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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
26 September 2022

Overview

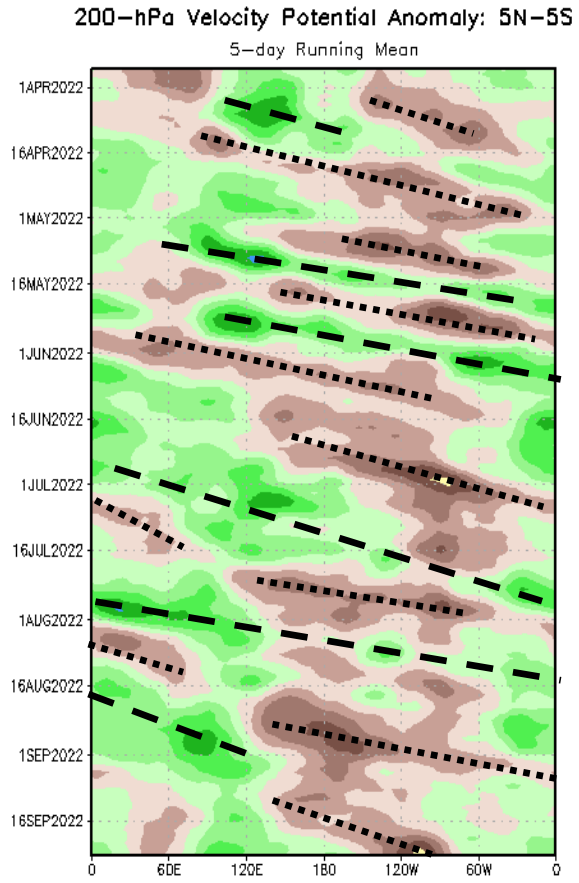
- The RMM index and upper-level velocity potential anomaly analyses indicate a weak MJO.
- Widespread agreement among forecast models of an increase in MJO activity in the coming weeks.
- TC activity in the Atlantic basin has increased, and some activity in the Main Development Region remains a possibility as we move into early October.

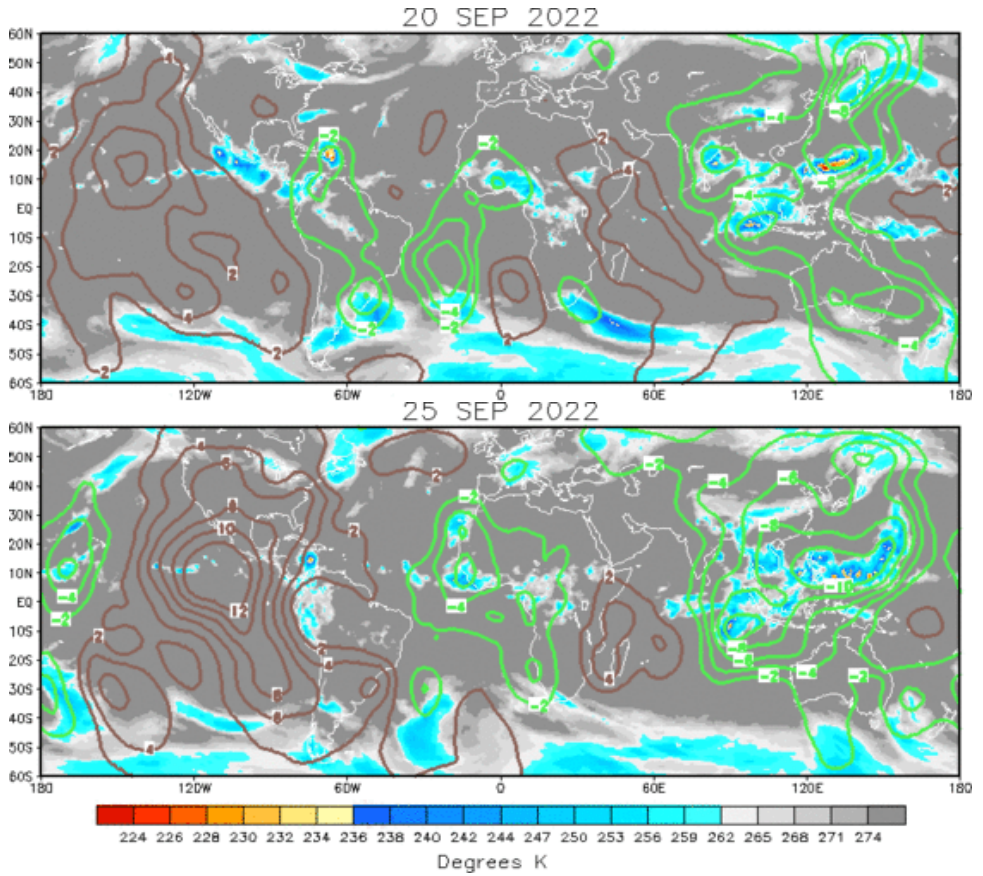
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



