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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
2 October 2023

Overview

- The RMM-based MJO index remained inside the unit circle, with dynamical models depicting a more continued eastward propagation but at a weak amplitude during the next 2 weeks.

- Despite the weak RMM-based MJO signals, the upper-level velocity potential filtering depicts a much more coherent eastward propagating MJO signal from the Indian Ocean/Maritime Continent to the Western Hemisphere by mid-October.

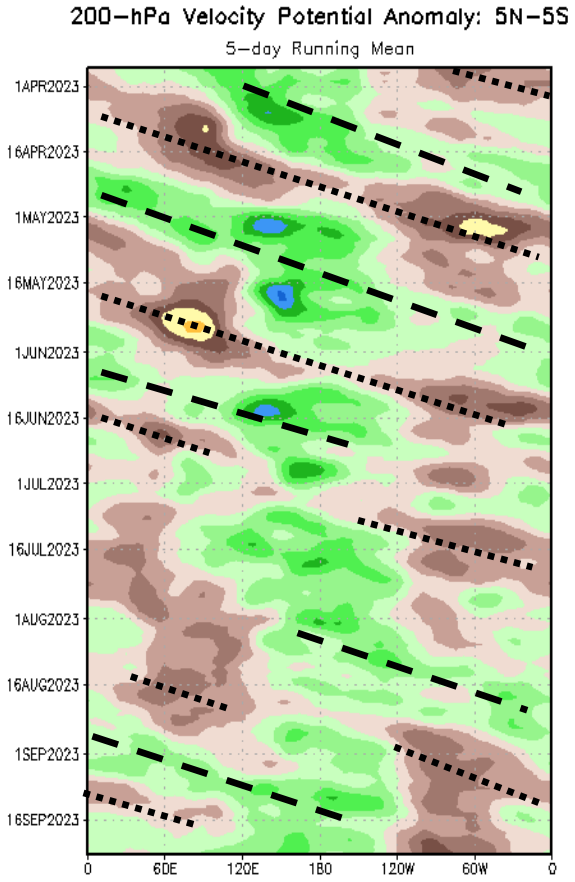
- With the potential for MJO activity moving through the Western Hemisphere during weeks 2 and 3, probabilities of tropical cyclone (TC) activity are enhanced for the Eastern Pacific, while suppressed convection around the Maritime Continent will likely suppress TC genesis over the Western Pacific.

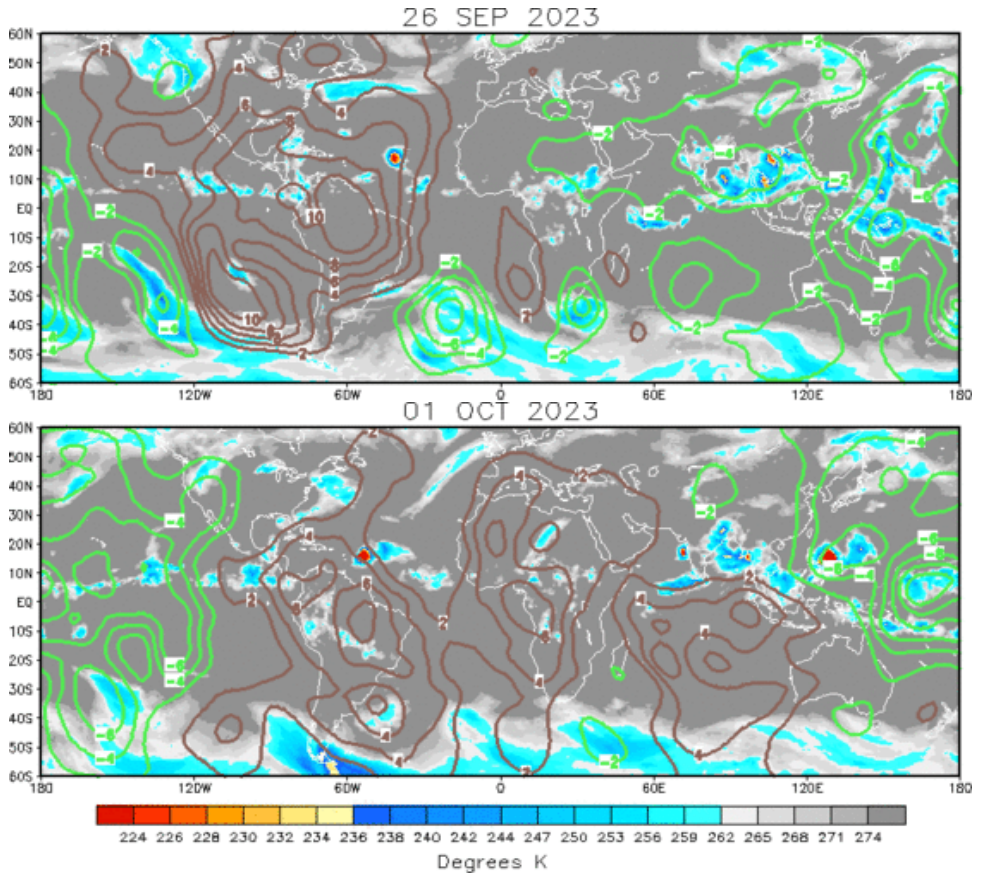
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



