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

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

Overview

- The RMM-based MJO index reflects high amplitude over the far West Pacific with little eastward propagation, while the upper-level velocity potential based MJO index has weak amplitude.

- The La Niña response featuring enhanced trade winds over the Pacific and enhanced convection across the Maritime Continent remains the primary driver of the tropical convective pattern; however, the intraseasonal signal may be destructively interfering with this signal.

- Widespread enhanced convection in the vicinity of the Philippines may be associated with MJO activity, and dynamical models forecast this area of enhanced convection to shift poleward.

- Enhanced convection across the Northwest Pacific and Bay of Bengal may provide opportunities for tropical cyclone development, while Rossby wave activity across the Indian Ocean may prompt cyclogenesis over the southeastern Indian Ocean in late Week-1 or early Week-2.

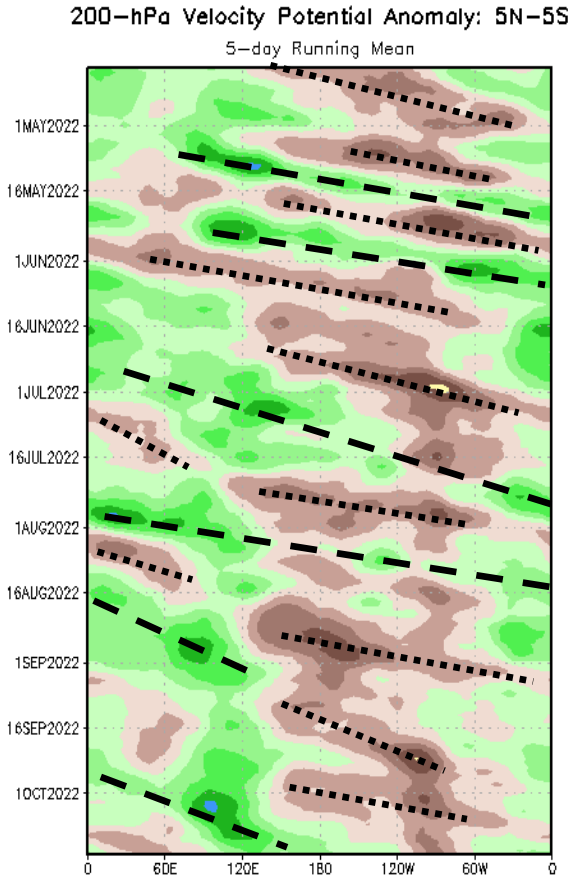
- Should any remnant MJO signal emerge over the Western Hemisphere, a window of favorability for tropical cyclone development may open across the Caribbean Sea over the next few weeks.

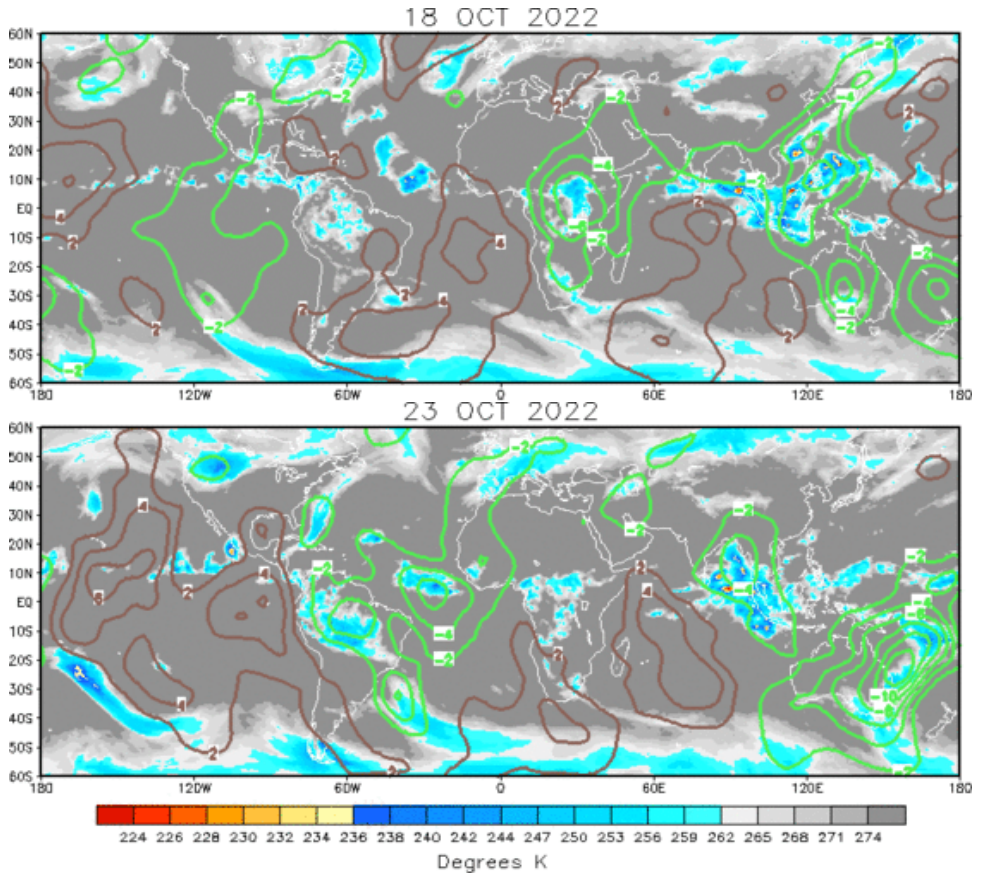
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

