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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
29 November 2021

Overview

- Both velocity potential based MJO and RMM indices continue to indicate a weak MJO, as enhanced convection remains anchored over the Maritime Continent consistent with the low frequency footprint.

- There is continued agreement among the dynamical models favoring renewed MJO activity, as the intraseasonal signal is forecast to become more amplified and begin to propagate eastward across the western Pacific during the next two weeks.

- A Pacific MJO event is likely to destructively interfere with La Niña, and there remains uncertainty as to whether the MJO will maintain an organized structure, as evidenced by large ensemble spread in the RMM forecasts through mid-December. Any coherence of the intraseasonal signal is more likely to be south of the equator.

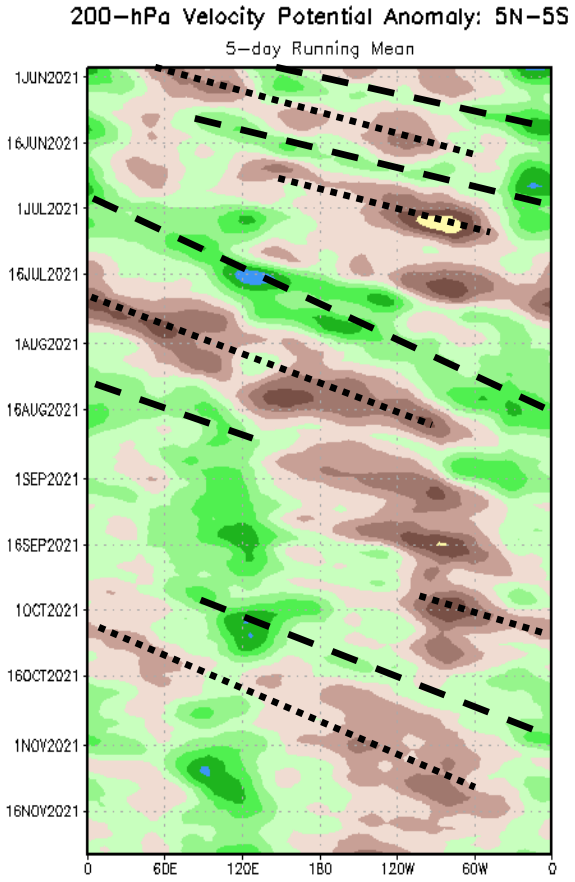
- Tropical cyclogenesis is favored over the eastern Indian Ocean and western Pacific during week-1, with increasing chances for development over the southeastern Indian Ocean and South Pacific later in the outlook period. A quiet conclusion to the East Pacific and Atlantic Hurricane seasons remains likely.

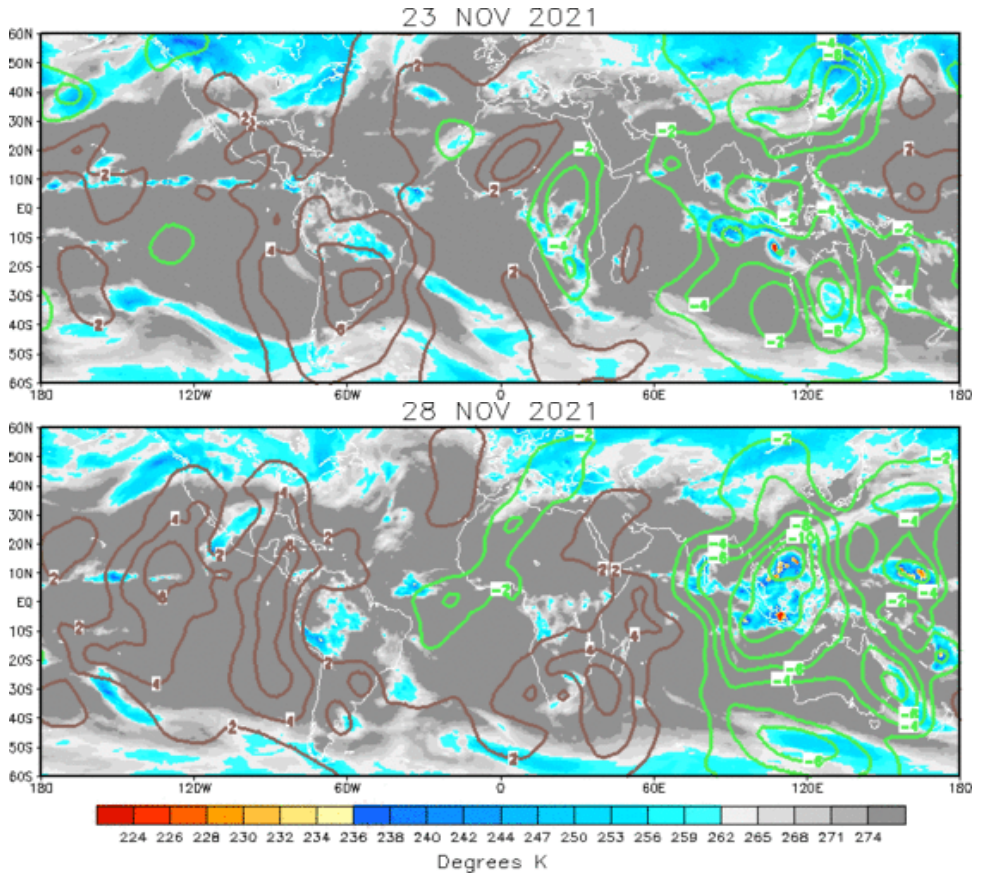
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

