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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
10 October 2022

Overview

- As previously forecast, the RMM index indicates the MJO has propagated eastward across the Maritime Continent, but has struggled to gain amplitude while straddling the RMM unit circle during the past week.

- Dynamical models remain bullish in developing a more coherent MJO over the western Pacific during the next two weeks. However, there is continued uncertainty as to how well the MJO will remain organized due to destructive interference with the established low frequency footprint, with extended range mean solutions failing to fully propagate a healthy intraseasonal signal into the western Hemisphere later in October.

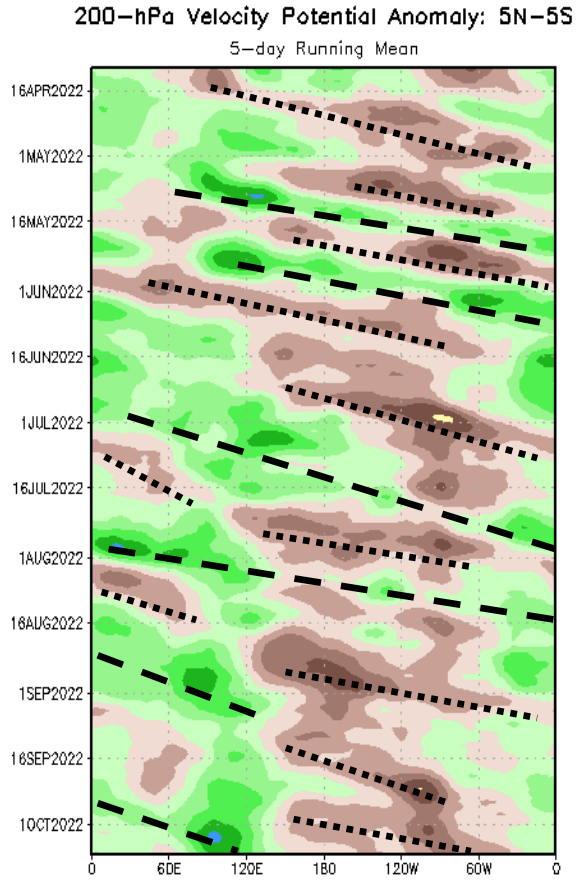
- Combined with Rossby wave activity forecast in the western Pacific, the large scale environment is expected to be conducive for tropical cyclone (TC) formation in the eastern Hemisphere, with decreased chances for development over the eastern Pacific and Atlantic, coinciding with a climatological downtick in TC activity in these basins later in October.

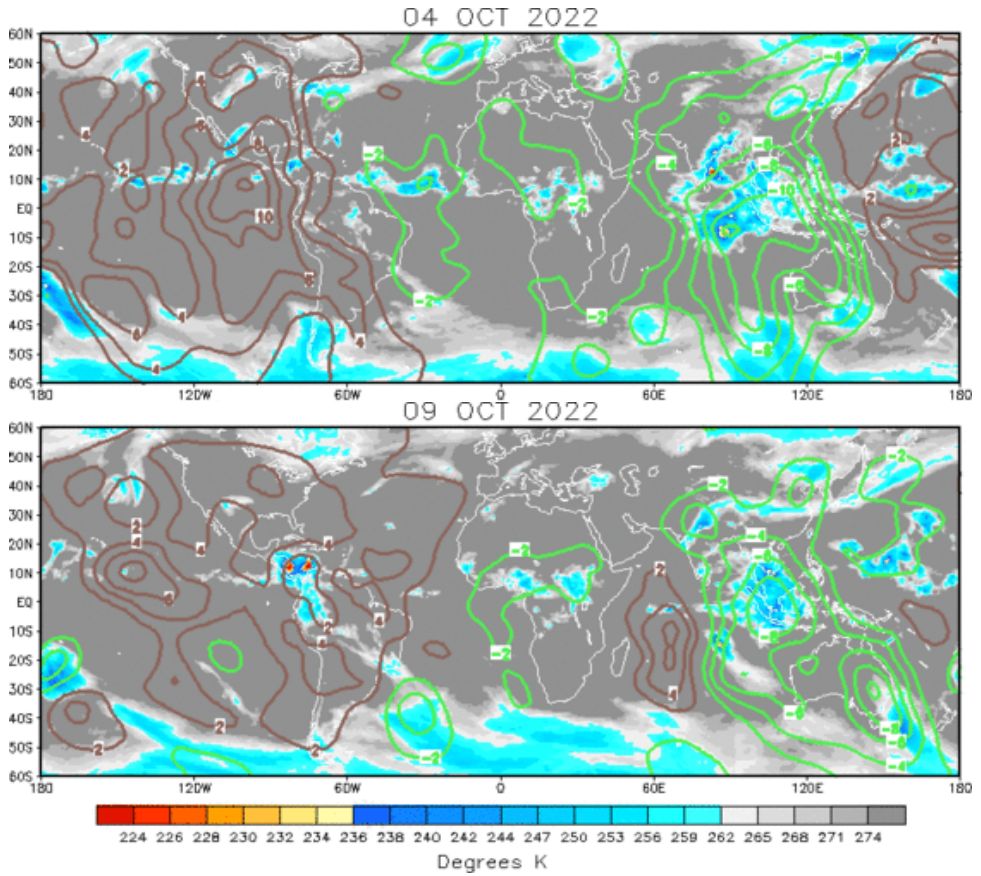
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



