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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
15 August 2022

Overview

- The MJO remains weak with La Niña and other modes of tropical variability influencing global tropical rainfall and tropical cyclone development.

- A Kelvin Wave (KW) recently propagated eastward from the Americas to Africa. Many GFS and ECMWF ensemble members depict a strengthening MJO over Africa and the Indian Ocean during the latter half of August.

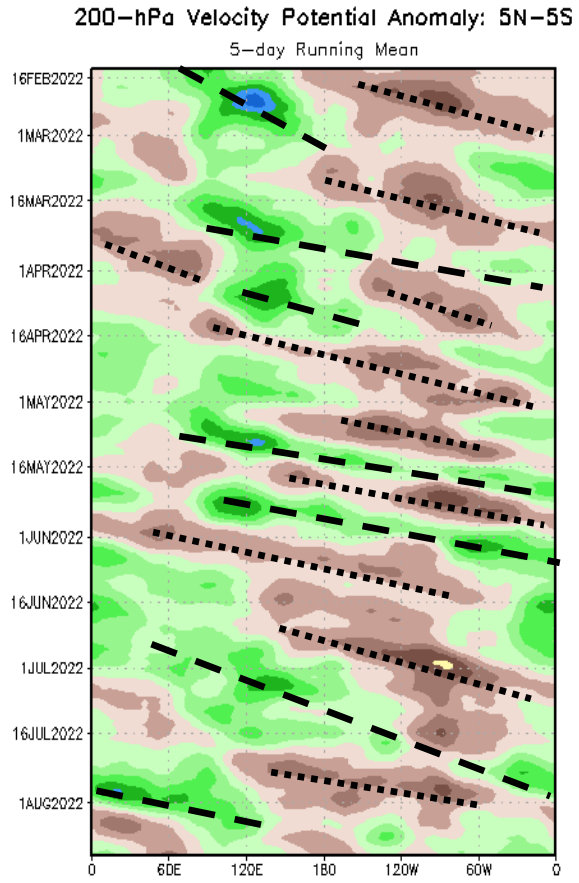
- The passage of the KW, the predicted MJO evolution, and climatology would favor an increasing chance of tropical cyclone development across the Main Development Region of the Atlantic during late August.

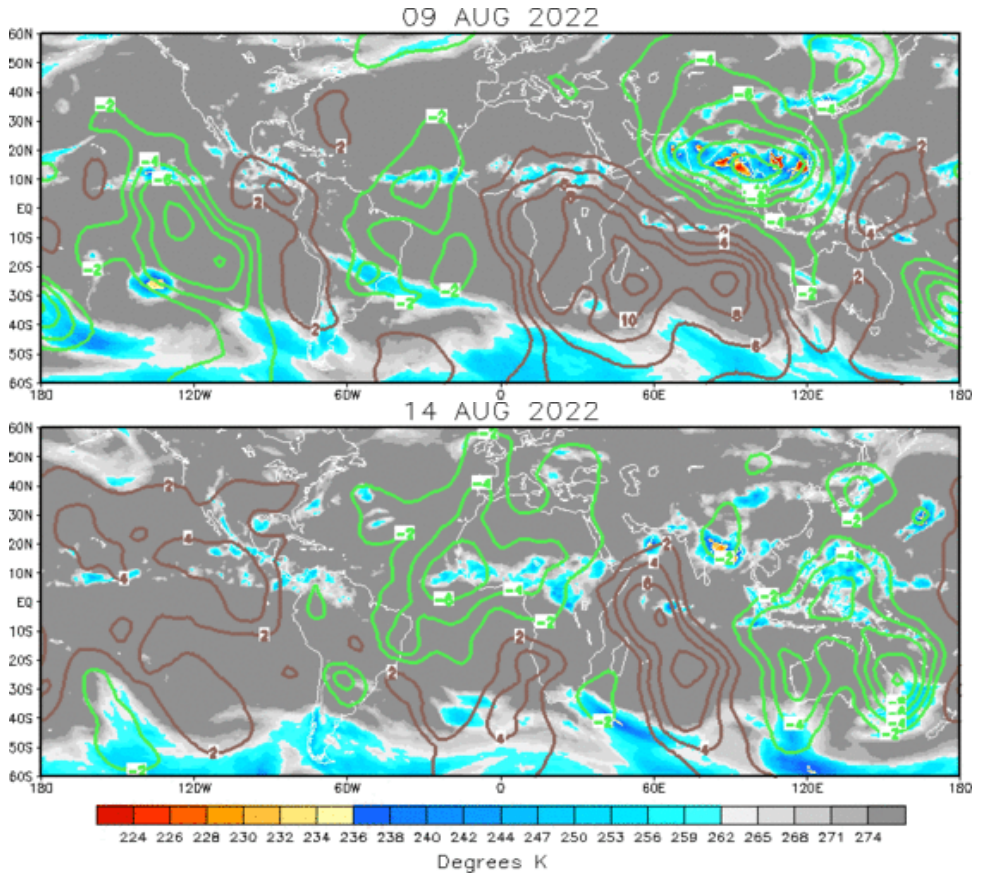
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