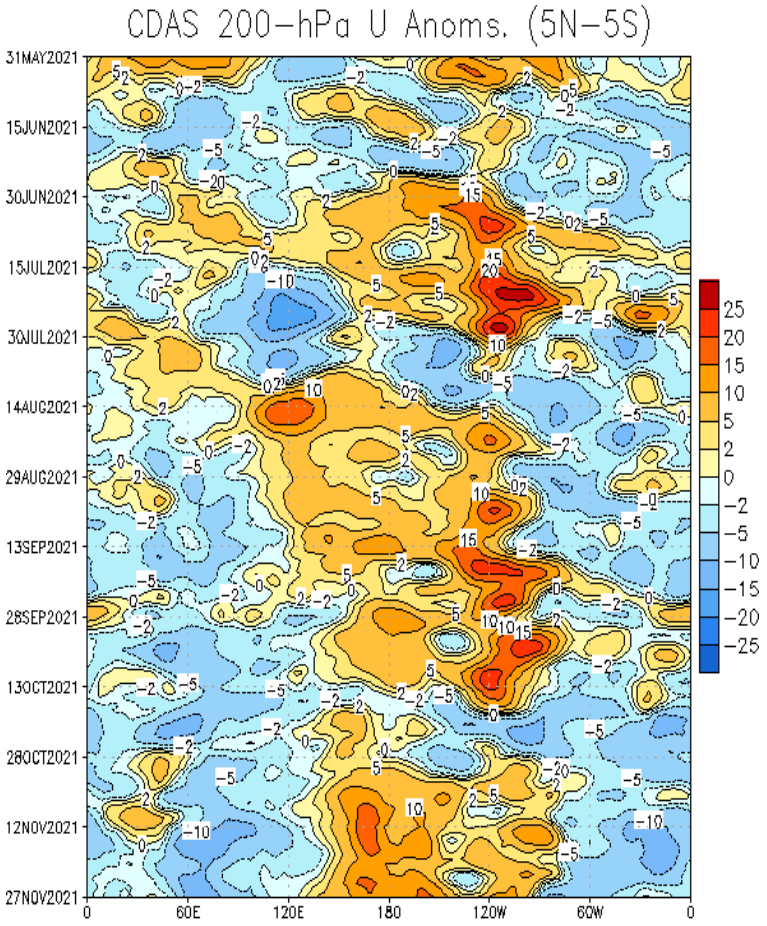


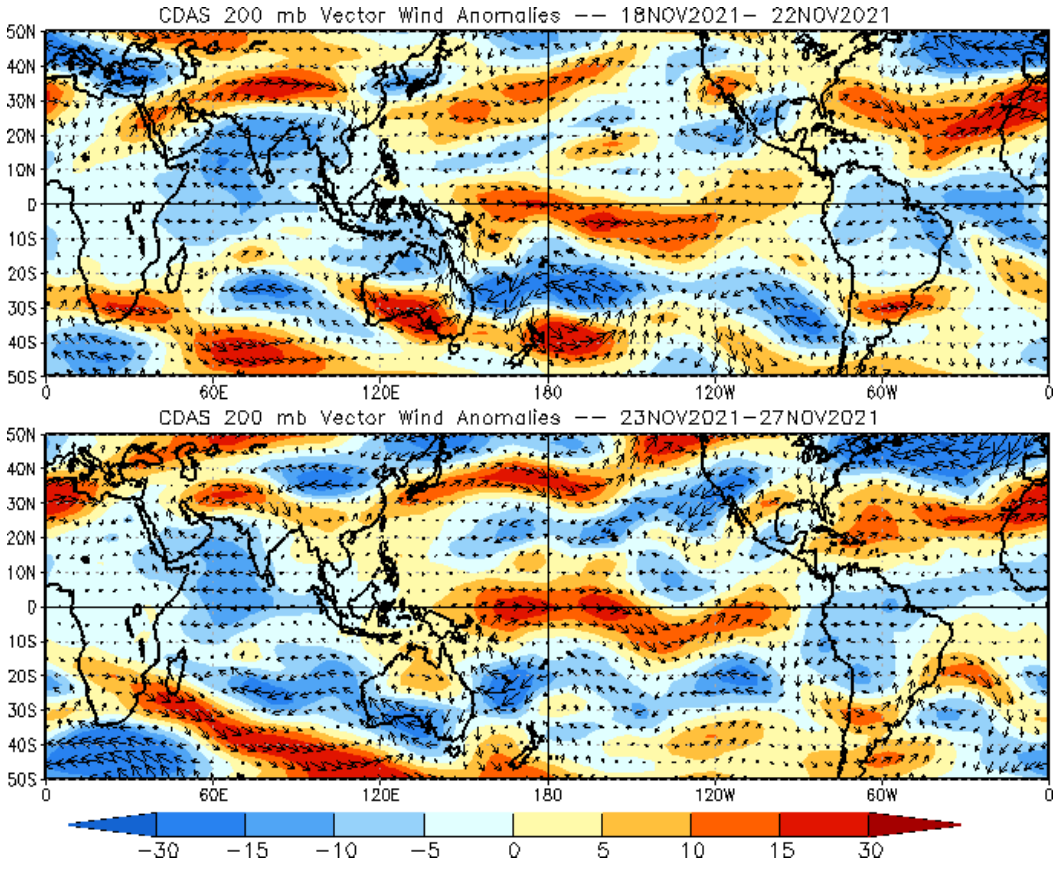


- The velocity potential pattern continues to primarily driven by low frequency variability since September.
- Enhanced conditions have recently developed to the west of the Date Line as well as throughout the SPCZ region.