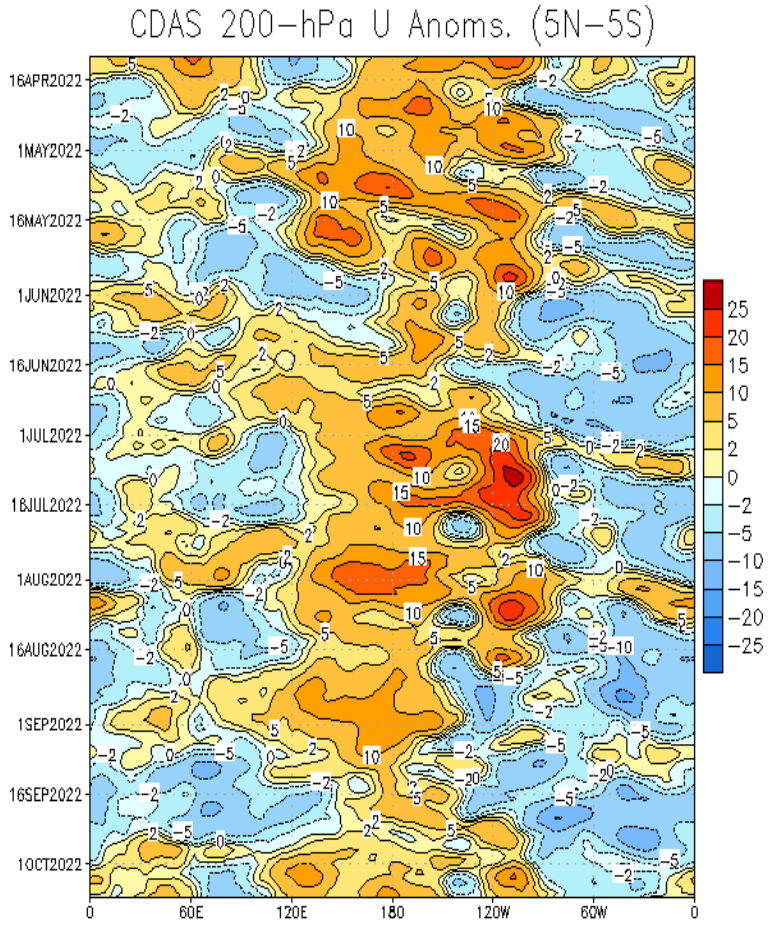


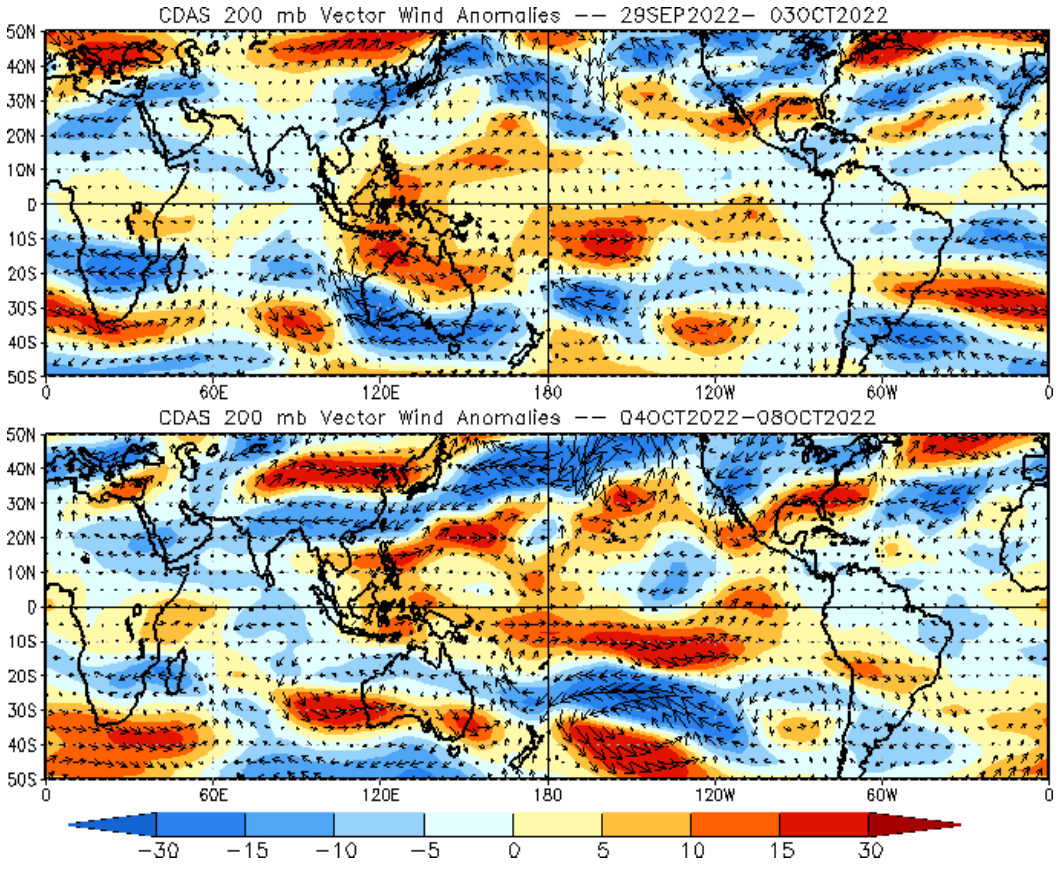
- The upper-level velocity potential field has devolved somewhat from a wave-1 pattern since earlier in October, with two distinguishable areas of anomalous divergence aloft over Africa and the Maritime Continent in the latest analysis.

- The main convective MJO envelope has been slow to propagate eastward over the Maritime Continent, however suppressed conditions have become more widespread over the tropical Atlantic.