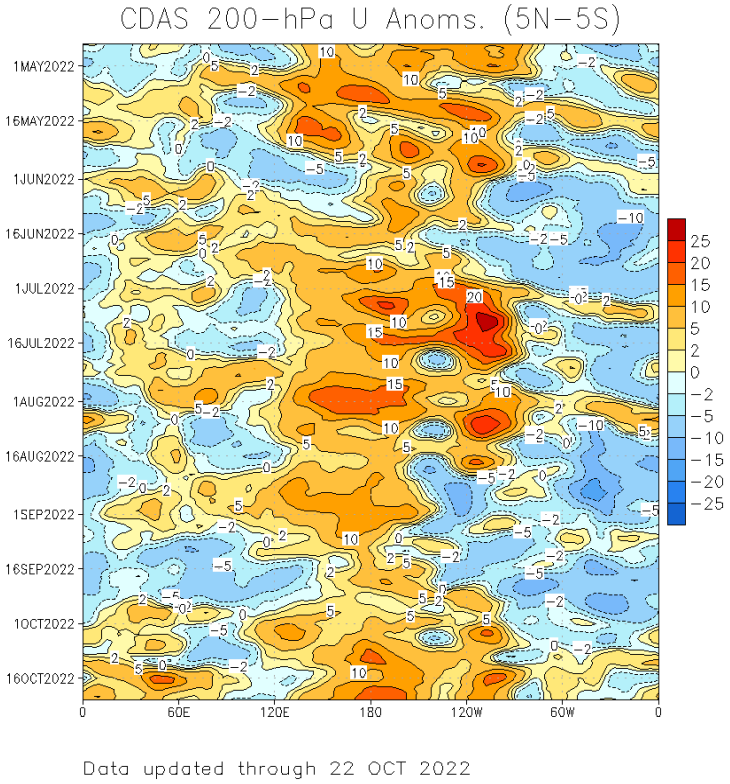


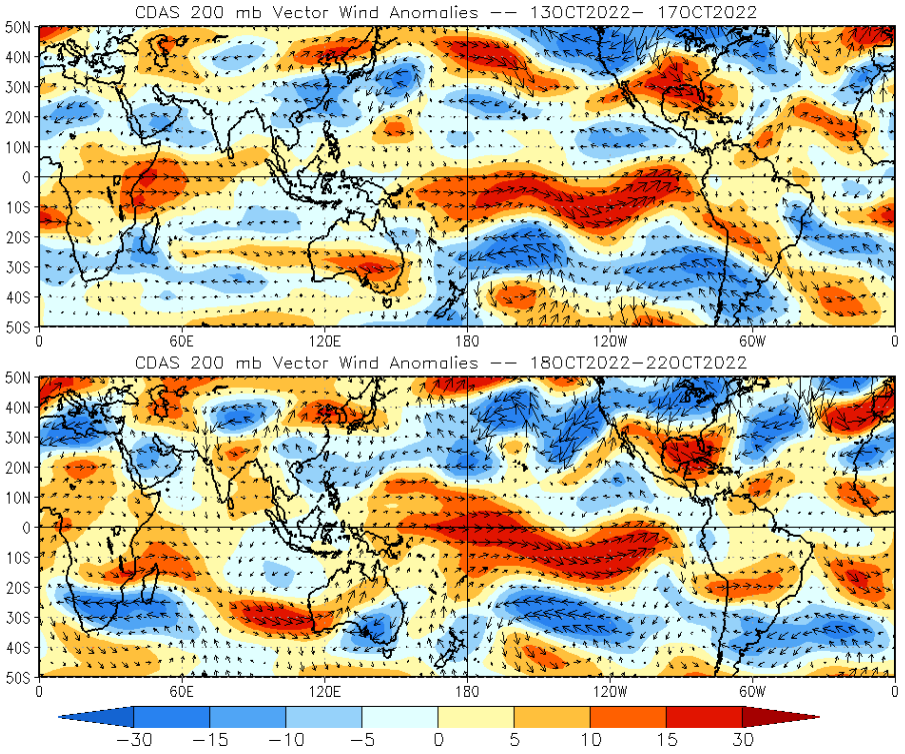


- Note: The upper-level Time-Longitude plot did not update correctly and reflects last week's status.
- Following a period of increased activity through early October, the intraseasonal signal became increasingly incoherent during mid and late October.

200-hPa Wind Anomalies

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



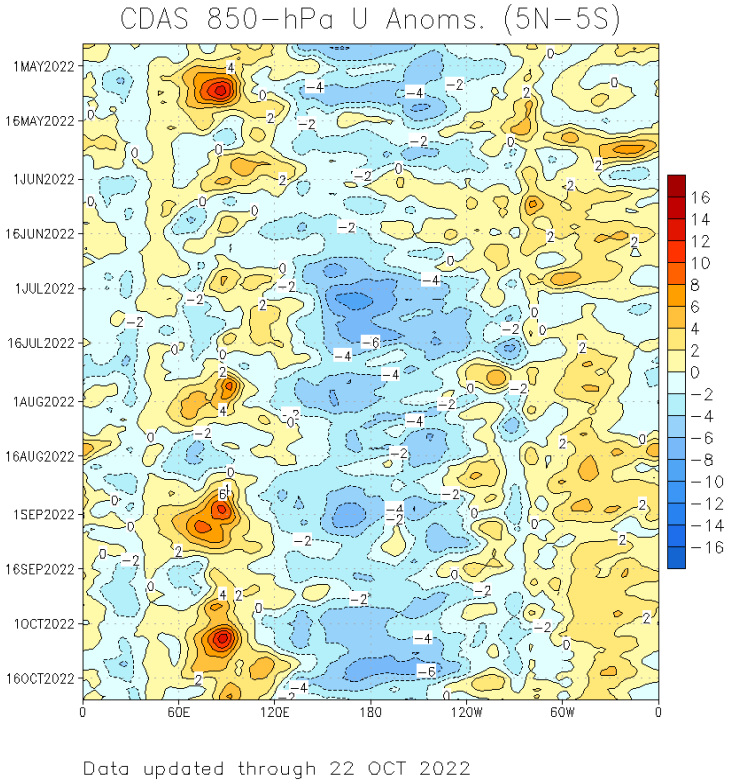


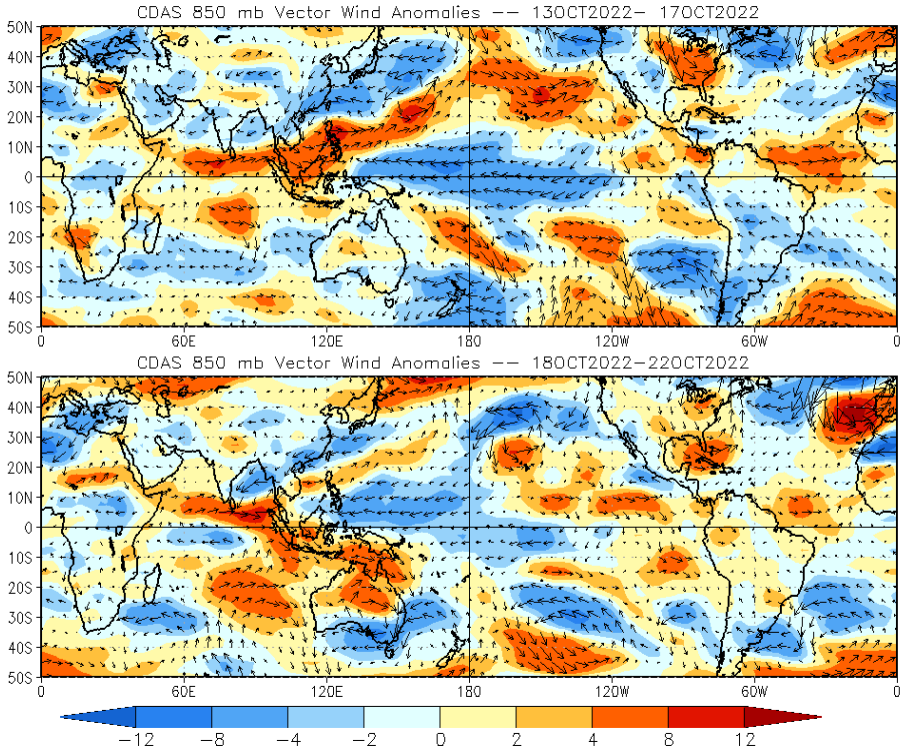
- Anomalous westerlies aloft continue to prevail throughout the equatorial Pacific consistent with the ongoing atmospheric response of La Niña, with a noted strengthening near and west of the Date Line recently.

- Rossby wave activity is apparent in the upper-level wind field over the Maritime Continent and East Pacific.