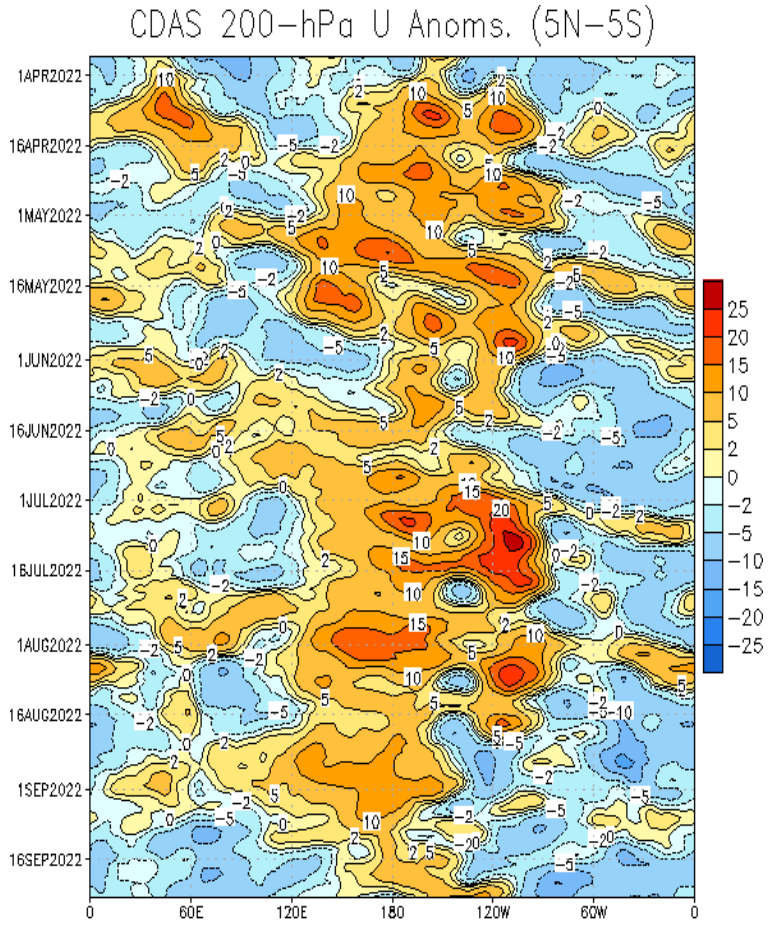


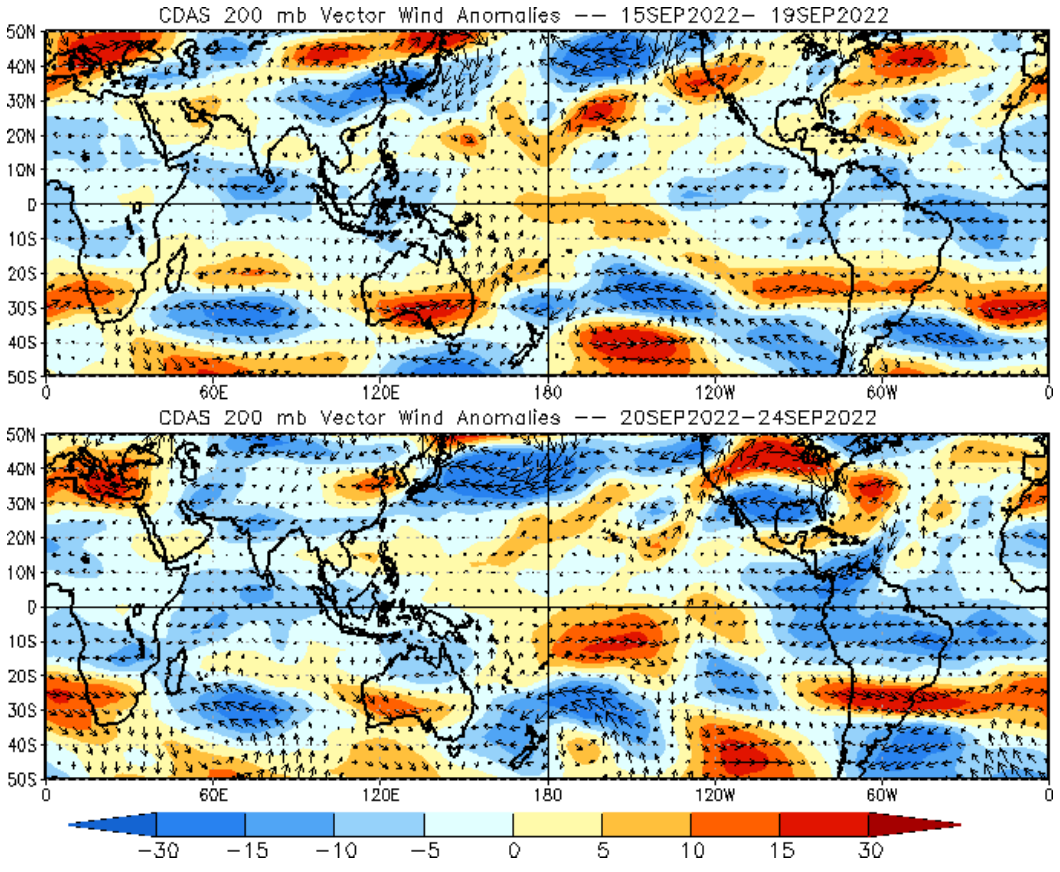
- The upper-level velocity potential pattern continues to be mostly stationary during the second half of September. Level of organization in synoptic structure appears to be increasing.

- The largest anomalies of upper-level divergence remain centered over the Maritime Continent which is consistent with La Niña.