200-hPa Wind Anomalies

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



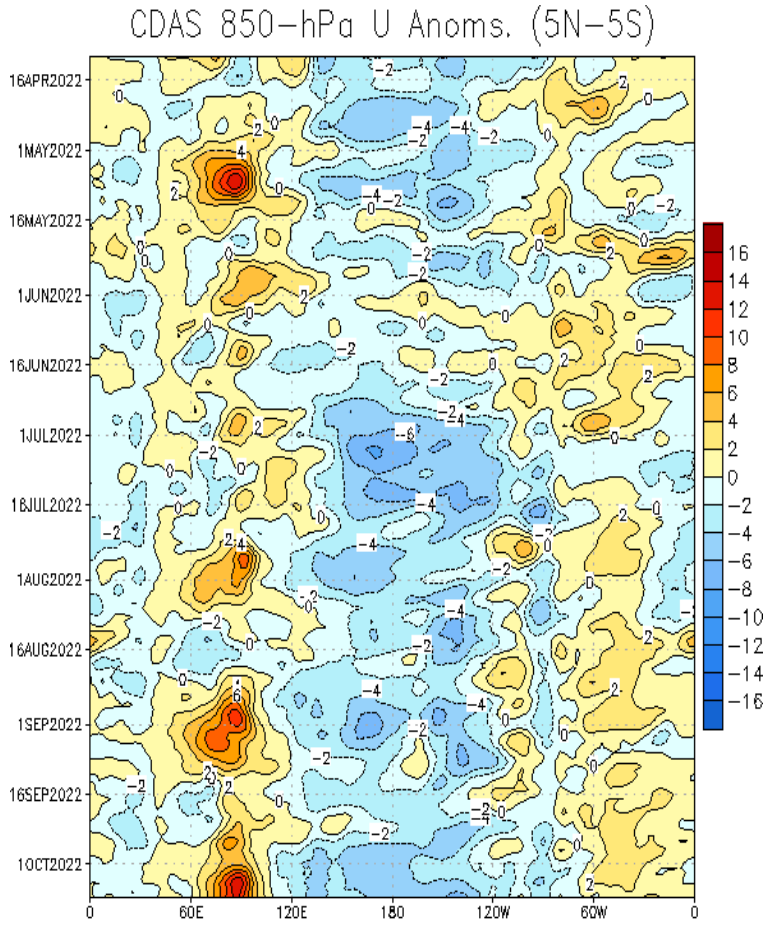


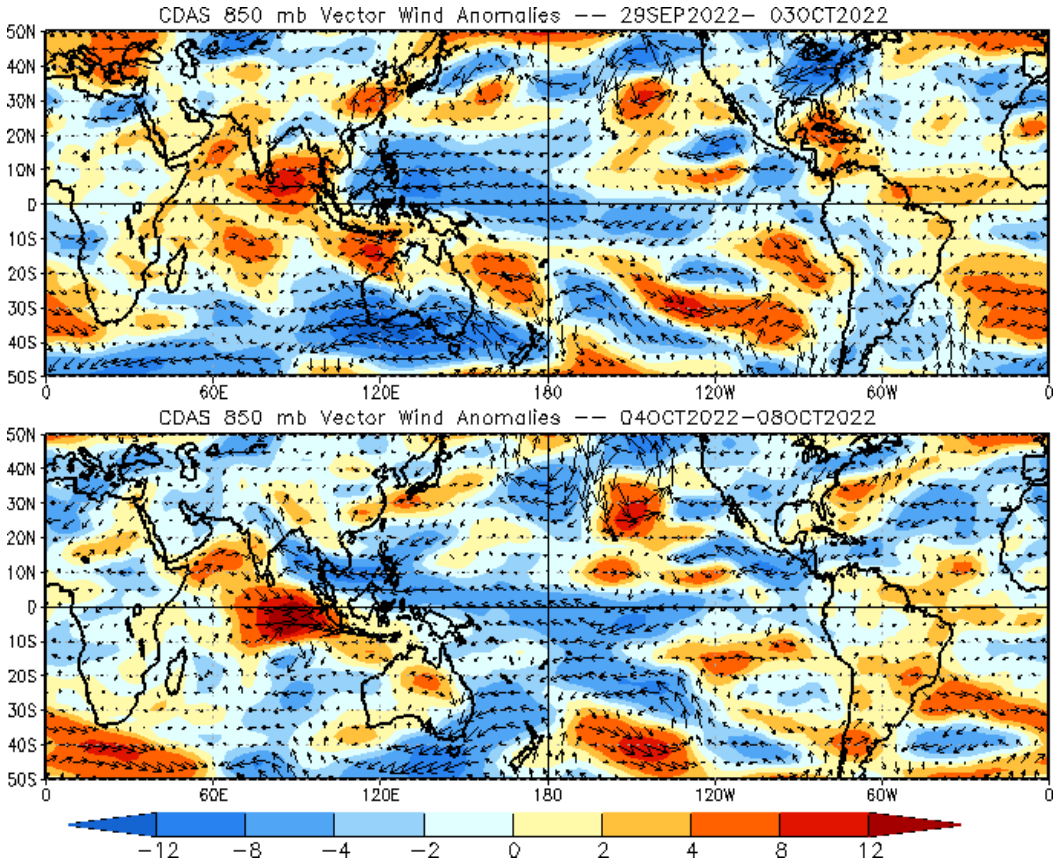
- Anomalous westerlies aloft continue to prevail throughout the equatorial Pacific consistent with the ongoing atmospheric response of La Niña, with a noted strengthening near and west of the Date Line recently.

- Anomalous upper-level easterlies have strengthened across the equatorial Indian Ocean and have slightly shifted eastward.

850-hPa Wind Anomalies

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



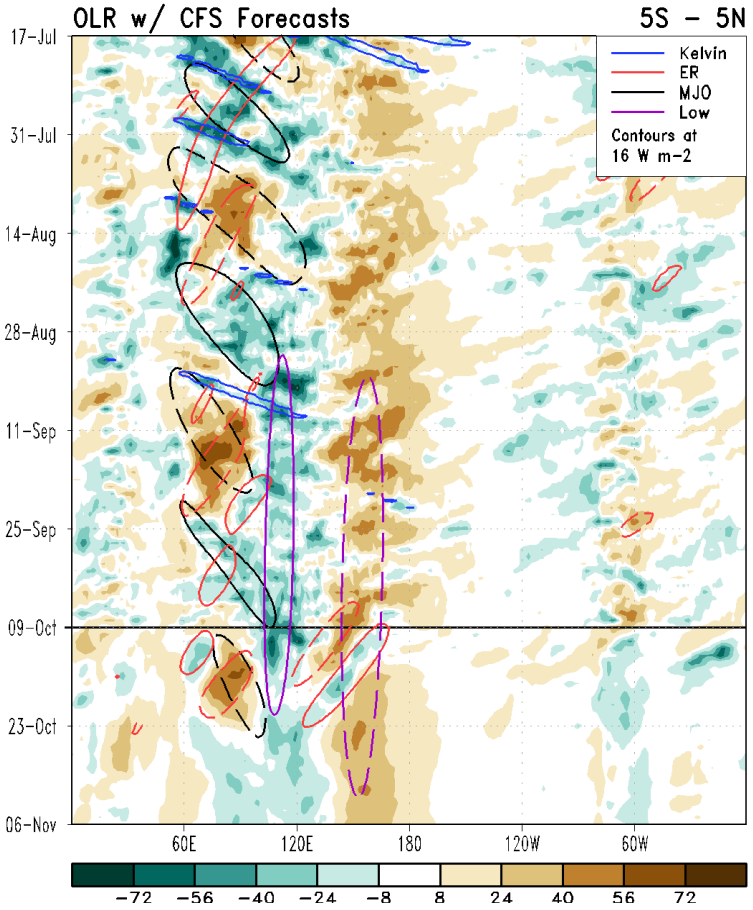


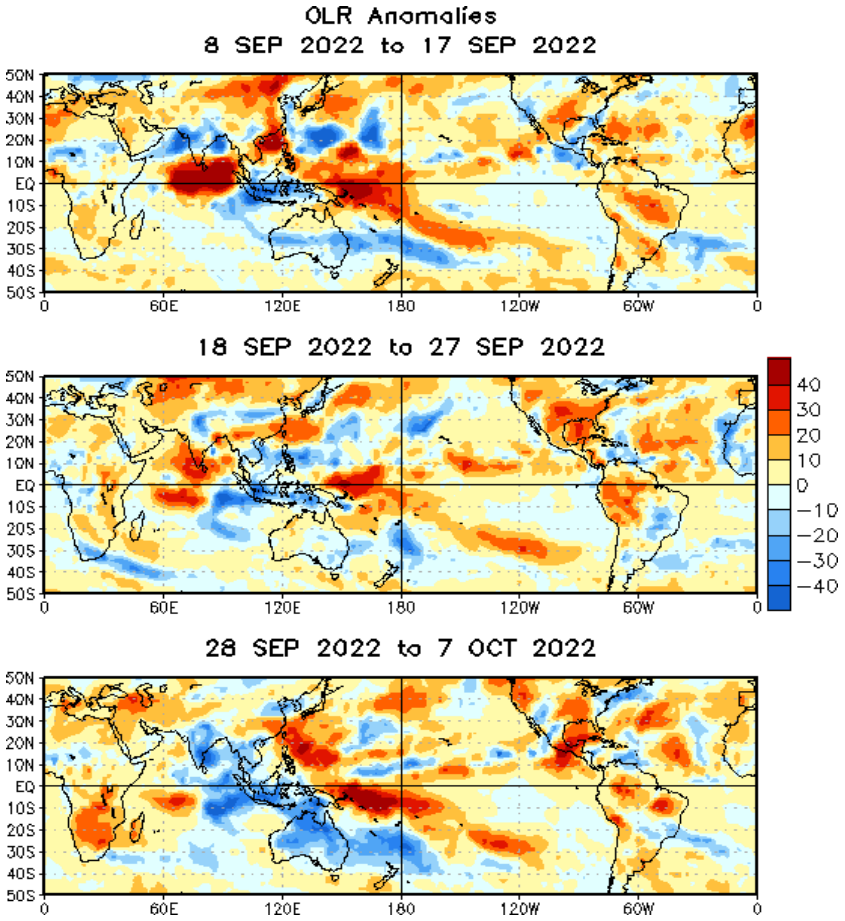
- Another westerly wind burst is evident in the equatorial Indian Ocean (90E), likely triggering tropical cyclone formation (Balita) in the southern Indian Ocean during the past week.

- Enhanced trades continue to dominate the equatorial Pacific, and have expanded into the western Pacific north of the equator which has quelled tropical cyclone activity since the beginning of October.

