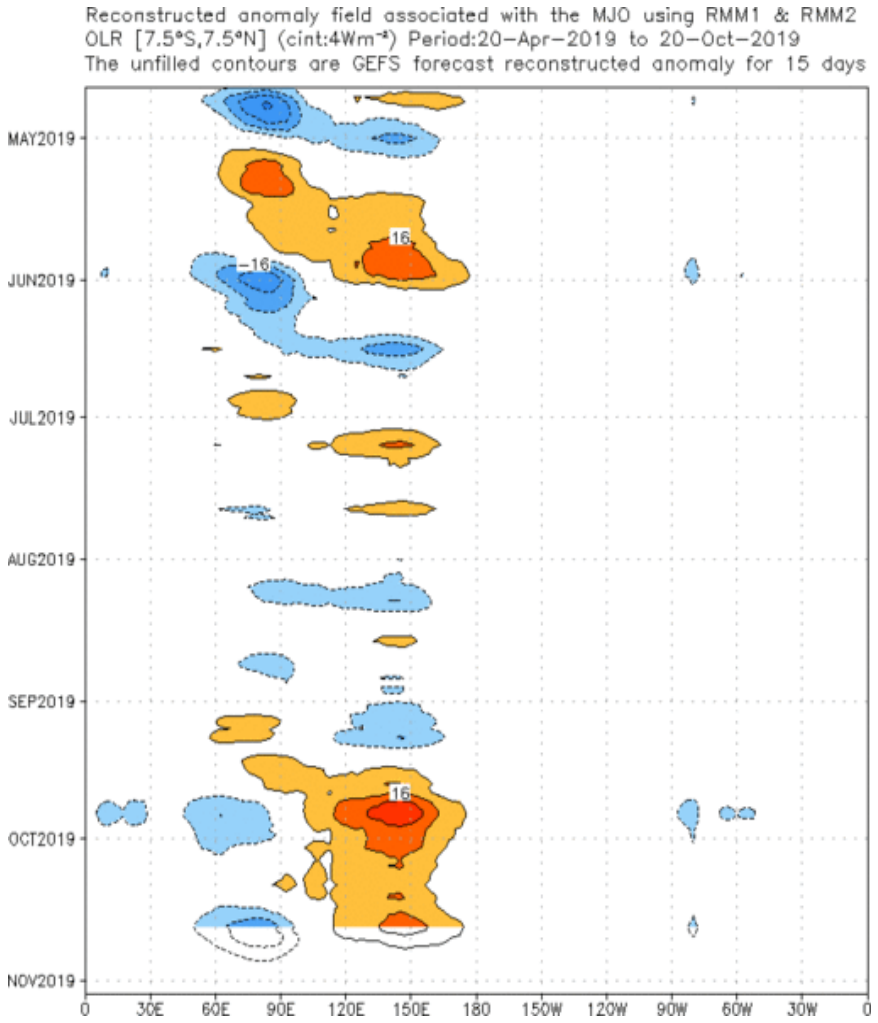
- The ECMWF mean and many of its ensemble members remain bullish on a MJO propagating east from the Indian Ocean to the Maritime Continent during the next two weeks.

- Although the GFS model maintains eastward propagation during the next week, it weakens the signal rapidly as the MJO destructively interferences with the background IOD.

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.)