200-hPa Wind Anomalies

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

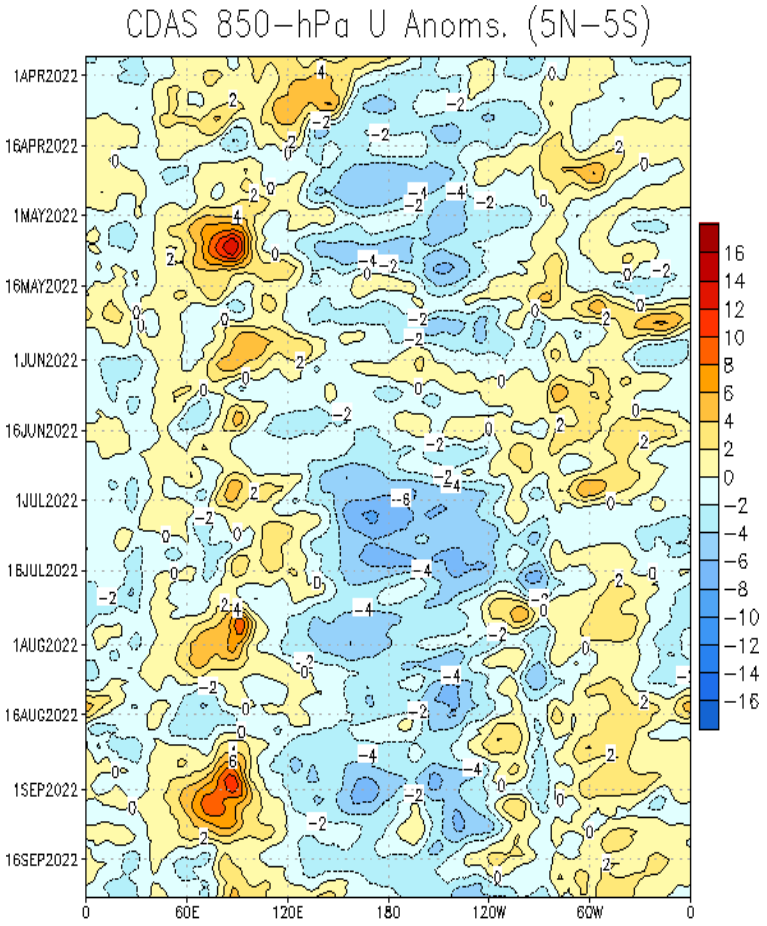


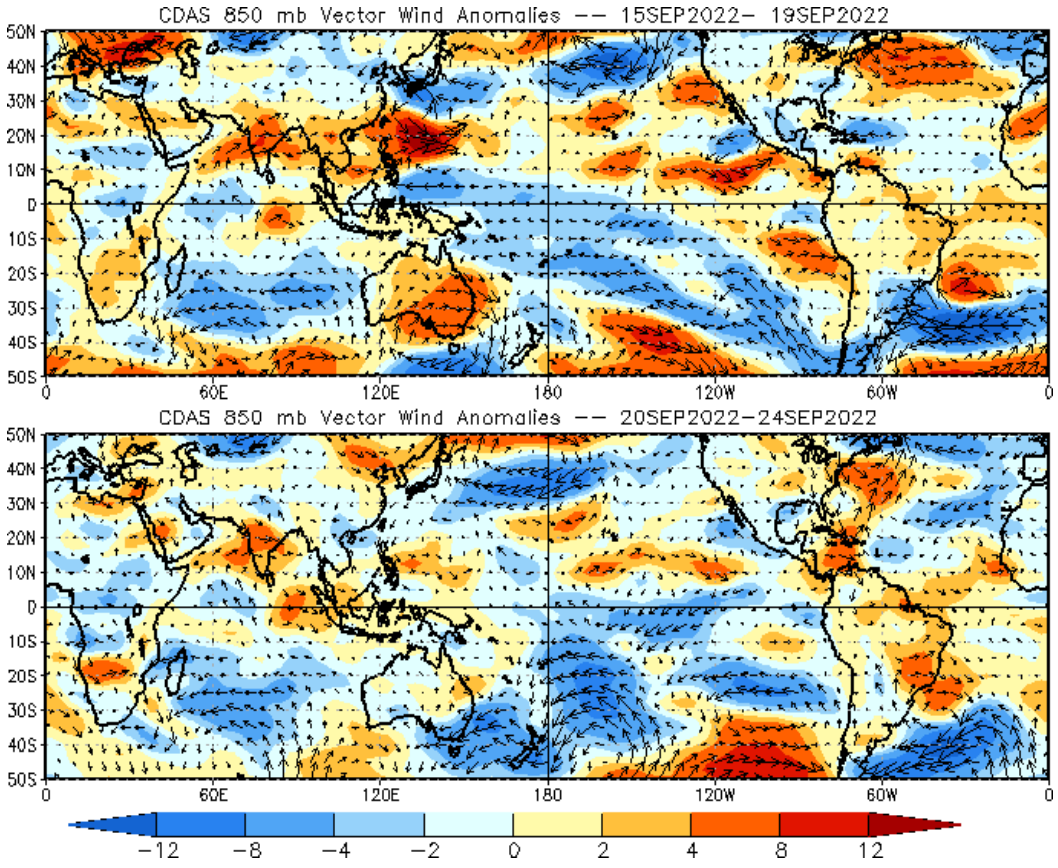


- Anomalous upper-level westerlies continue to be observed along the equatorial Pacific, with the anomalous area shifting eastward and strengthening somewhat in the last week.
- Anomalous easterlies aloft continue across the equatorial Indian Ocean since early September.
- Anomalous easterlies continue over the tropical Atlantic, and have recently increased in intensity over South America.

850-hPa Wind Anomalies

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



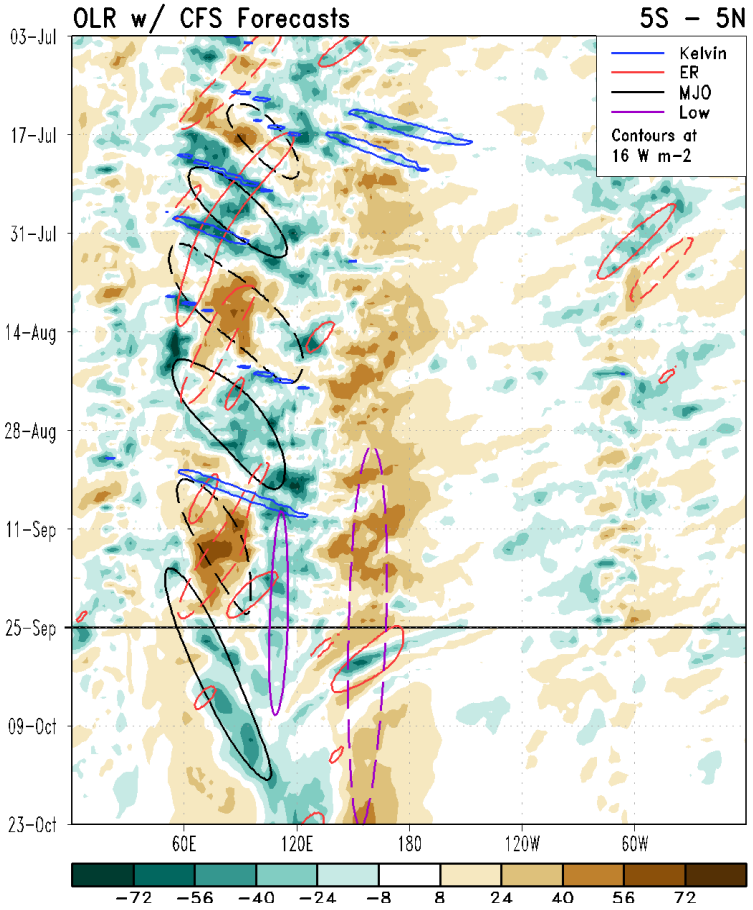


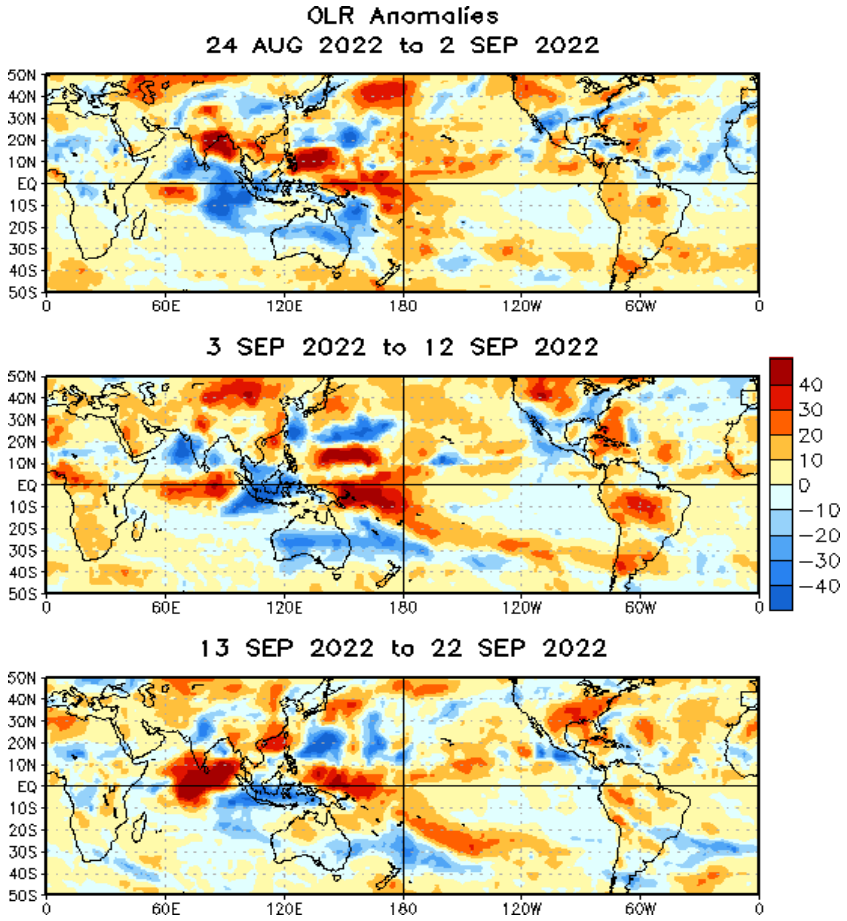
- Enhanced trades persist over much of the equatorial Pacific, consistent with the La Niña footprint. Strongest anomalies lie east of the Date Line.

- North of the equator, anomalous westerlies continue across much of the eastern Pacific and the Main Development Region of the Atlantic, relaxing shear for tropical cyclone development.