Outgoing Longwave Radiation (OLR) Anomalies

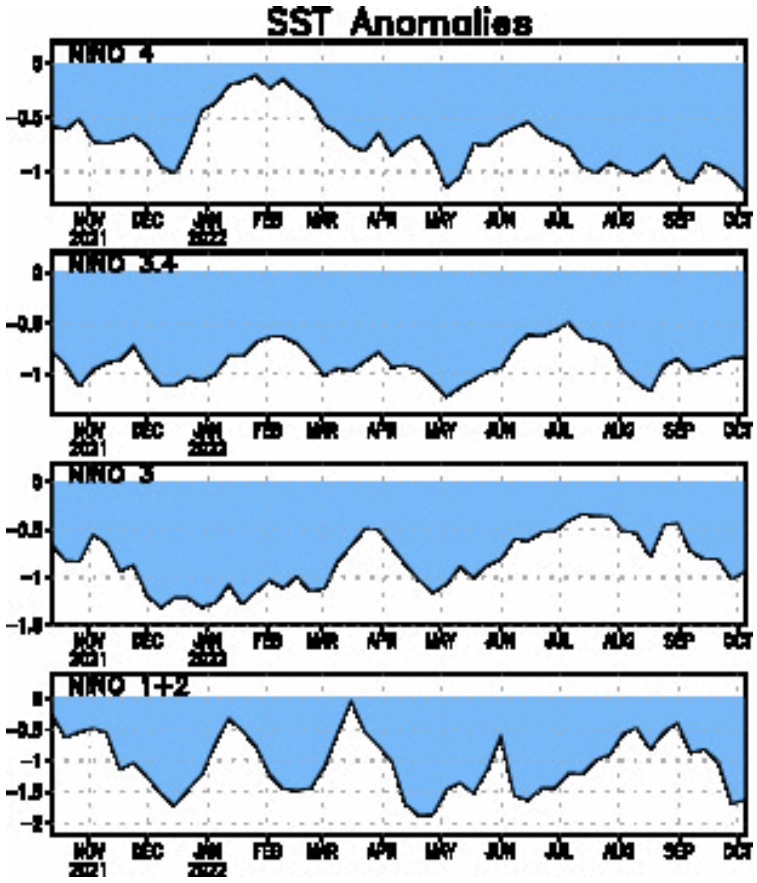
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

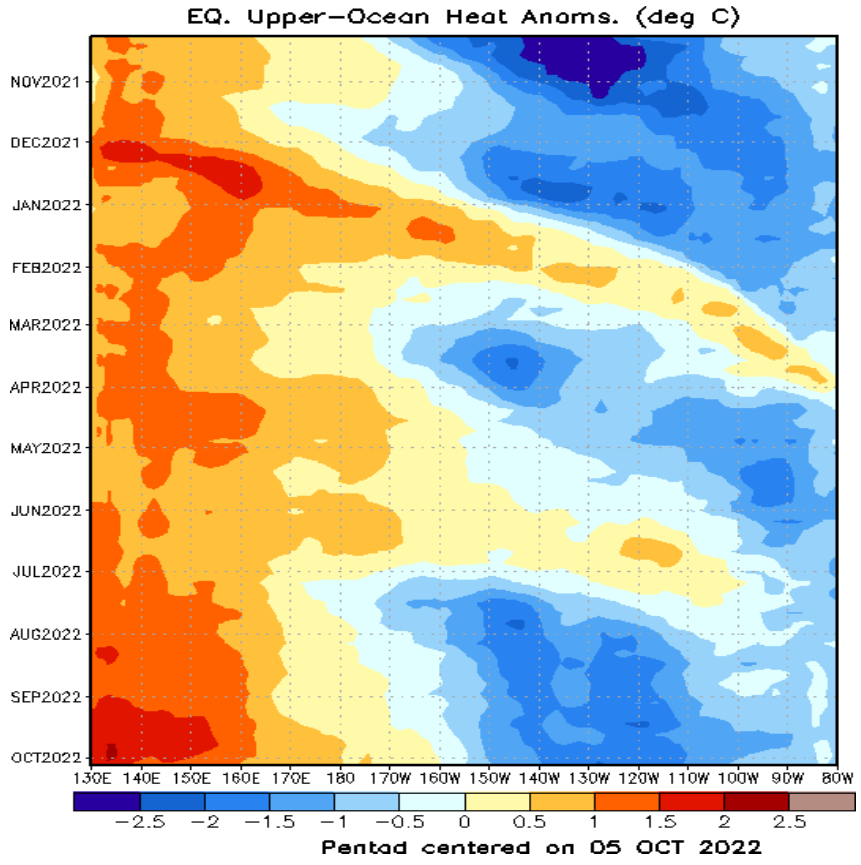




- Enhanced convection has strengthened over the eastern equatorial Indian Ocean, Maritime Continent, as well as throughout many areas in the extratropical eastern Hemisphere.
- While suppressed convection remains anchored over the western and central Pacific tied to La Niña, an uptick in convection is observed north of the equator near the Date Line.
- The CFS forecast favors the return of enhanced convection between 120E and the Date Line, with Rossby wave activity coming through the filtering.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

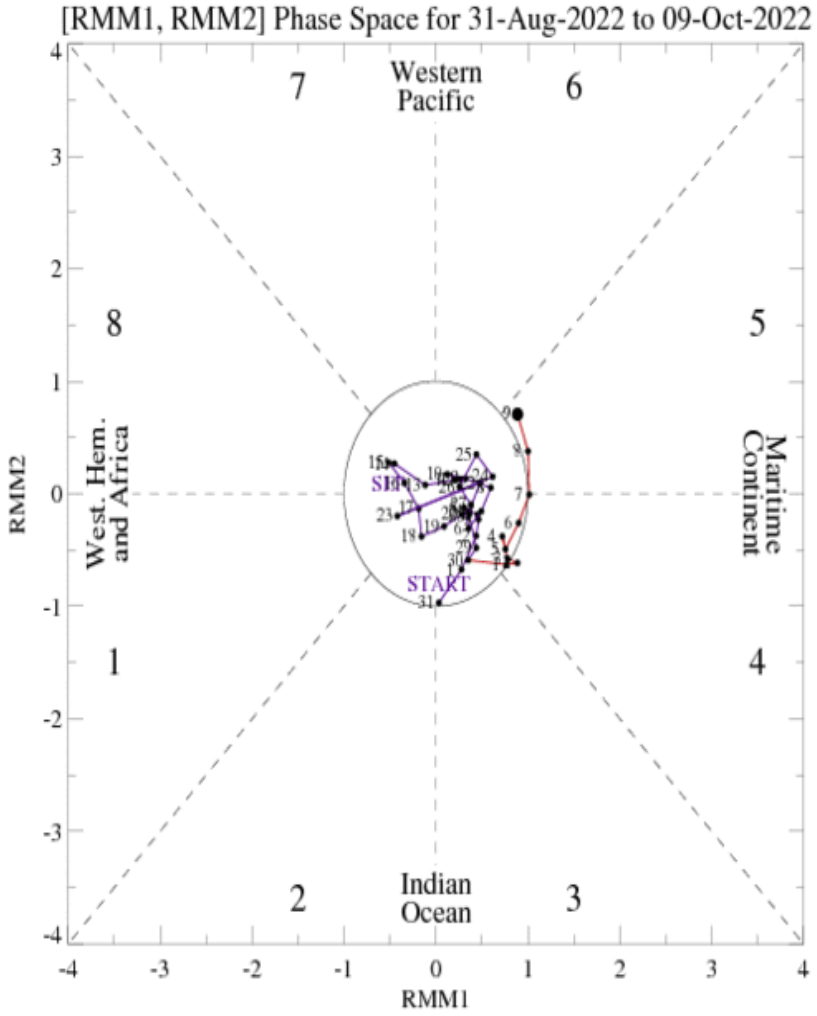




- Enhanced trades tied to the ongoing La Niña have resulted in subsurface below-normal heat content, though an eastward expansion of warmer waters has been observed east of the Date line since mid-September.
- SSTs remain below average across all Niño basins, with substantial SST decreases noted across the East Pacific (Niño-1+2 and Niño-3)

