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

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

Overview

- As previously forecast, the RMM index indicates the MJO has propagated eastward across the Maritime Continent and briefly increased in amplitude before once again dropping down to near the unit circle.

- Dynamical models mostly favor a stagnating MJO signal, with ensemble means remaining confined to the Western Pacific and relatively weak amplitude, either at or just outside the unit circle.

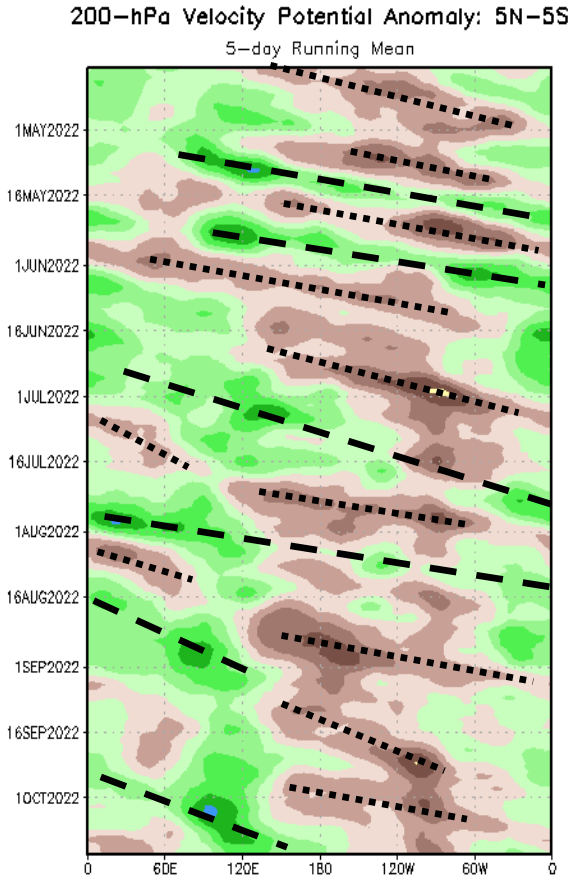
- Large-scale pattern favors a continued conducive environment for tropical cyclone (TC) formation for the eastern Hemisphere, with decreasing chances for development over the eastern Pacific and Atlantic, coinciding with a climatological downtick in TC activity in these basins later in October.

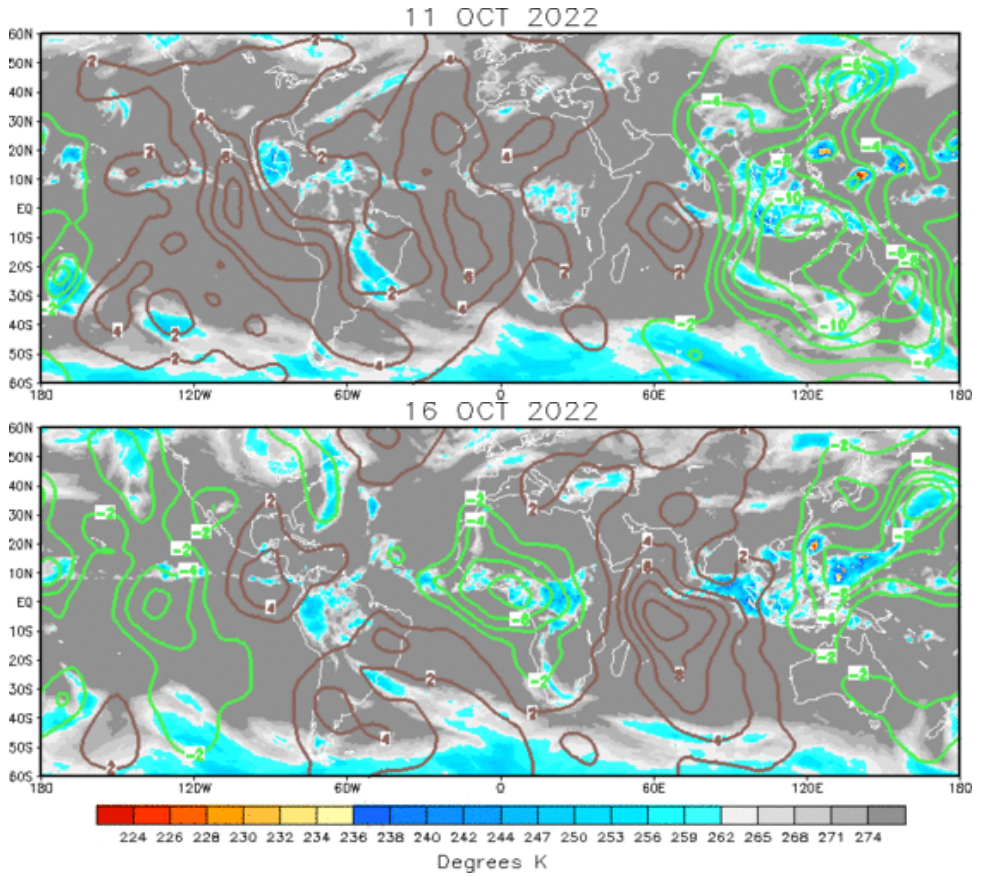
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