Outgoing Longwave Radiation (OLR) Anomalies

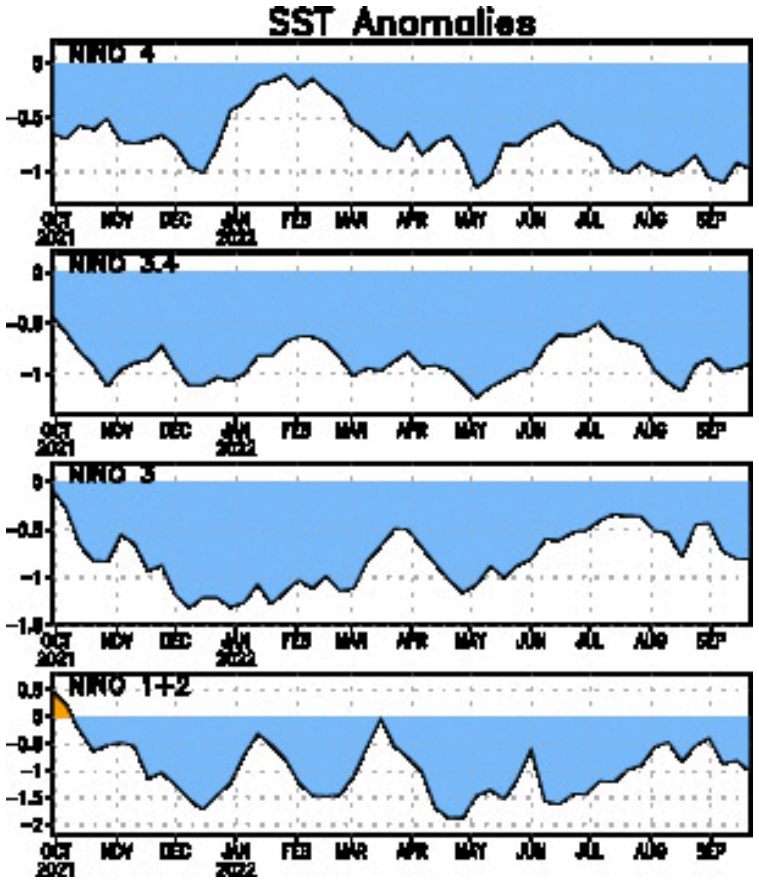
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

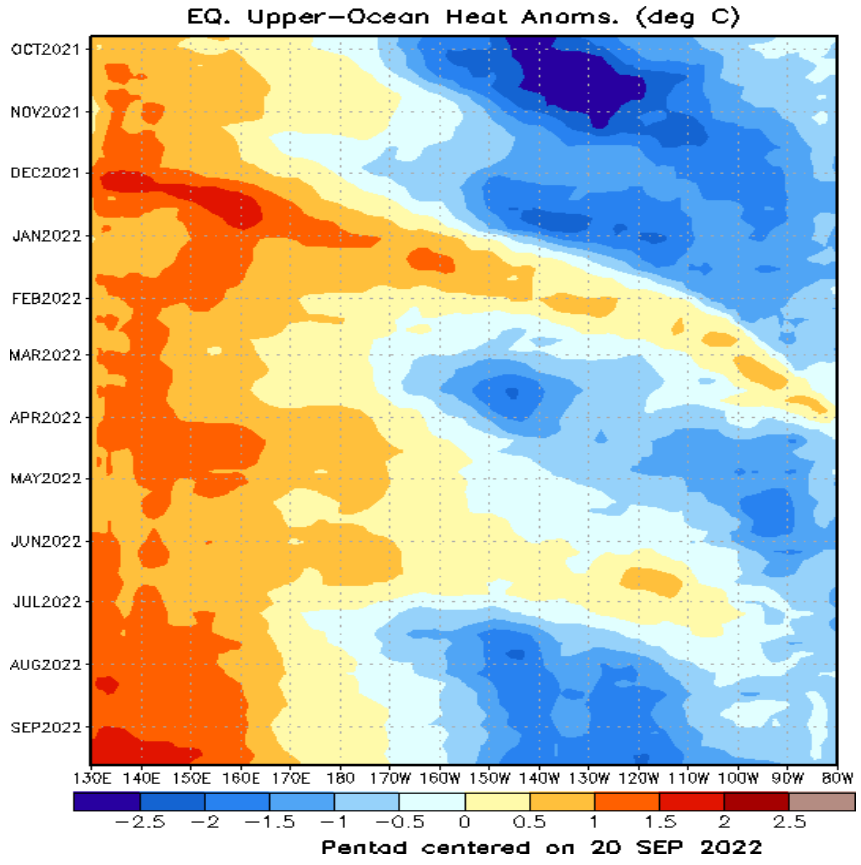




- Enhanced (suppressed) convection remains anchored over the Maritime Continent (equatorial central Pacific) due to La Niña.
- Enhanced convection continued across the East Pacific with multiple tropical cyclones forming.
- CFS OLR forecast depicts a fairly robust MJO signal emerging over the Indian Ocean over the next 2 weeks.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

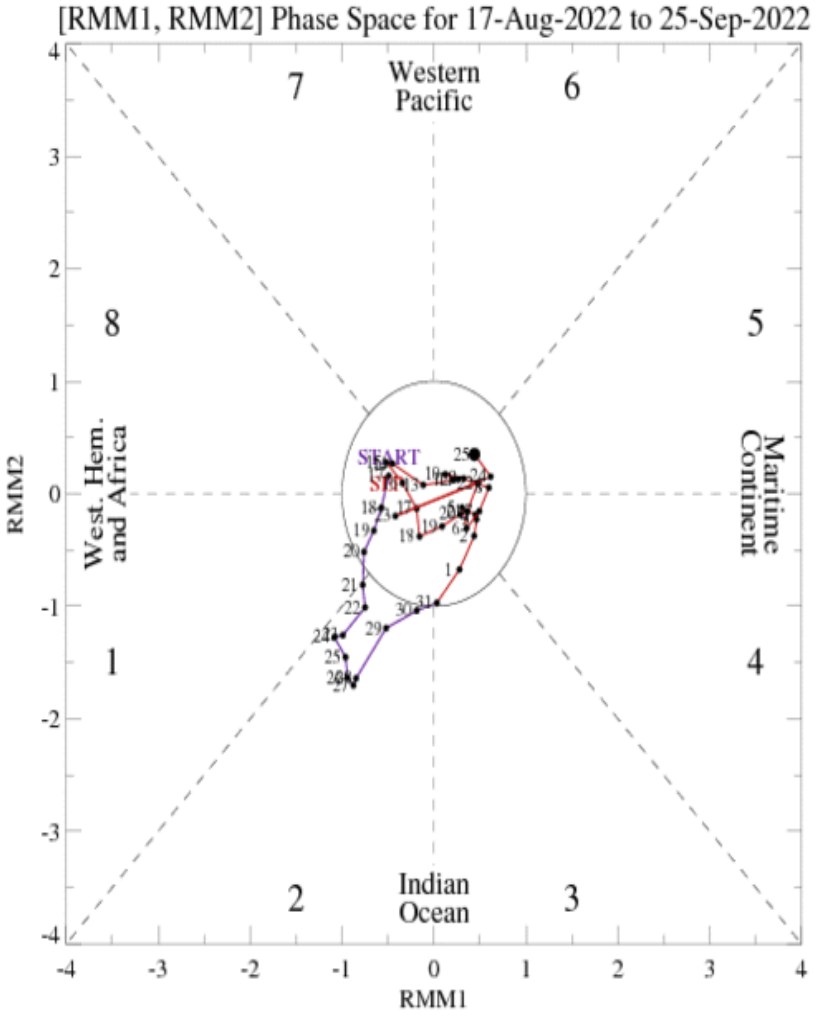




- Following a warming trend in subsurface temperatures over the equatorial Pacific in May and June, enhanced trades tied to the ongoing La Niña have led to continued subsurface below-normal heat content mainly east of the Date Line since July.
- SSTs remain below average across all Niño basins, with the magnitude of the negative anomalies generally unchanged from the previous week.