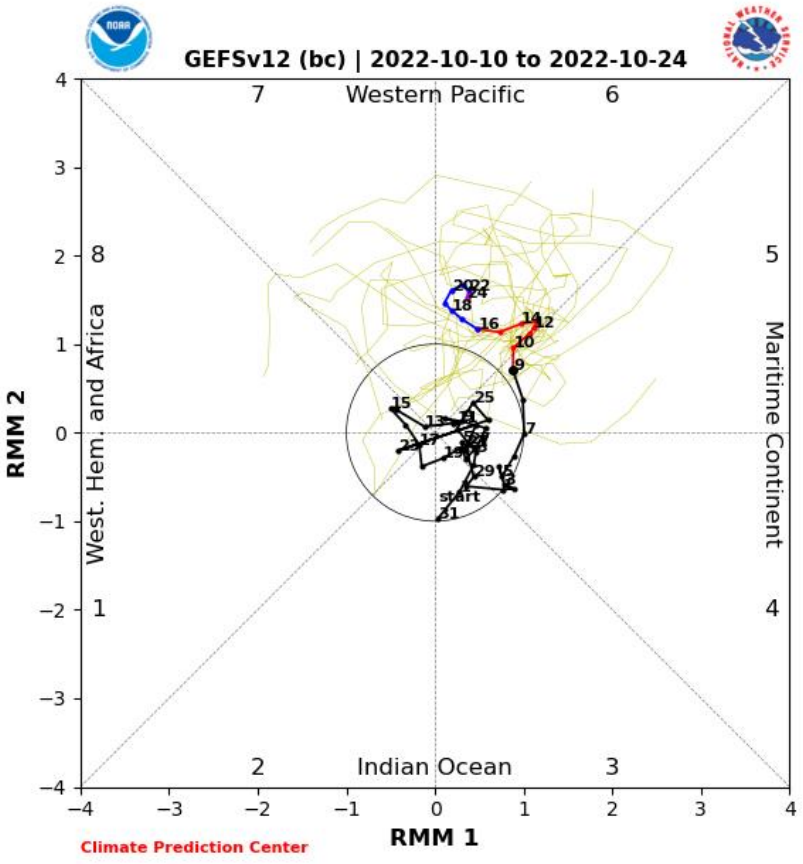
MJO Index: Recent Evolution

- Following an incoherent MJO throughout September, the RMM-based index shows an eastward propagating signal over the Maritime Continent, albeit at a low amplitude since the beginning of October.