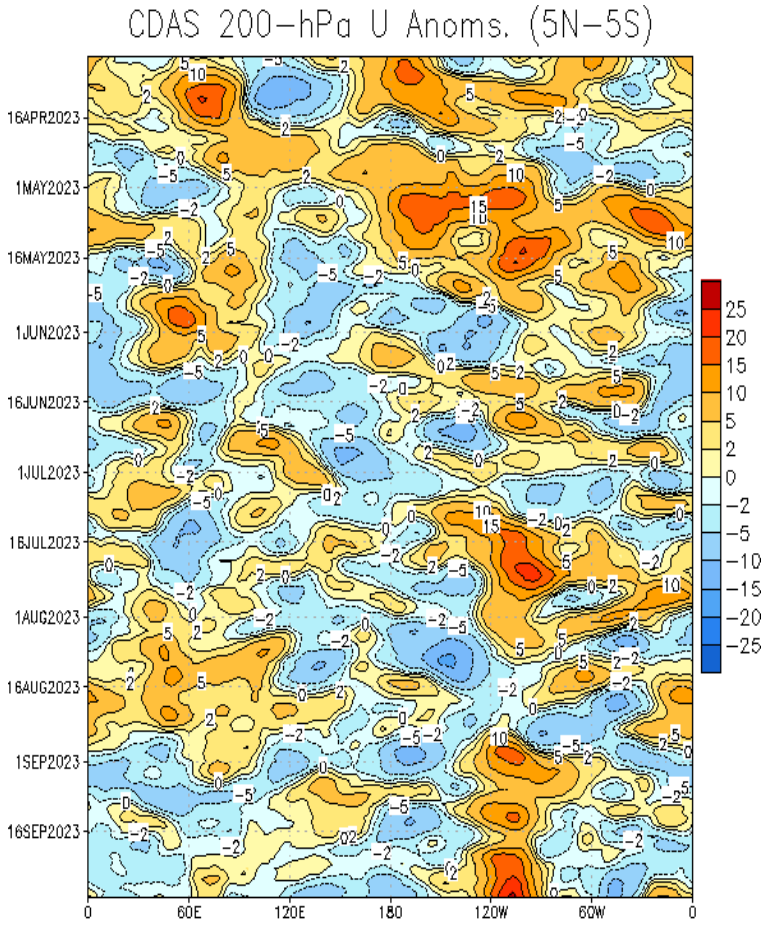


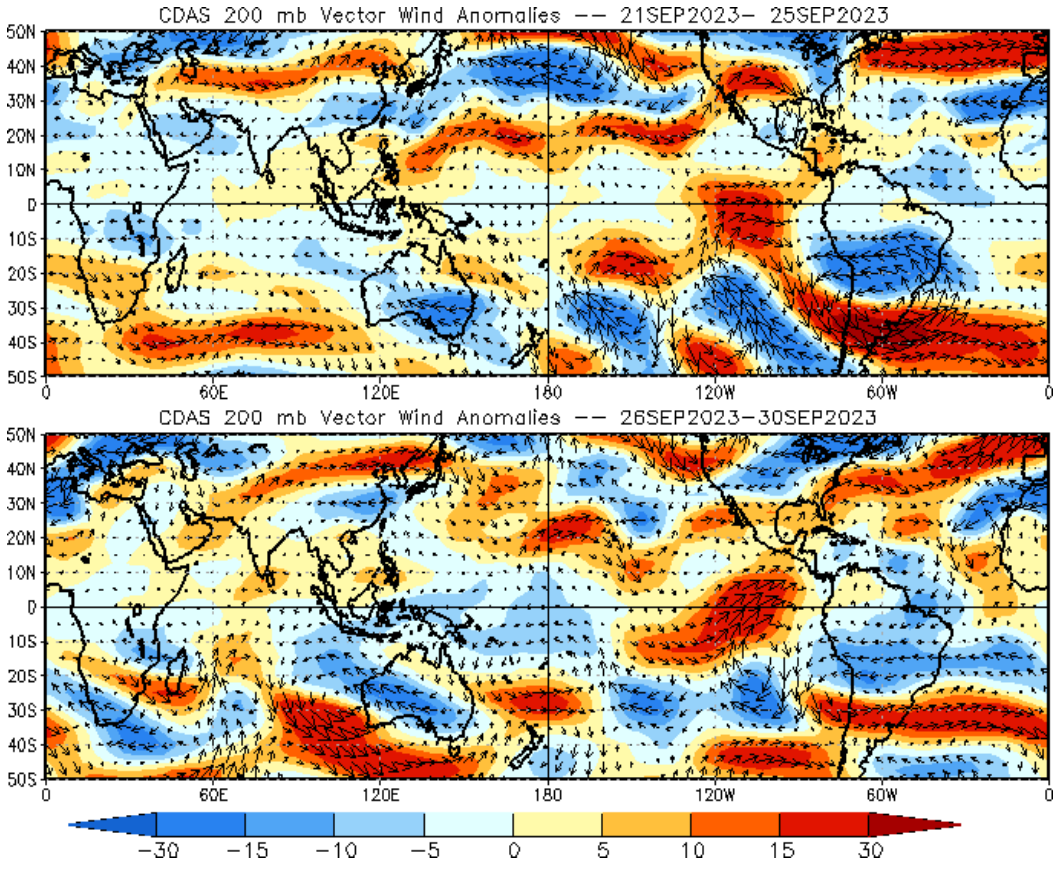
- A coherent wave-1 pattern has continued and propagated eastward over the last week, suggesting a renewed MJO despite a relatively week signal in the RMM-based MJO index.

- The enhanced convective envelope is currently over the Western and Central Pacific, while suppressed convection is present over South America, the Atlantic Ocean, Africa and the Indian Ocean.