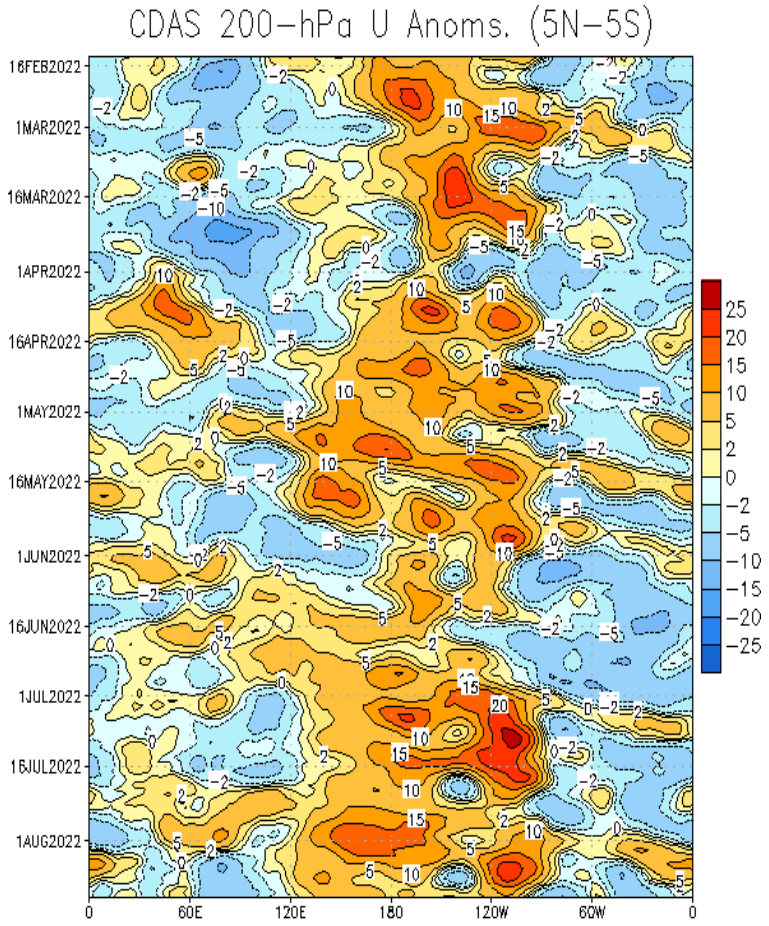


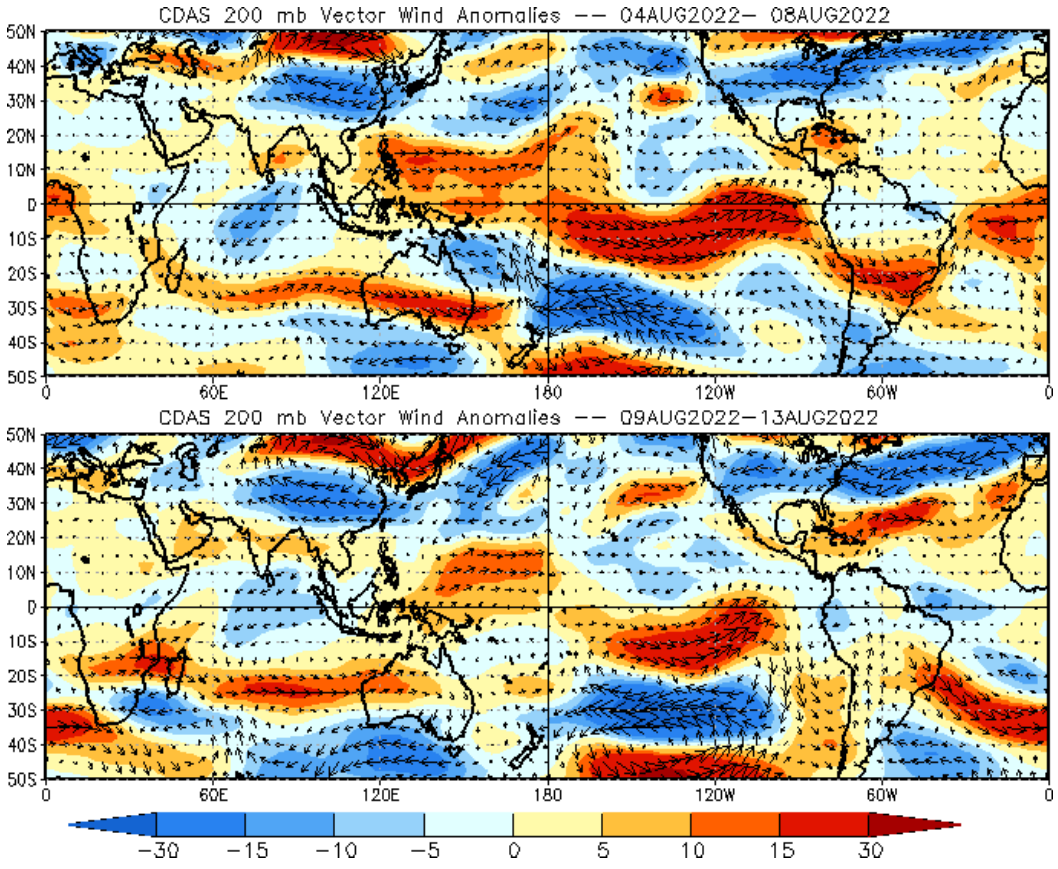


- The spatial pattern of 200-hPa velocity potential anomalies become poorly defined during early August.
- During the past week, a Kelvin Wave propagated rapidly eastward over the Western Hemisphere with anomalous upper-level divergence centered across Africa.

200-hPa Wind Anomalies

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



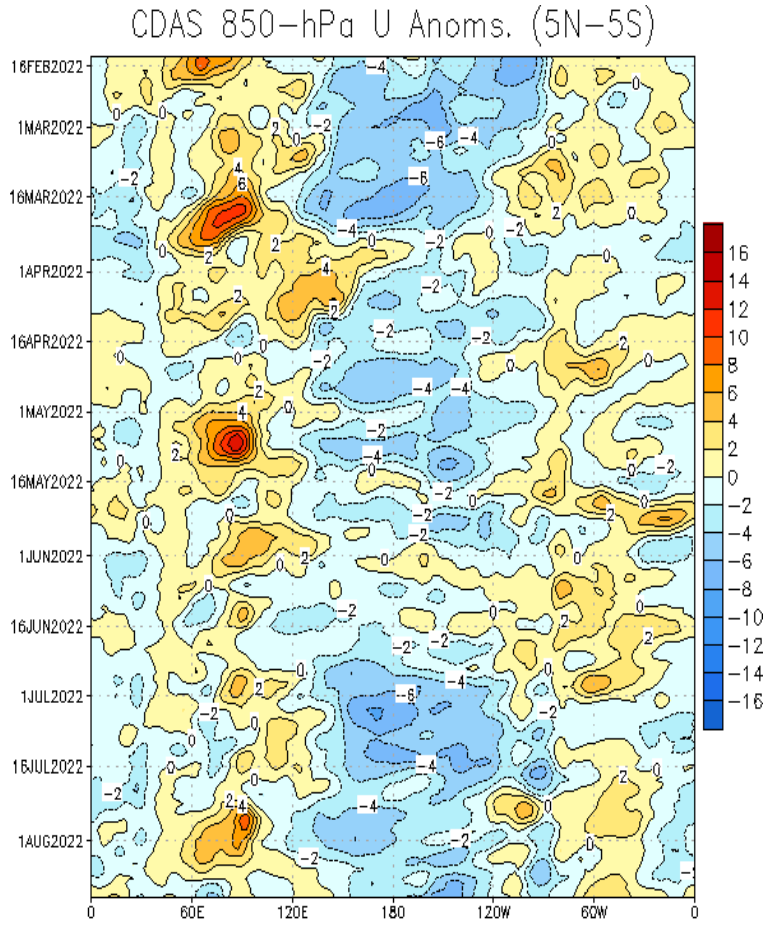


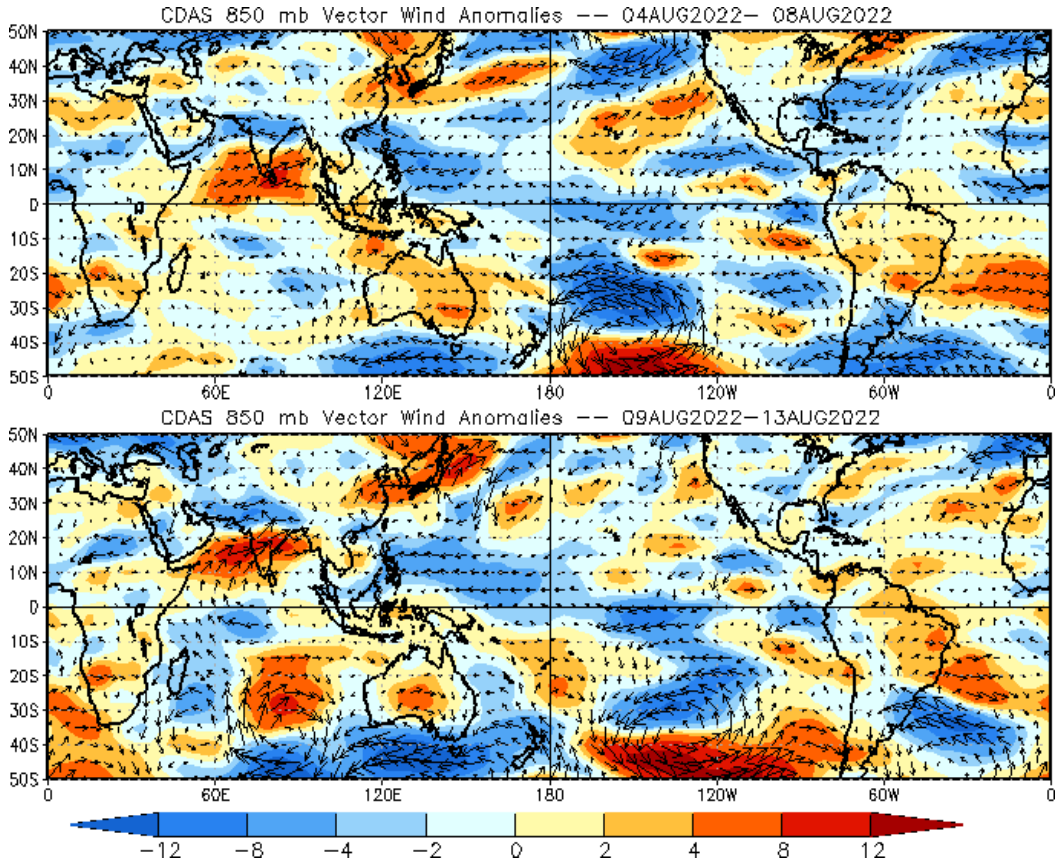
- Anomalous westerlies aloft continue across much of the equatorial Pacific consistent with the ongoing La Niña which has exhibited an unusually strong atmospheric response during the boreal summer.

