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

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

Overview

- The MJO remains weak, as the RMM index indicates the intraseasonal signal has returned to the Maritime Continent. The eastward evolution of this signal in RMM space is likely tied to the passage of a Kelvin wave over the Indian Ocean during the past week.

- Dynamical models generally feature a westward shift of the intraseasonal signal likely tied to Rossby wave activity favored over the Indian Ocean in the near-term, followed by eastward propagation over the Maritime Continent at a low amplitude during the next two weeks.

- While several ensemble members show a stronger MJO crossing the western Pacific later in the period, there remains a good deal of uncertainty in this realization given the strengthening low frequency base state associated with the ongoing La Niña.

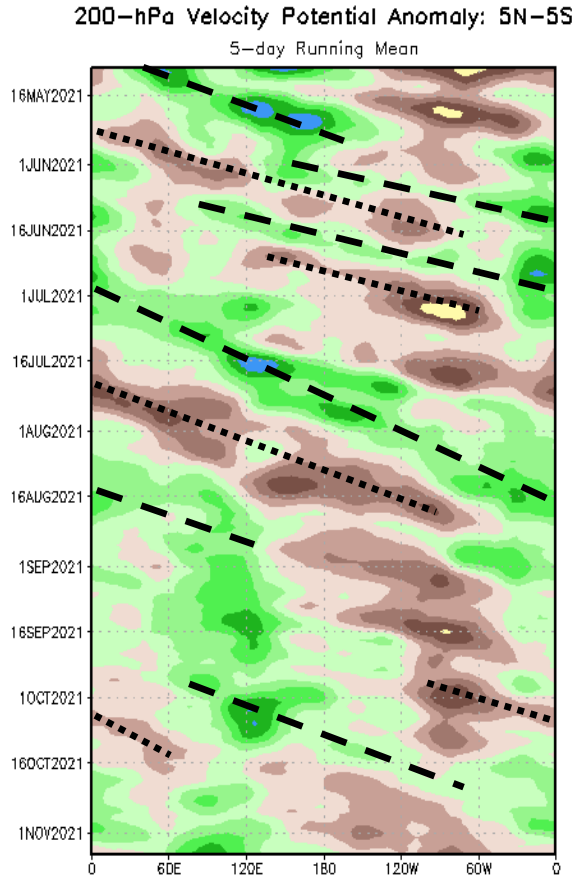
- The large scale environment is expected to be conducive for tropical cyclone development in the eastern Hemisphere. Conversely, quieter conditions are anticipated for the eastern Pacific and the Atlantic basins in conjunction with a less active climatology later in November.

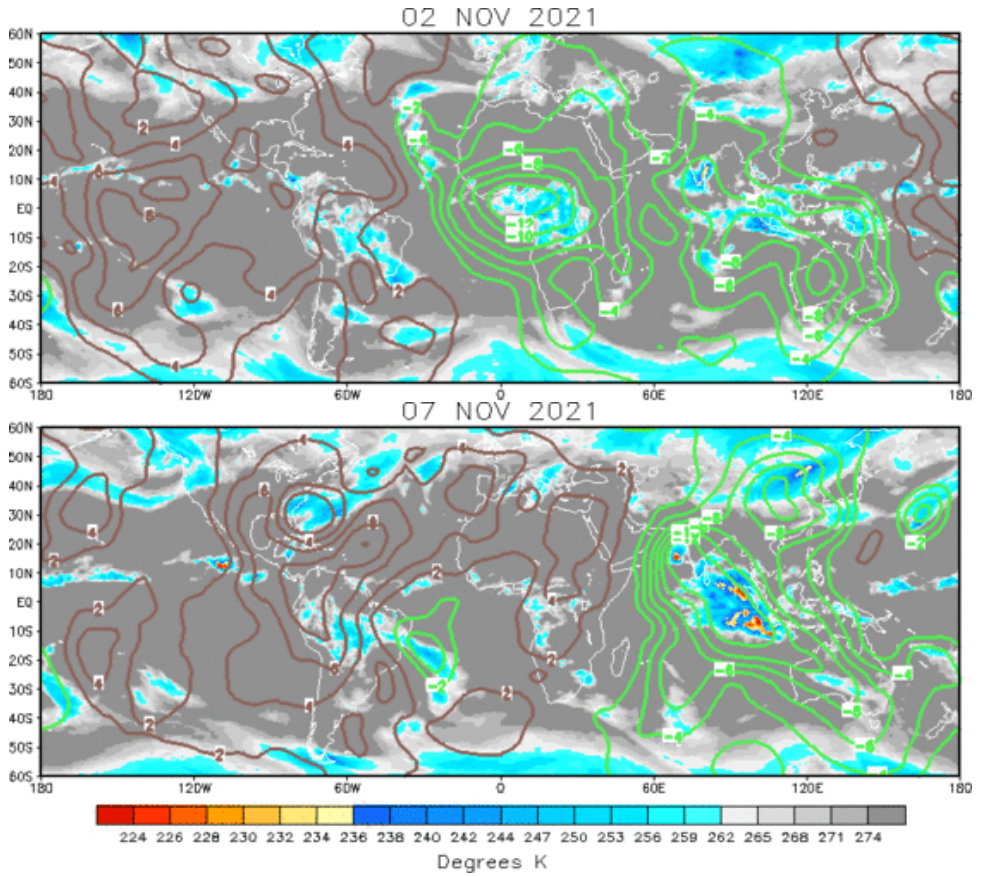
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