200-hPa Wind Anomalies

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



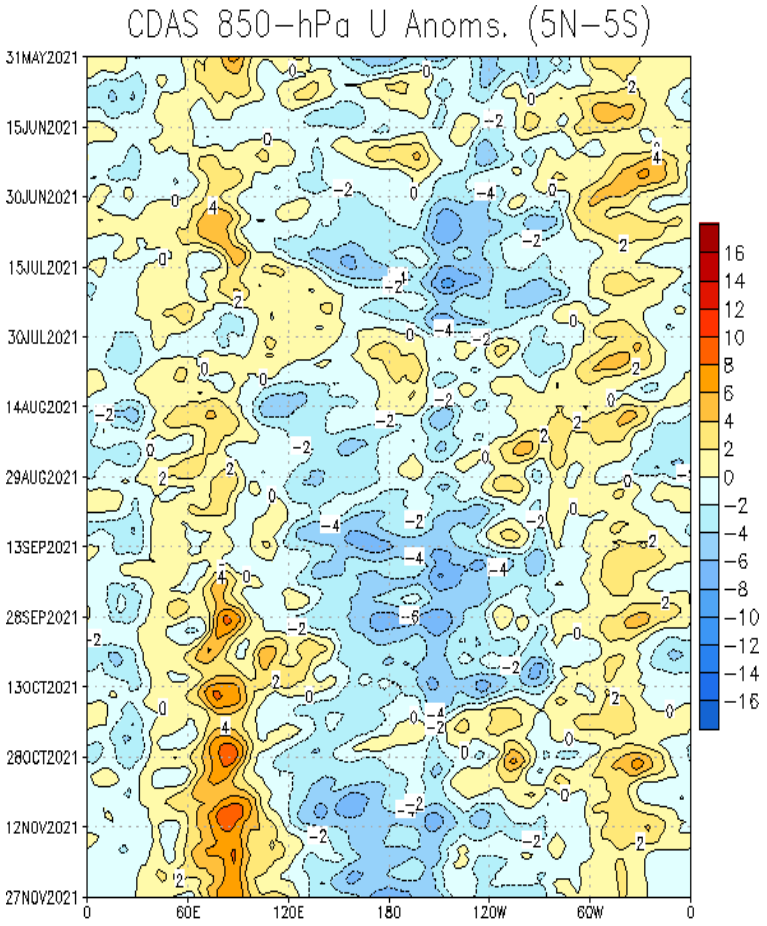


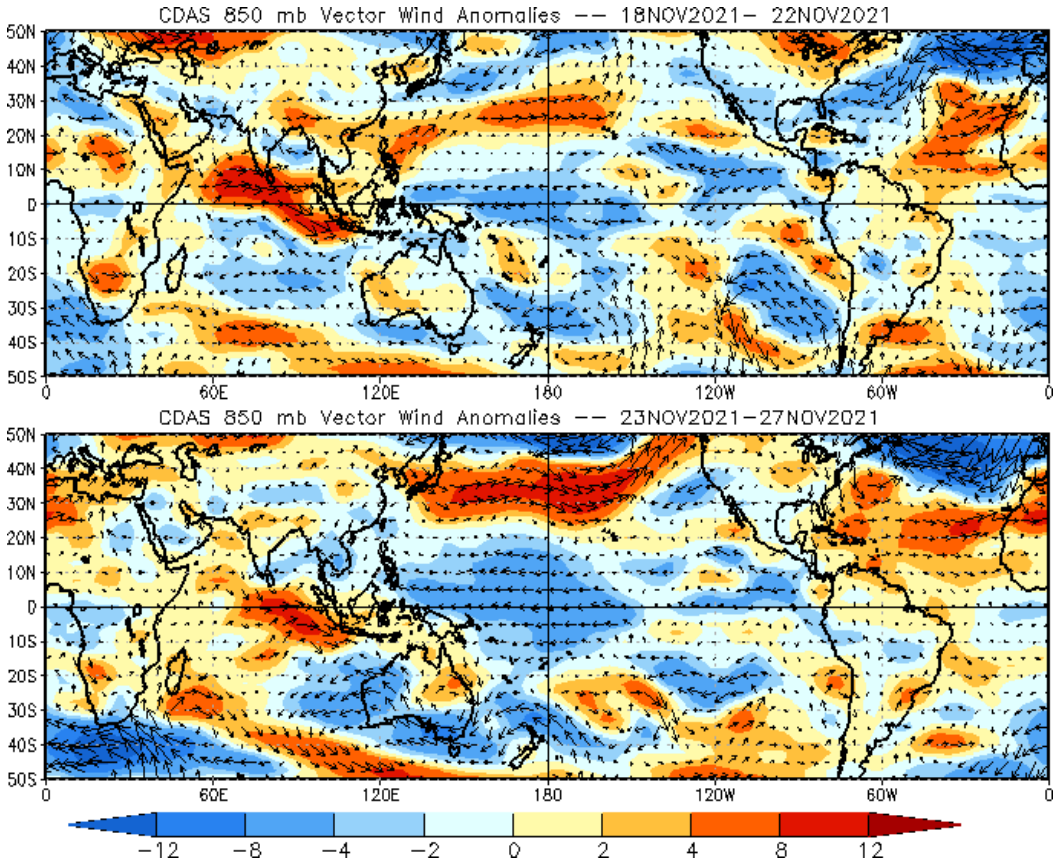
- The upper-level pattern appears to be reflective of the La Niña base state with enhanced easterlies (westerlies) over the Indian Ocean and Maritime Continent (Pacific).

- Much of the anomalous westerlies aloft near the Date Line appear to be reinforced by an anomalous cyclonic circulation aloft over the South Pacific.

850-hPa Wind Anomalies

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





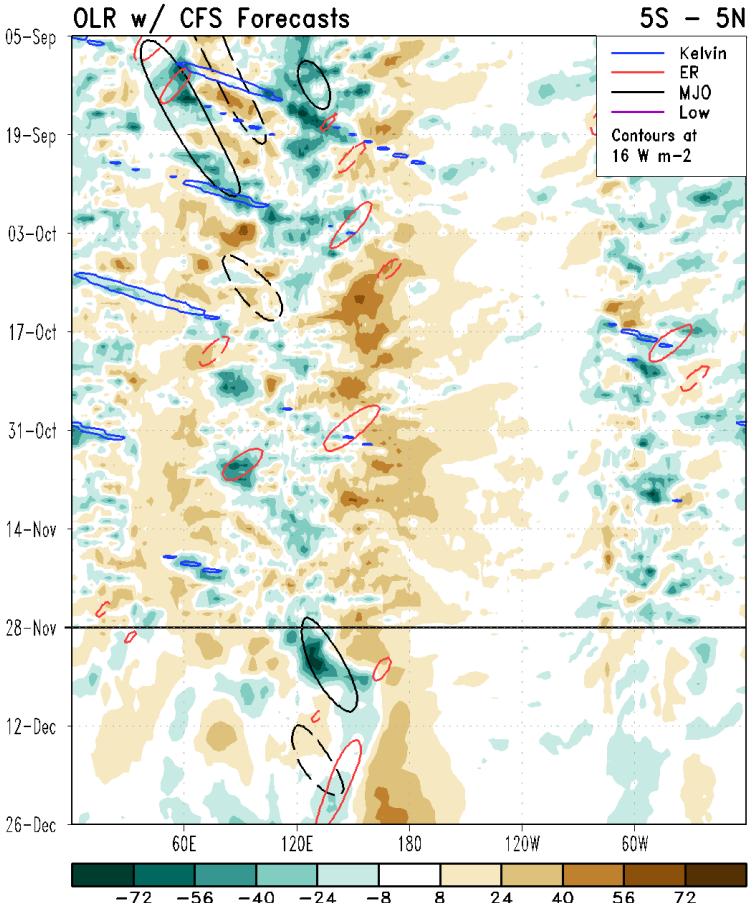
- Enhanced trades persisted over equatorial Pacific, as much of these anomalous easterlies have expanded into the northwestern Pacific during late November.

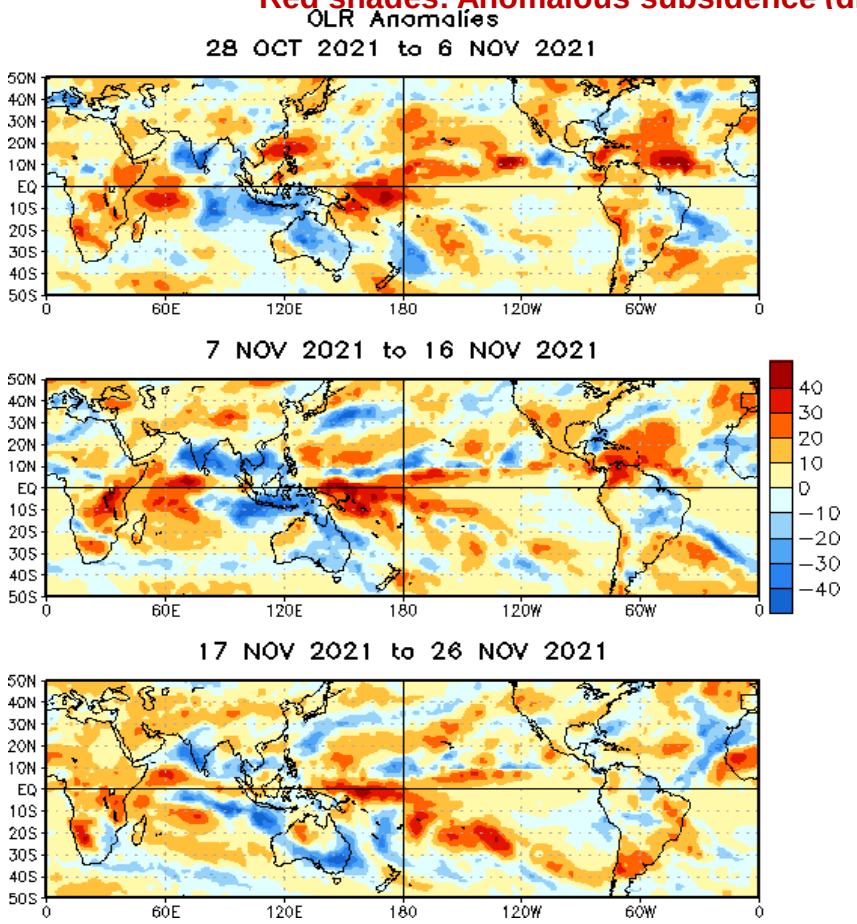
- Anomalous westerlies are observed along the SPCZ region and have strengthened over the Maritime Continent.