850-hPa Wind Anomalies

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



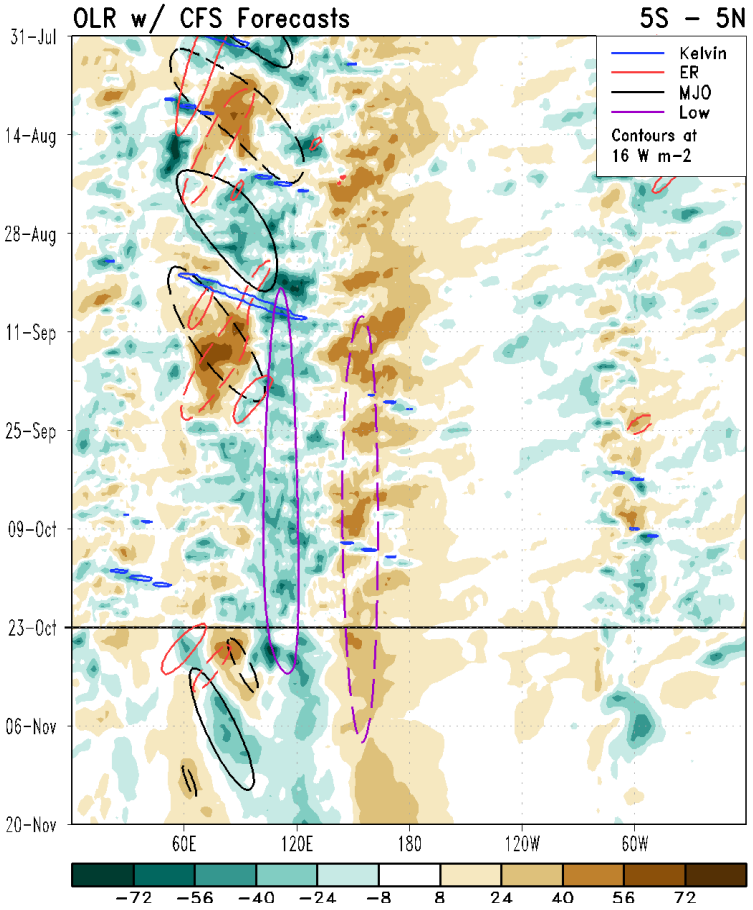


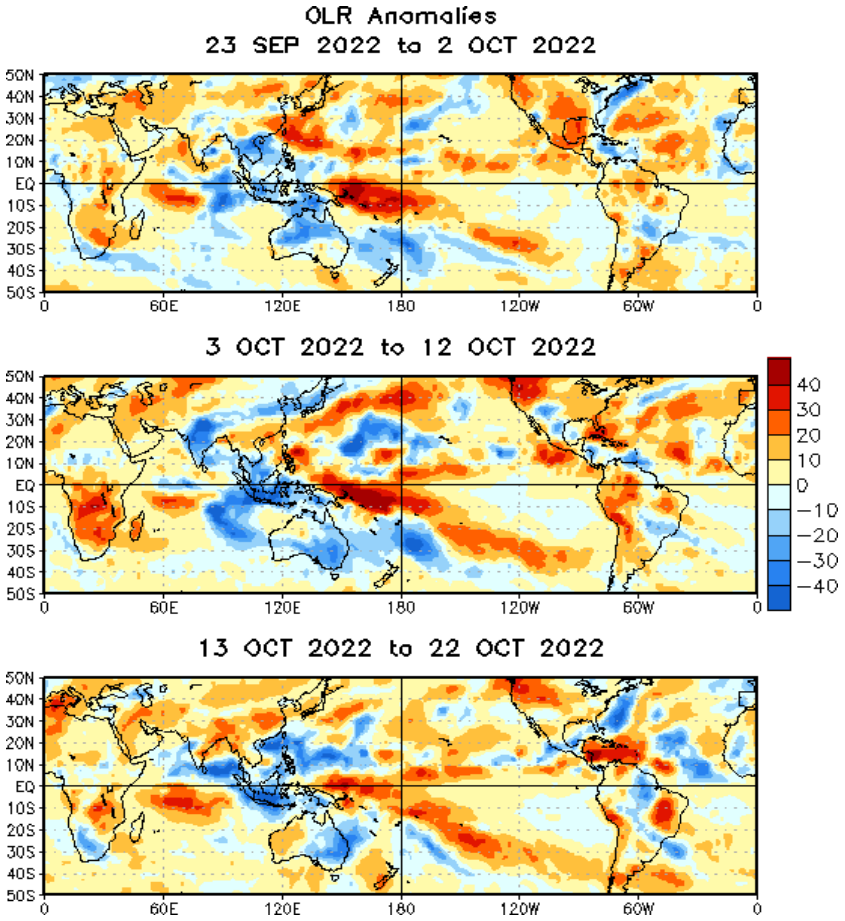
- Following a strong westerly wind burst (WWB) during early October over the Indian Ocean, another WWB is evident over the eastern Indian Ocean, associated with Rossby wave activity.

- Enhanced trade winds remain entrenched over the Equatorial Pacific, with a westward shift evident; however, the overall amplitude of the envelope of easterlies has diminished somewhat.

Outgoing Longwave Radiation (OLR) Anomalies

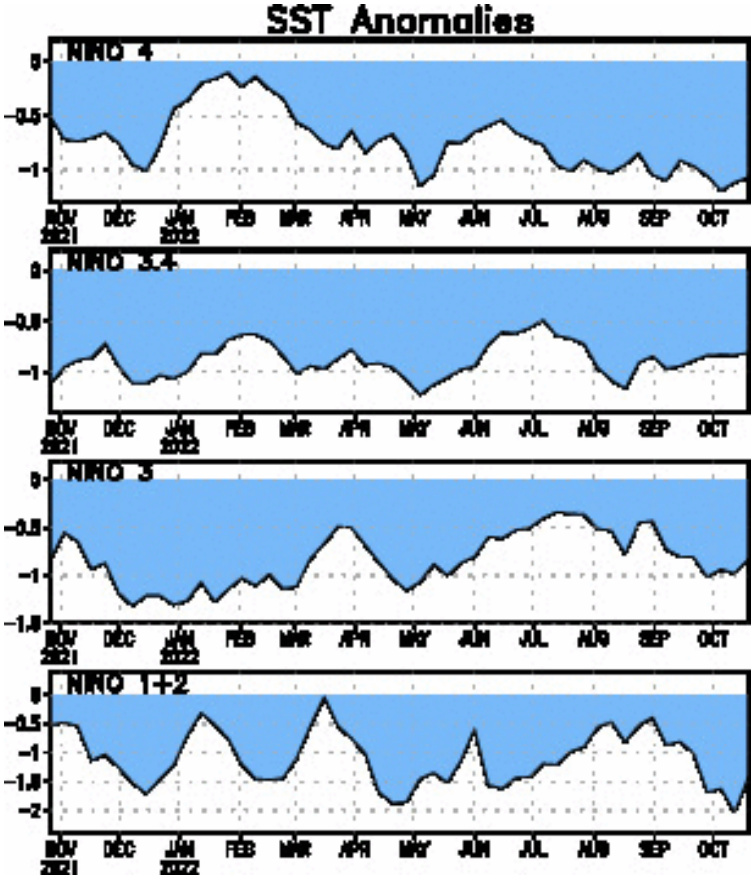
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