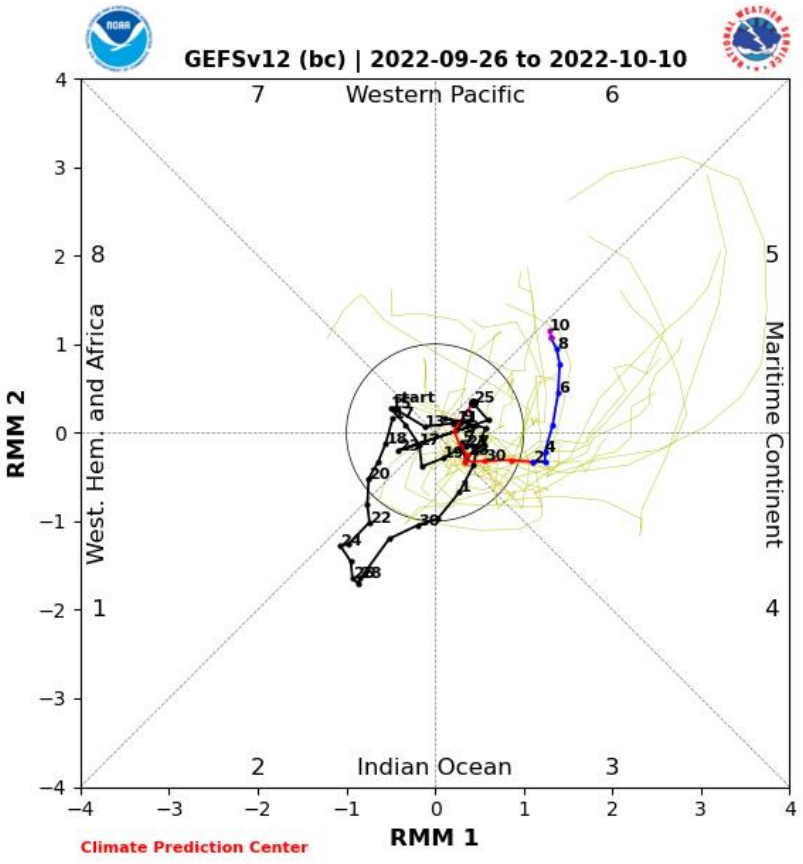
MJO Index: Recent Evolution

- Following eastward propagation of a MJO signal starting in late August and continuing early in September, the RMM index has remained inside the unit circle as any remnant MJO weakened and anomalous tropical rainfall has become mostly stationary.