Outgoing Longwave Radiation (OLR) Anomalies

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

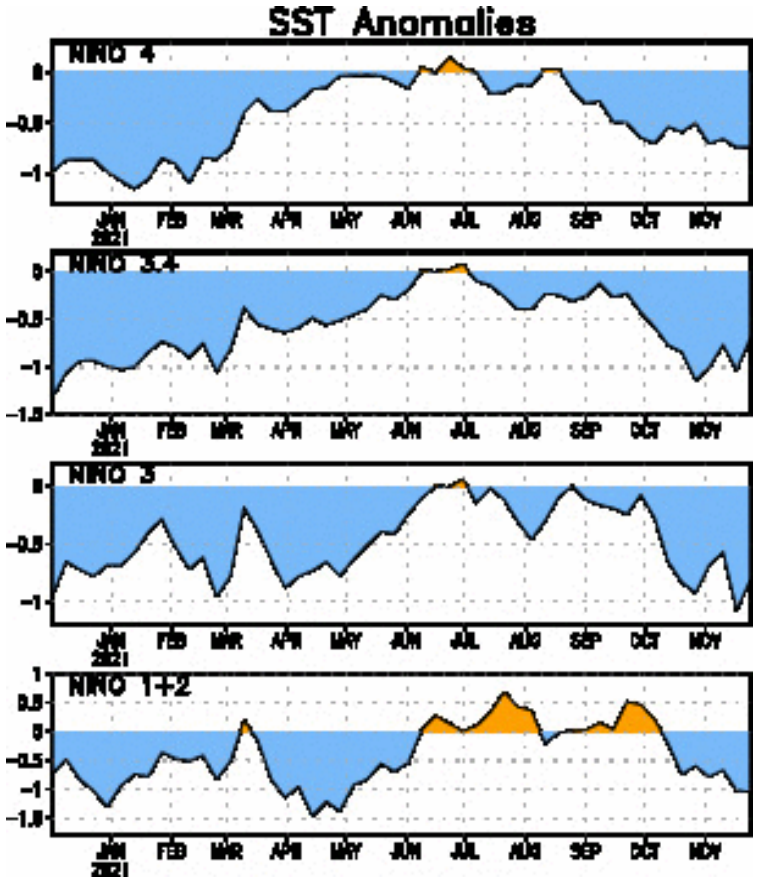
Blue shades: Anomalous convection (wetness)
Red shades: Anomalous subsidence (dryness)

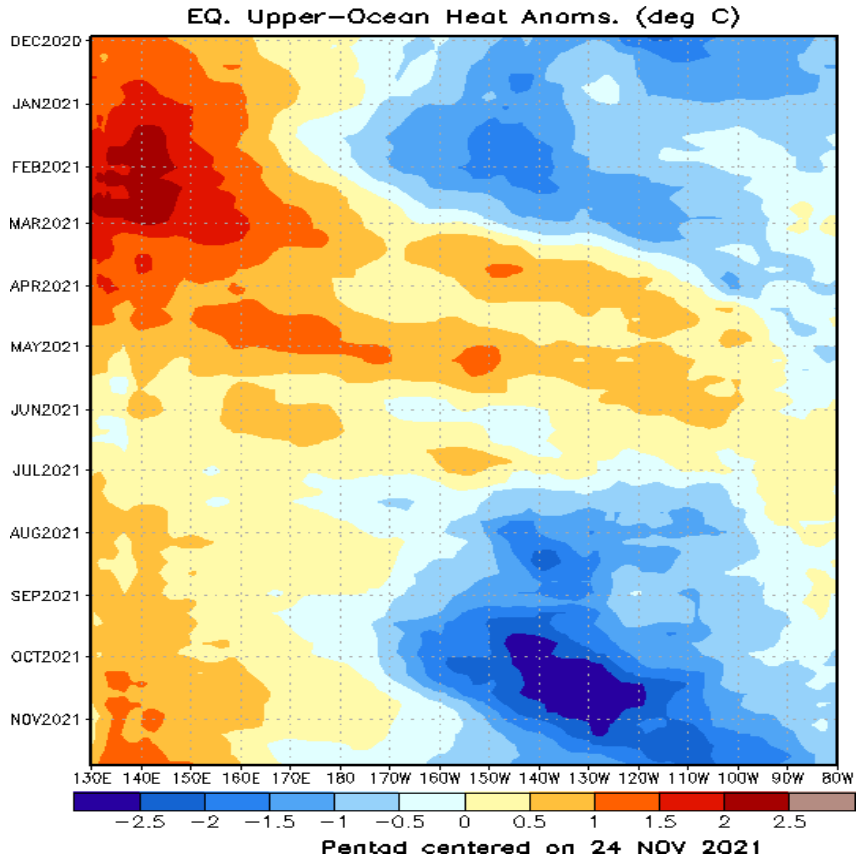




- Convection largely remains suppressed to the west of the Date Line and over the central and eastern Pacific north of the equator.
- However, forecast guidance favors the development of more enhanced convection east of 120E along the equator, and destructively interfere with the suppressed convective signal over the West Pacific during the next two weeks.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



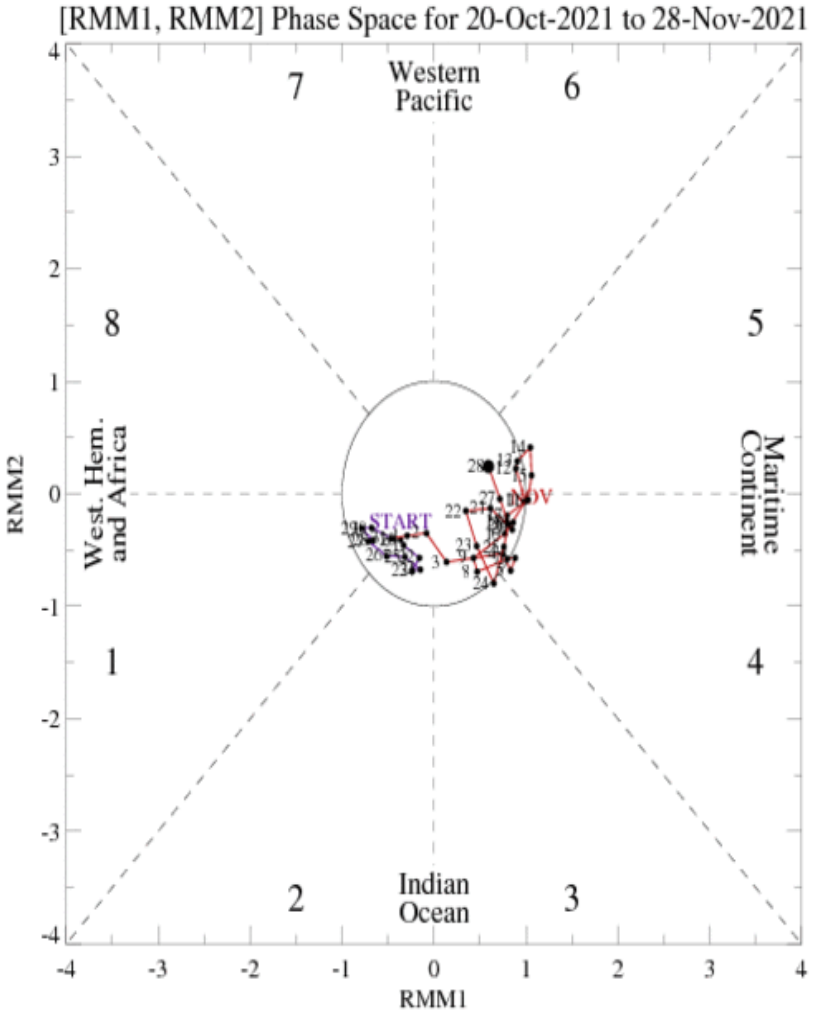


- Negative upper-ocean heat content anomalies have relaxed across the central and eastern equatorial Pacific, with much of the sub-surface cooling continuing to expand eastward since early October.

- Consistent with La Niña, below-normal sea surface temperatures (SSTs) continue to be observed within all Niño regions, with SSTs holding steady or decreasing during November.