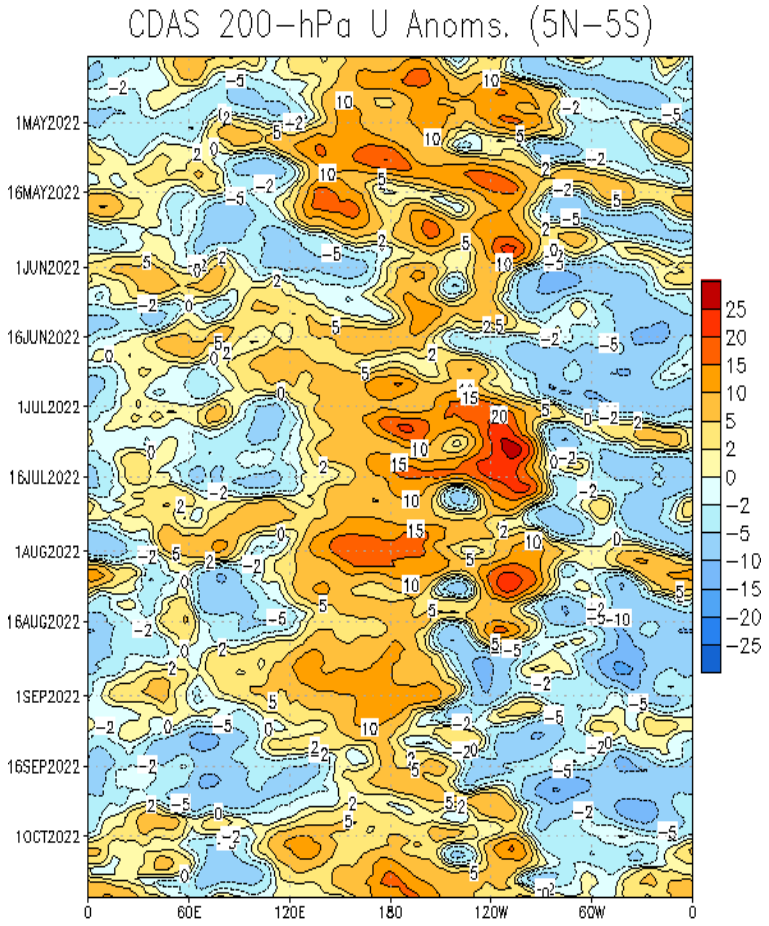


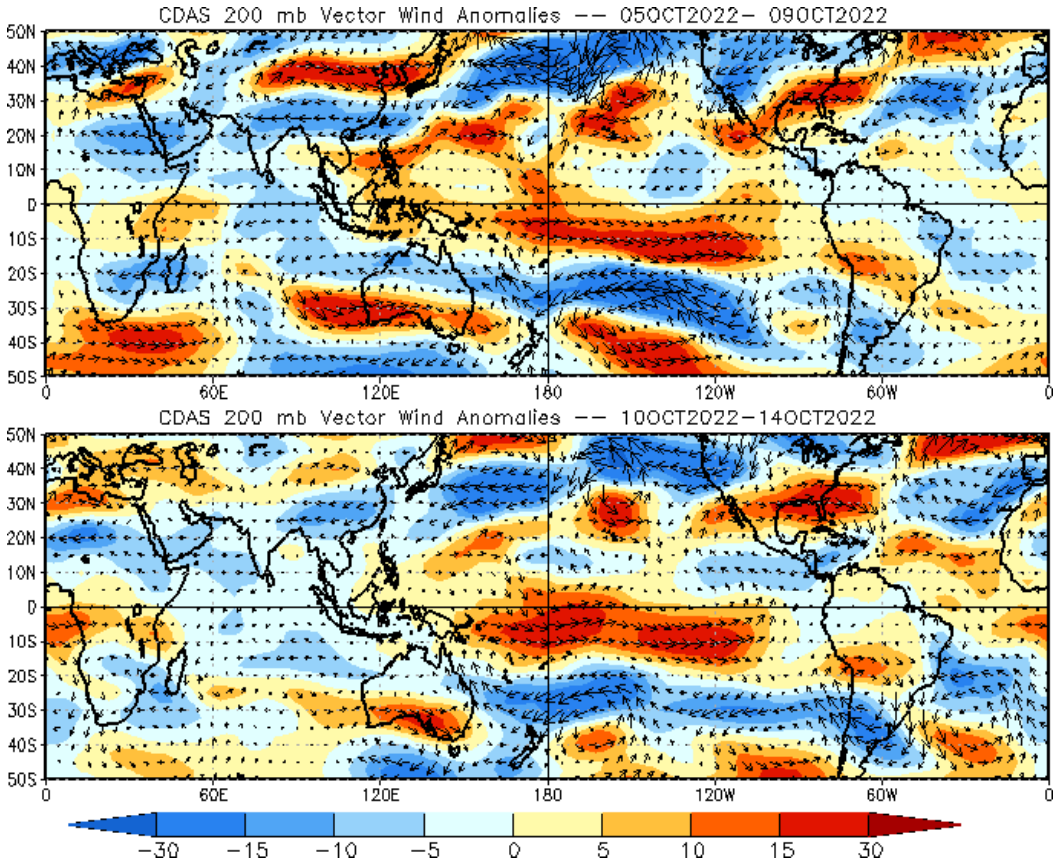
- The upper-level velocity potential field briefly organized into a wave-1 pattern before breaking down recently, with enhanced convection over Africa and the Maritime Continent.

- The main convective MJO envelope has been slow to propagate eastward into the Western Pacific, however suppressed conditions have become more widespread over the Indian Ocean.

200-hPa Wind Anomalies

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



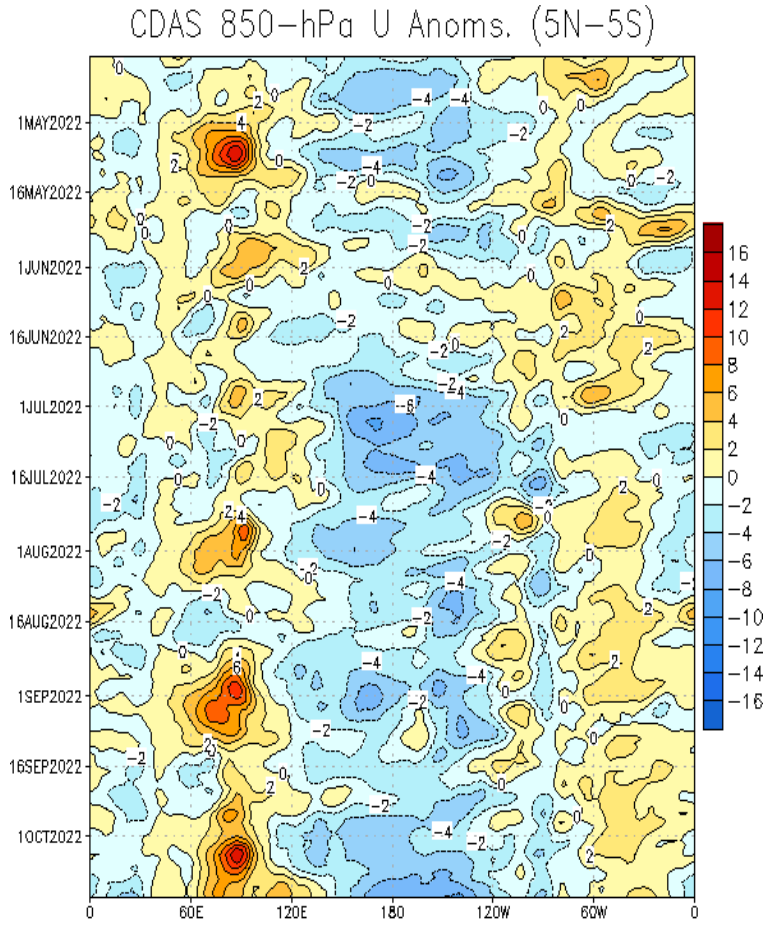


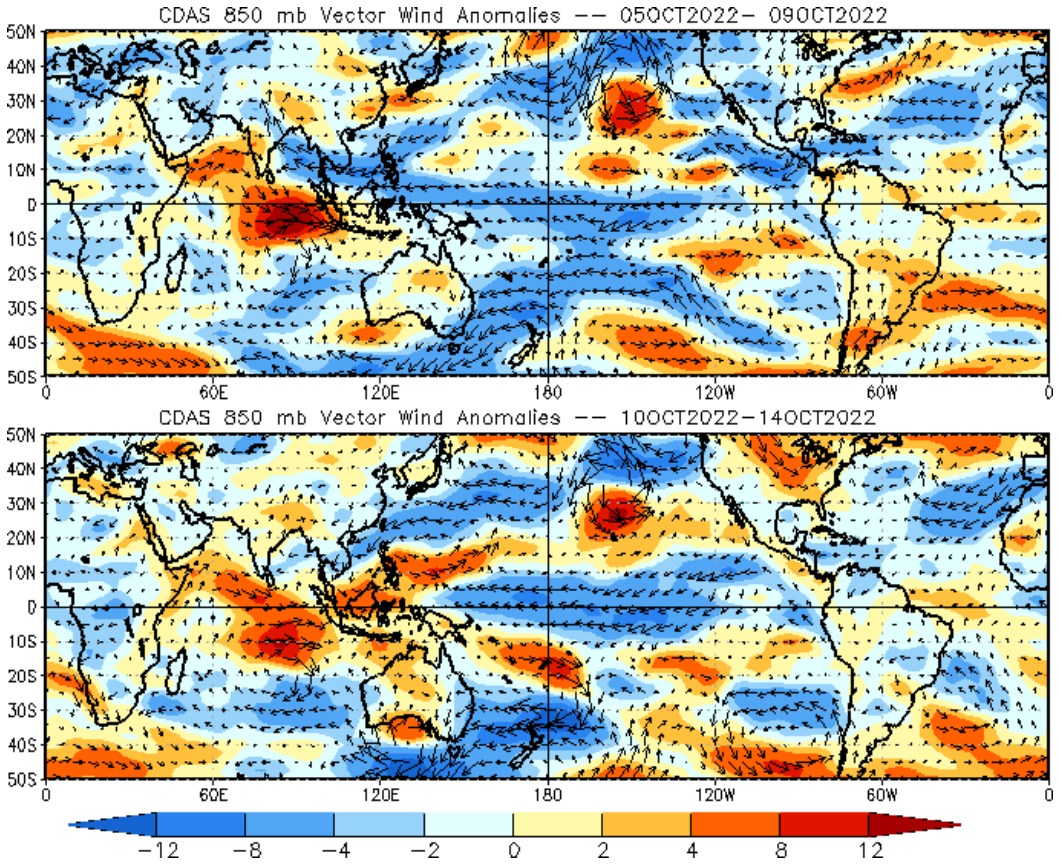
- Anomalous westerlies aloft continue to prevail throughout the equatorial Pacific consistent with the ongoing atmospheric response of La Niña, with a noted strengthening near and west of the Date Line recently.