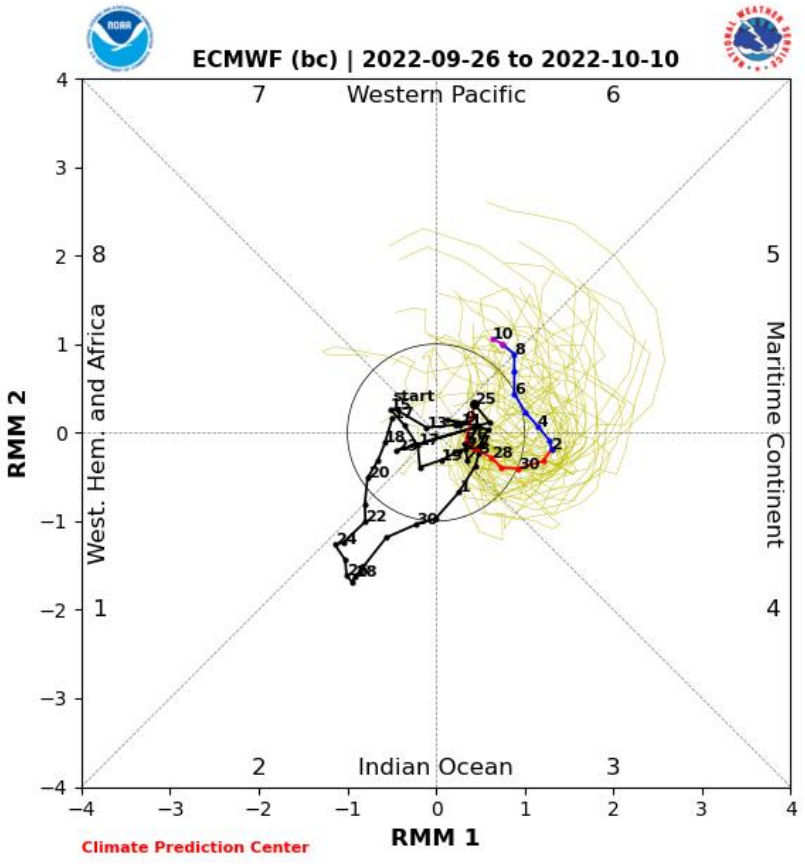


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

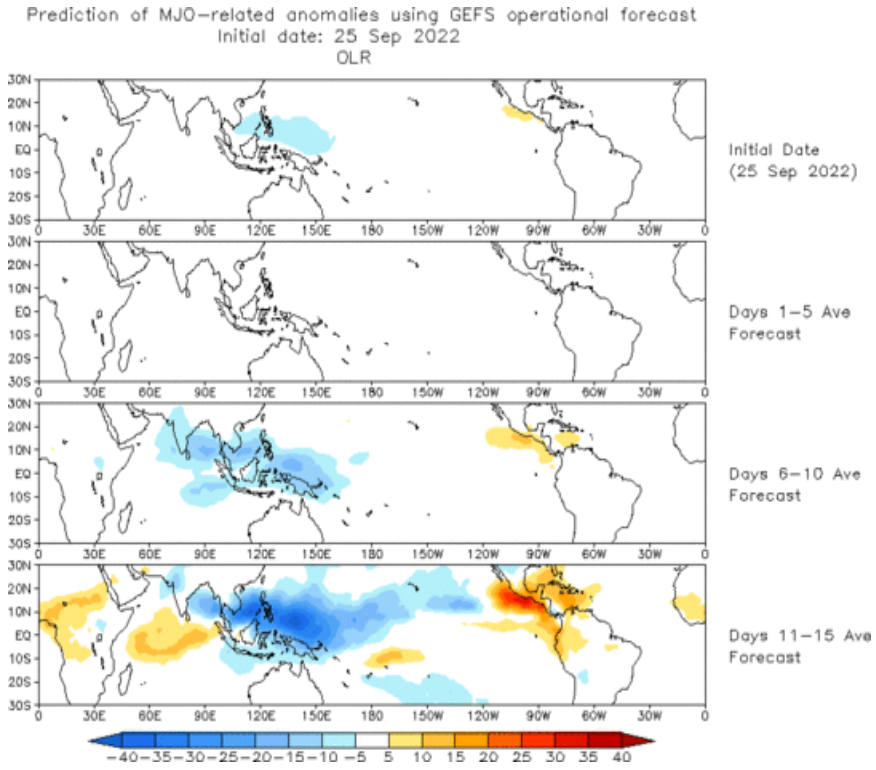


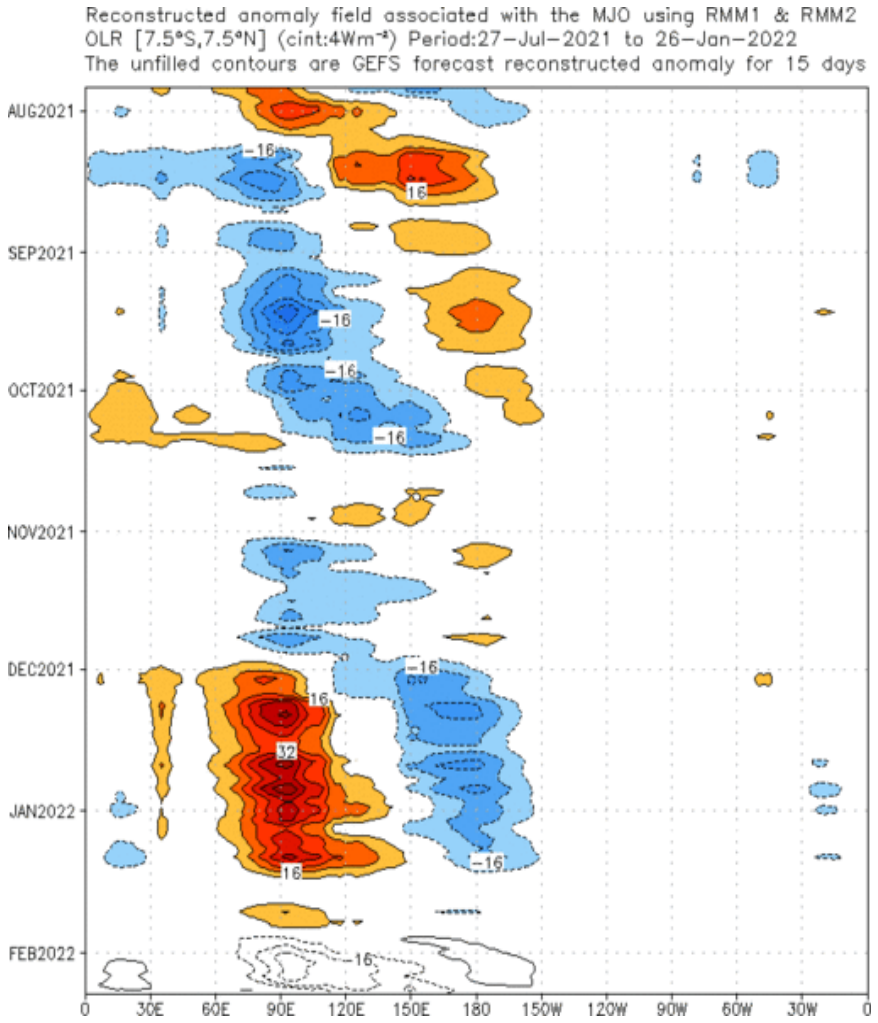
ECMWF Forecast

- There is strong model agreement on the re-emergence of the MJO signal in coming weeks. Almost all extended-range model solutions depict the RMM index emerging from the unit circle in phase 4 or 5 in week 2 and propagating eastward into week 3.

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.)

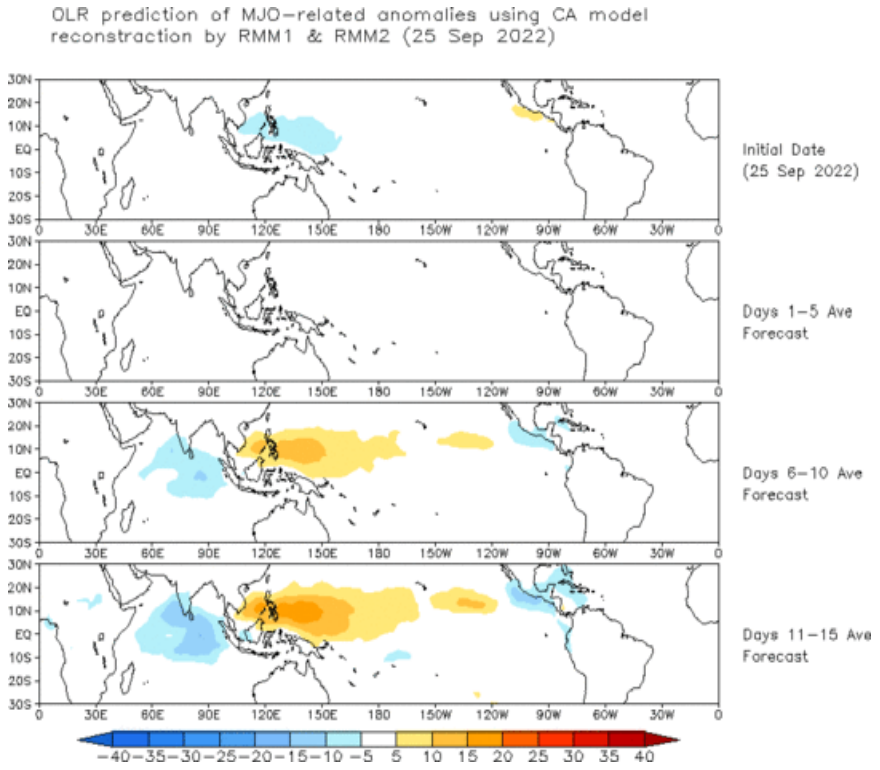


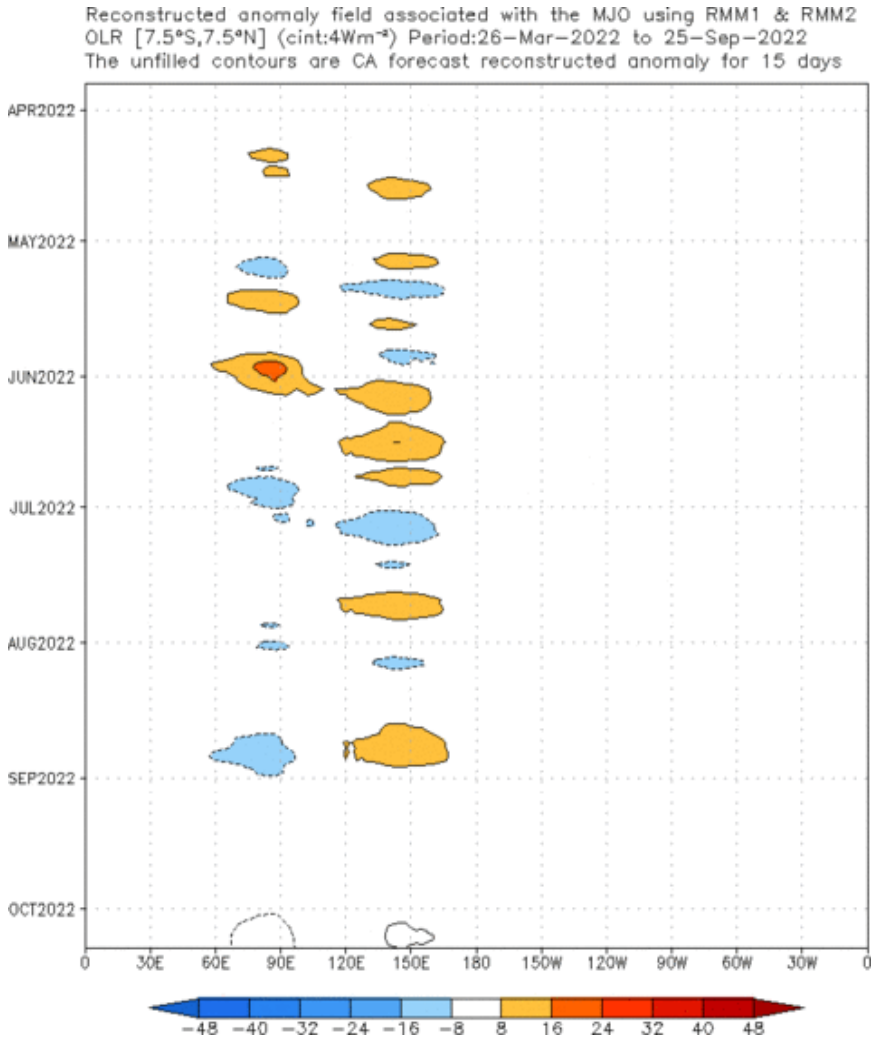


- The GEFS-based OLR anomaly fields favor the development of enhanced (suppressed) convection over the western (eastern Pacific) during the first half of October.