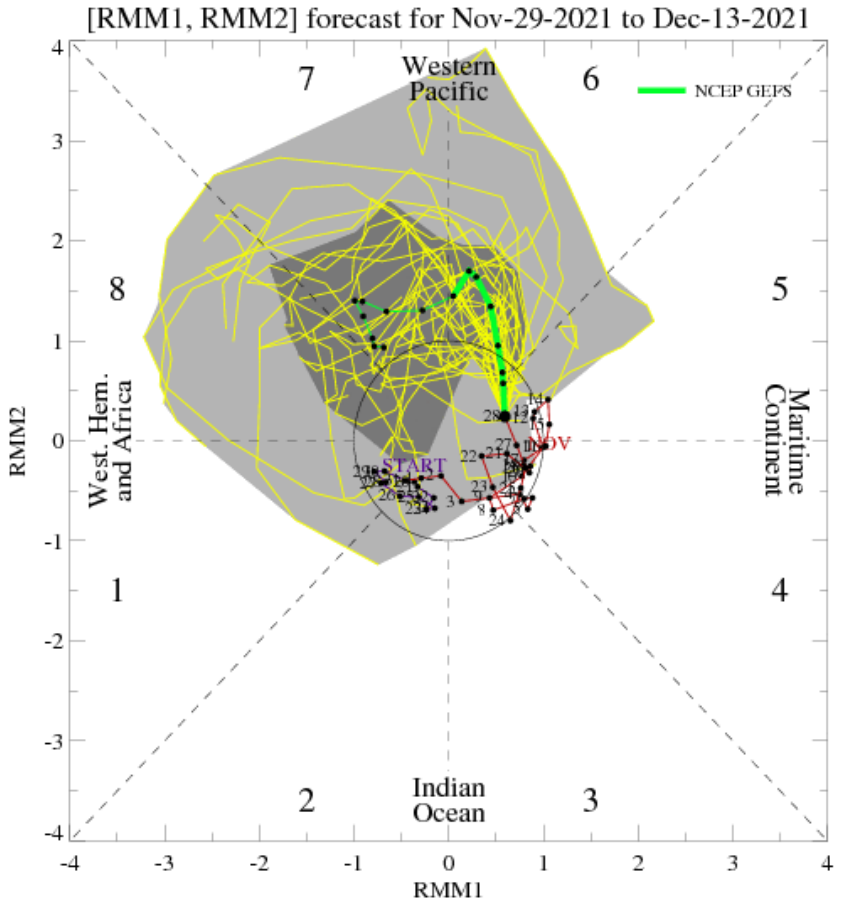
MJO Index: Recent Evolution

- The RMM based MJO index remains weak over the Maritime Continent and has been modulated by Rossby and Kelvin wave activity during the past few weeks.