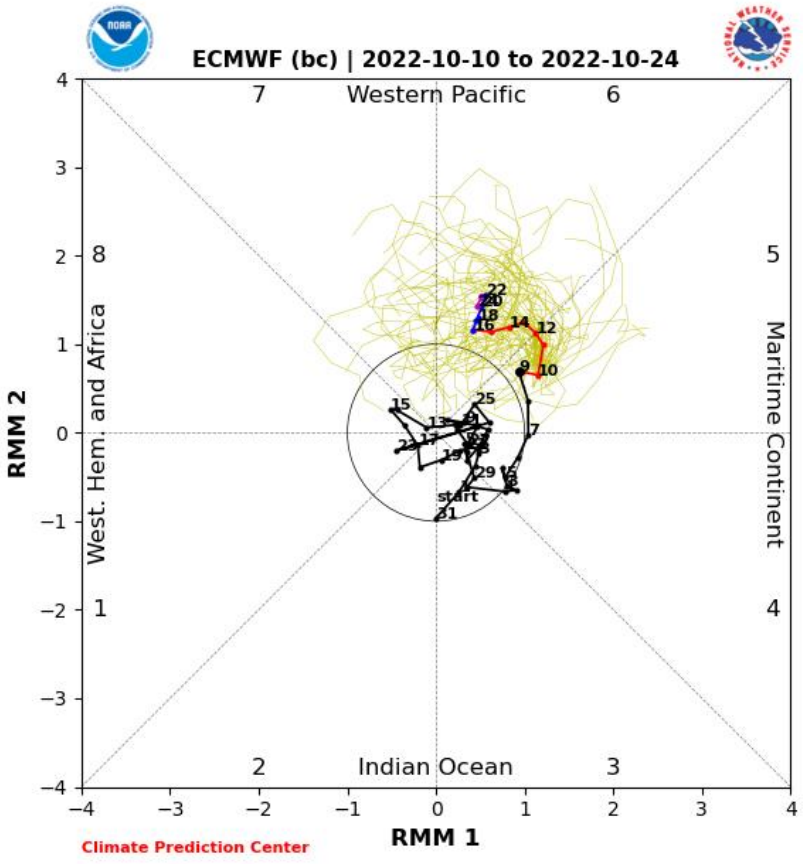


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

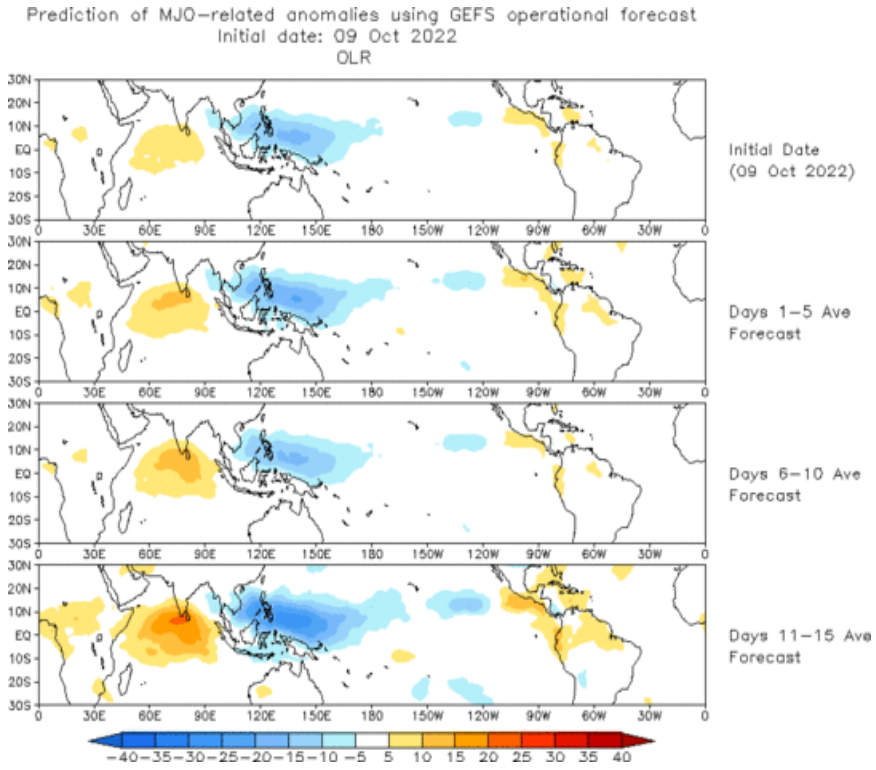


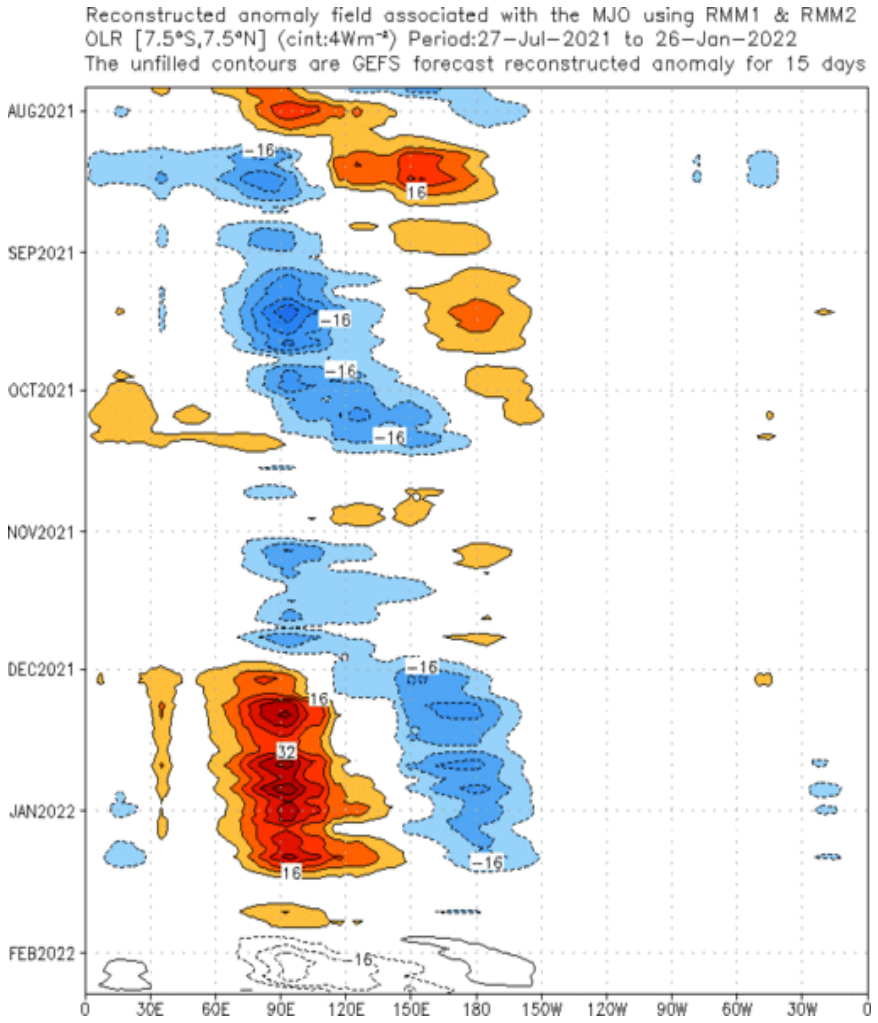
ECMWF Forecast

- Similar to last week, dynamical model continue to favor a renewed MJO event propagating across the Maritime Continent and into the western Pacific during the next two weeks. The ECWMF in particular appears to be more sensitive to Rossby wave activity favored in the western Pacific resulting in relatively slower progression in RMM space.
- Large ensemble spread exists in the extended range model guidance, with mean solutions showing either a weakening or stagnant signal over the western Pacific through the end of October.

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.)

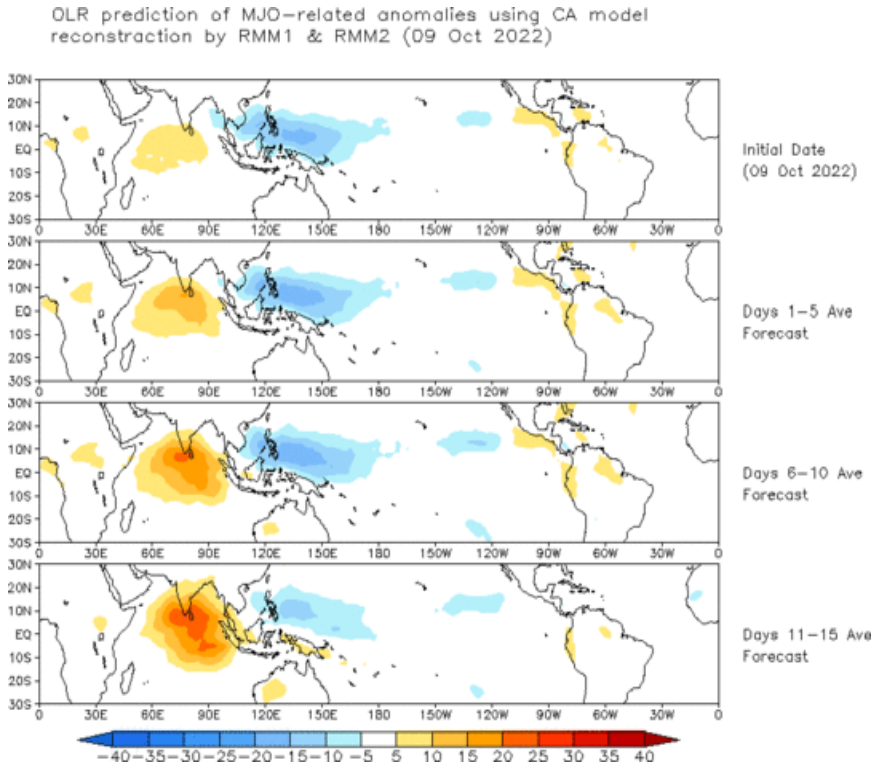


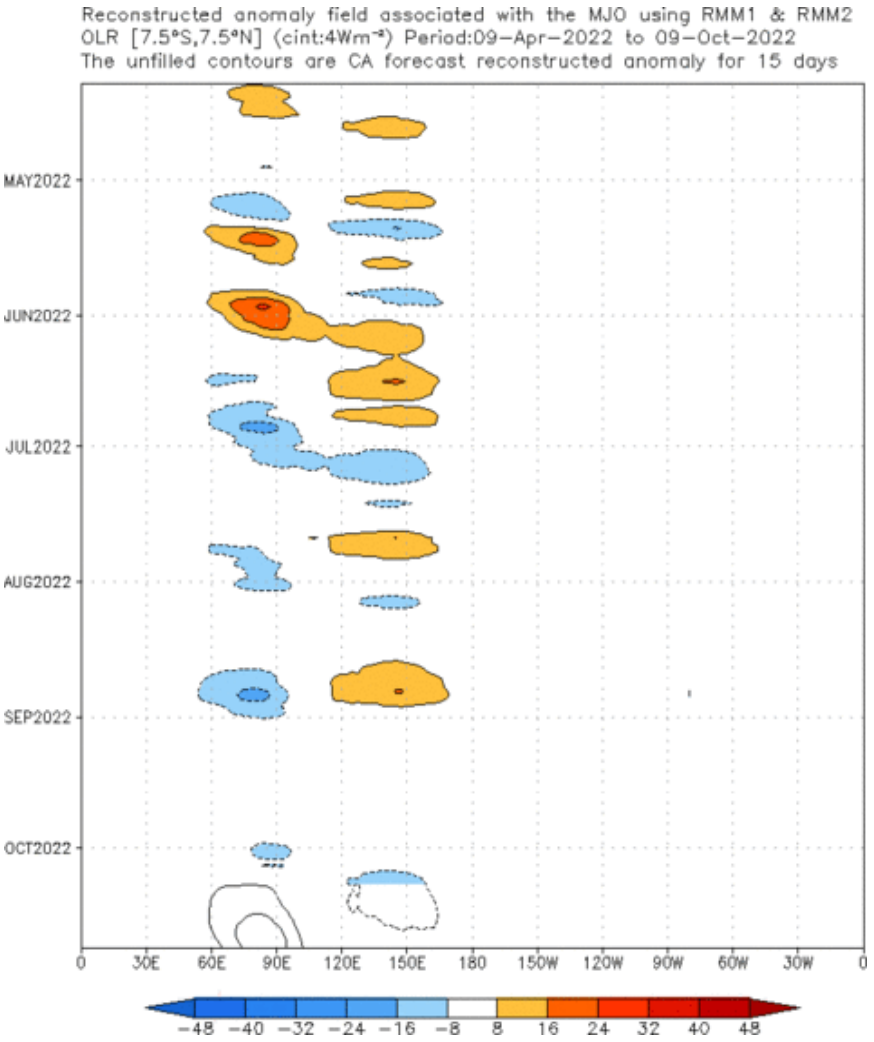


- The GEFS-based OLR anomaly fields favor a strengthening convective dipole over the eastern hemisphere, but remains nearly stationary throughout the period.