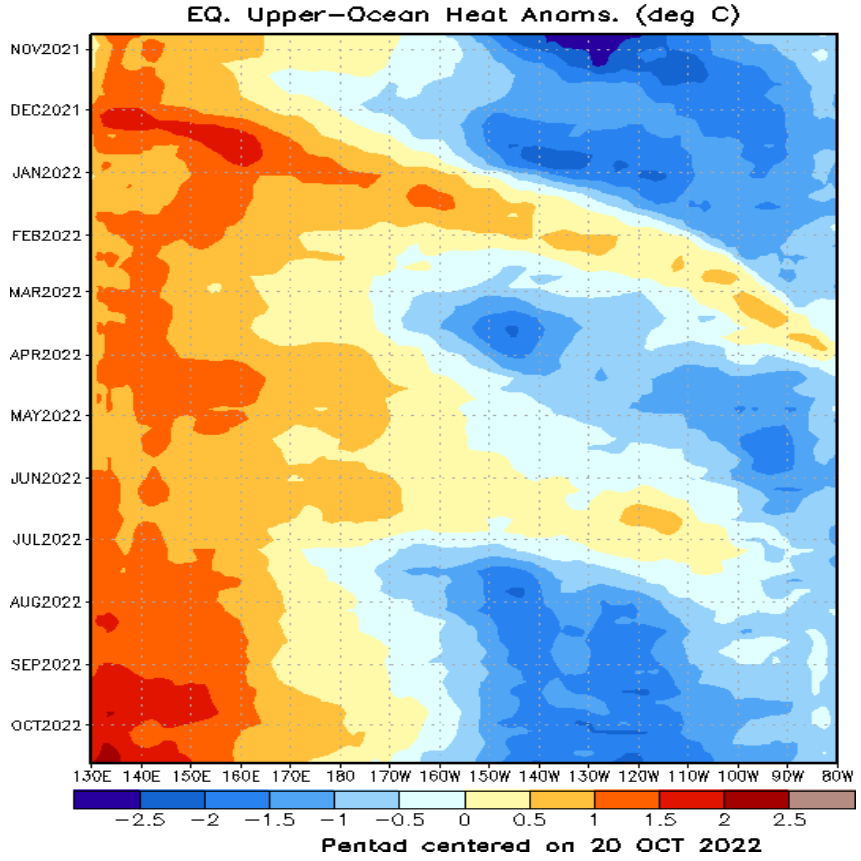




- The dipole of suppressed (enhanced) convection over the central Pacific (Maritime Continent) associated with La Niña remains the most robust feature across the global tropics.
- Enhanced convection over the Northwest Pacific may be reflective of MJO activity and provide an impetus for tropical cyclone formations, similar to enhanced convection over the Bay of Bengal resulting in the development of TC Sitrang.
- Suppressed convection overspread the Caribbean as the Atlantic basin became much quieter.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

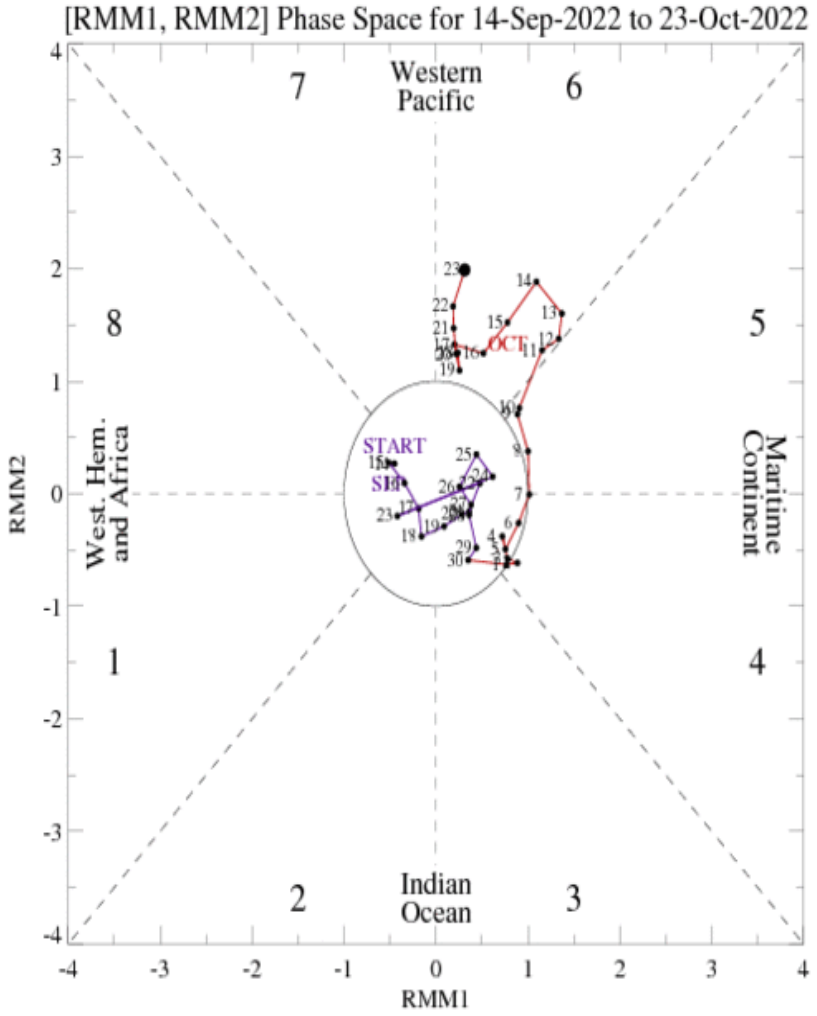




- Enhanced trades tied to the ongoing La Niña have resulted in subsurface below-normal heat content.
- An eastward expansion of positive subsurface heat content anomalies since September just east of the Date Line has begun to retreat during October.
- SSTs remain below average across all Niño basins, reflecting robust and persistent cold ENSO conditions.