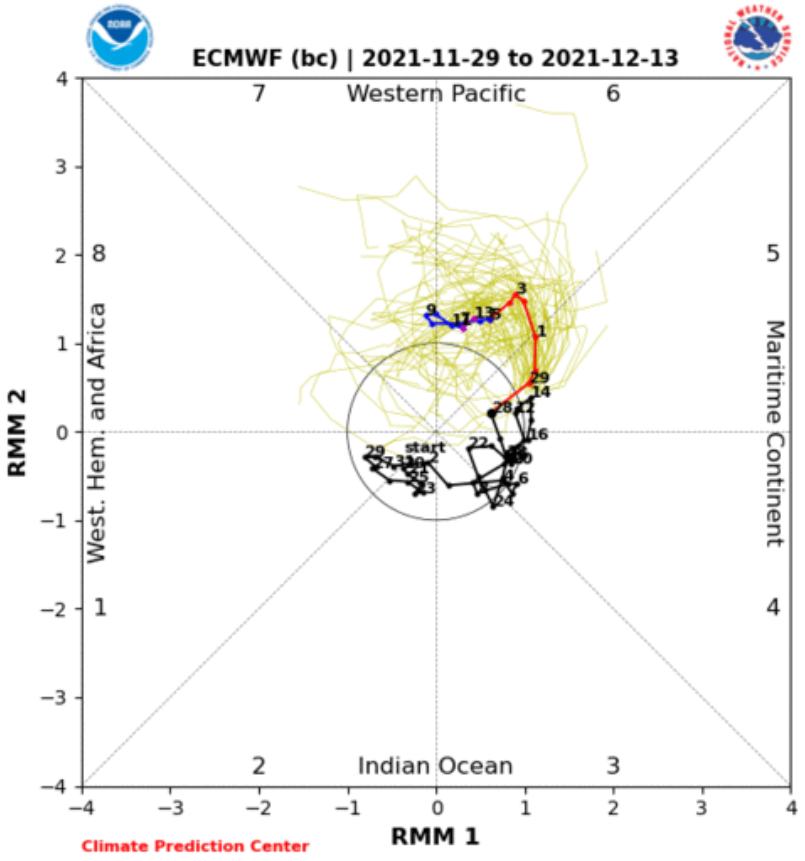


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

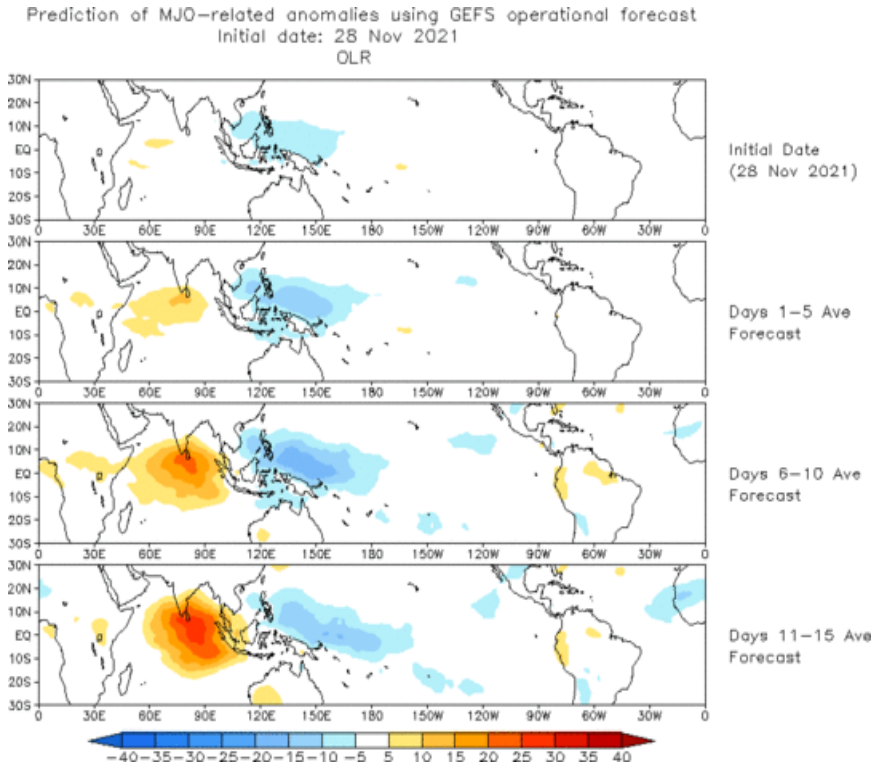


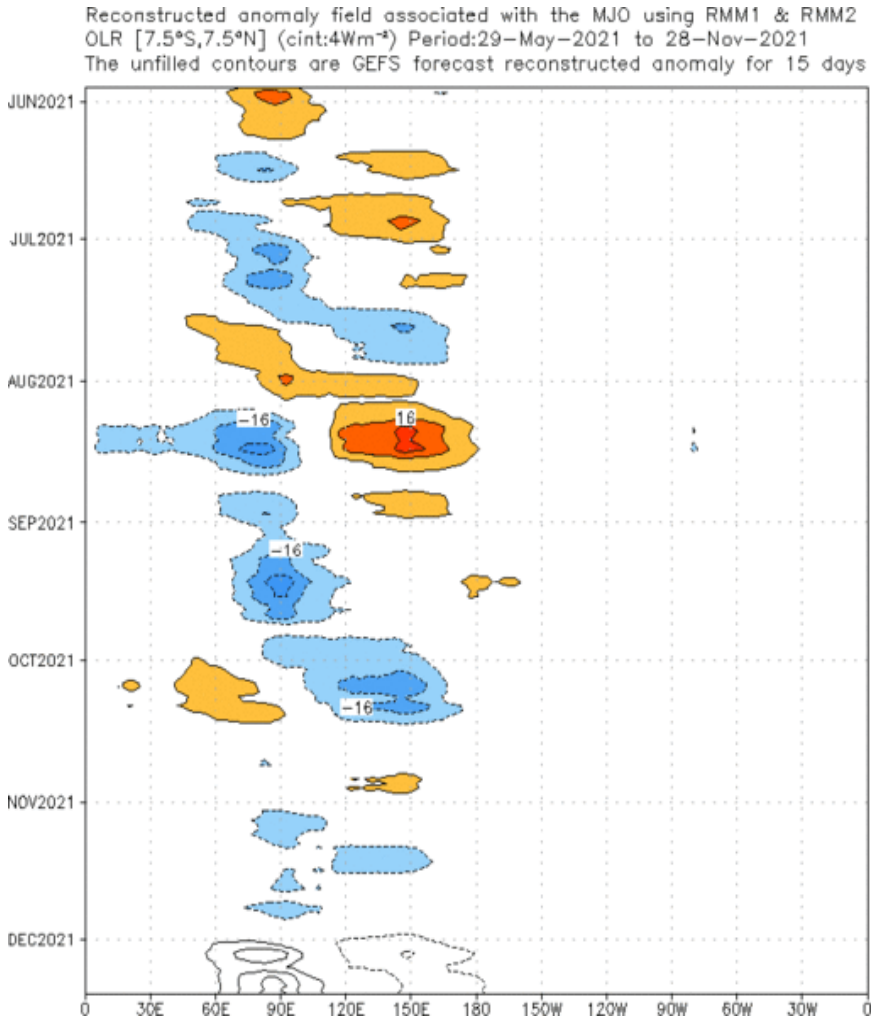
ECMWF Forecast

- There is good agreement in the dynamical models advertising a more coherent MJO emerging from the Maritime Continent that propagates eastward over western Pacific in phase 6 (phase 7) during week-1 (week-2).
- There is still some question as to whether the MJO will maintain an organized structure due to destructive interference with La Niña over the Pacific, as evidenced by large ensemble spread in the models.

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.)

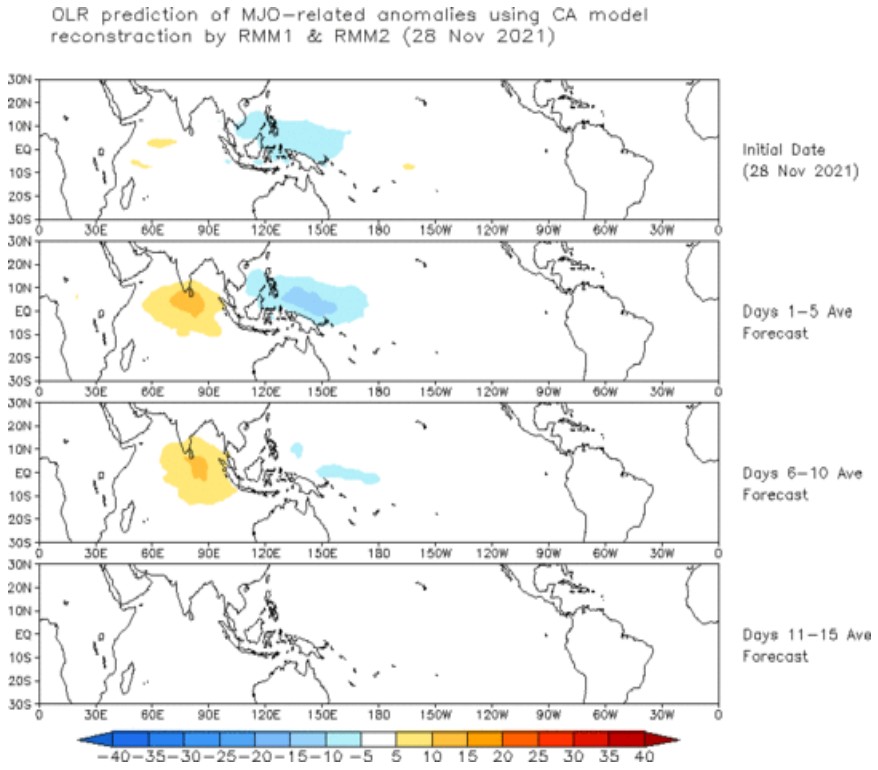


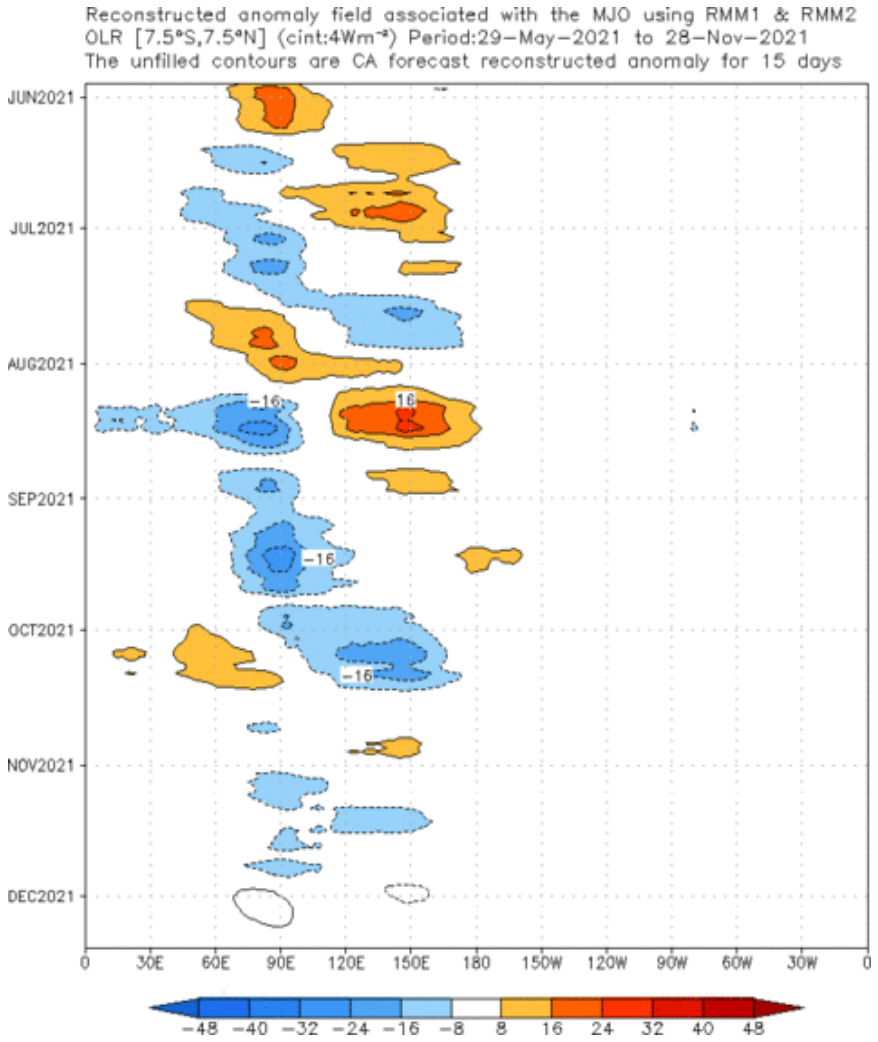


- The GEFS RMM-based OLR anomaly forecast depicts more enhanced convection shifting eastward into the West Pacific, and suppressed convection developing over the Indian Ocean during the next two weeks.