200-hPa Wind Anomalies

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

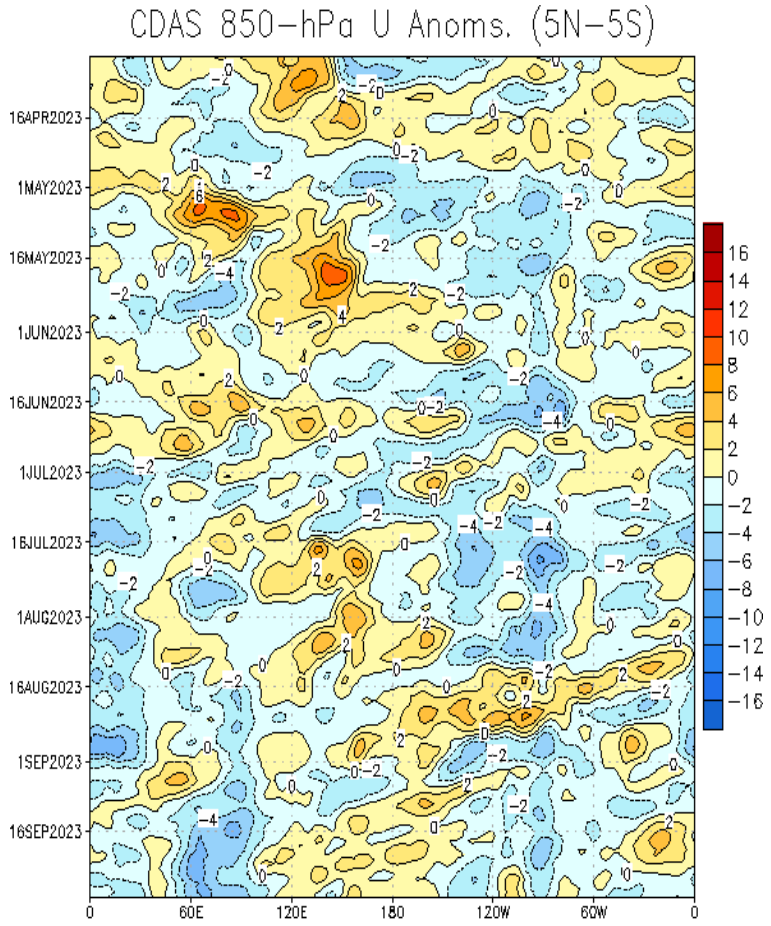


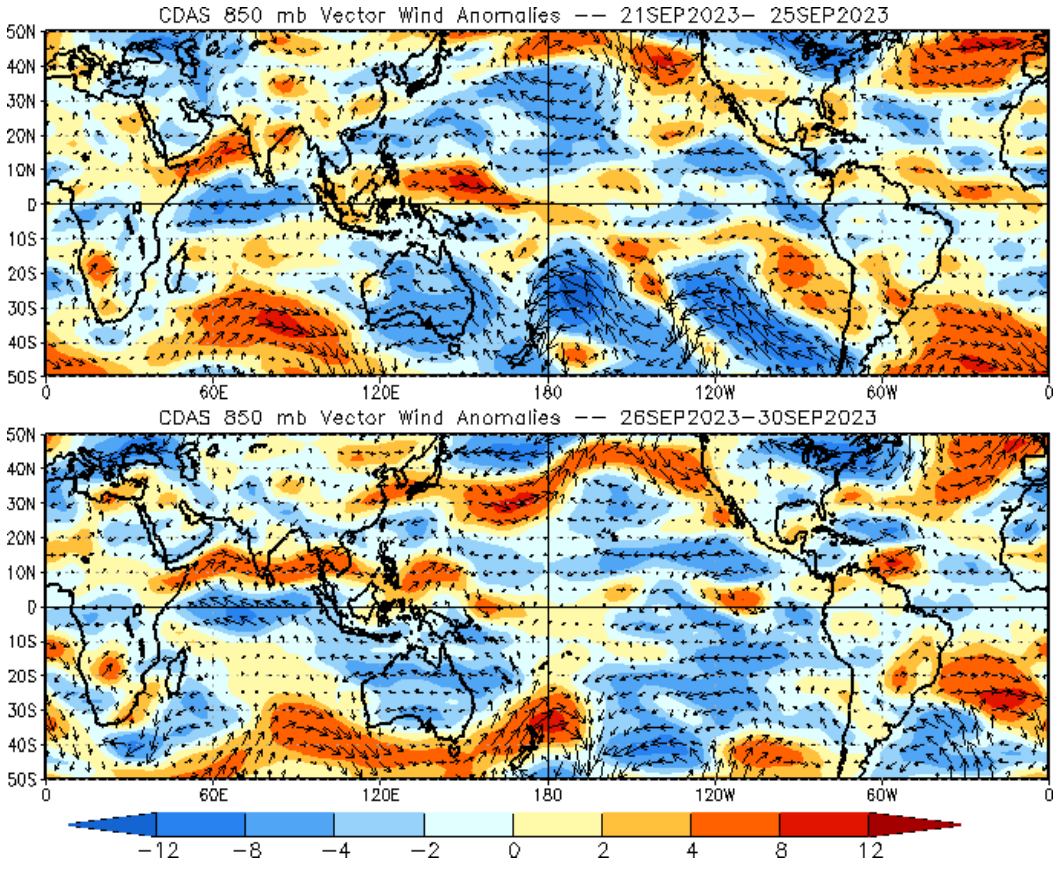


- An active subtropical branch of the jet stream remains over the Eastern Pacific, though an anticyclone over the North Pacific has weakened this feature somewhat over the last week.
- Anomalous westerlies continue over the eastern Equatorial Pacific, and have increased in intensity in recent days.

850-hPa Wind Anomalies

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

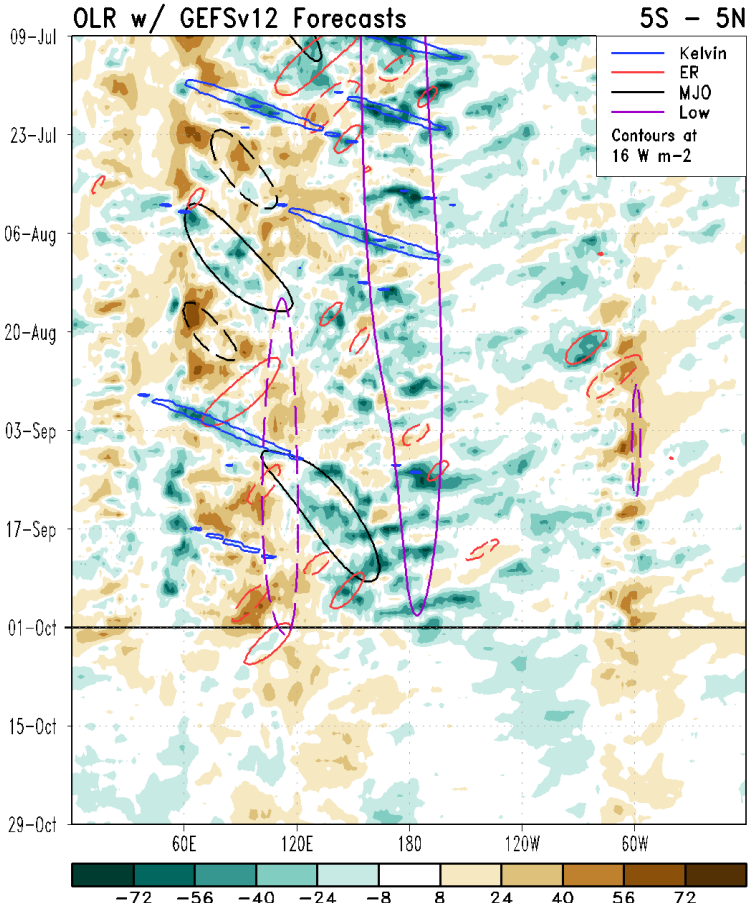


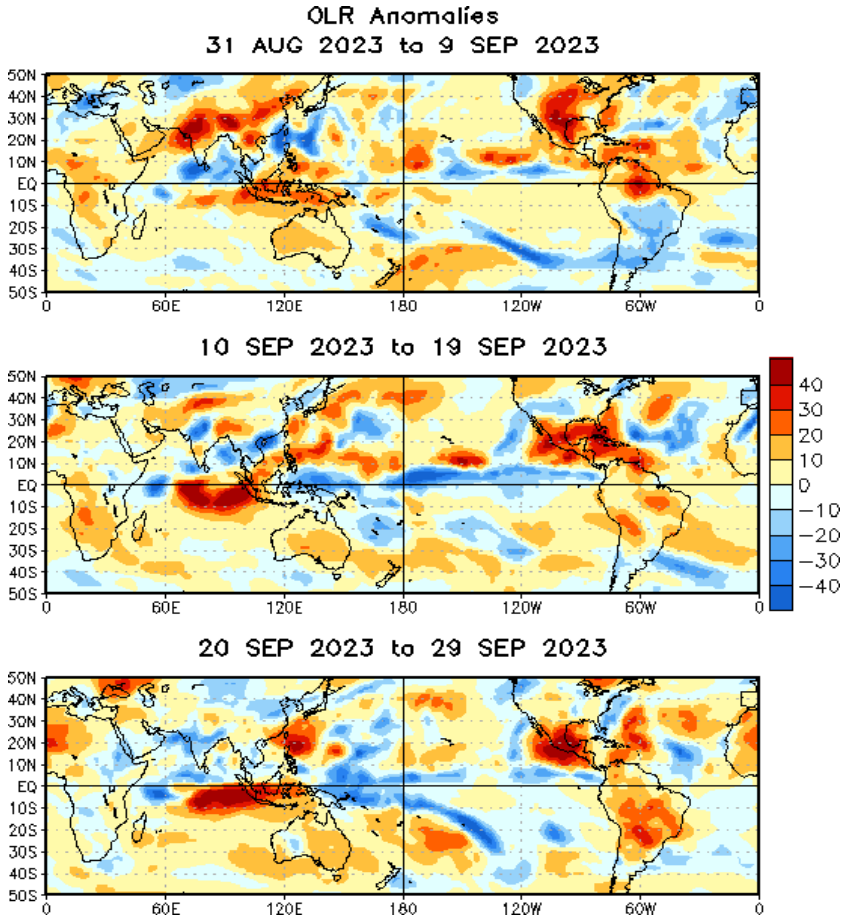


- Weakened trade winds continue over the Central and Western Equatorial Pacific, while enhanced easterlies persist over the Equatorial Indian Ocean.
- A long-lived west-moving feature circled the globe through most on August and into September. This feature may have come to an end, though background noise in the Hovmoller makes it difficult to determine this definitively.