- Anomalous easterlies have developed across the equatorial Indian Ocean supporting the enhancement of convection across the Maritime Continent.

850-hPa Wind Anomalies

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



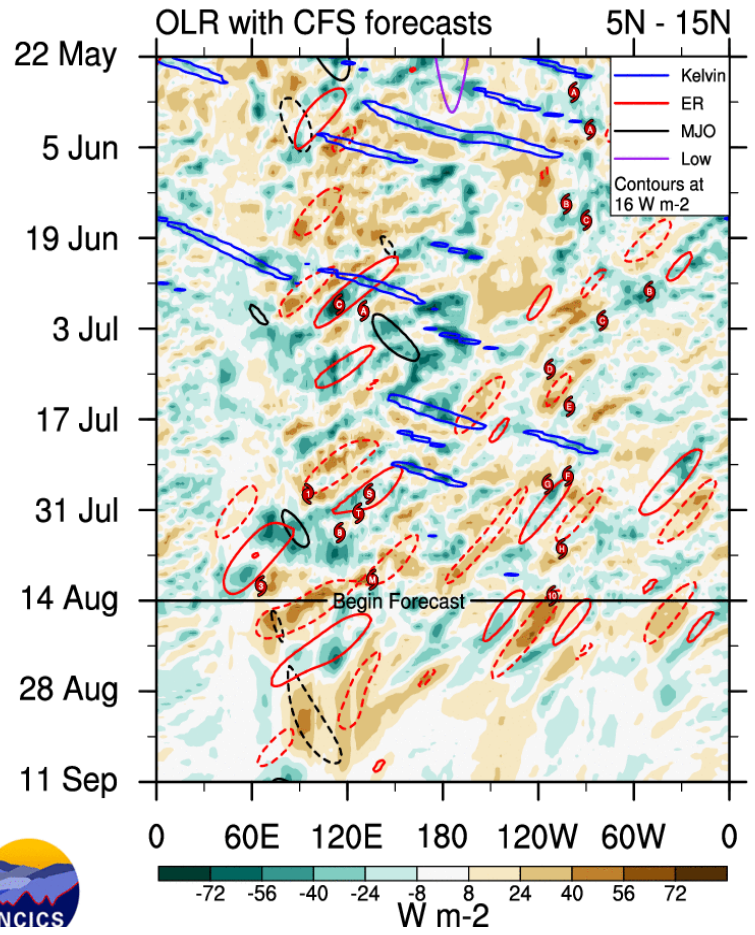


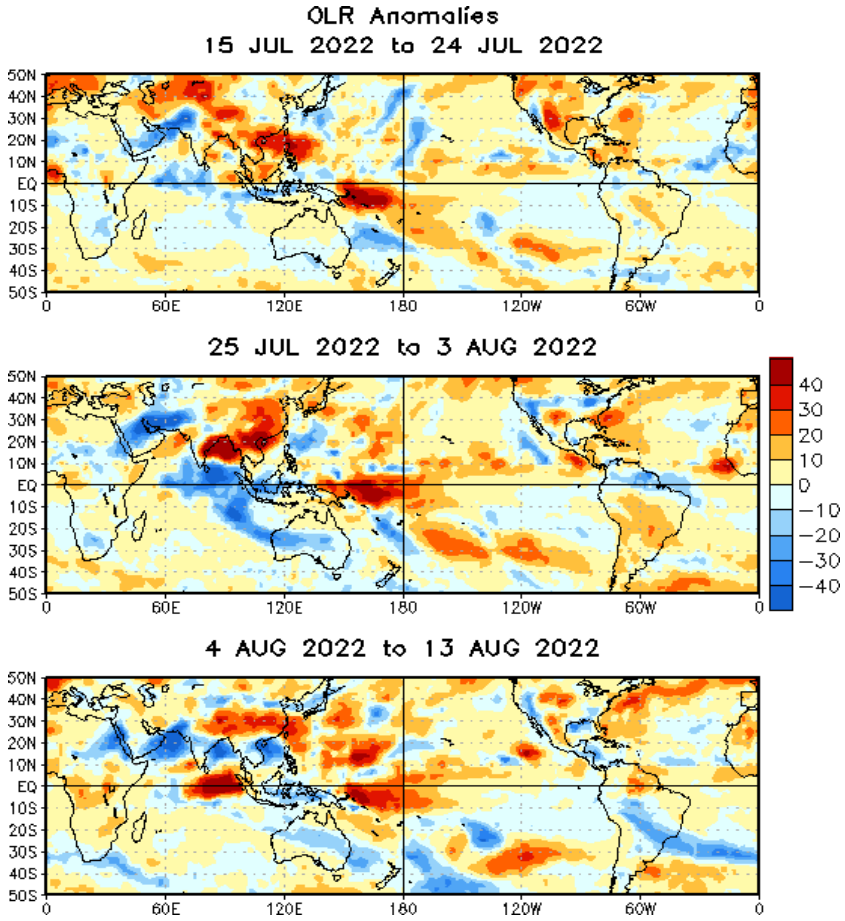
- An enhanced trade wind regime continues across the equatorial Pacific, which is also consistent with the ongoing La Niña.

- From Aug 8-13, anomalous easterly flow over the North American Monsoon region contributed to above-average rainfall and flash flooding across the southwestern United States.