- Anomalous upper-level easterlies have eased since early October across the equatorial Indian Ocean.

850-hPa Wind Anomalies

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



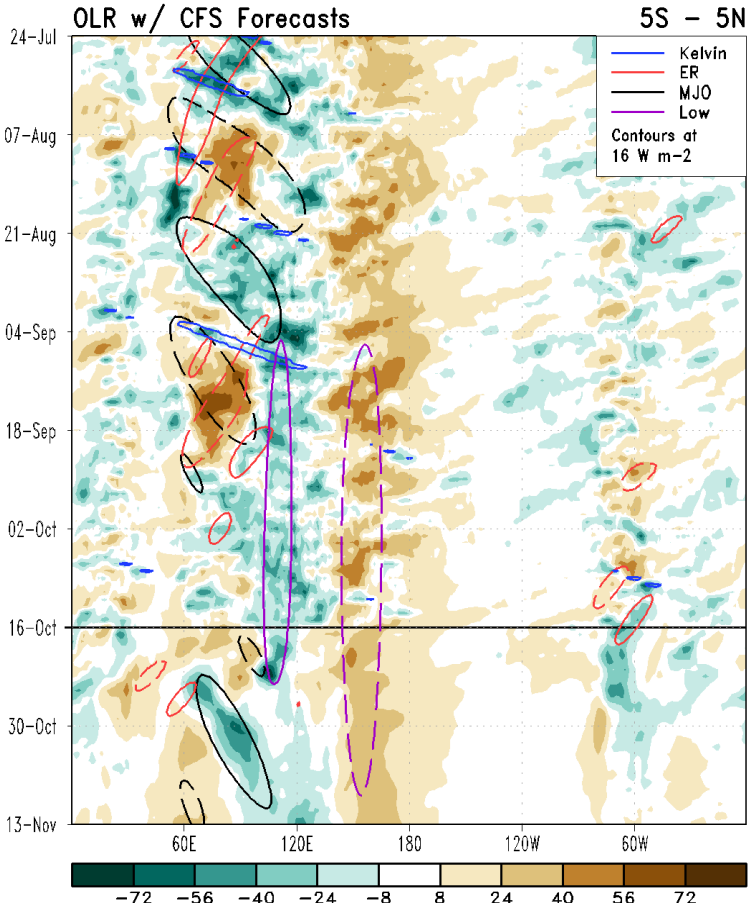


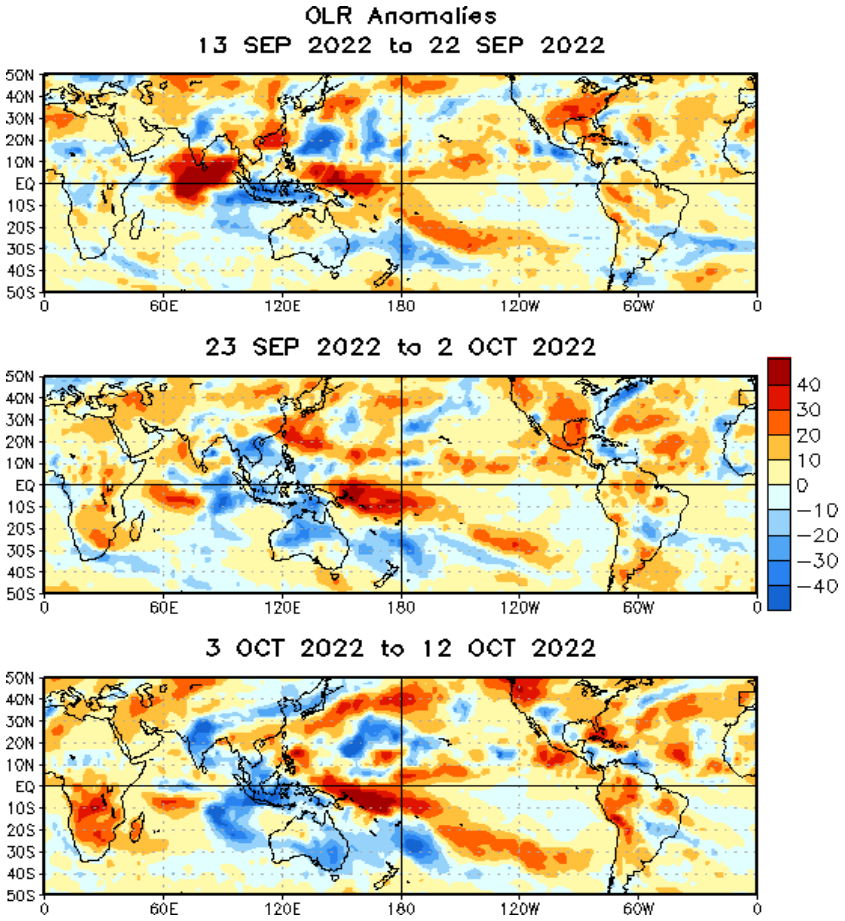
- Another westerly wind burst is evident in the equatorial Indian Ocean (90E), although its intensity is diminishing and dispersing relative to its peak in early October.

- Enhanced trades continue to dominate the equatorial Pacific. The western extent has retreated away from the Maritime Continent but the core area has been increasing in strength over the last week.