Outgoing Longwave Radiation (OLR) Anomalies

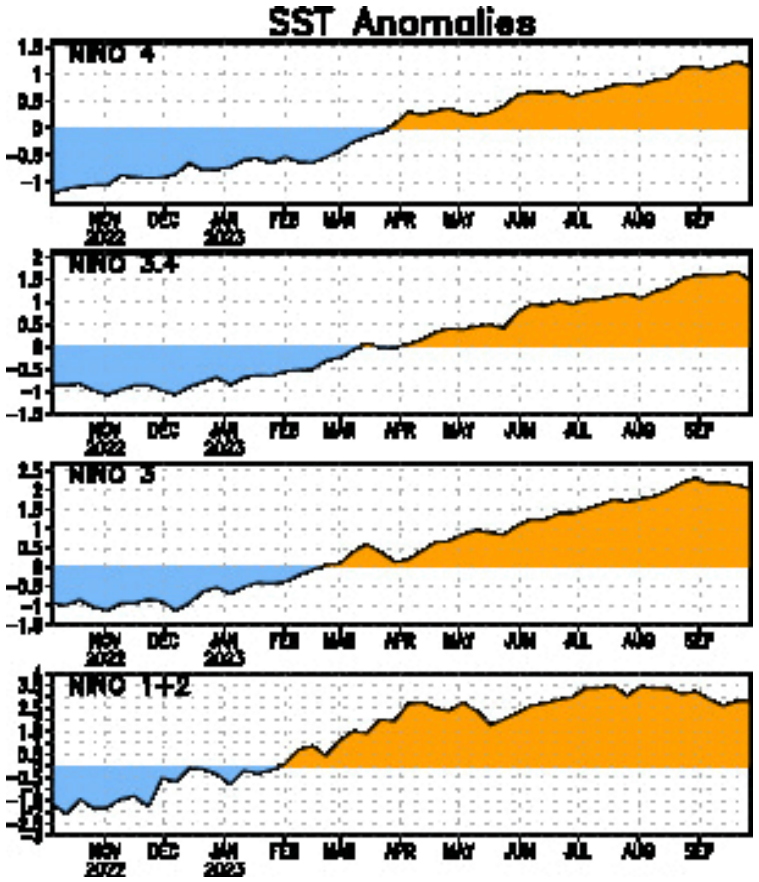
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

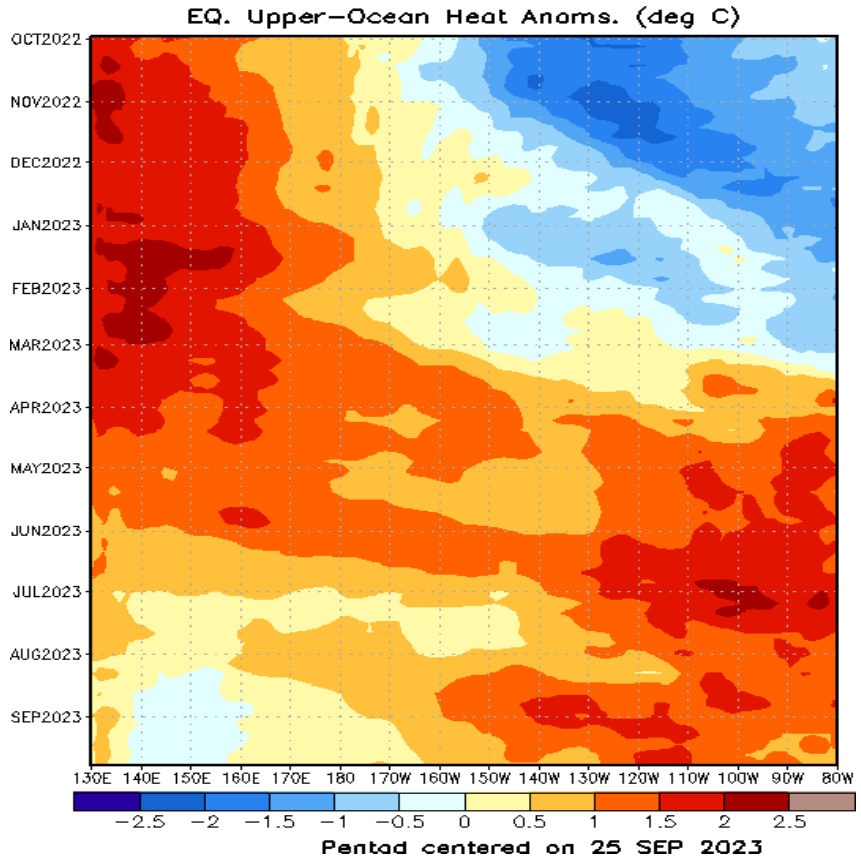




- OLR observations continue to reflect the influence of El Nino on the global tropics. The Hovmoller plot depicts continued enhanced precipitation near the Date Line, while suppressed convection persists over the Indian Ocean. These features are also well-indicated on the OLR anomaly maps over the last week.
- Positive OLR anomalies over South America indicate a continued regime of below-normal precipitation.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

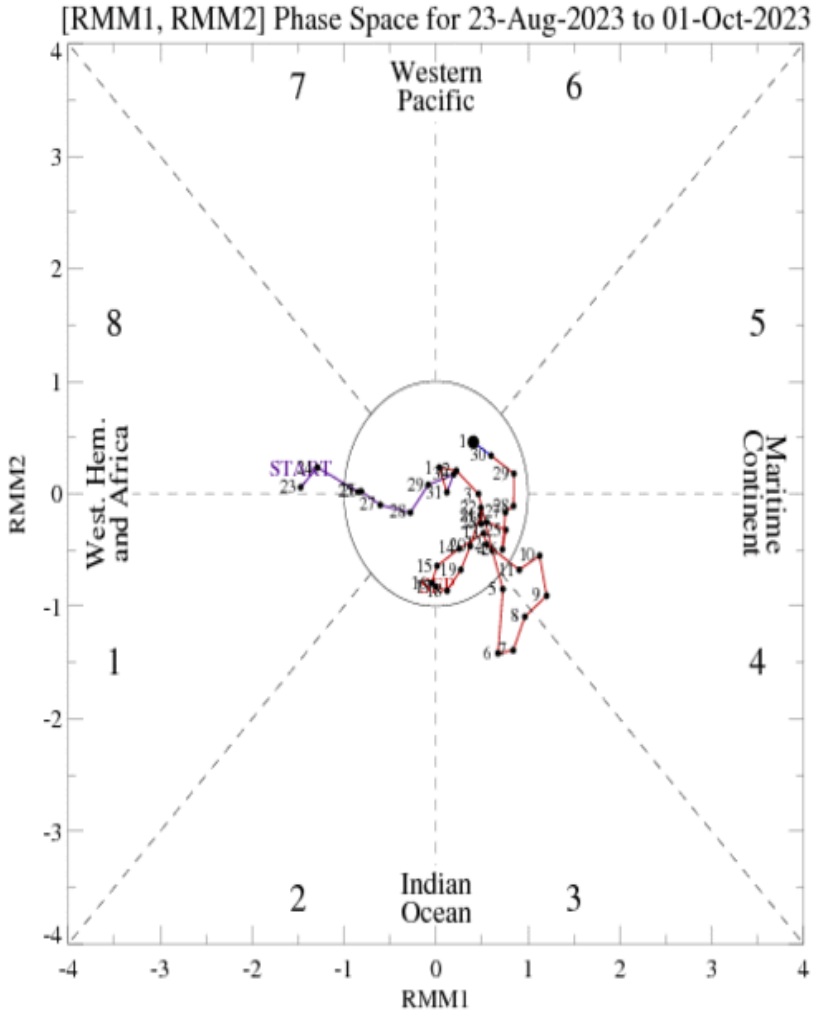




- El Niño conditions are present across the equatorial Pacific as SST anomalies remain strongly positive in all of the Niño basins, although the upward trend appears to have leveled off for all but Nino 4.
- Negative heat content anomalies observed in the West Pacific Warm Pool persist after a westerly wind burst and associated downwelling oceanic Kelvin wave pushed warmer water across the Equatorial Pacific.