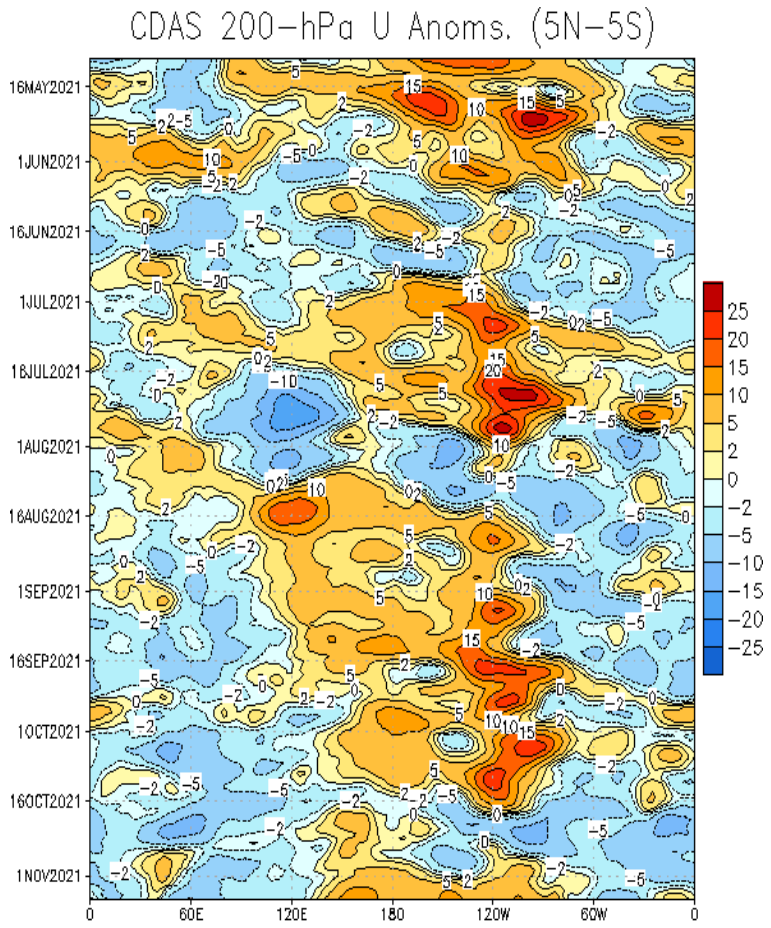


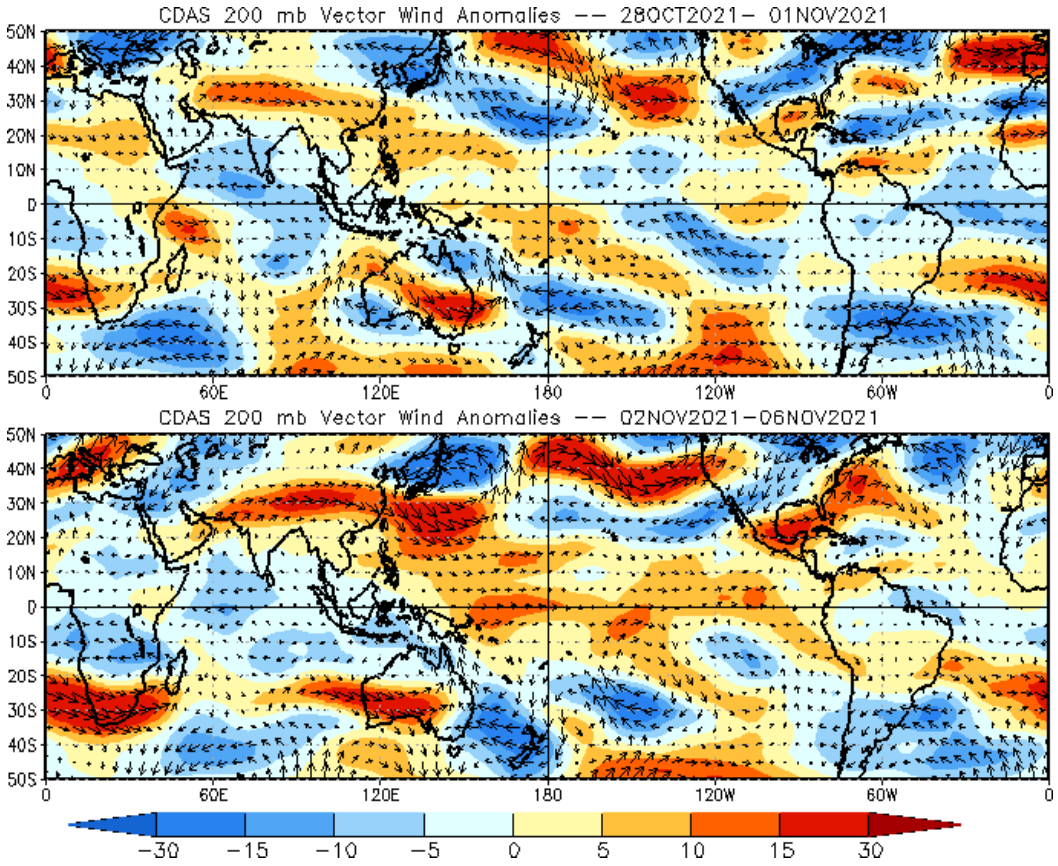
- A more coherent spatial pattern is observed in the upper-level velocity potential field, however, there continues to be little sign of an eastward propagating MJO envelope.

- A Kelvin wave is likely constructively interfering with low frequency footprint over the