Outgoing Longwave Radiation (OLR) Anomalies

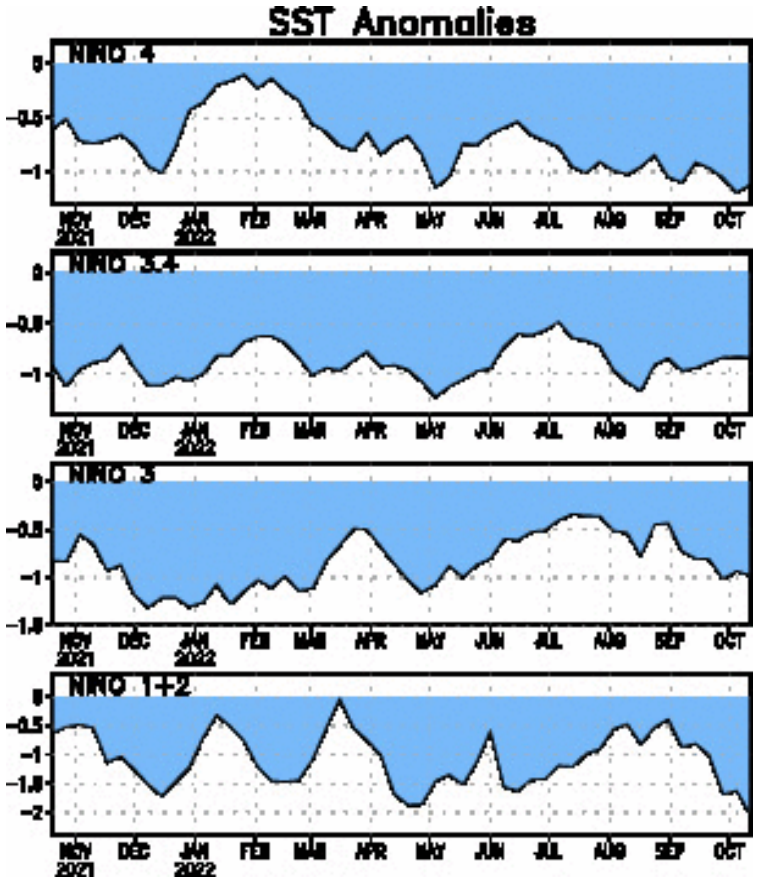
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

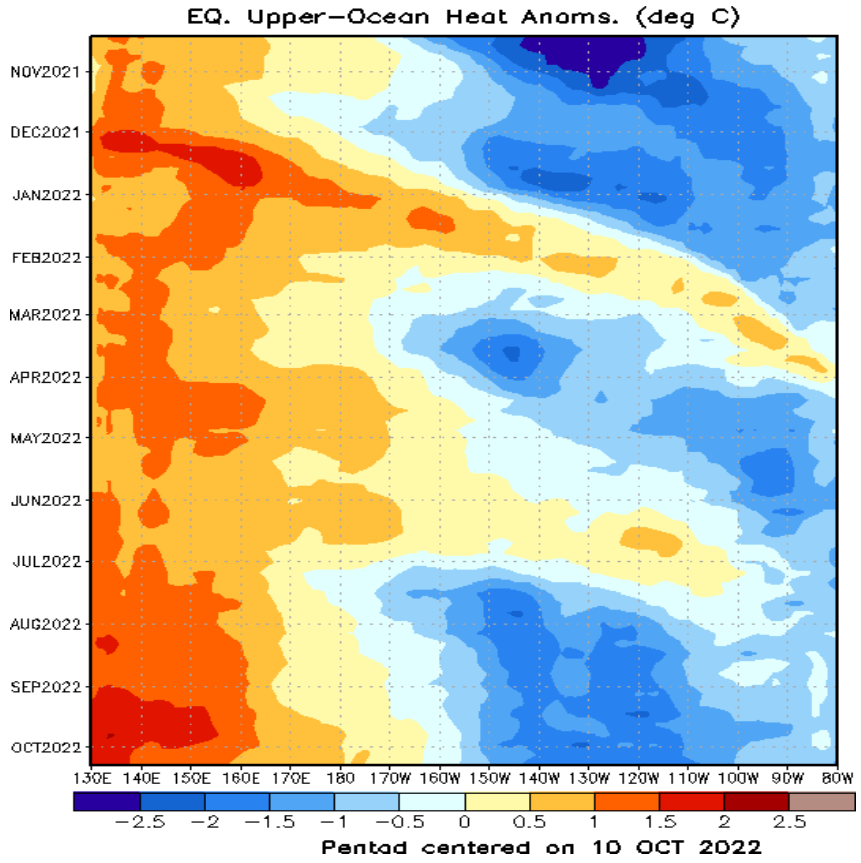




- Enhanced convection continues to be enhanced and even strengthen over the eastern equatorial Indian Ocean, Maritime Continent, as well as throughout many areas in the extratropical eastern Hemisphere.
- Suppressed convection remains anchored over the western and central Pacific tied to La Niña, although this feature has been shifting southward over the last several weeks.
- The CFS forecast favors the return of MJO activity with a strong pulse of convection emerging over the western Indian Ocean toward the end of October, although most other model guidance disagrees with this solution.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

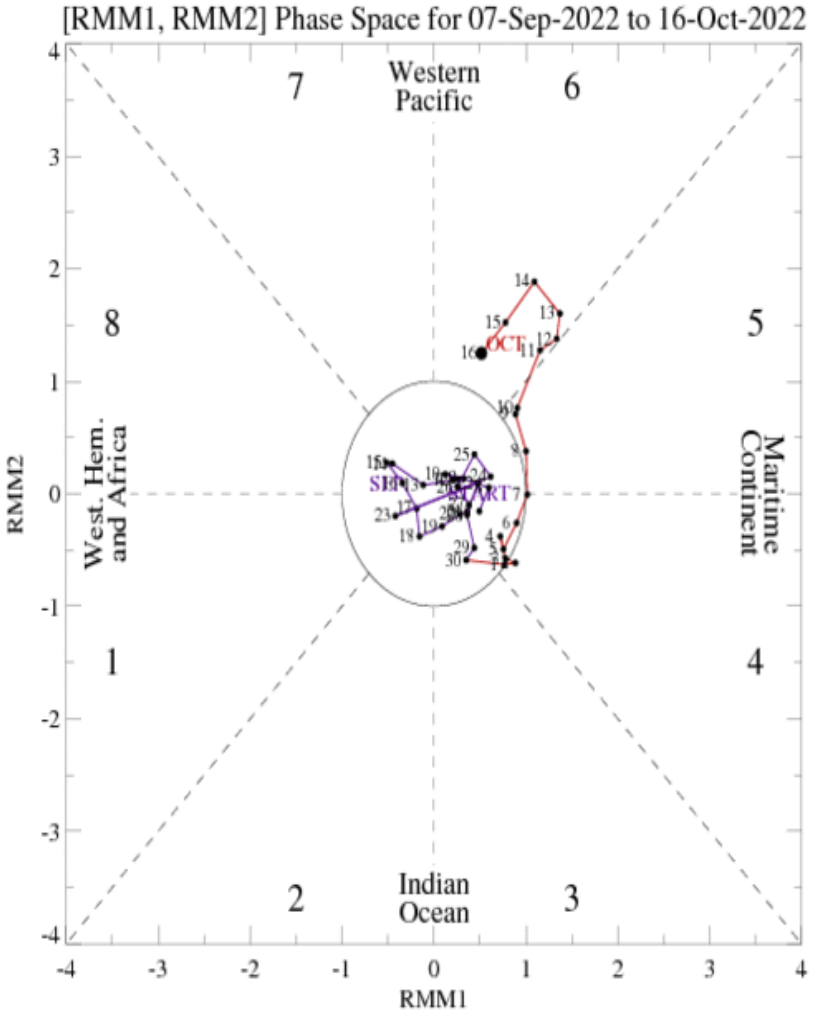




- Enhanced trades tied to the ongoing La Niña have resulted in subsurface below-normal heat content, though an eastward expansion of warmer waters has been observed east of the Date Line since mid-September.
- SSTs remain below average across all Niño basins, with substantial SST decreases noted across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