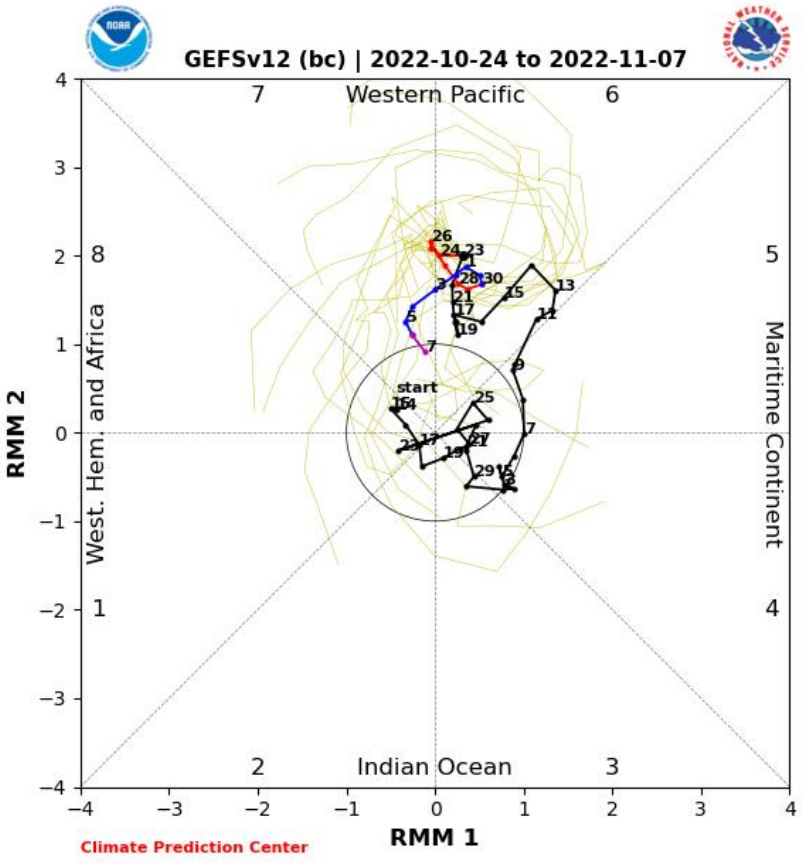
MJO Index: Recent Evolution

- The RMM index reflects fairly substantial amplitude over the West Pacific, though enhanced convection is primarily off-Equator.
- Little eastward propagation of the amplified signal was observed over the past few days.