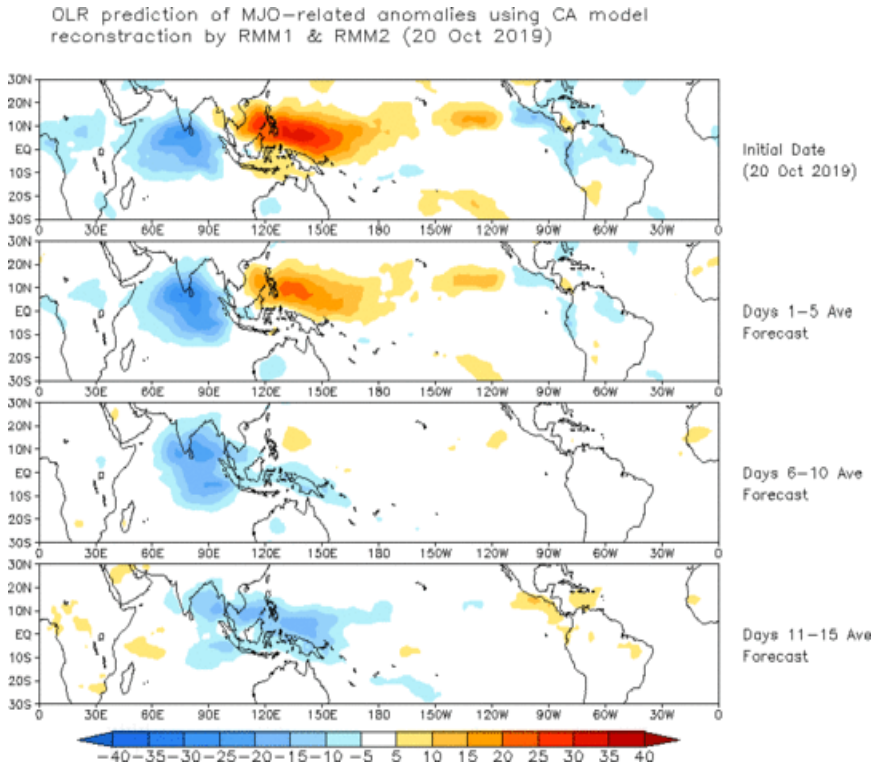


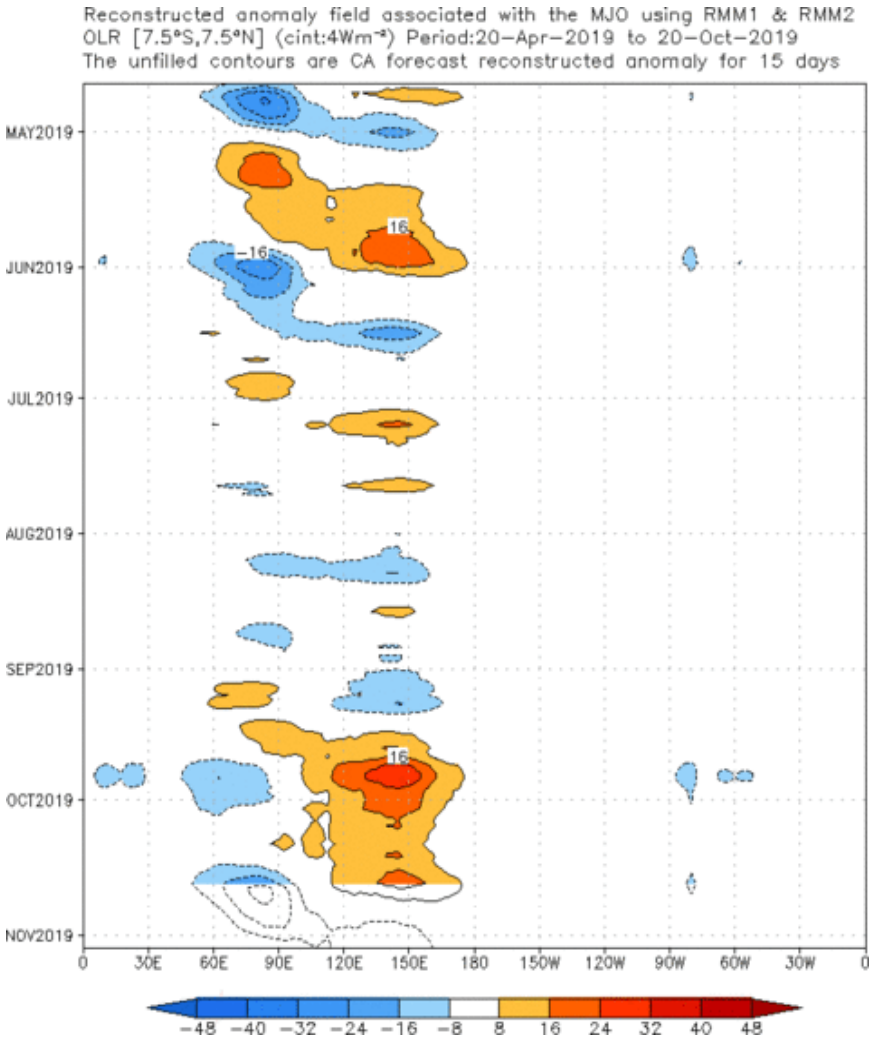


- The GEFS indicates OLR anomalies diminishing as the MJO and IOD offset one another with time.

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.)