Outgoing Longwave Radiation (OLR) Anomalies

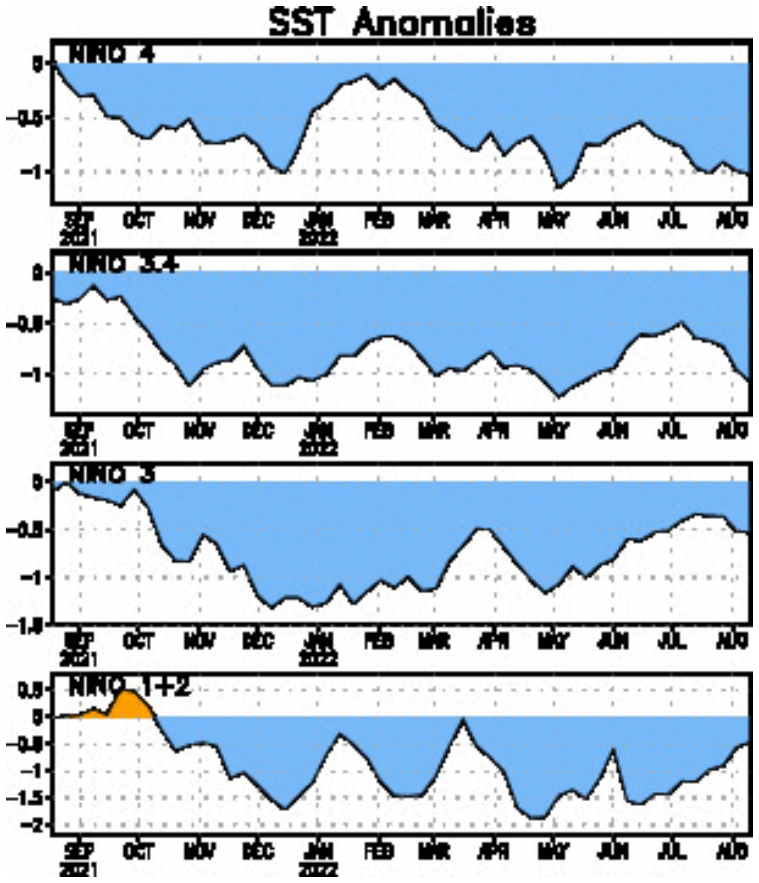
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

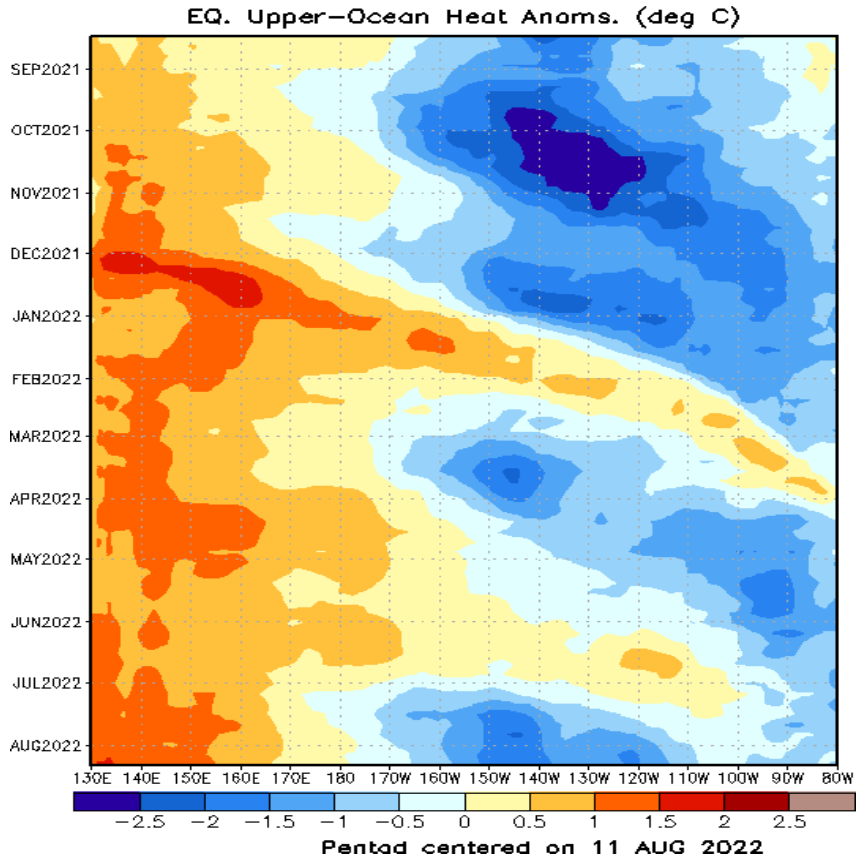




- A strong atmospheric response to La Niña is evident in the OLR anomaly field.
- Enhanced convection persists across the southwestern United States with East Pacific cyclones since late July helping to contribute to anomalous moisture.
- The CFS forecast depicts a number of westward moving convective features indicative of Rossby wave activity influencing the global tropics.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



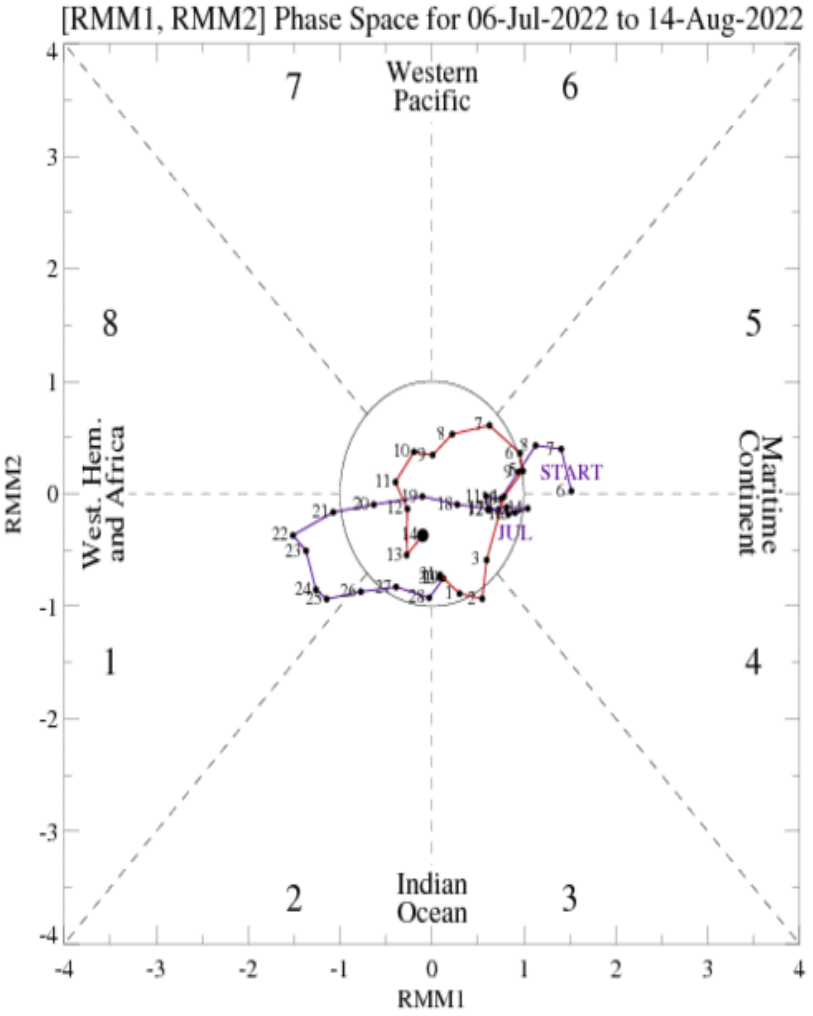


- The persistence of strongly enhanced trade winds and an upwelling oceanic Kelvin wave response have resulted in the continued strengthening of cold subsurface anomalies east of the Date Line since July.

- SSTs remain below average across all Niño basins.