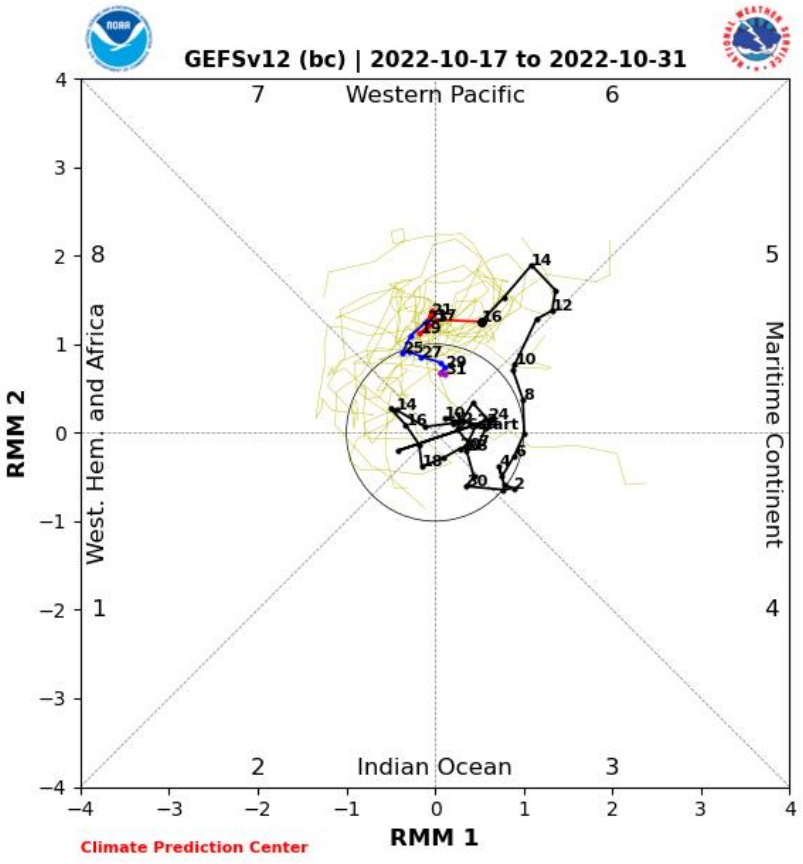
MJO Index: Recent Evolution

- Following an incoherent MJO throughout September, the RMM-based index shows an eastward propagating signal over the Maritime Continent since the beginning of October with a sudden increase and subsequent decrease in amplitude over the Western Pacific.