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.)

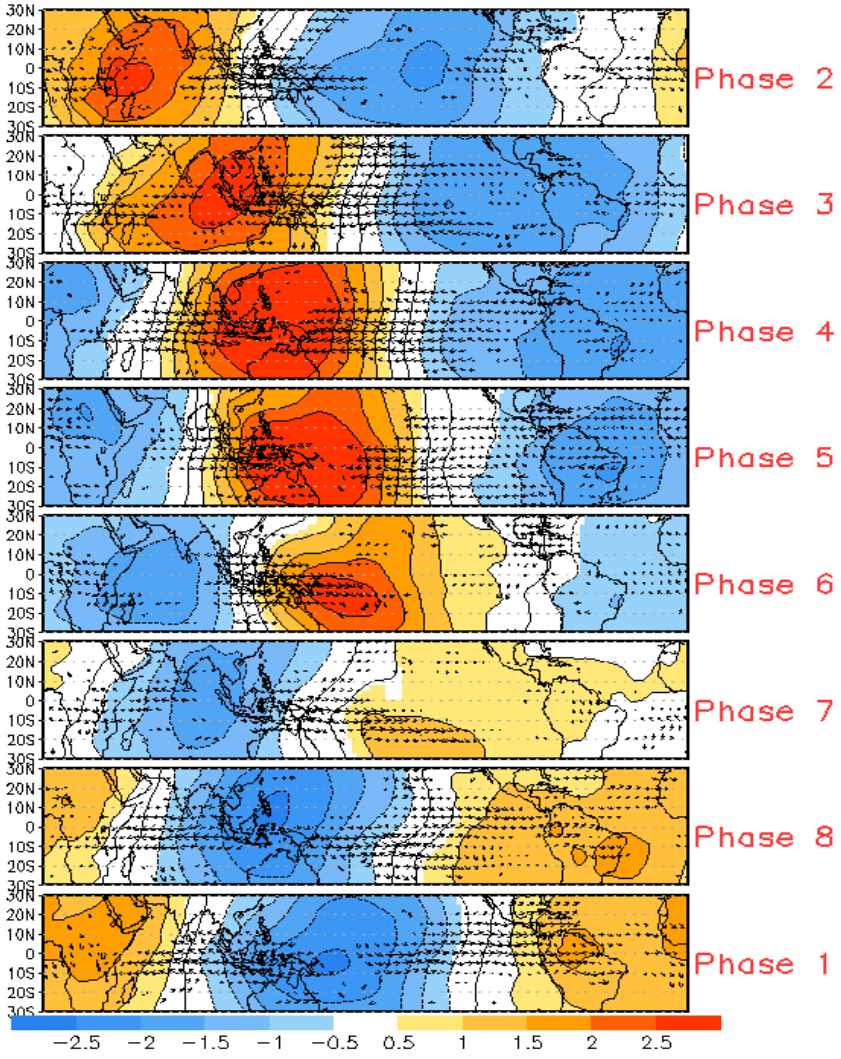




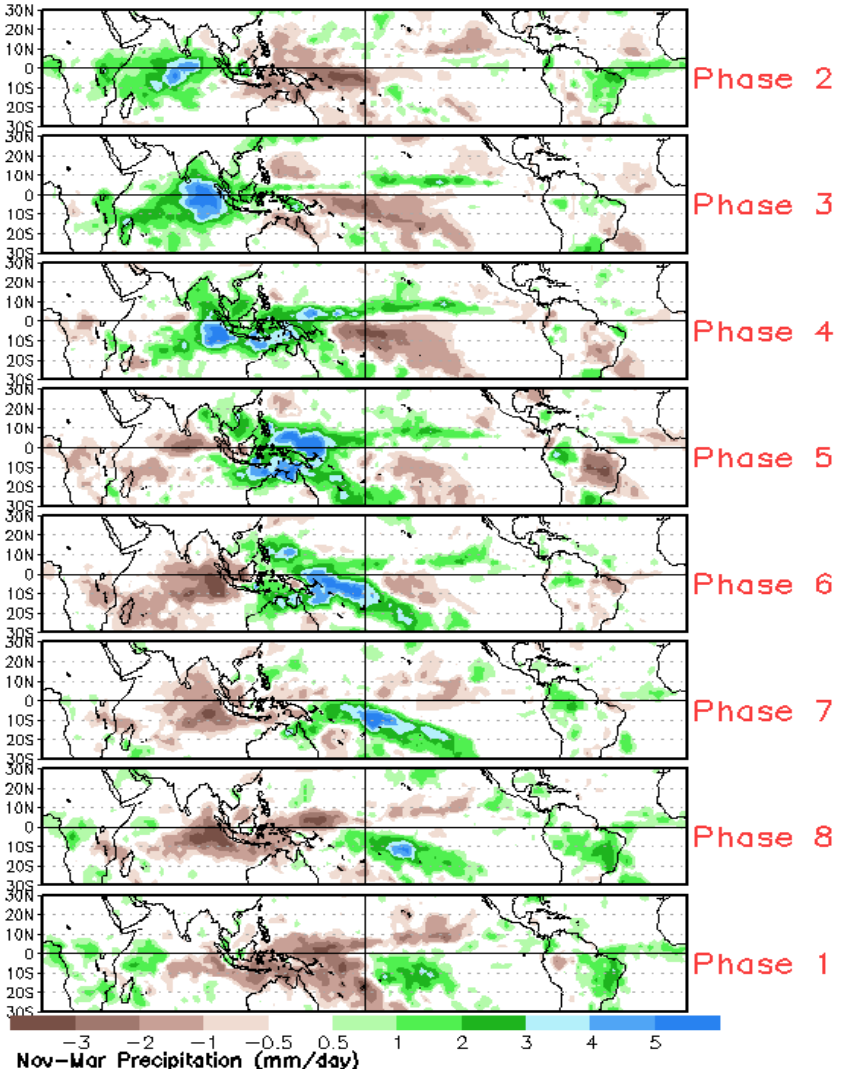
- The constructed analog forecast of RMM-based OLR depicts a convective dipole developing over the eastern Hemisphere, with suppressed convection emerging over the western Pacific later in week-2, while enhanced convection emerges over eastern Pacific and Indian Ocean.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