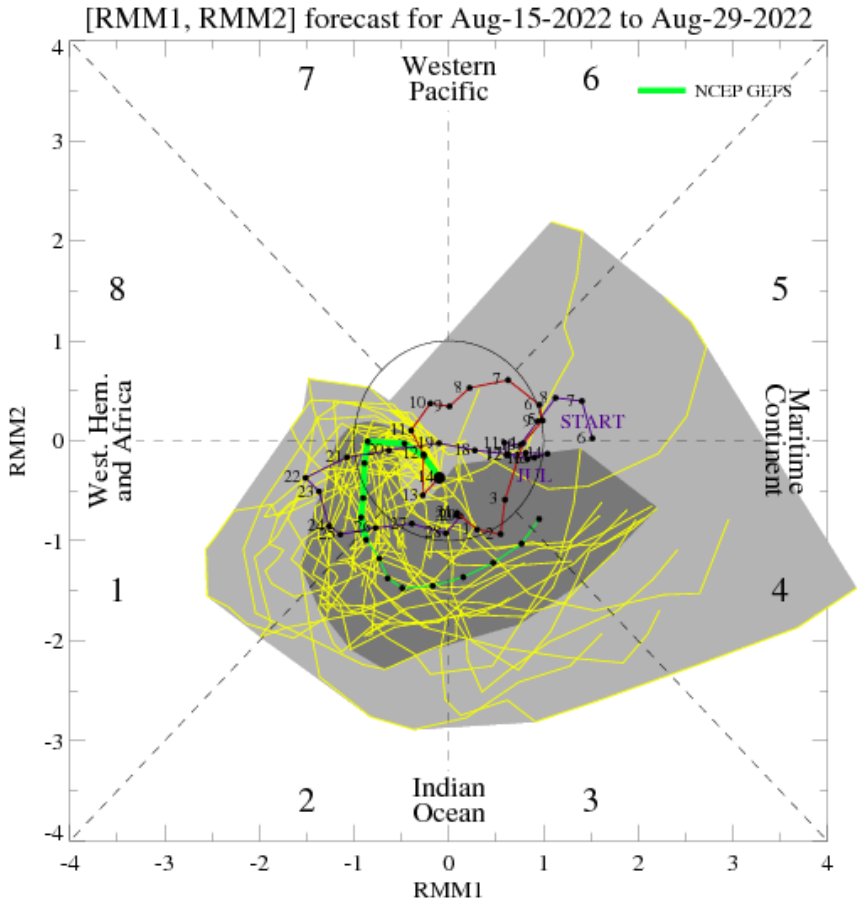
MJO Index: Recent Evolution

- After a period of renewed MJO activity in late July, the intraseasonal signal fell back within the RMM unit circle where it has largely remained since.