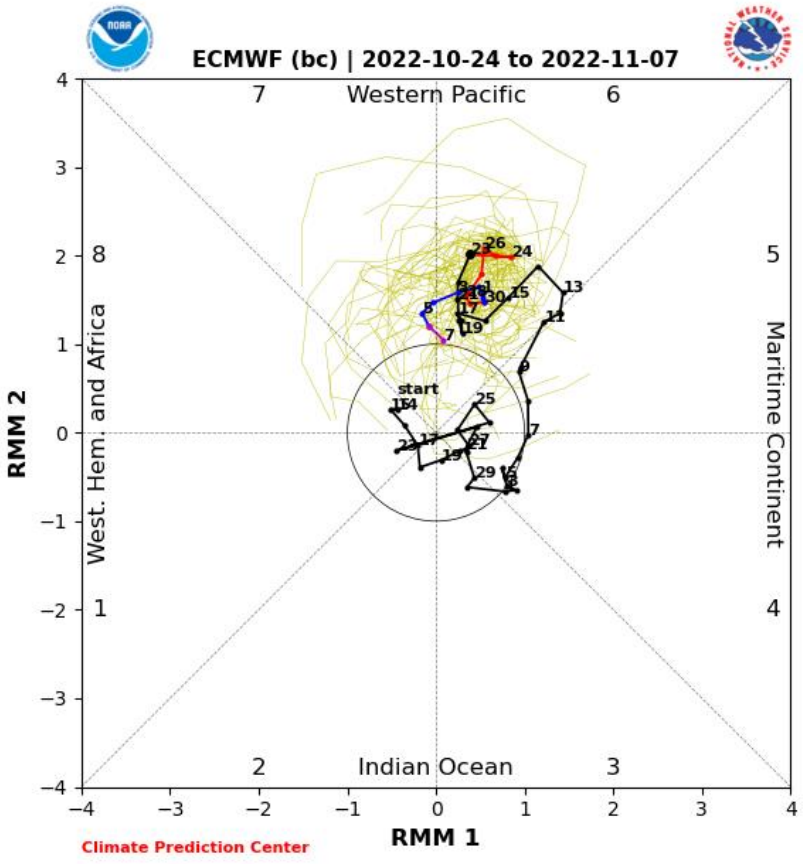


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

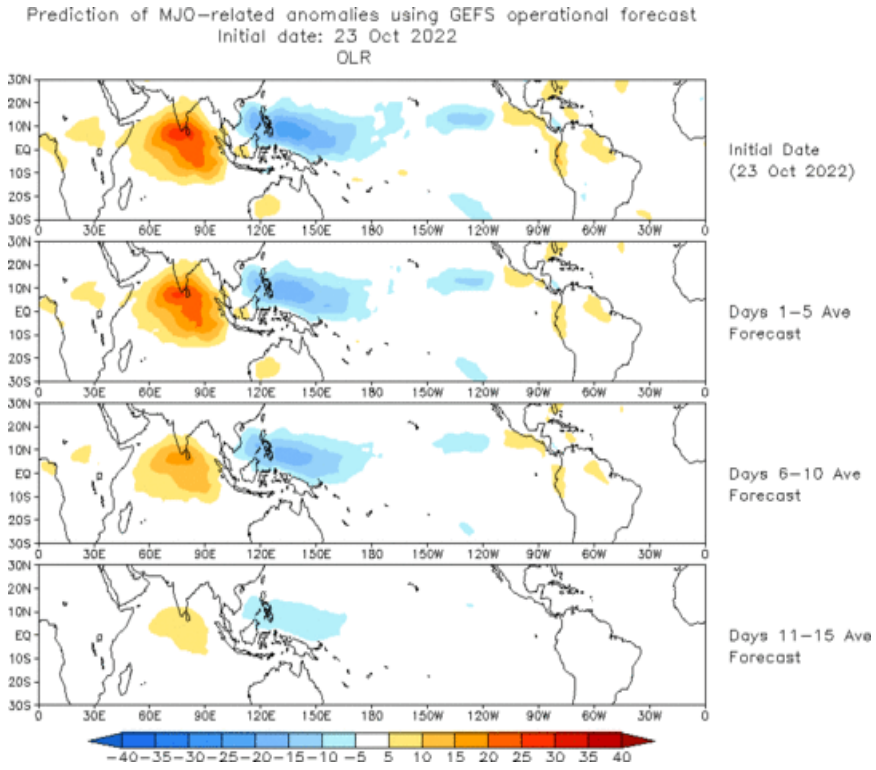


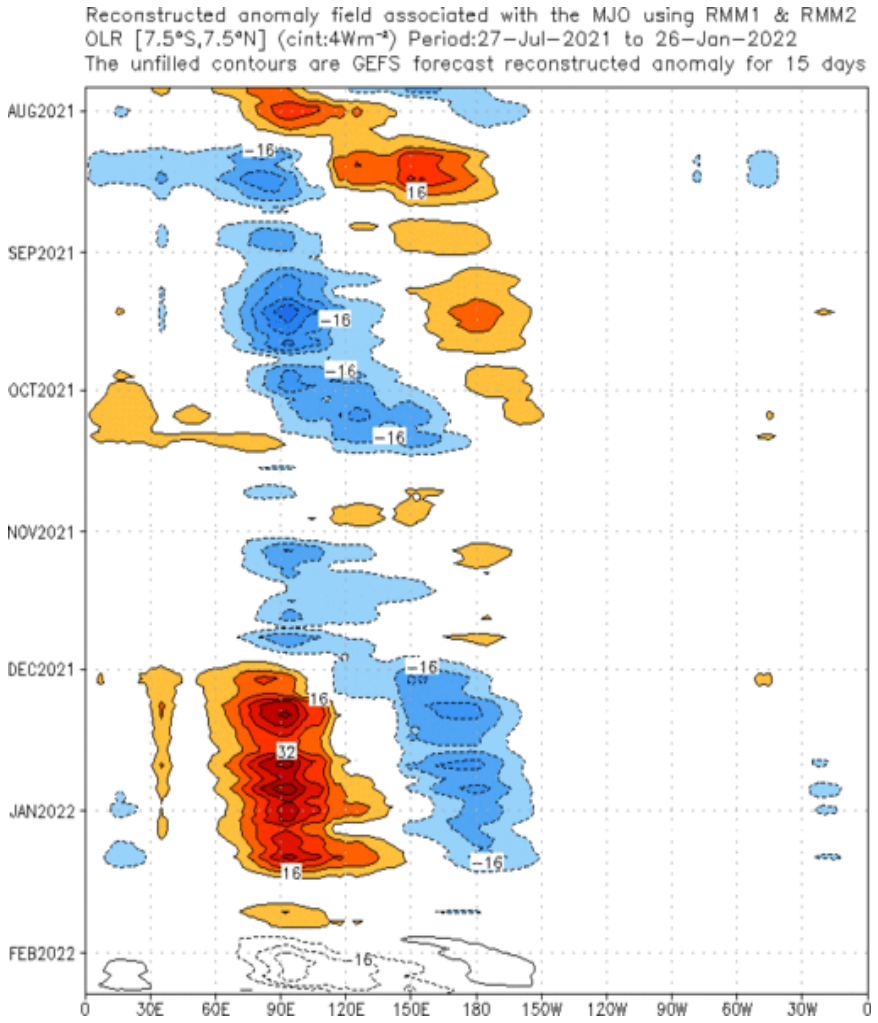
ECMWF Forecast

- Both the GEFS and ECMWF RMM-index forecasts show a notable shift in the RMM index towards the top quadrants of the diagram (West Pacific). Rapid eastward propagation about this shifted center of activity may be reflective of Kelvin wave activity, with some GEFS ensembles reflecting a more potent signal.
- The displacement of the RMM-index towards the West Pacific seems not to be a collapse of the cold ENSO response, but perhaps a reflection of shifting ENSO climatology or the off-Equator response.

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.)

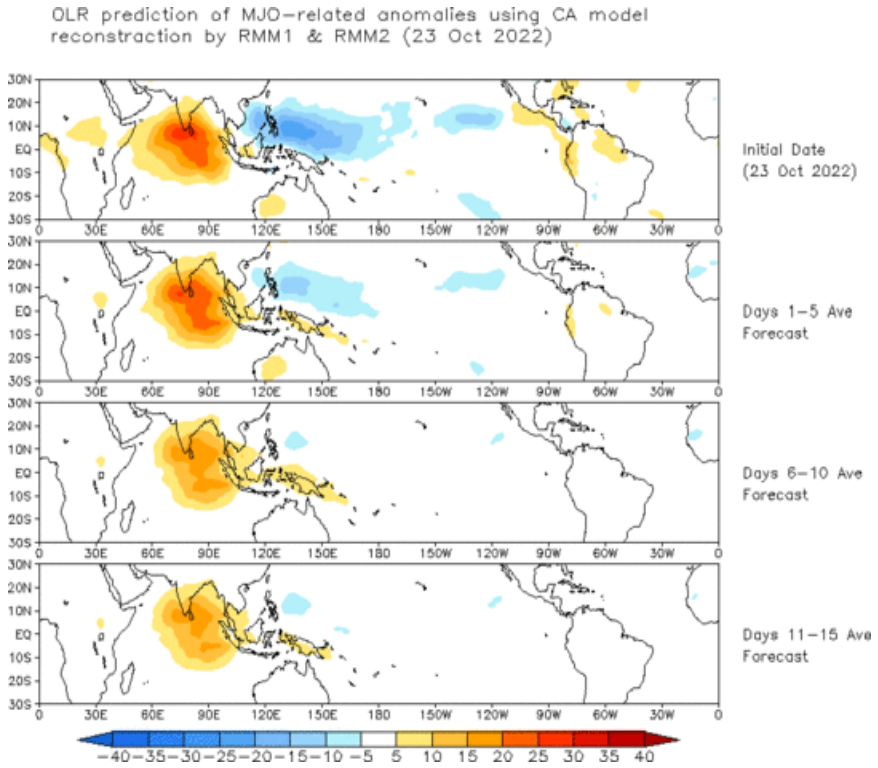


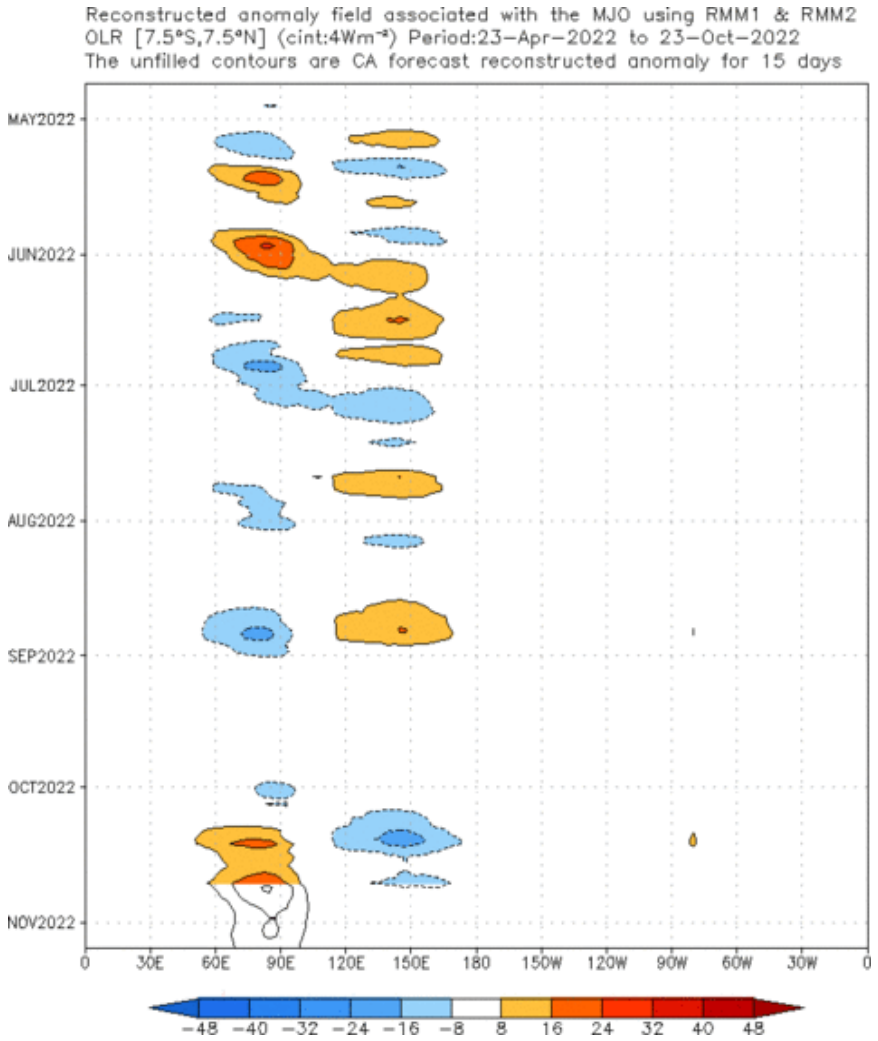


- The GEFS-based OLR anomaly fields favor a stationary pattern reflective of canonical Phase-6 MJO events.