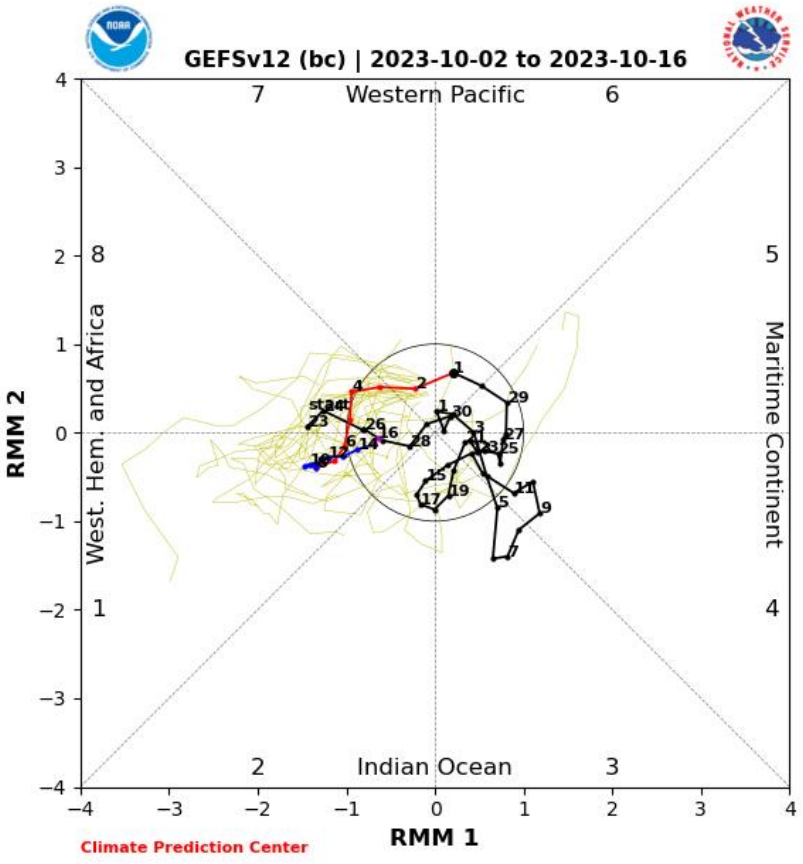
MJO Index: Recent Evolution

- The RMM-based MJO index has remained inside the unit circle during the past week following a brief increase in amplitude over the Indian Ocean and Maritime Continent in early September.