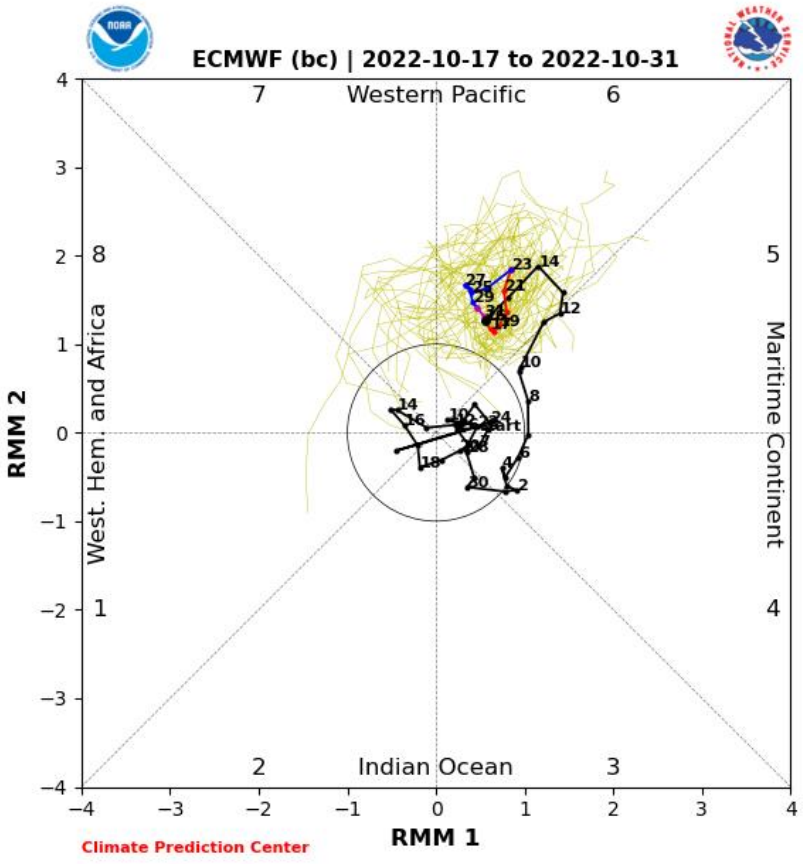


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

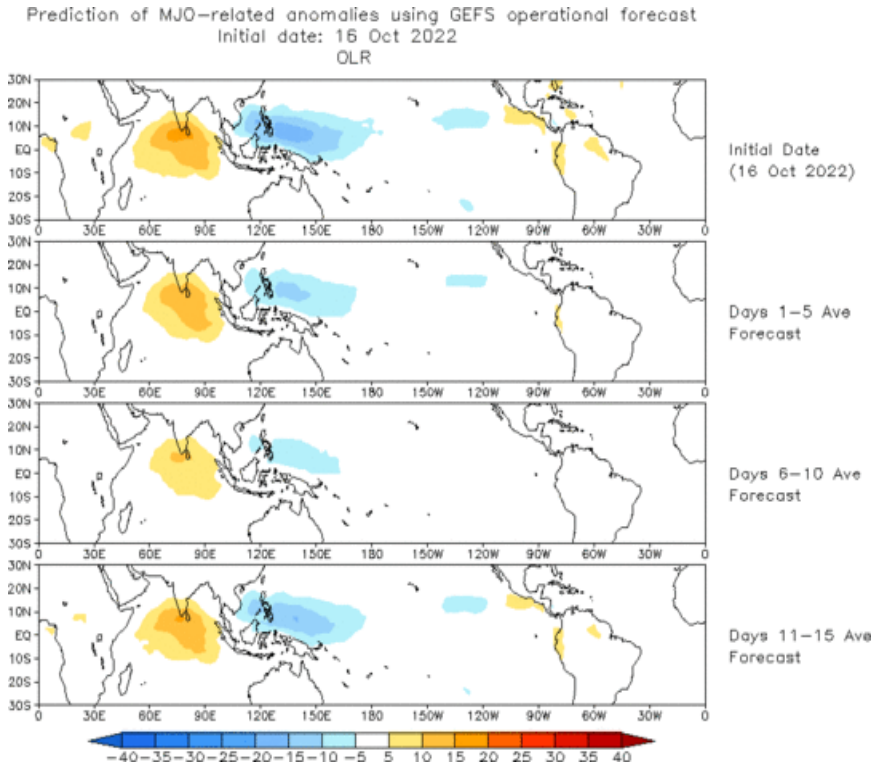


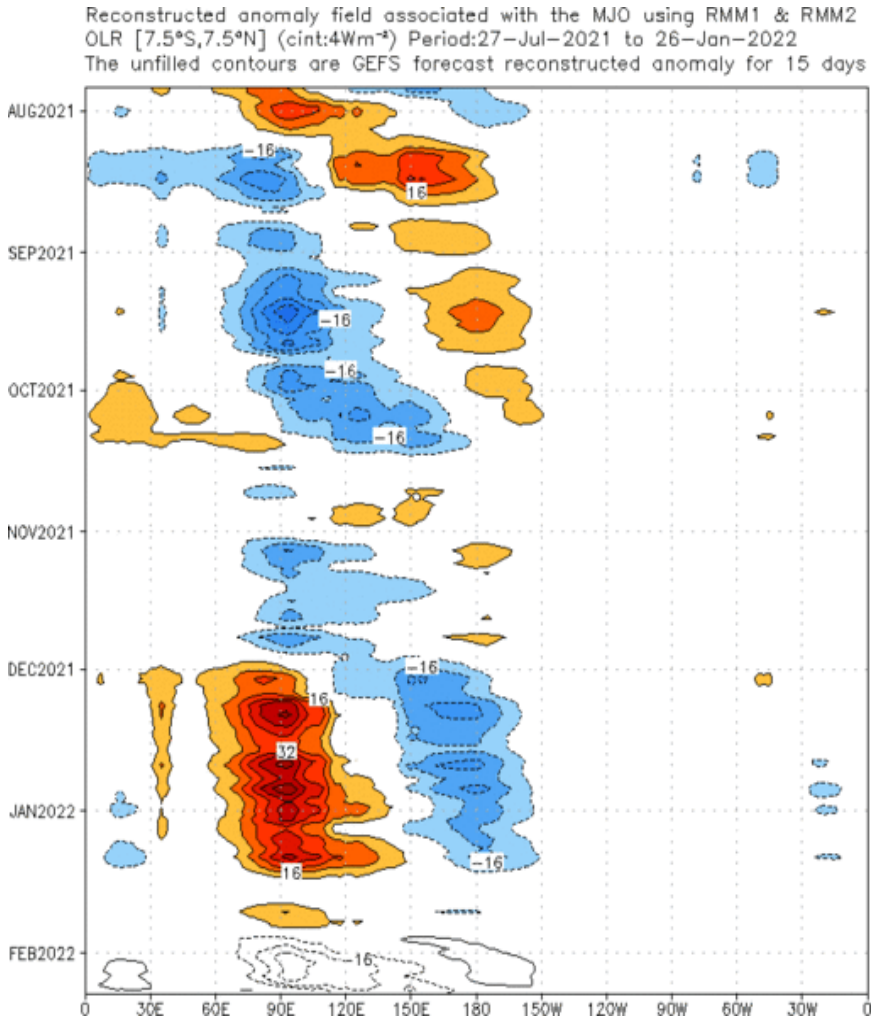
ECMWF Forecast

- After a fairly progressive pattern both as observed and as forecast, model solutions are now in close agreement on a stagnating signal in the RMM index.
- Ensemble spread is relatively small for most models, 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.)

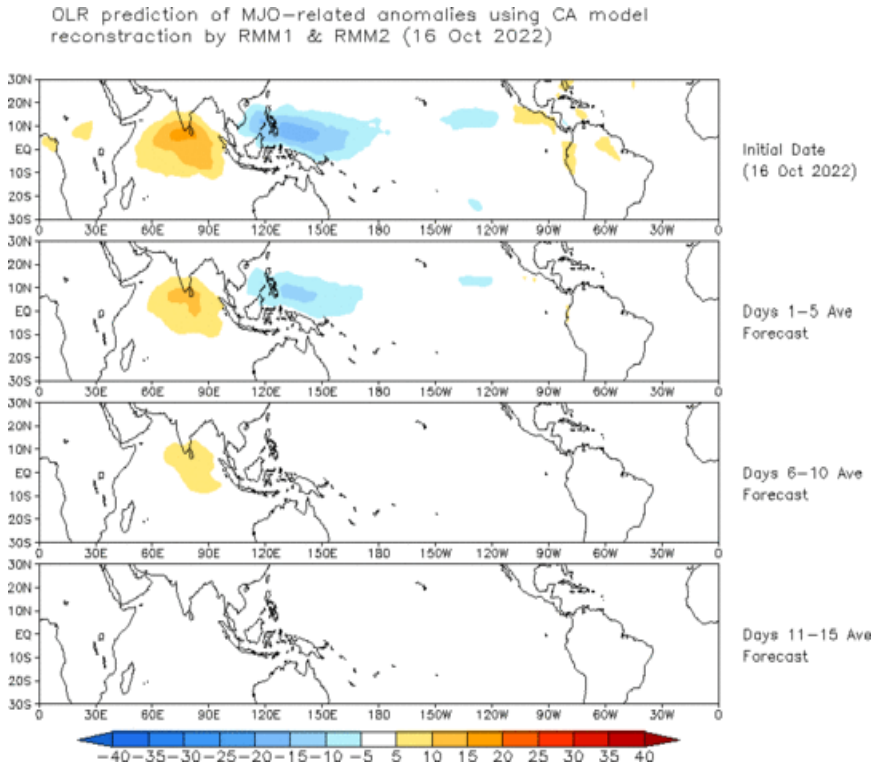


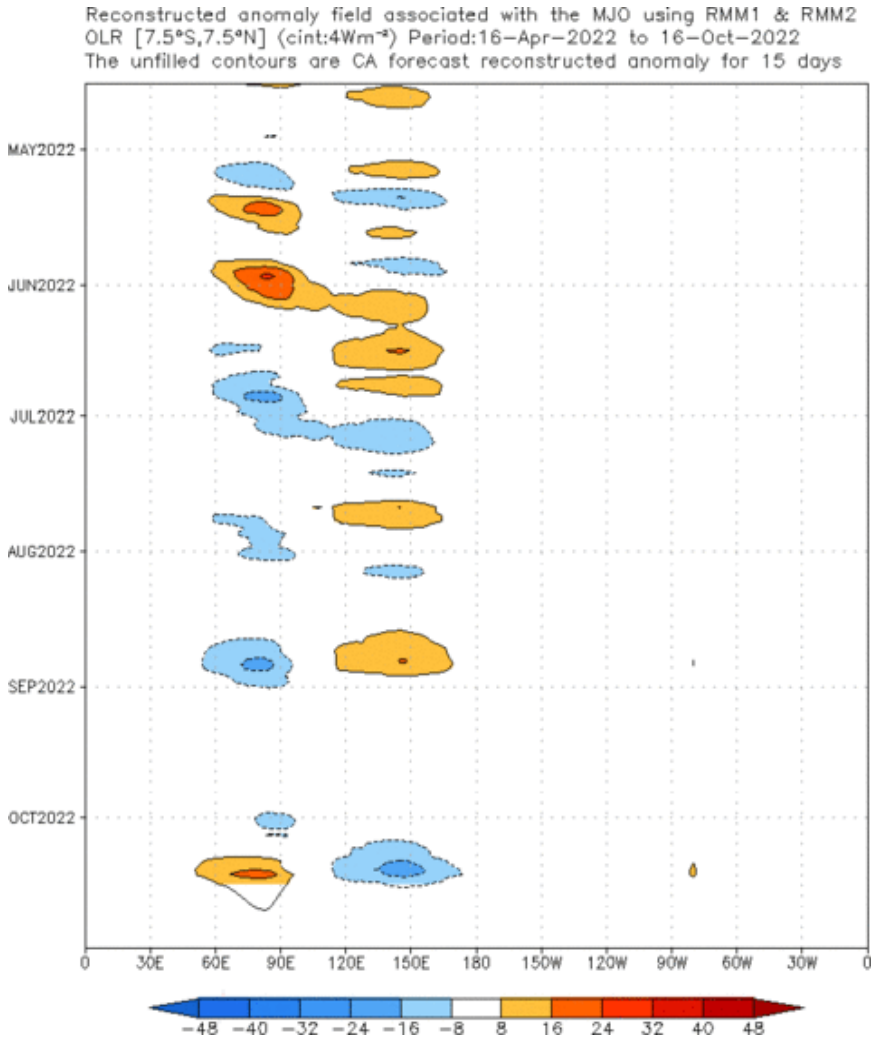


- The GEFS-based OLR anomaly fields favor a consistent convective dipole over the eastern hemisphere, but remains nearly stationary throughout the period.