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.)

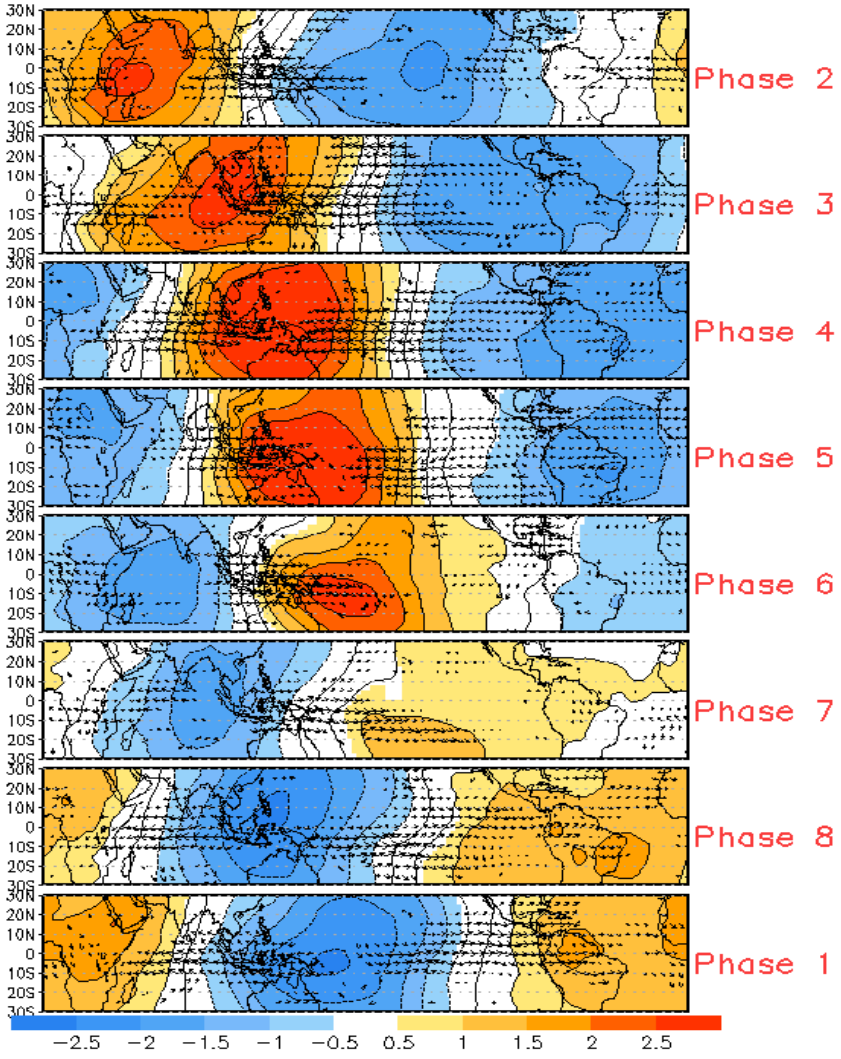




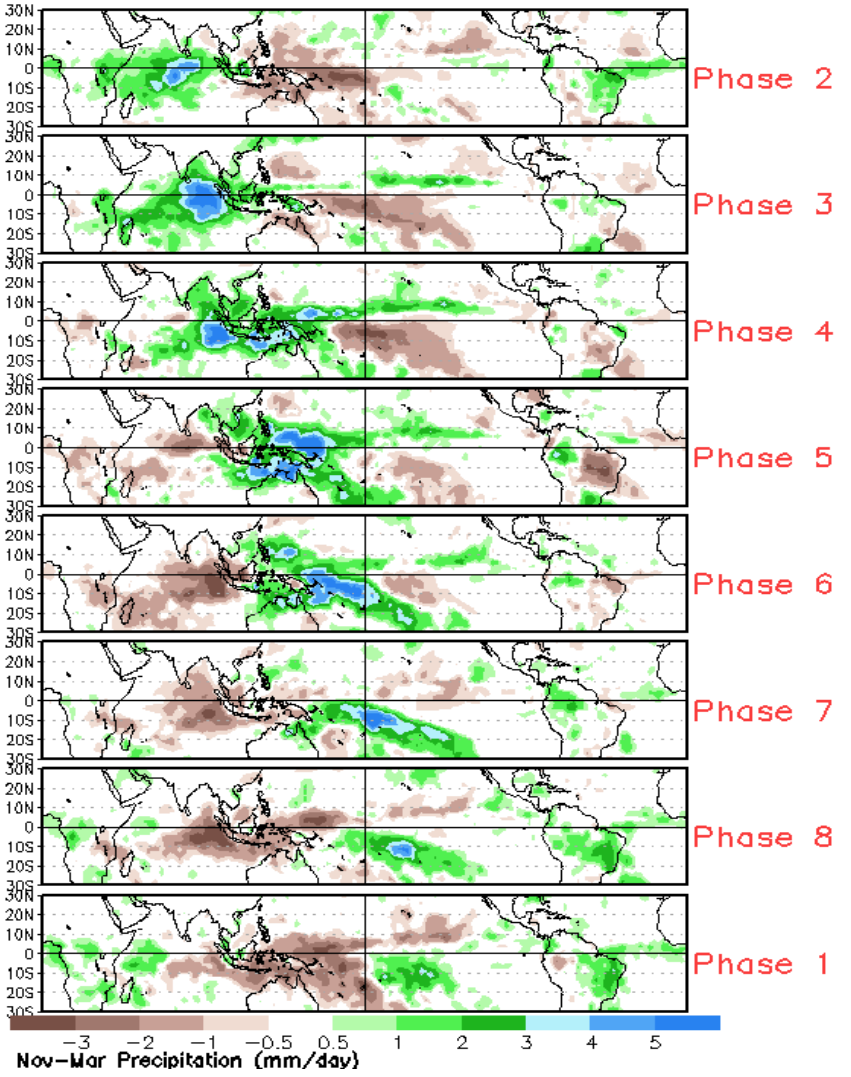
- The constructed analog forecast of RMM-based OLR is also fairly stationary, with the “enhanced phase” anomaly field weakening more rapidly than depicted in the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