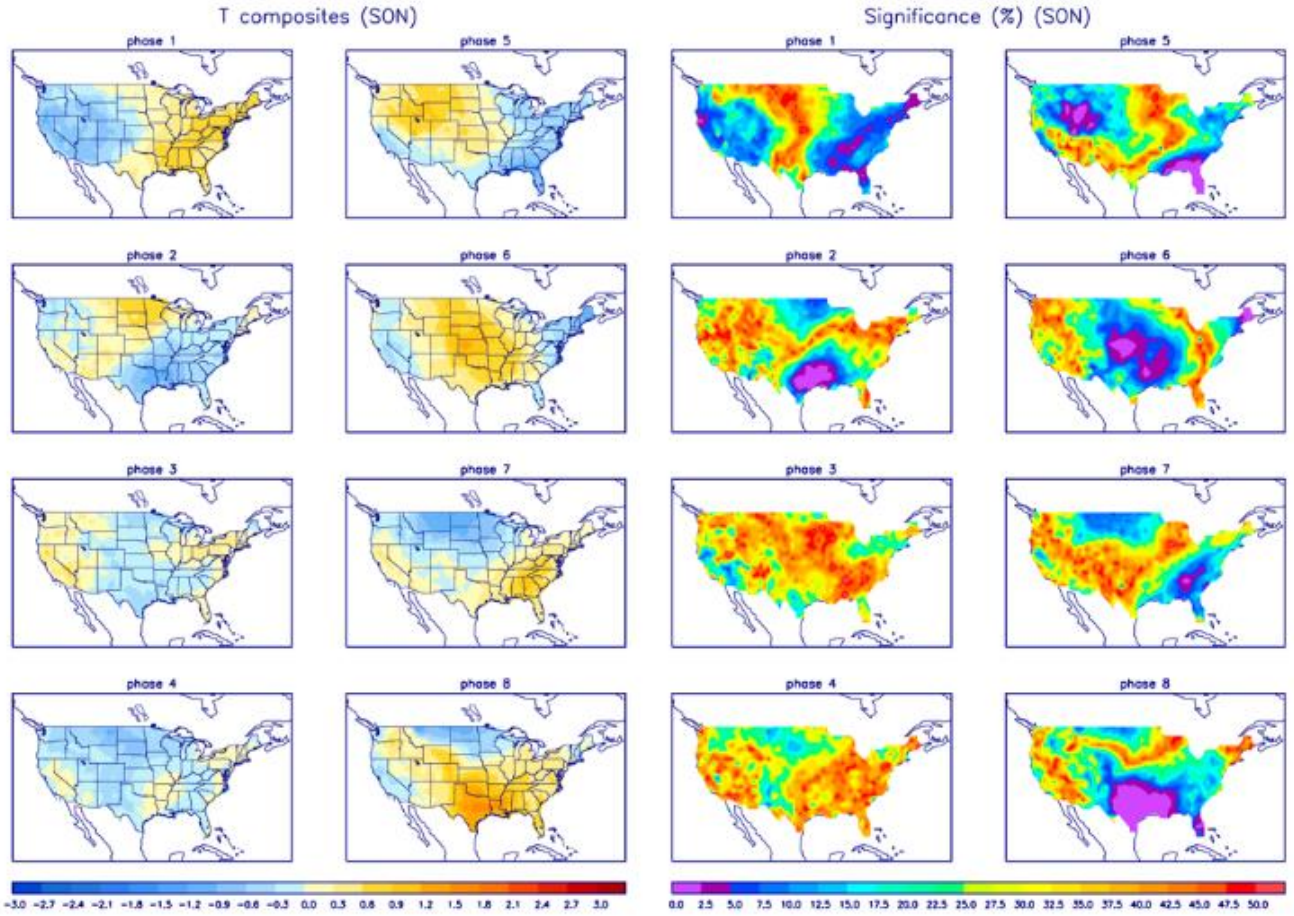
Precipitation Anomalies



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.

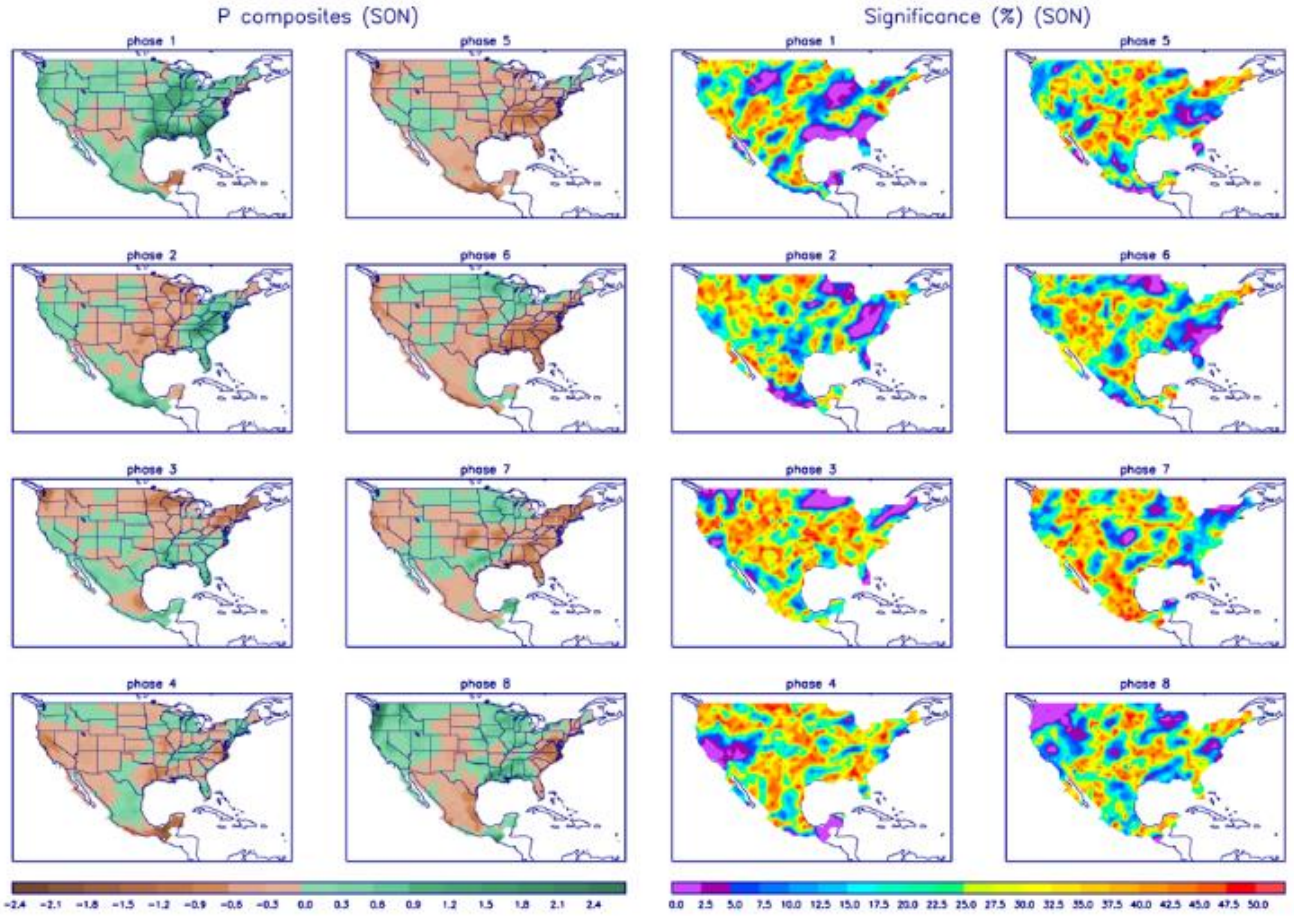


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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