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.)

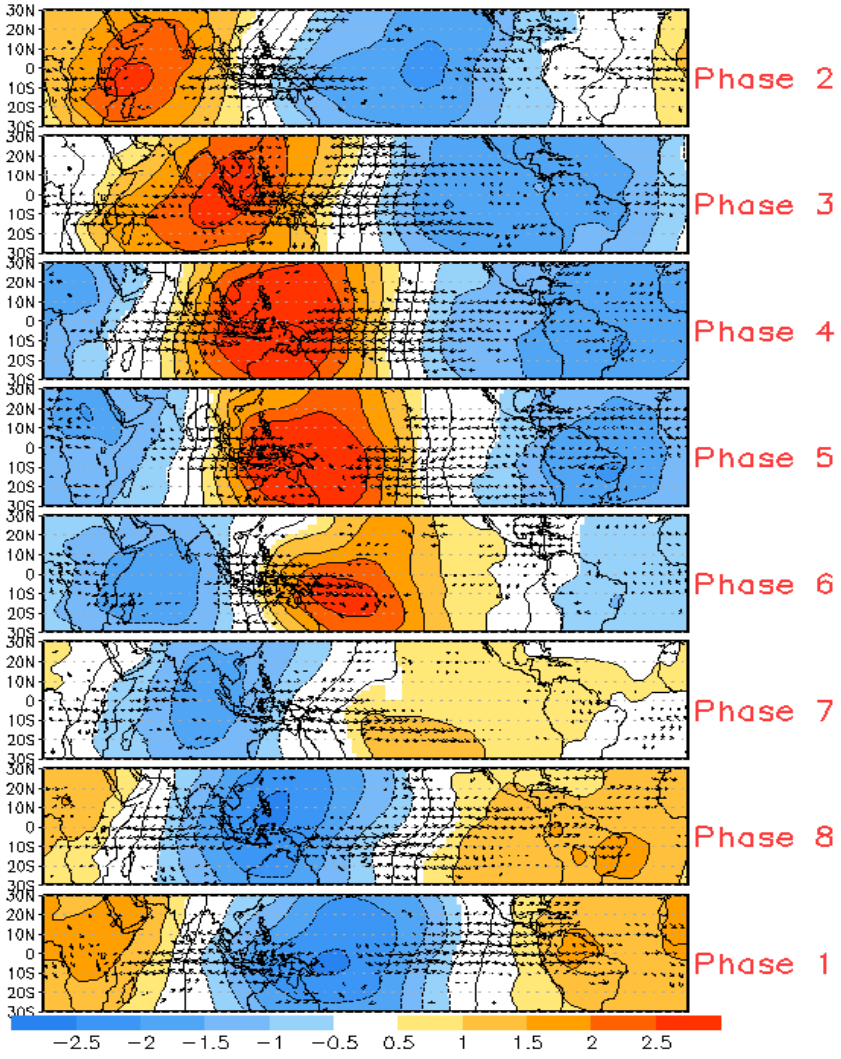




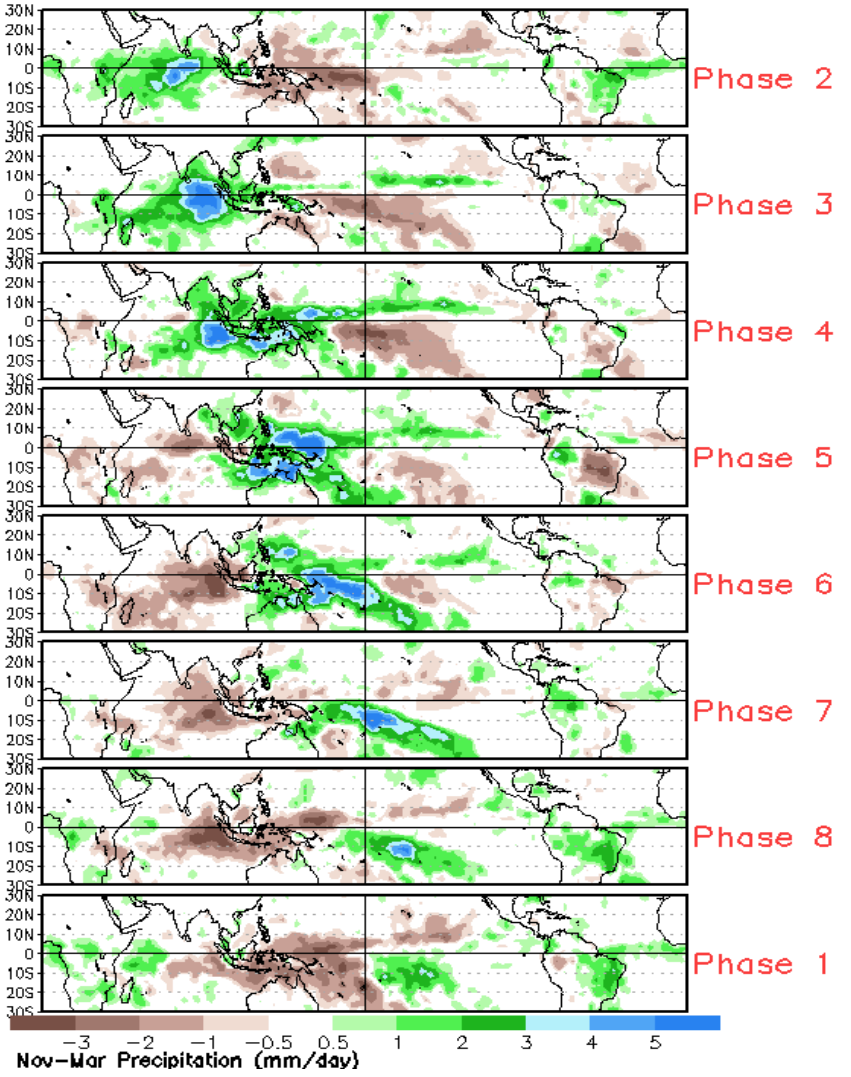
- The constructed analog forecast of RMM-based OLR favors a similar standing pattern, although the signal fades in week-2.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