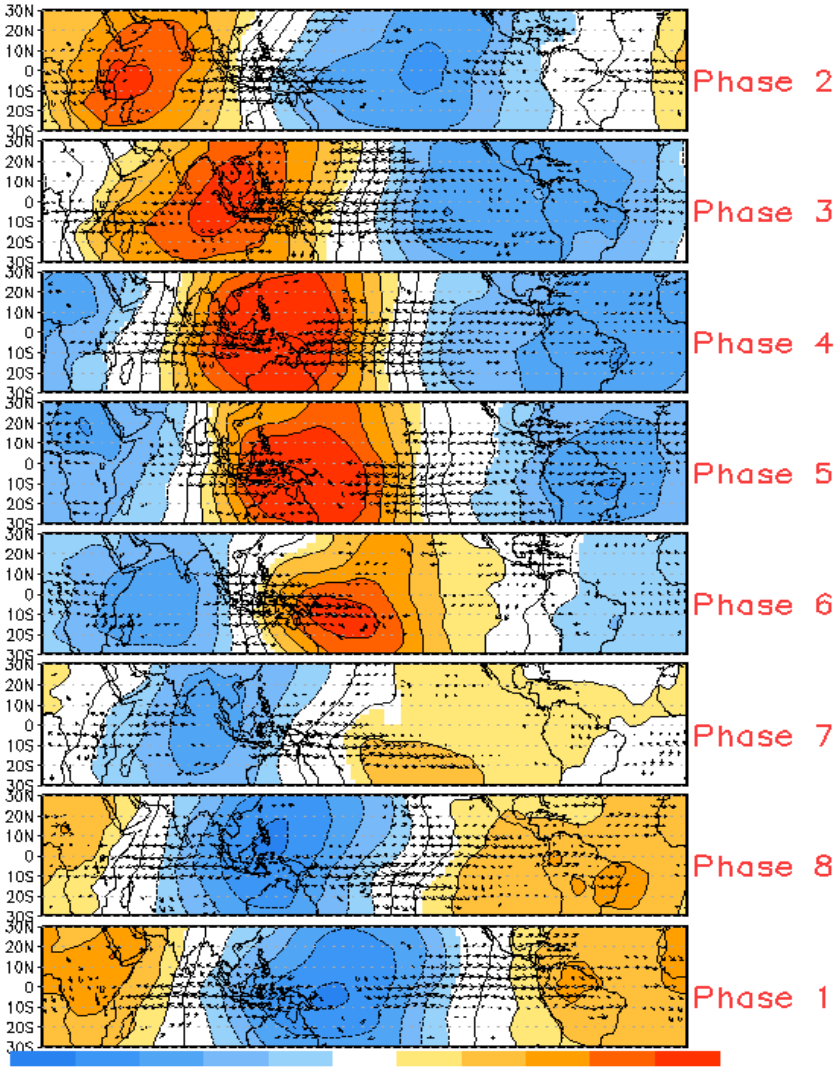




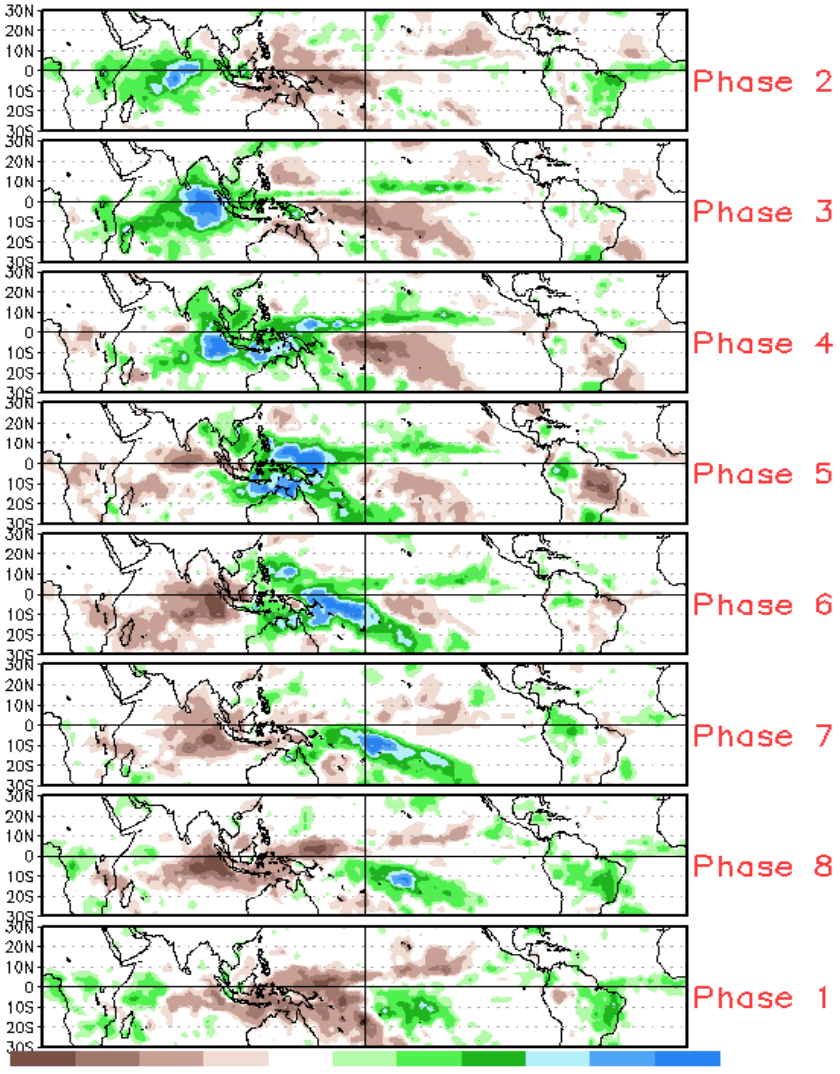
- The constructed analog forecast indicates enhanced convection shifting east from the Indian Ocean to the Maritime Continent and West Pacific during the next two weeks. This would be more supportive of a robust subseasonal influence as opposed to the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