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.)

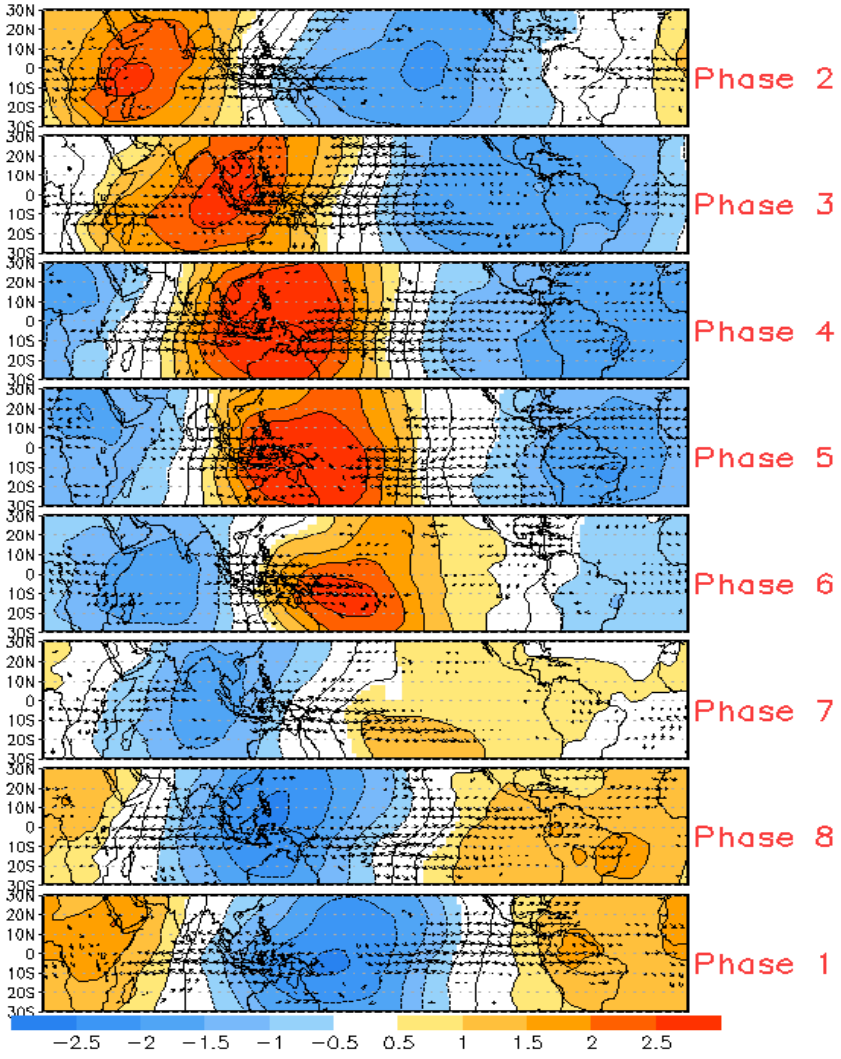




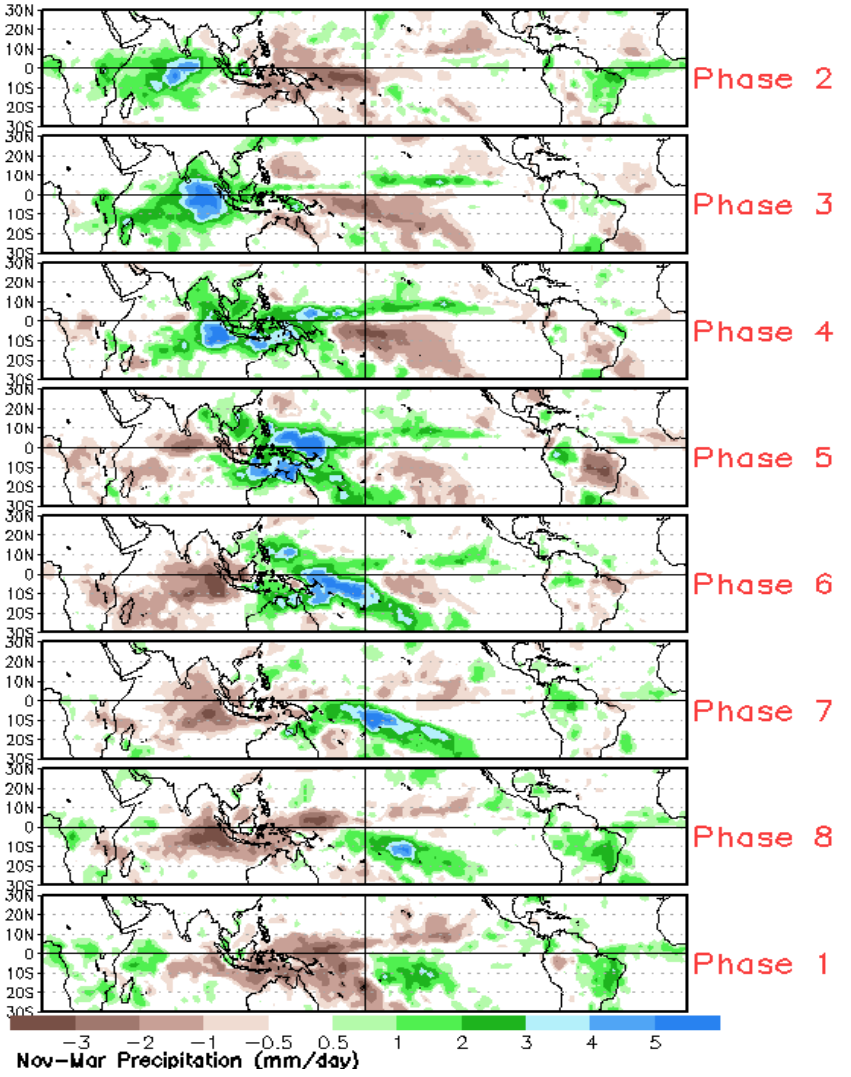
- The constructed analog depicts a more stationary and weaker convective pattern over the Eastern Hemisphere compared to the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