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.)

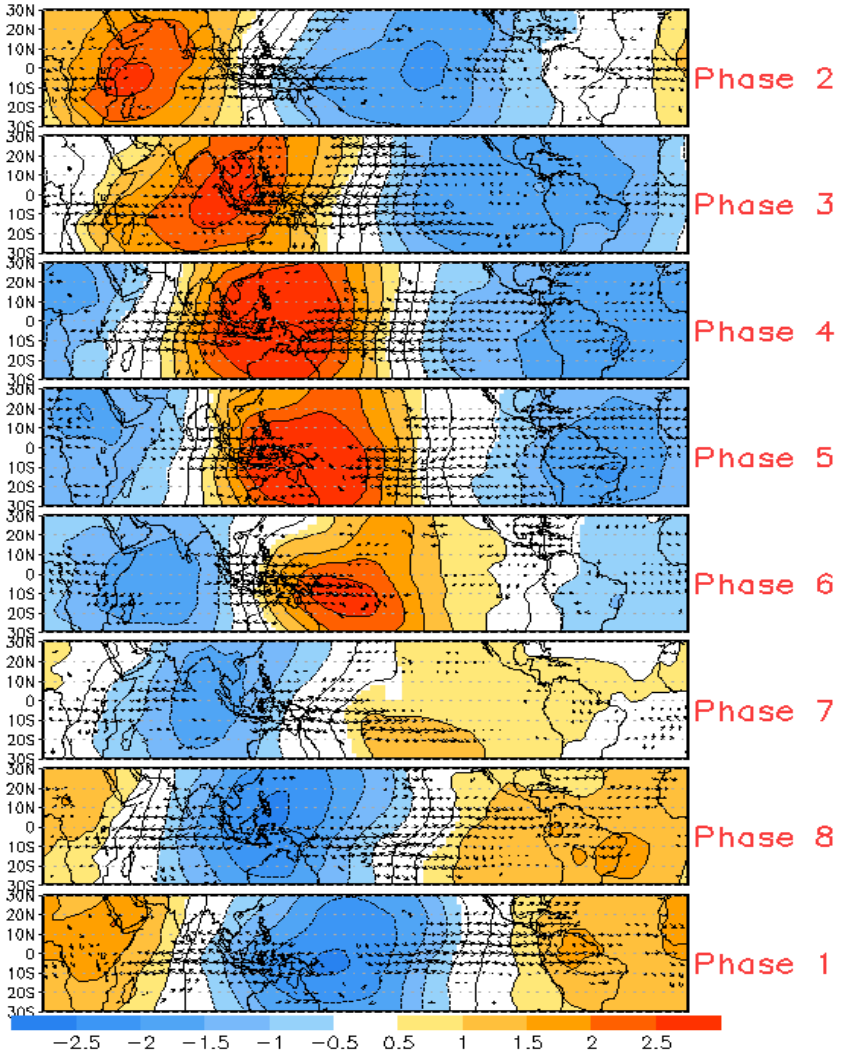




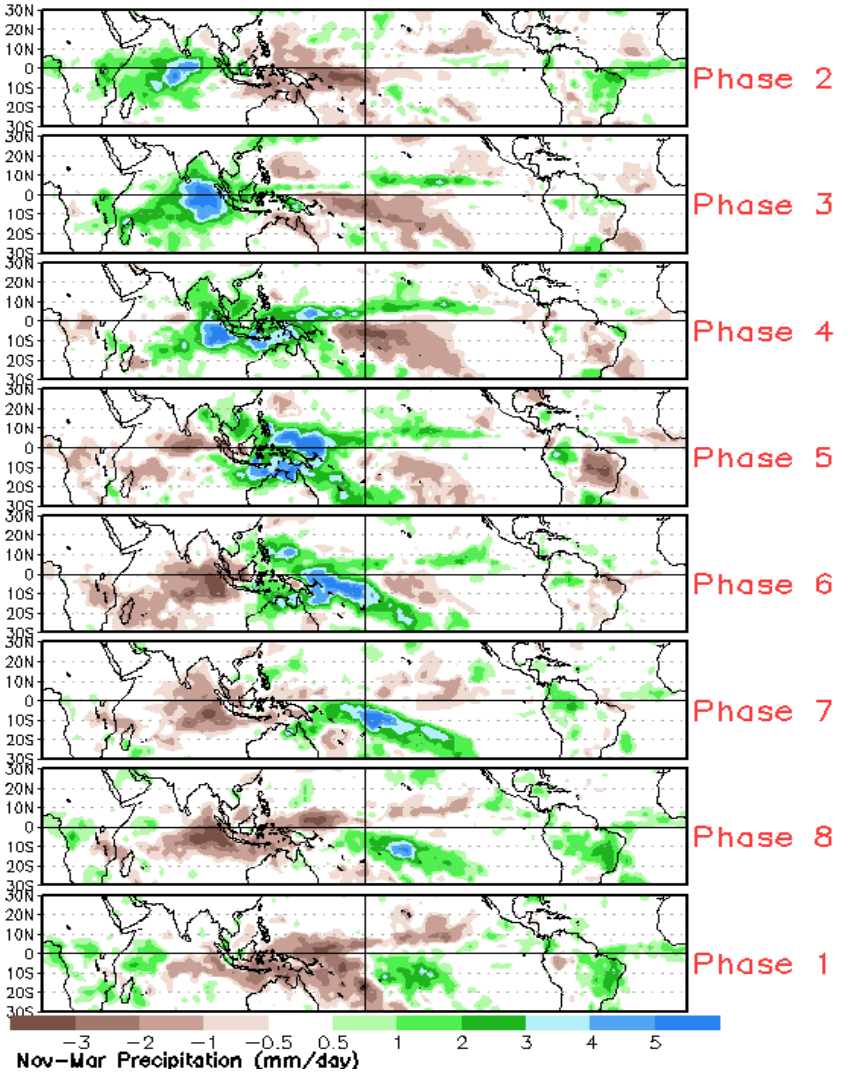
- The constructed analog forecast of RMM-based OLR favors a slightly more progressive and stronger convective pattern than the GEFS during the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