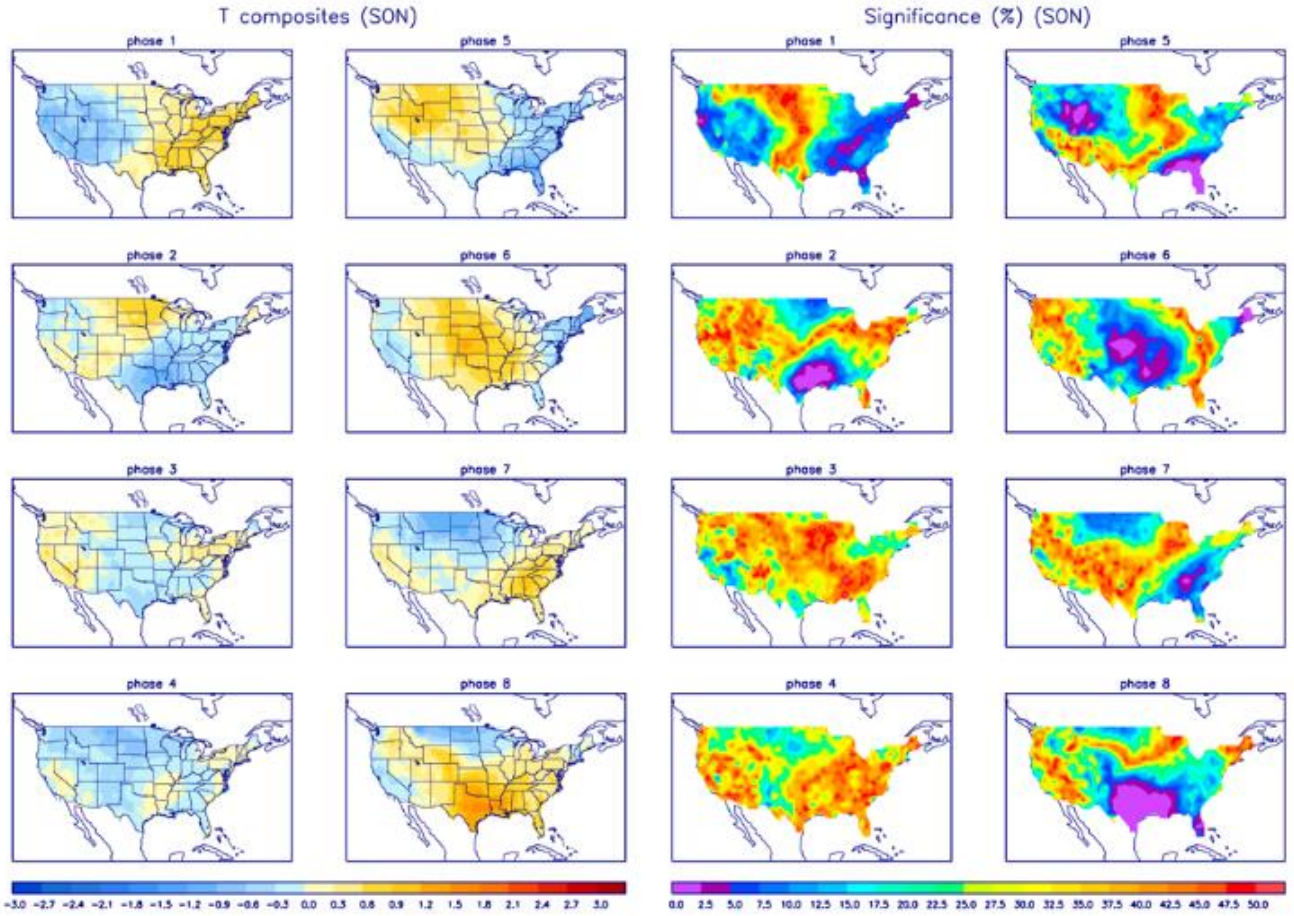
Precipitation Anomalies



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.