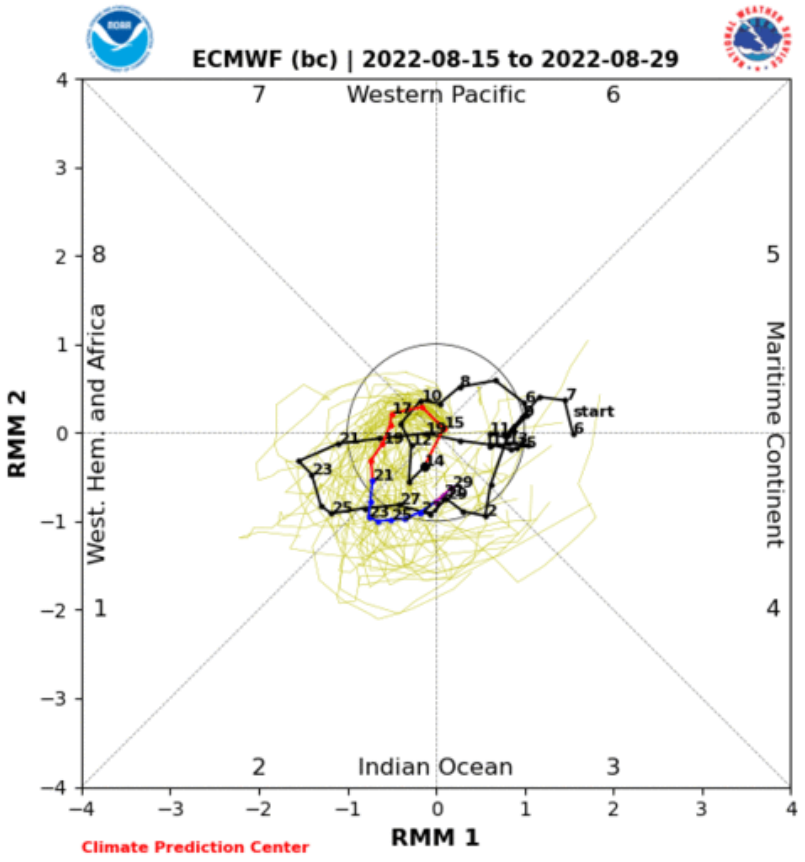


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



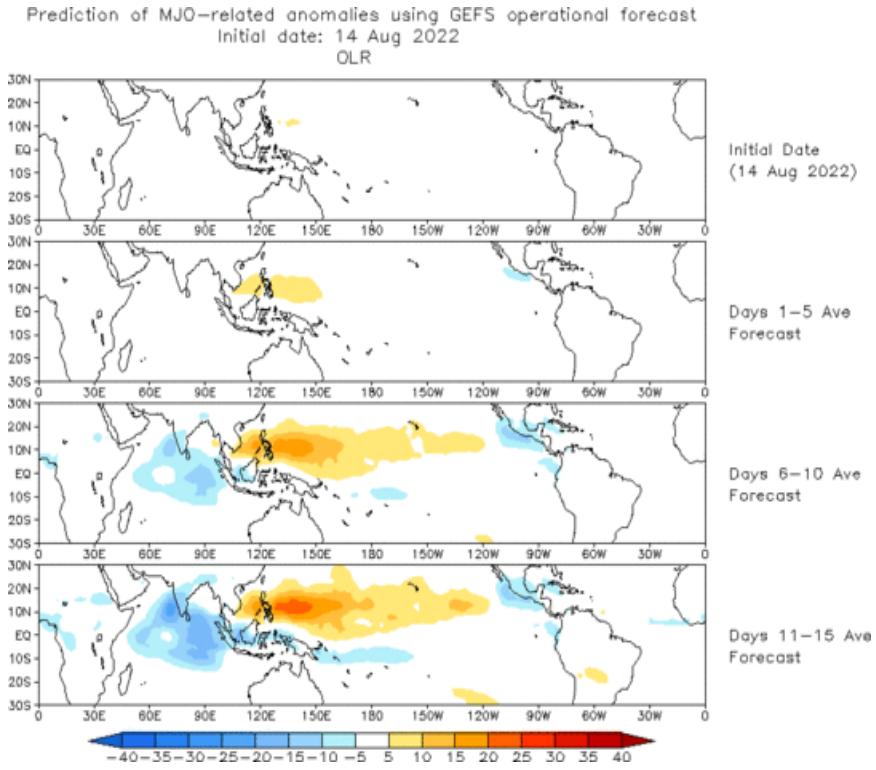
ECMWF Forecast

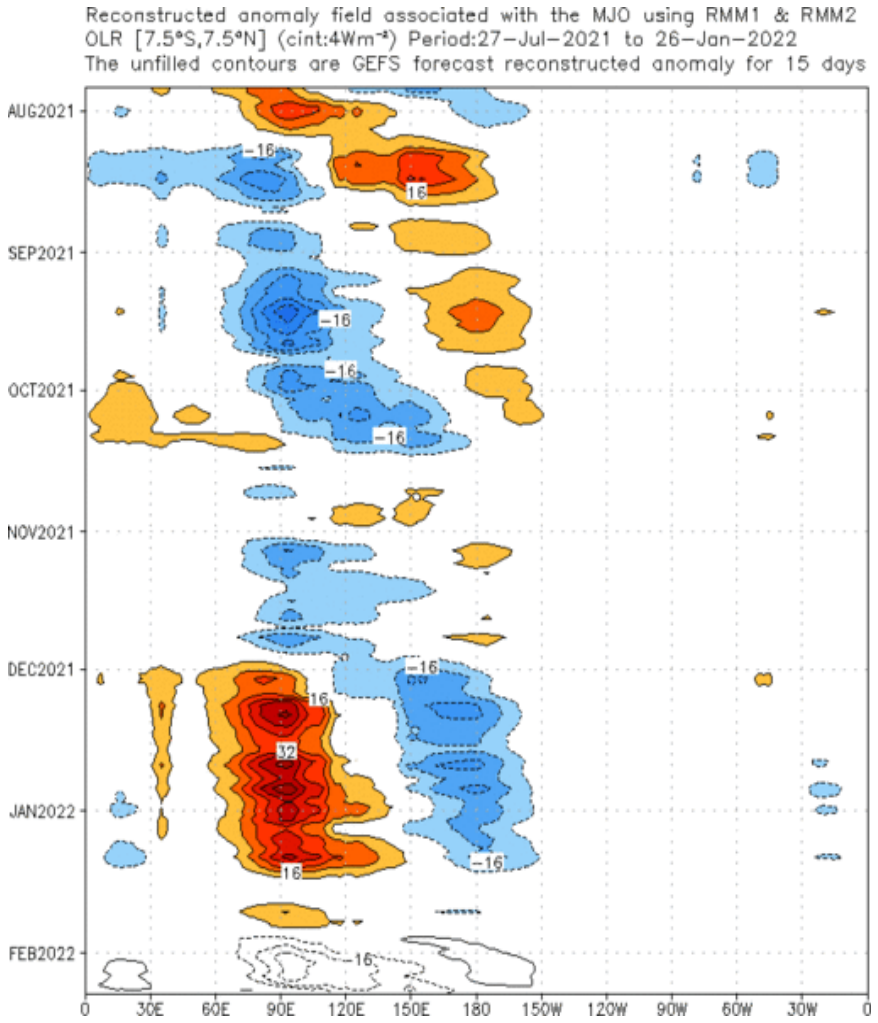
- The GEFS along with many ECMWF ensemble members depict a strengthening MJO over Africa and the Indian Ocean during the latter half of August.

- However, forecast confidence is low on its longevity given the continued strong atmospheric response associated with La Niña.

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.)

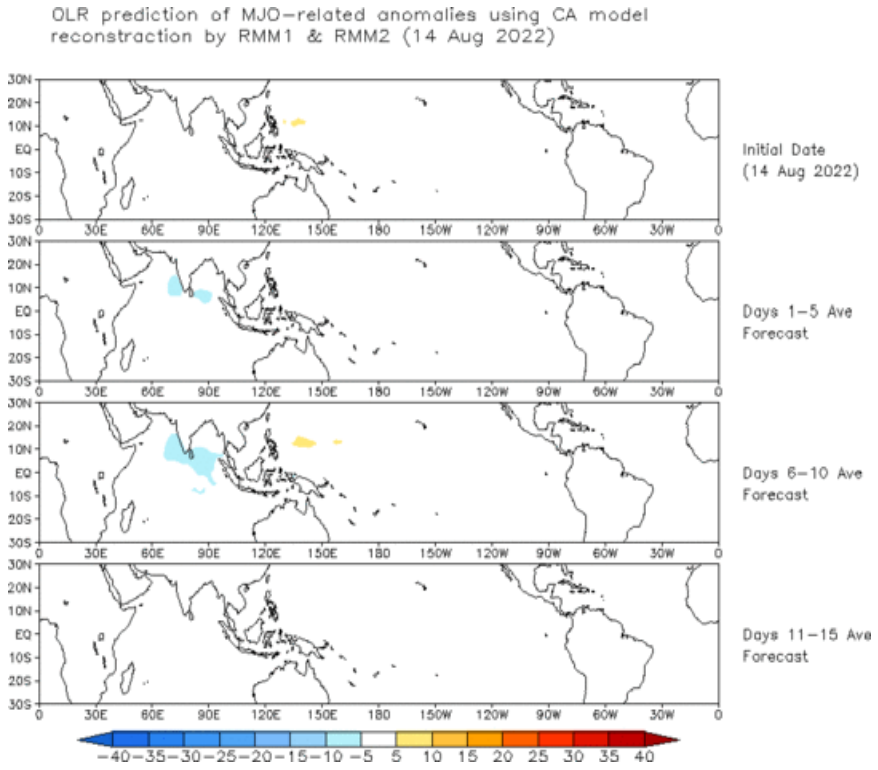


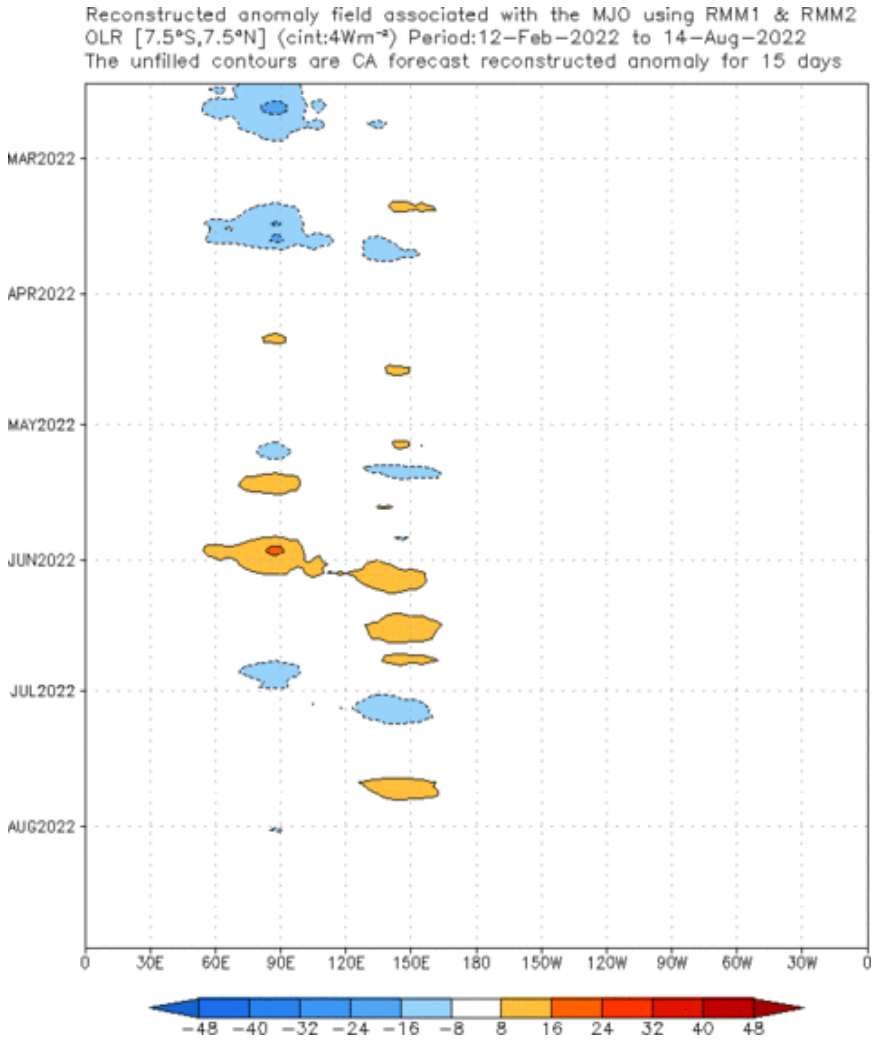


- The GEFS RMM-index based OLR anomaly field favors the return of enhanced (suppressed) convection over the Indian Ocean (West Pacific) by late August. Also, enhanced convection is forecast for the East Pacific and parts of North to Central America.