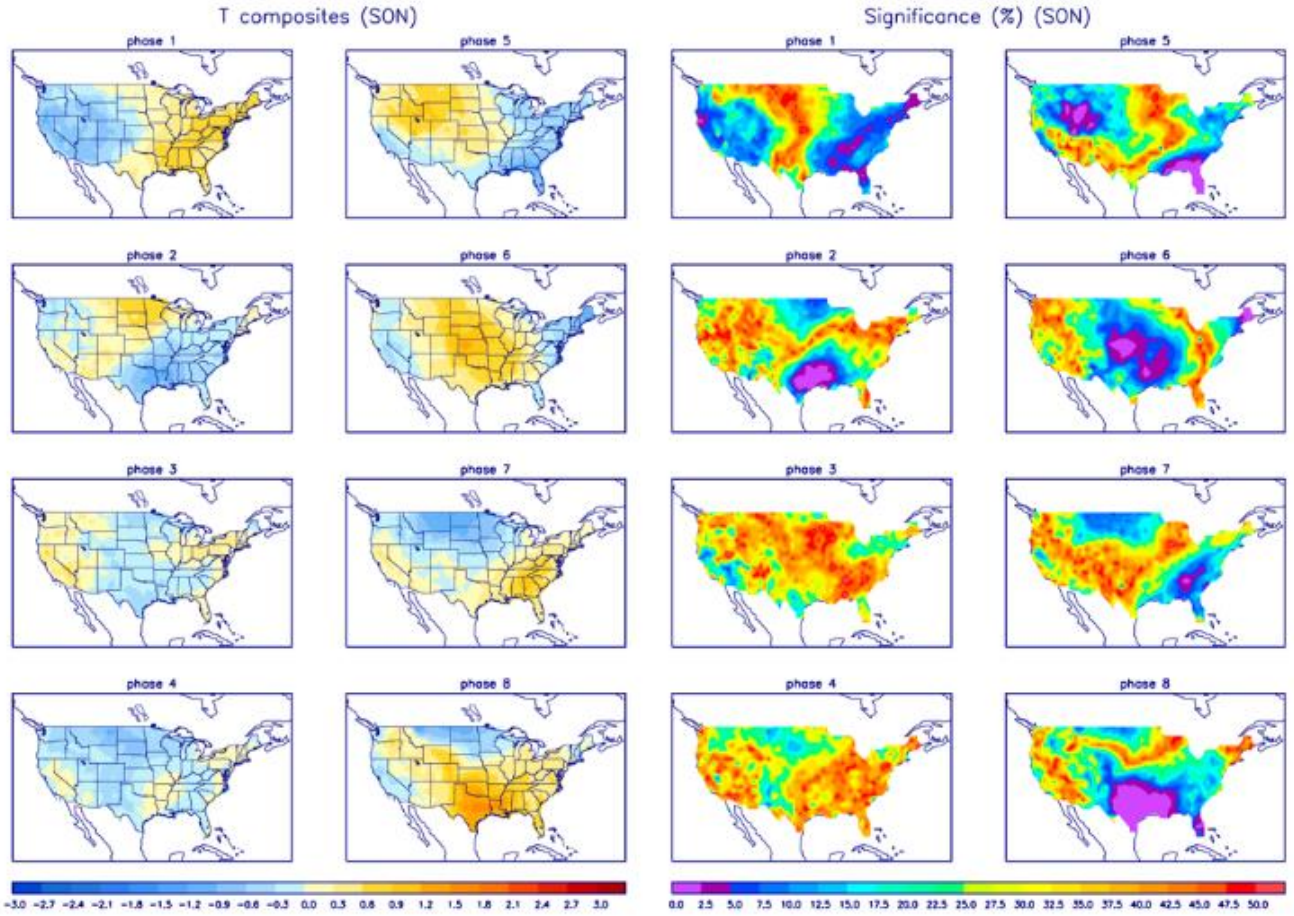
Precipitation Anomalies



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.

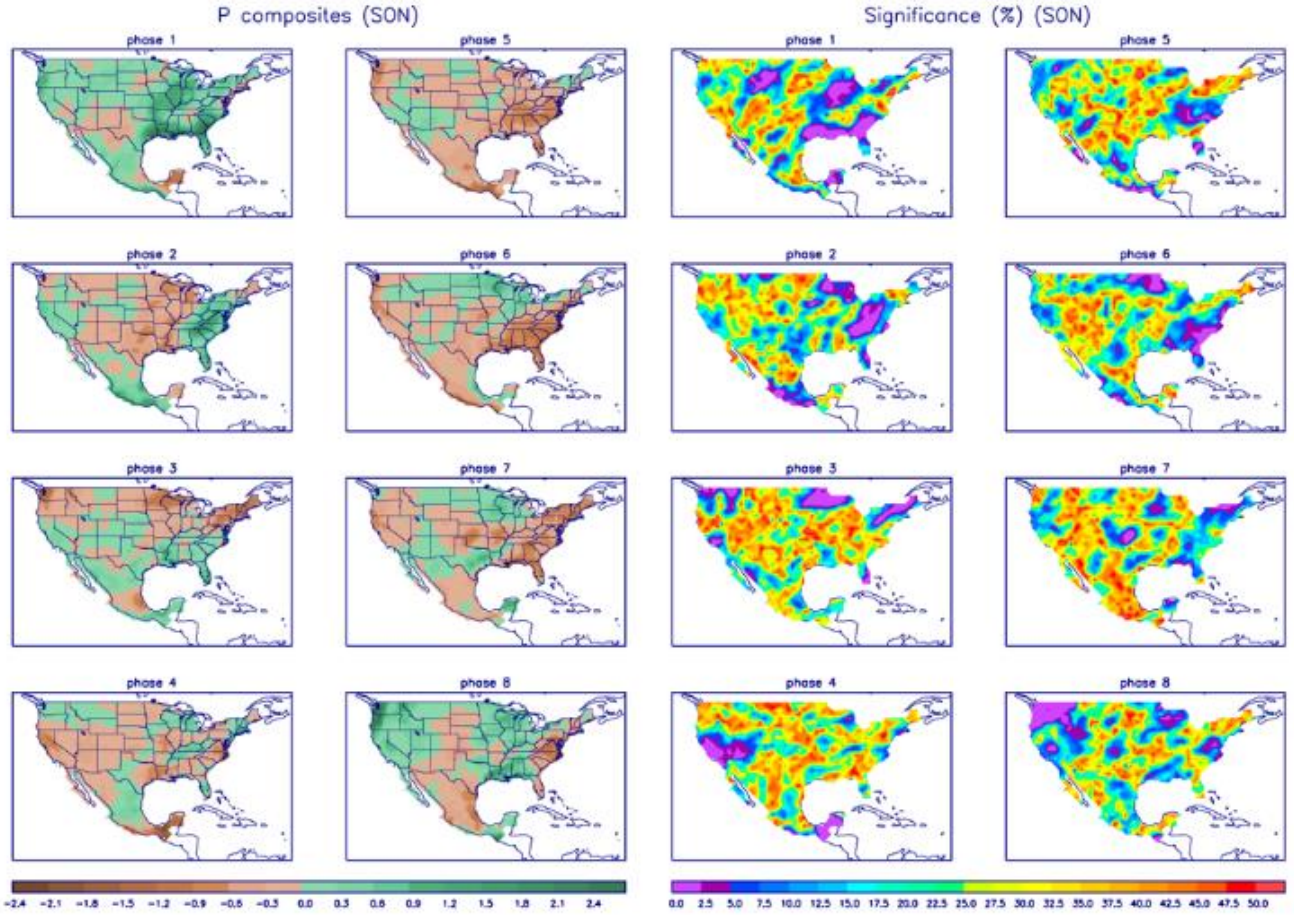


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - 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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