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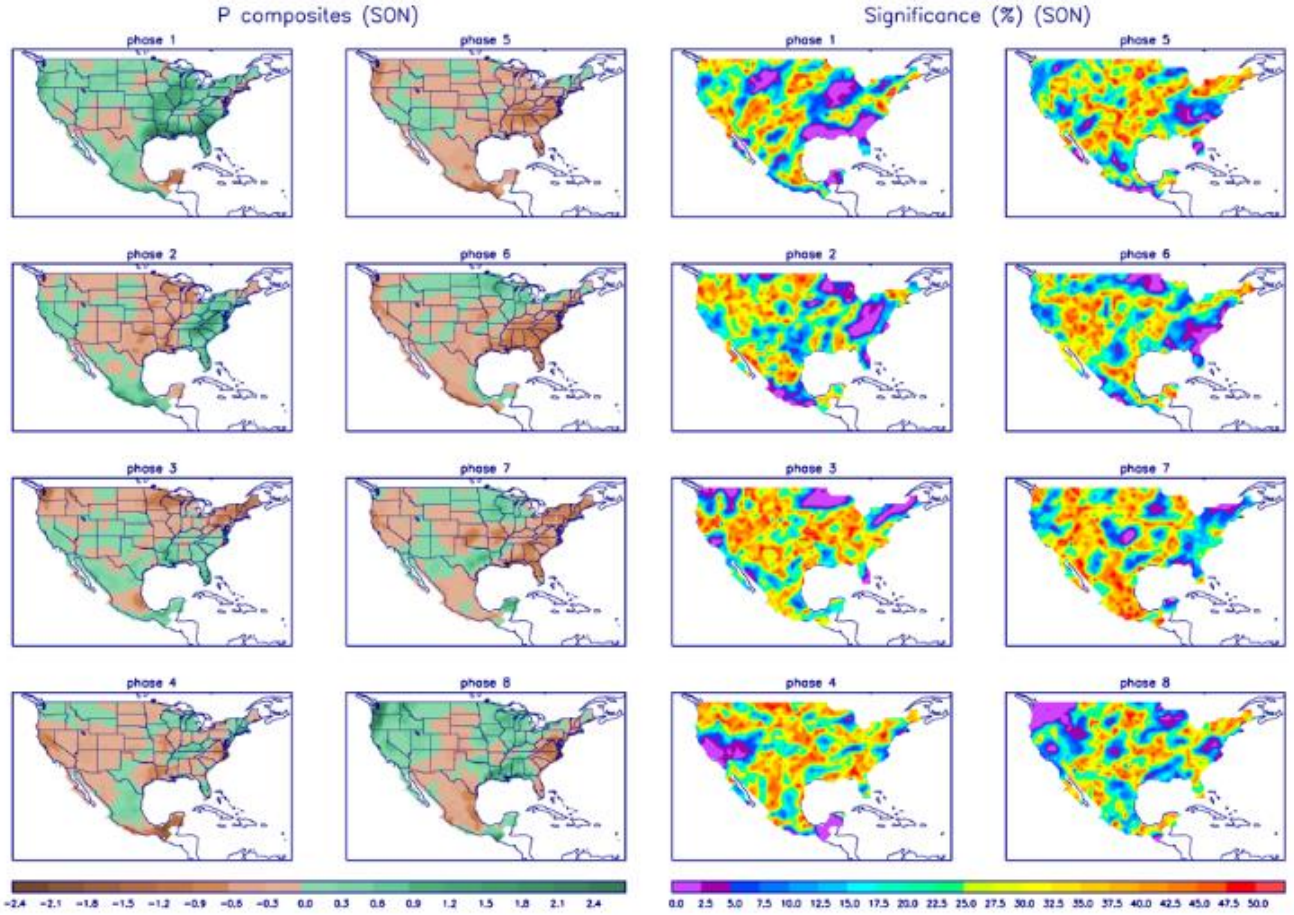

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