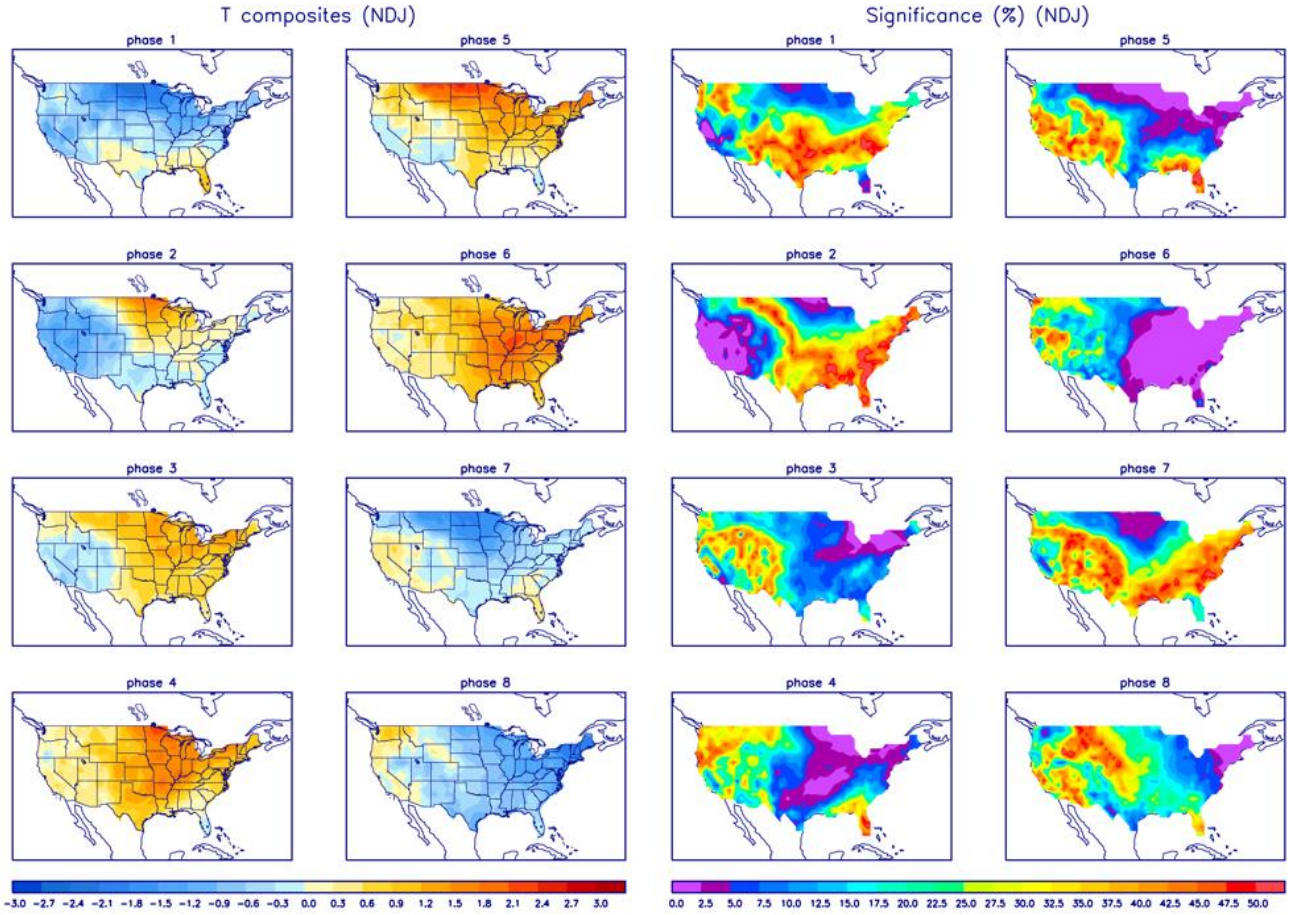
Precipitation Anomalies



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.

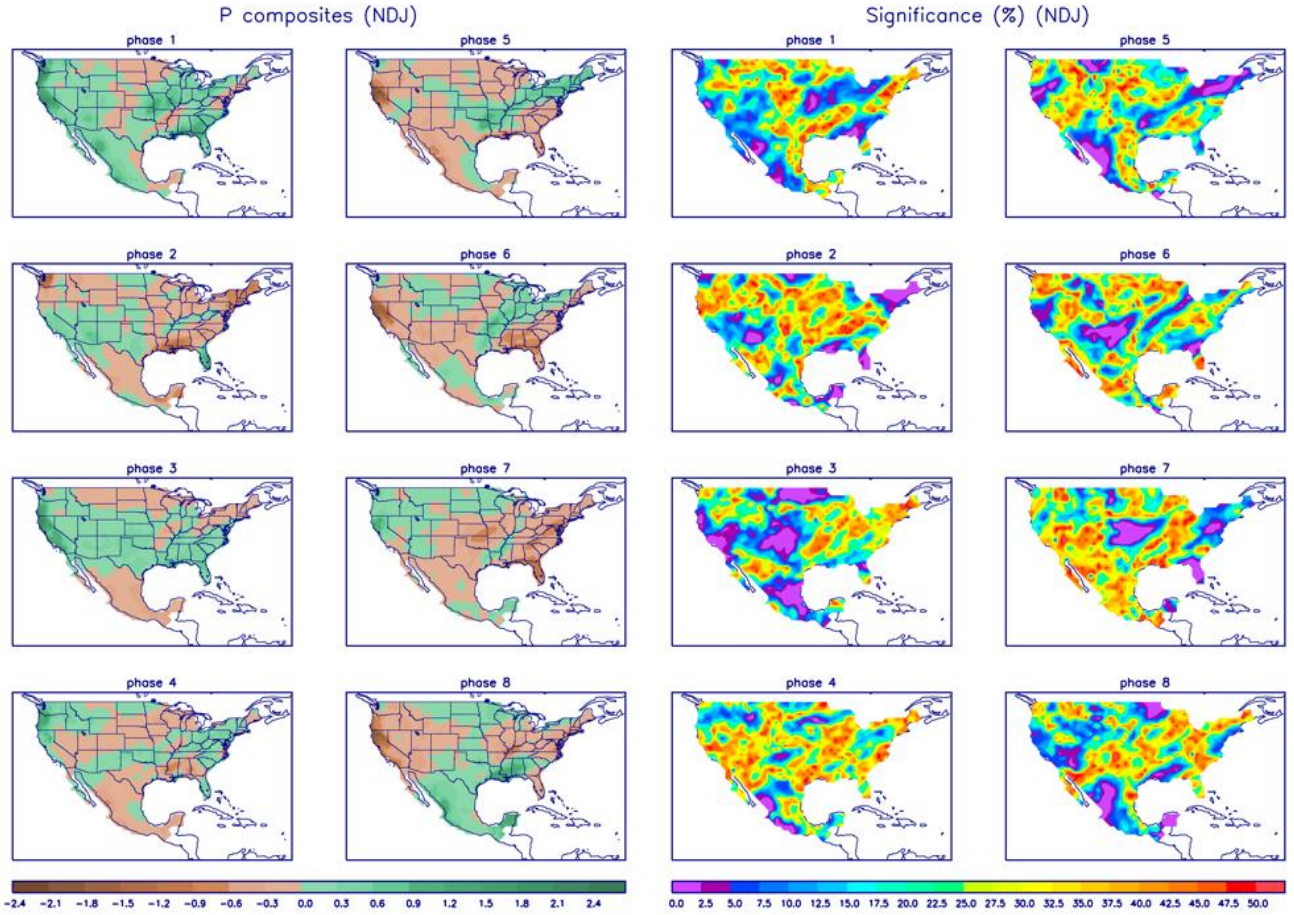


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - 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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