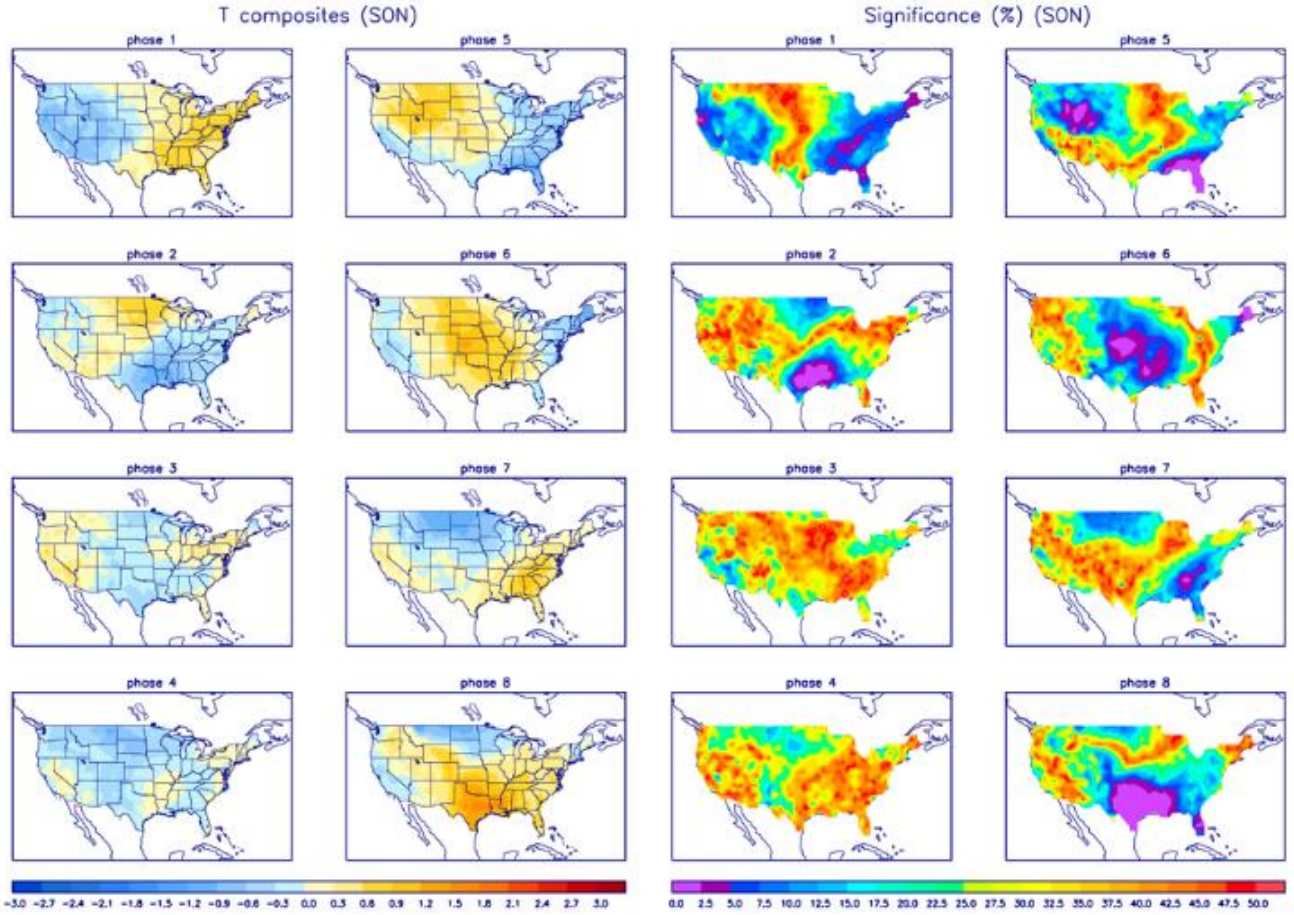
Precipitation Anomalies



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.

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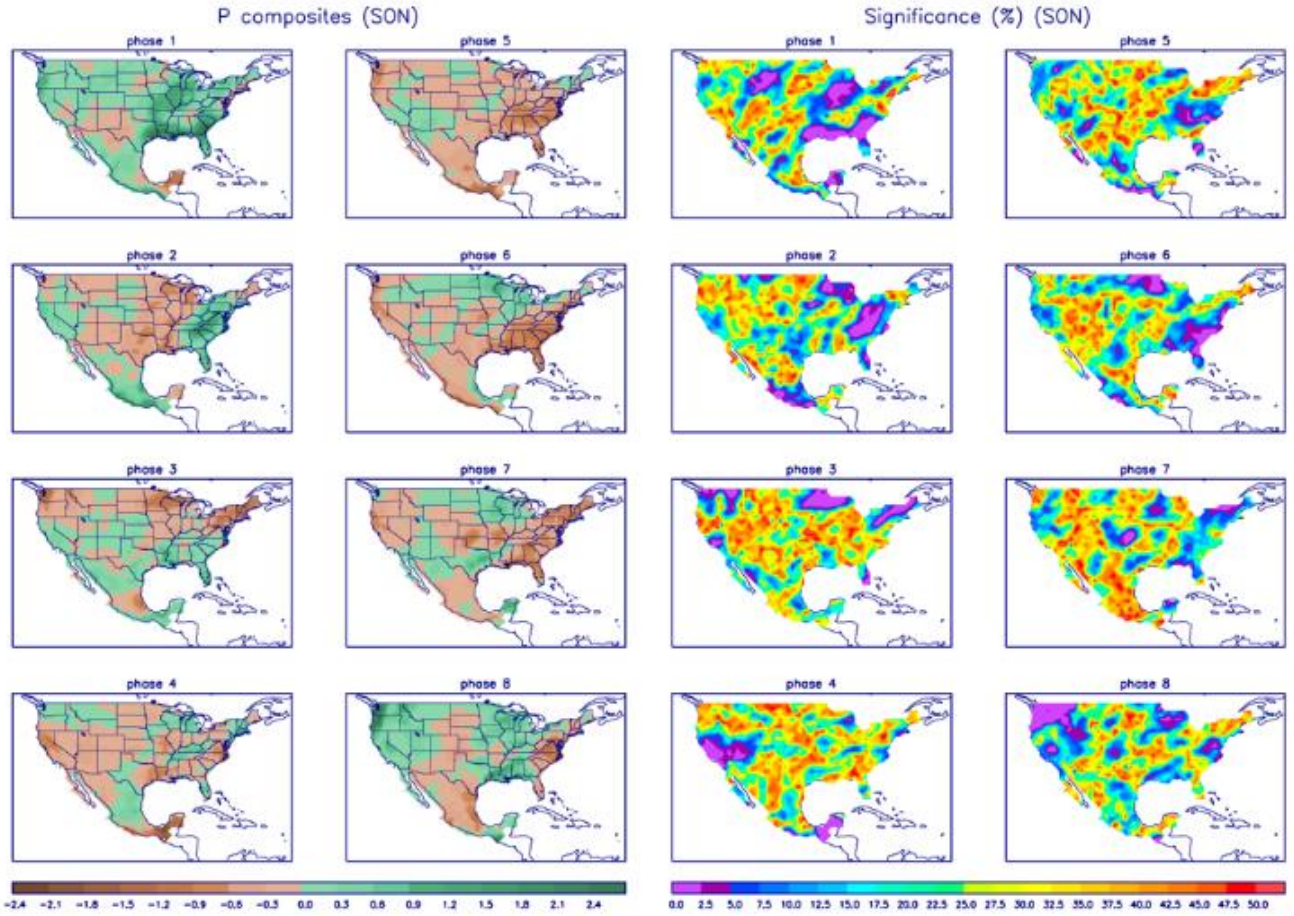

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