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.)

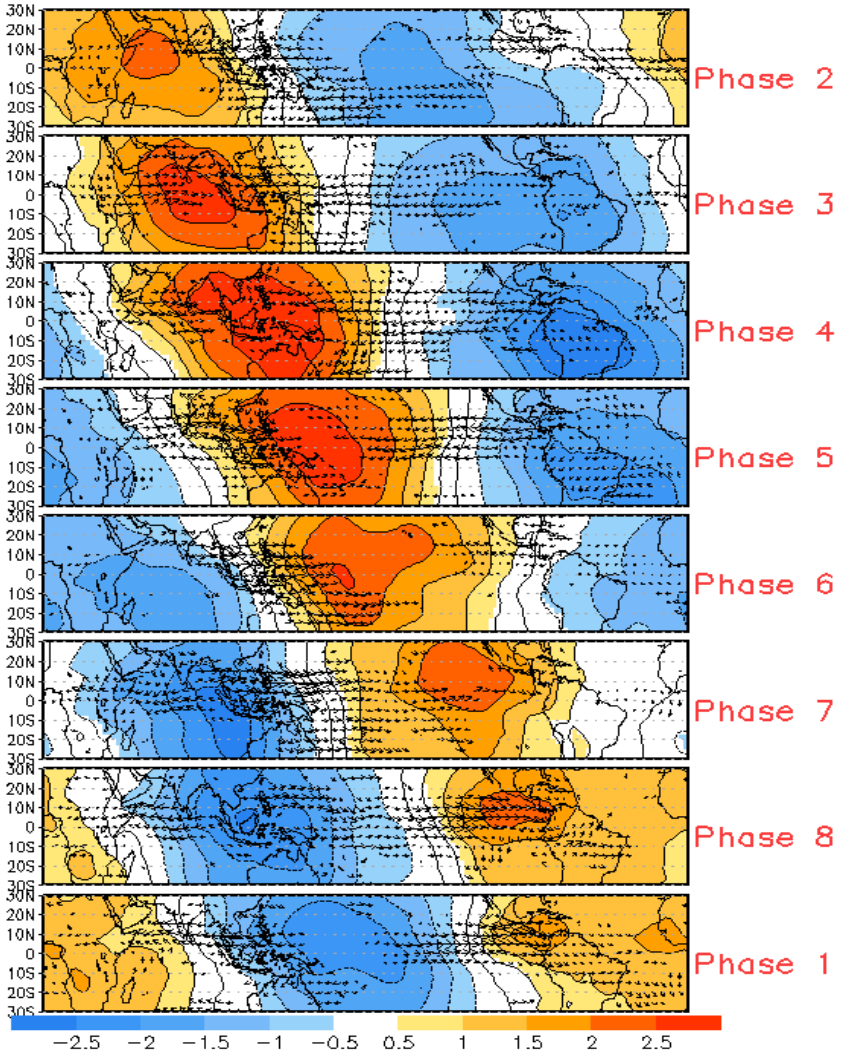




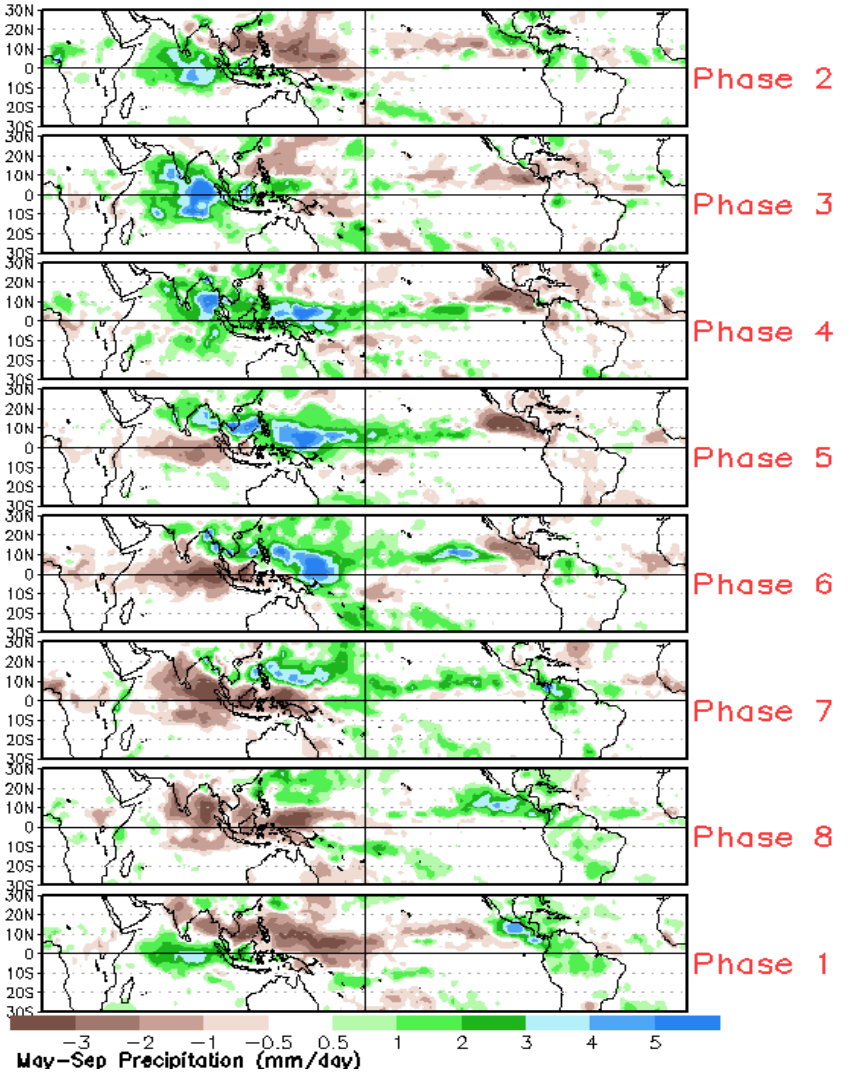
- The constructed analog forecast of RMM-based OLR features little to no signal.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