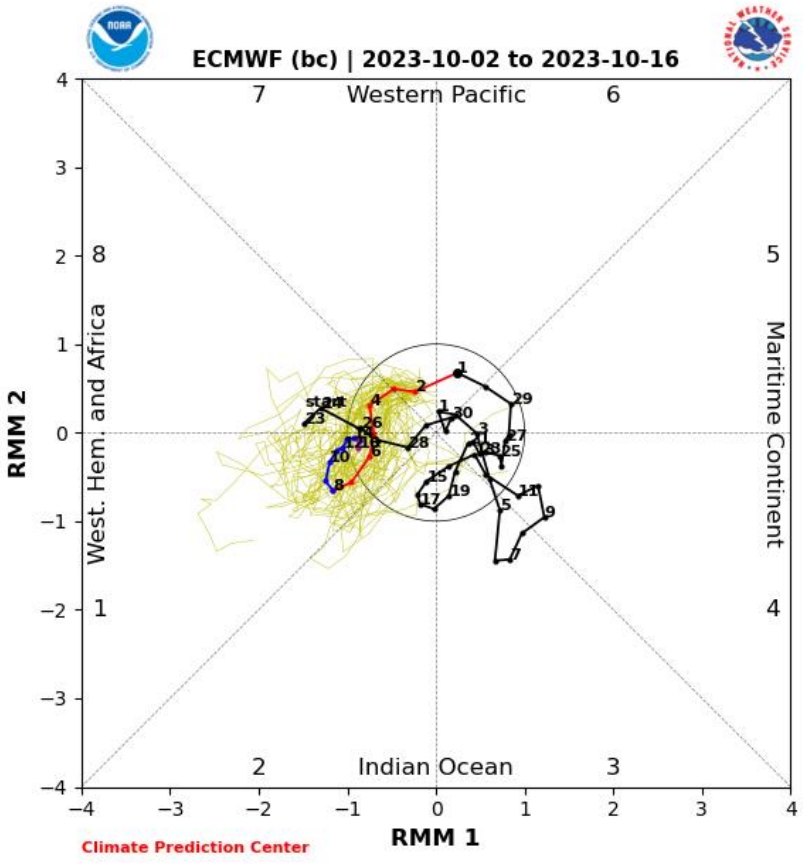


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

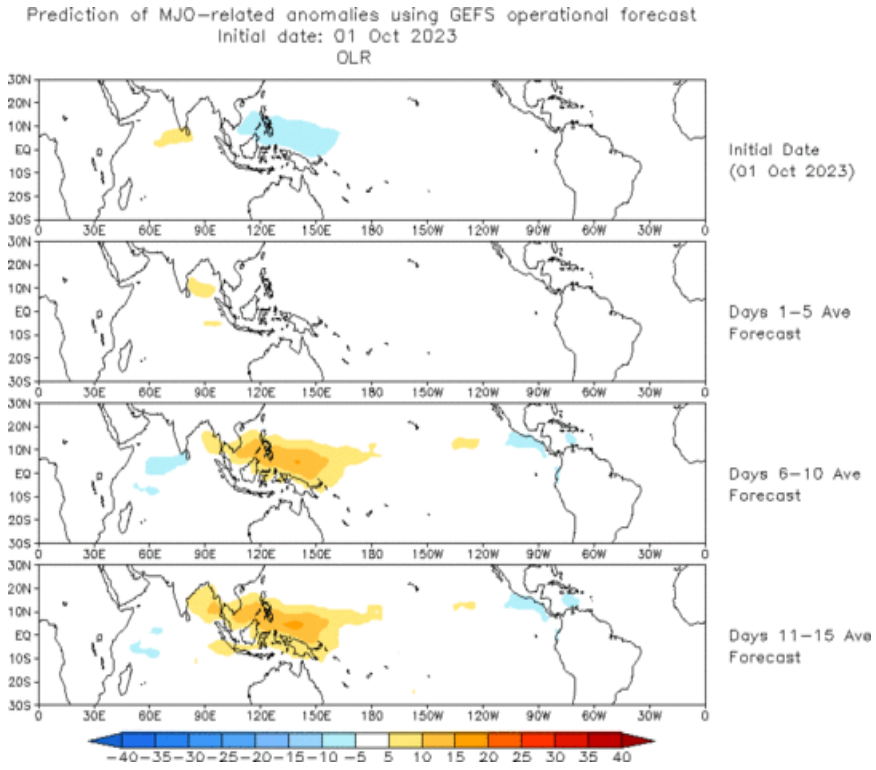


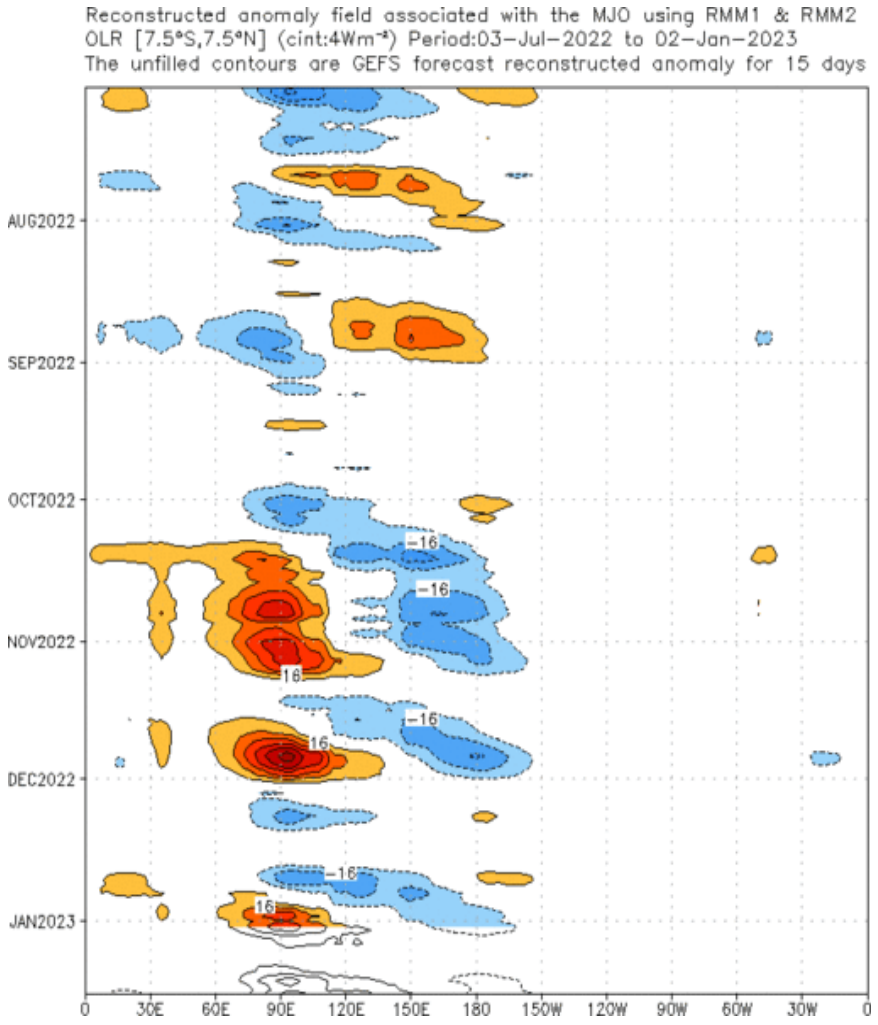
ECMWF Forecast

- Both the GEFS and ECMWF model forecasts of the RMM-index generally depict a weak MJO, although there is a much more coherent depiction of eastward propagation of the MJO signal during the next 2 weeks.
- Both models (and others not shown) are in good agreement that the MJO is likely to be in phases 8 or 1 over much of the week 2-3 period.

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.)

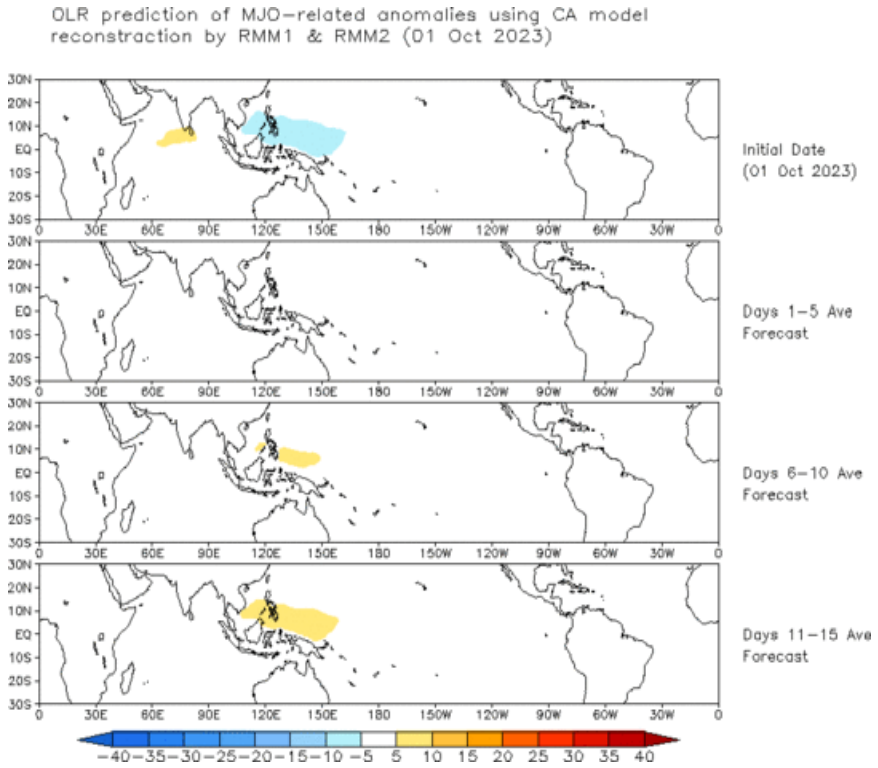


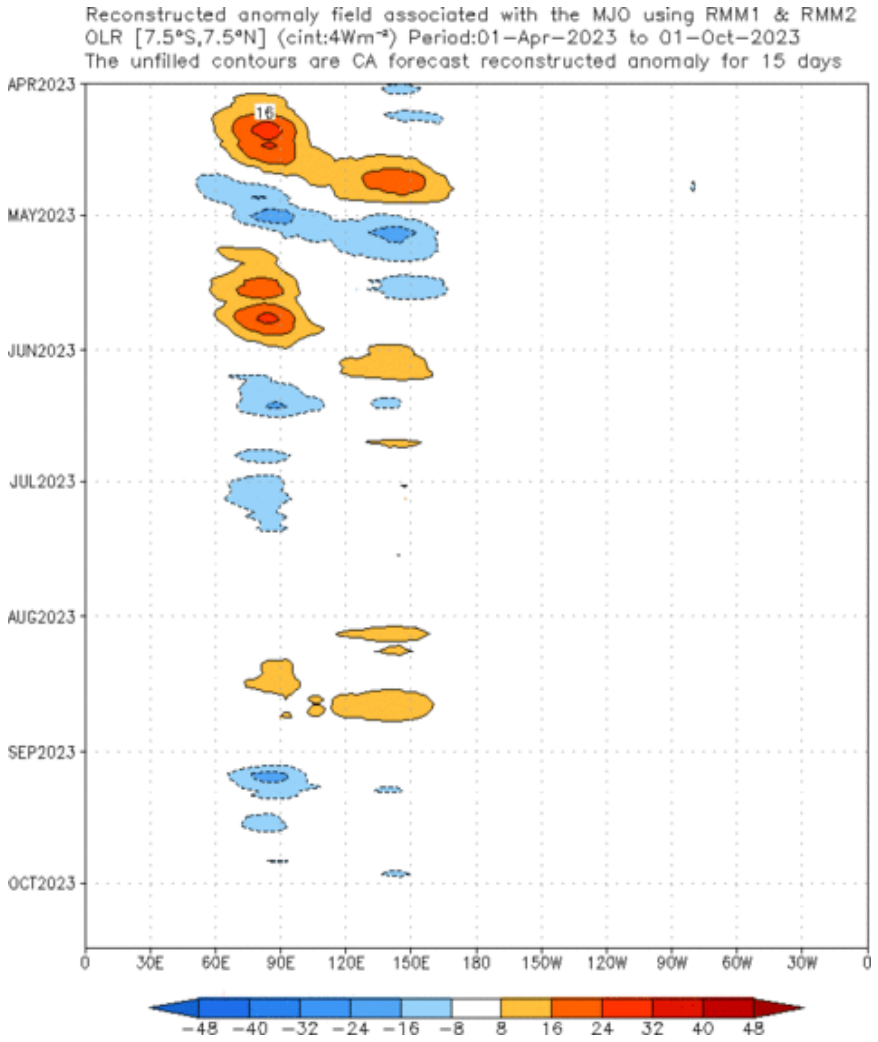


- The GEFS RMM-based OLR forecast depicts emerging positive OLR anomalies over the Western Pacific, strengthening during week-2.
- Some negative OLR anomalies are noted across the Eastern Pacific and Caribbean.