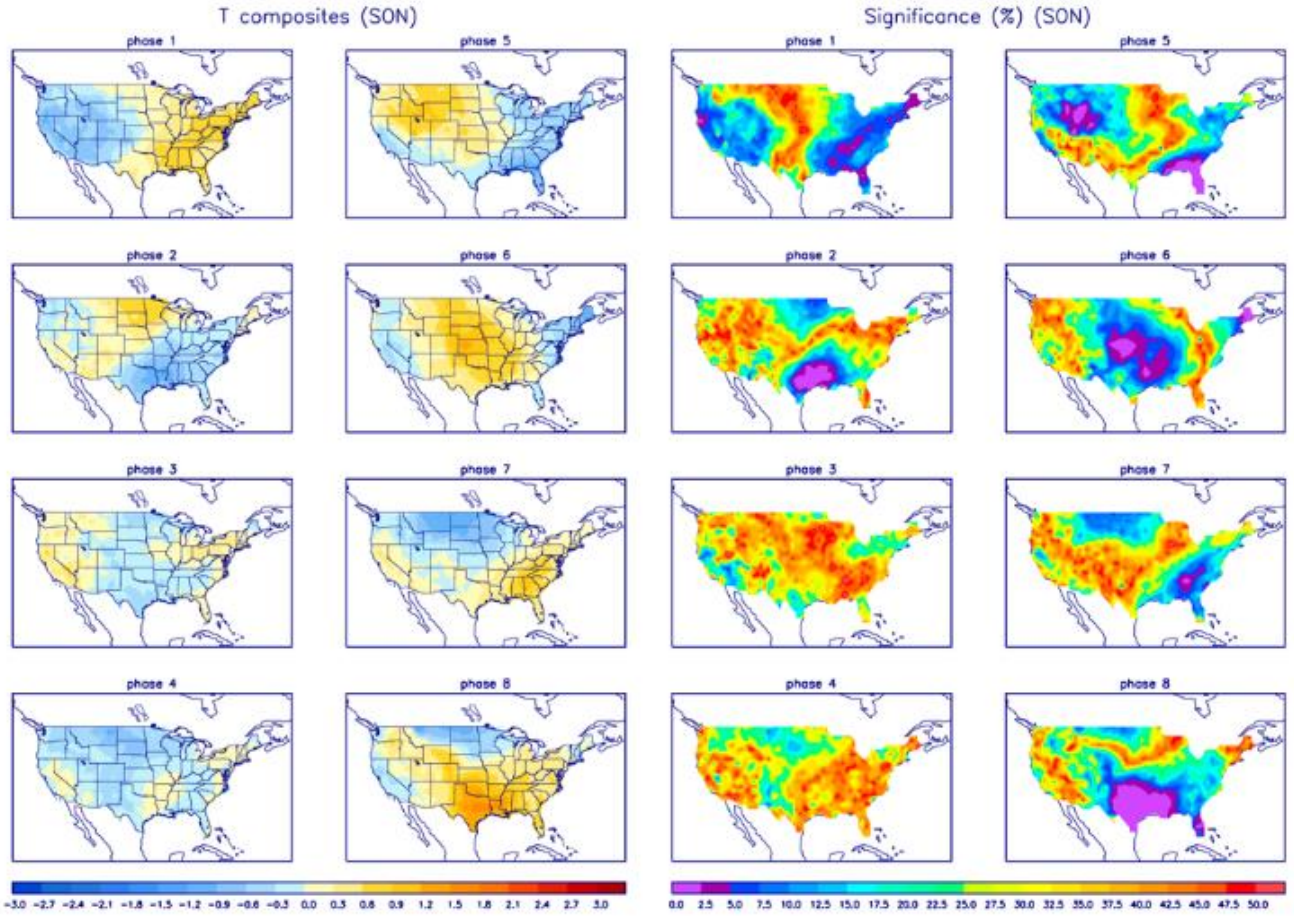
Precipitation Anomalies



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.

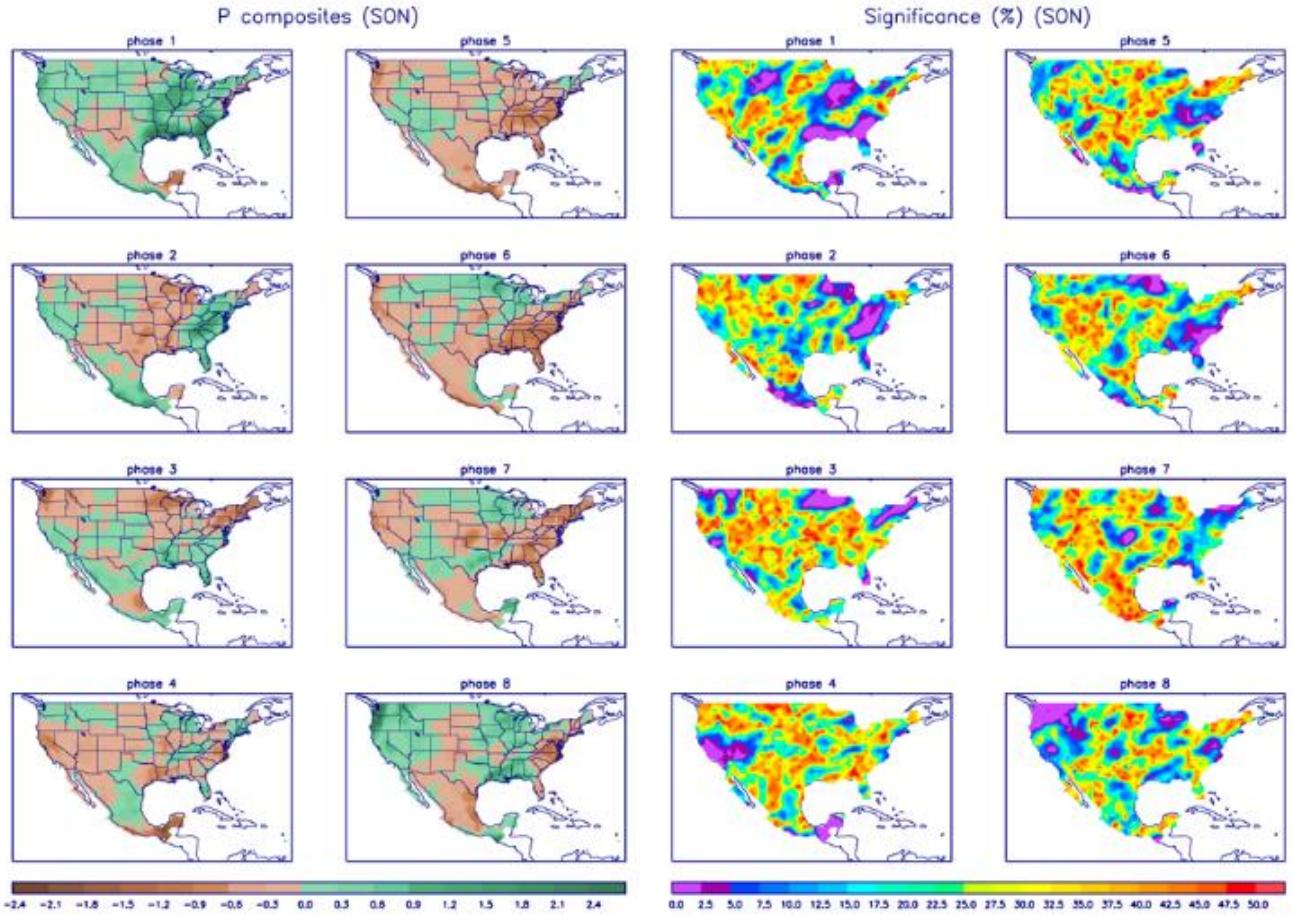


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - Precipitation

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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