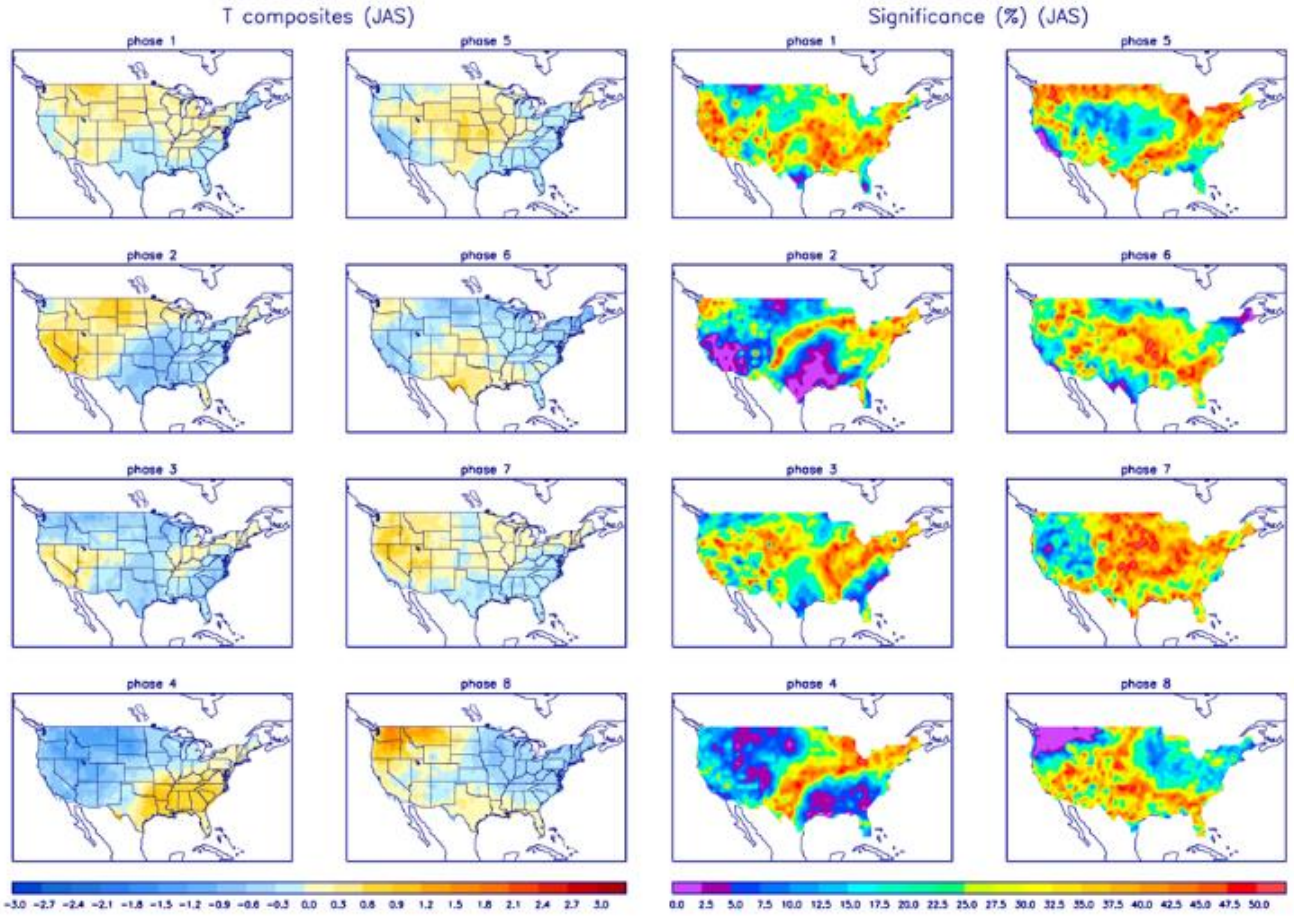
Precipitation Anomalies



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.

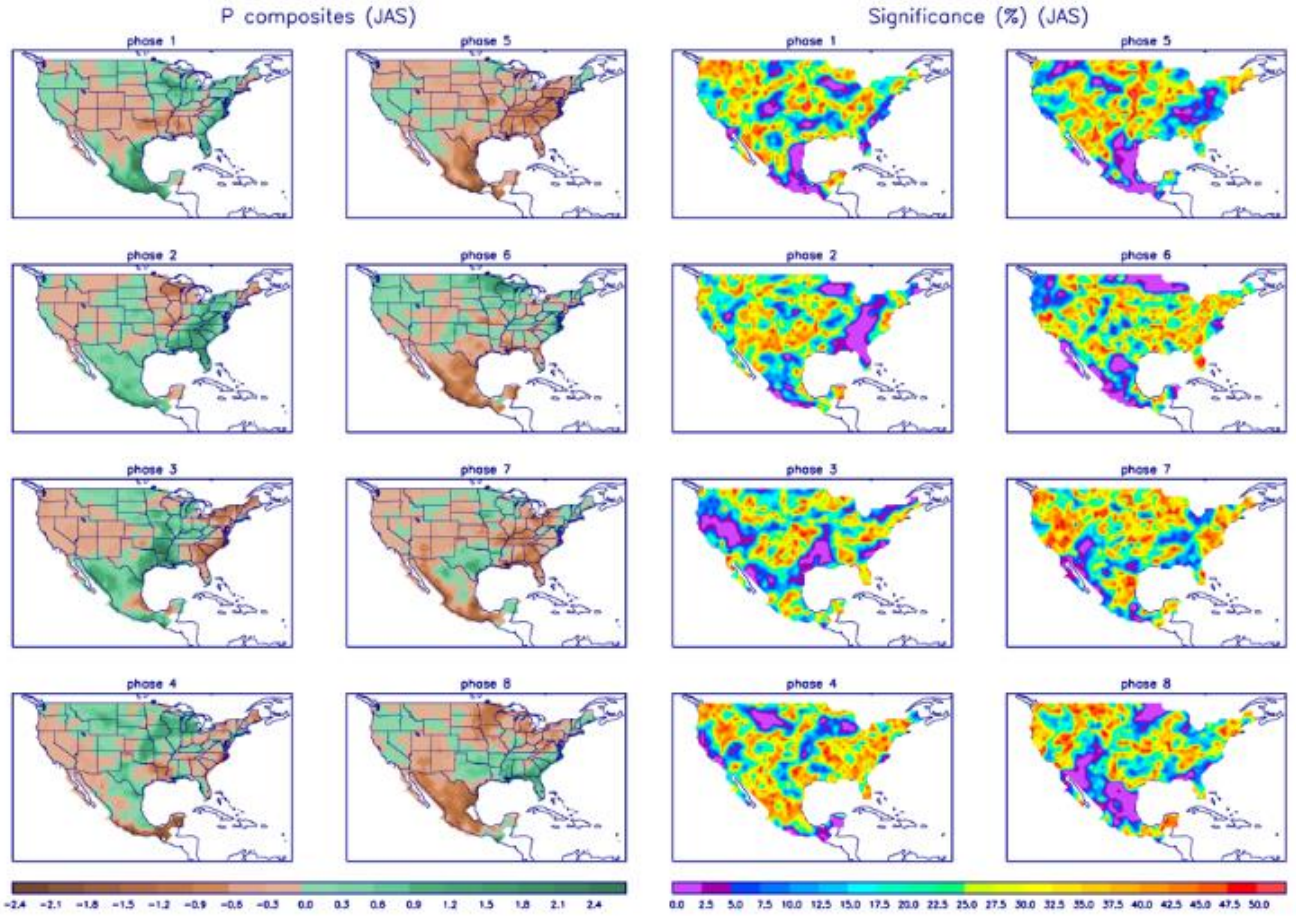


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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