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.)

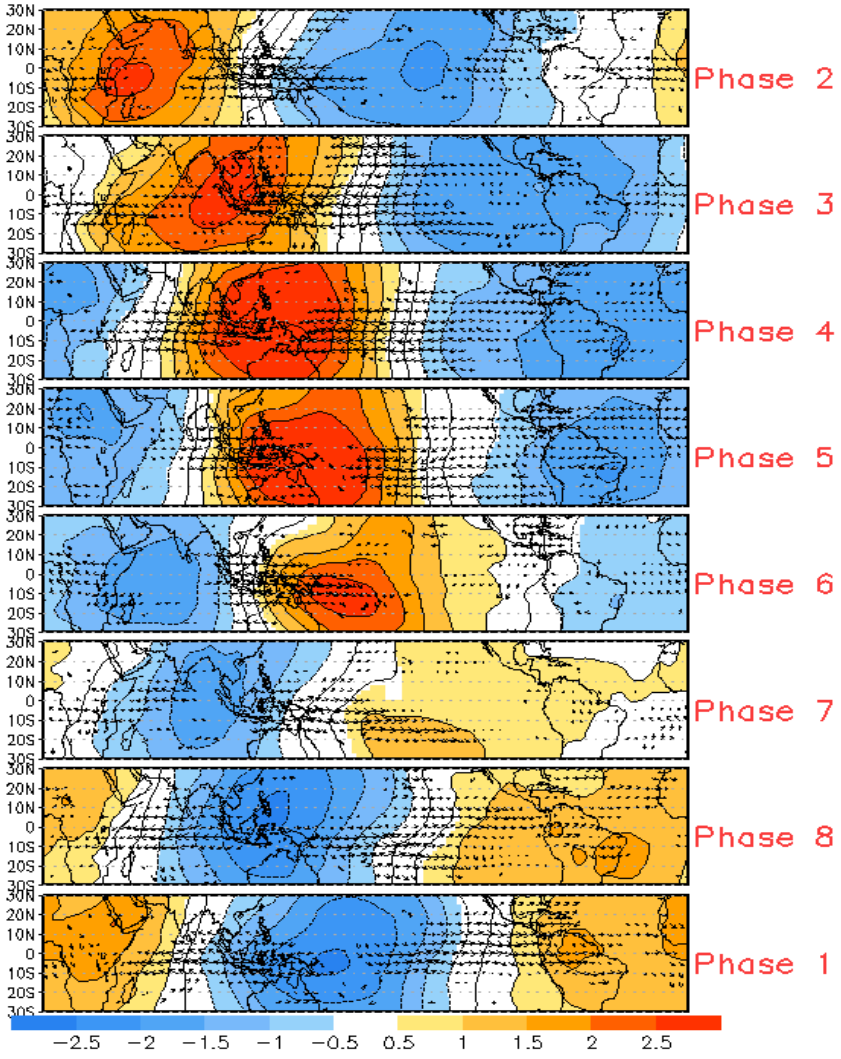




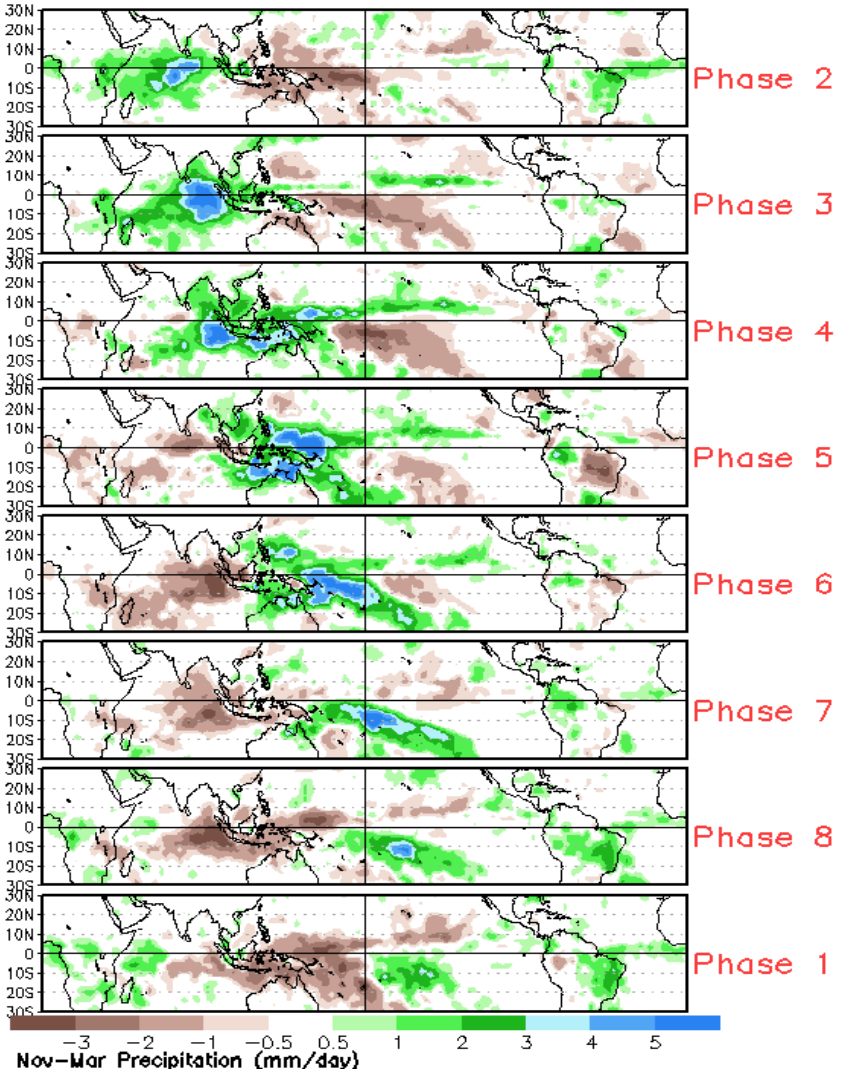
- The constructed analog RMM-based forecast indicates a similar pattern as the GEFS but with weaker OLR anomalies.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



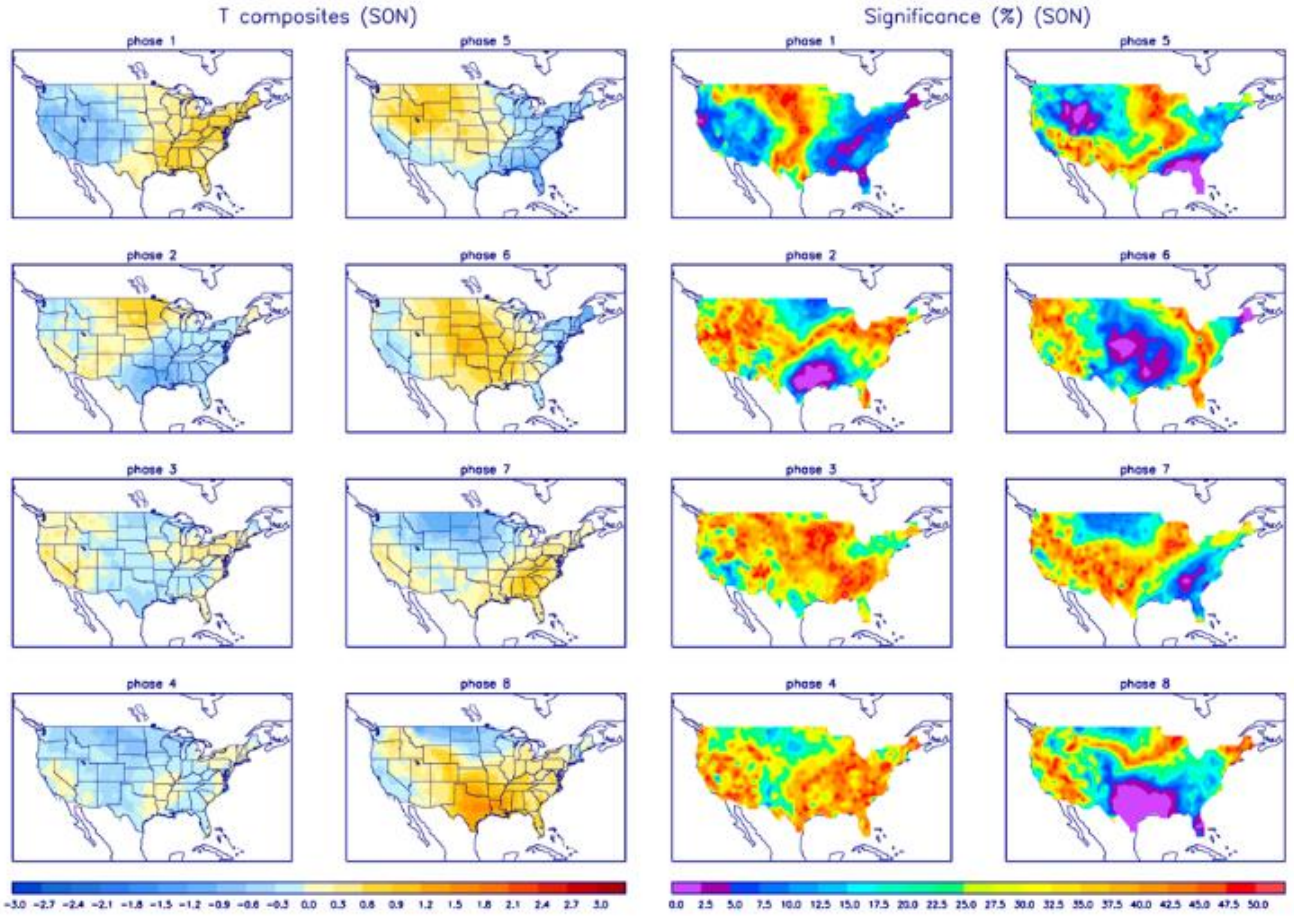
Precipitation Anomalies



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.

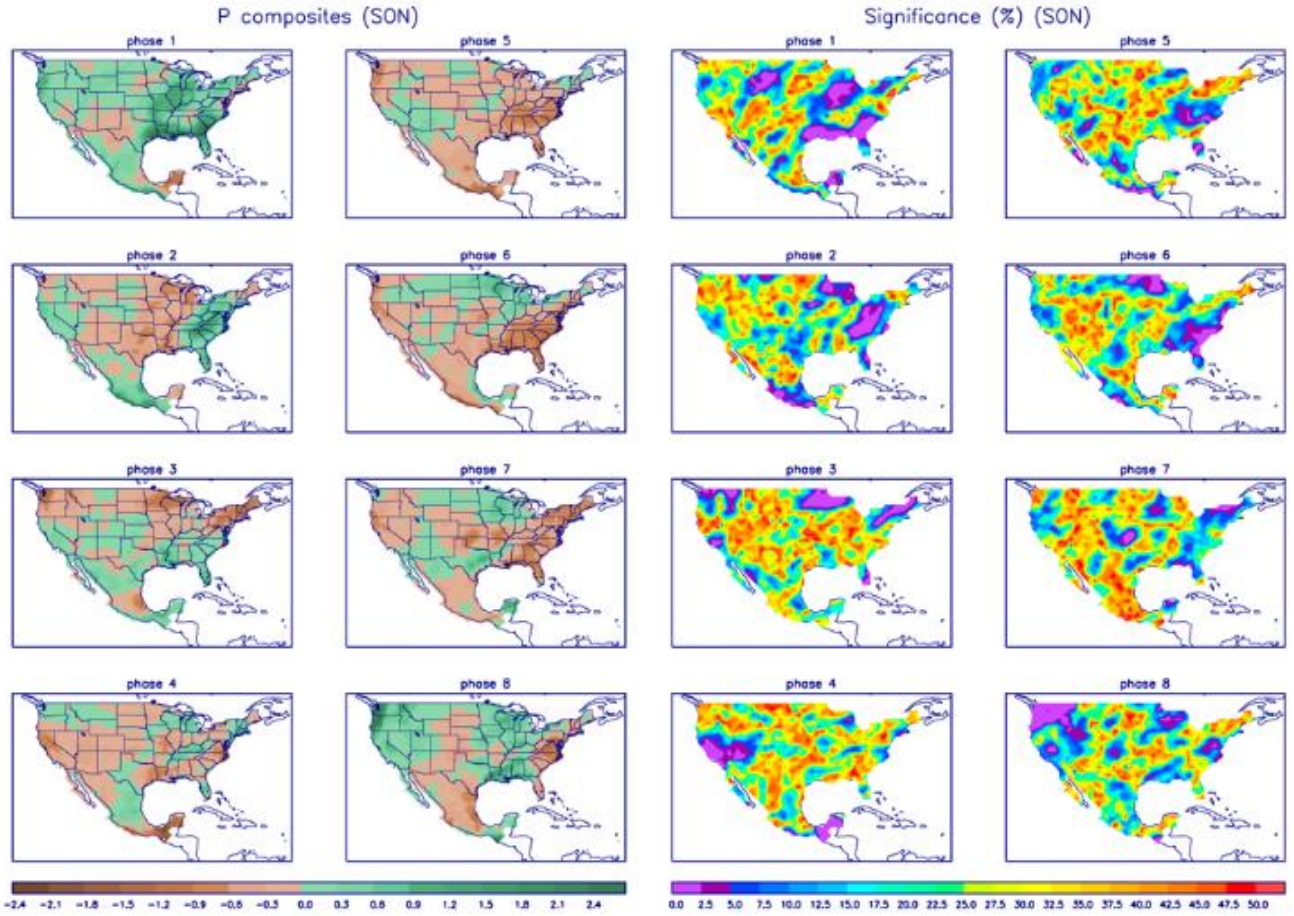


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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