eastern Indian Ocean and Maritime Continent, contributing to an increase in anomalous upper-level divergence and convection over the region. Suppressed conditions have prevailed over the Western Hemisphere since early November.

200-hPa Wind Anomalies

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



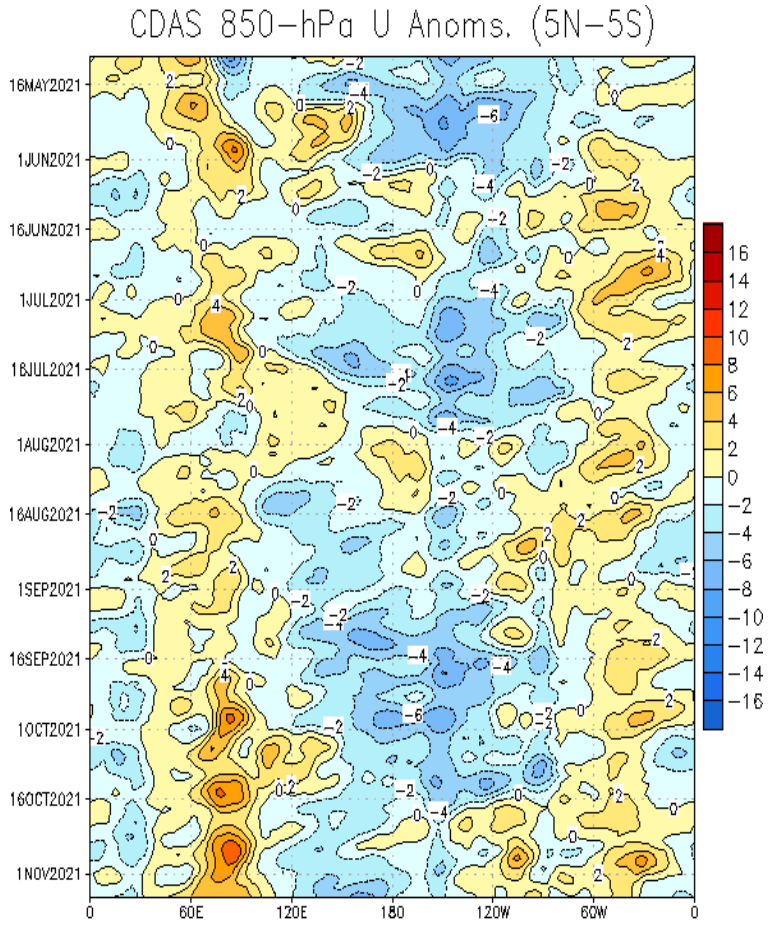


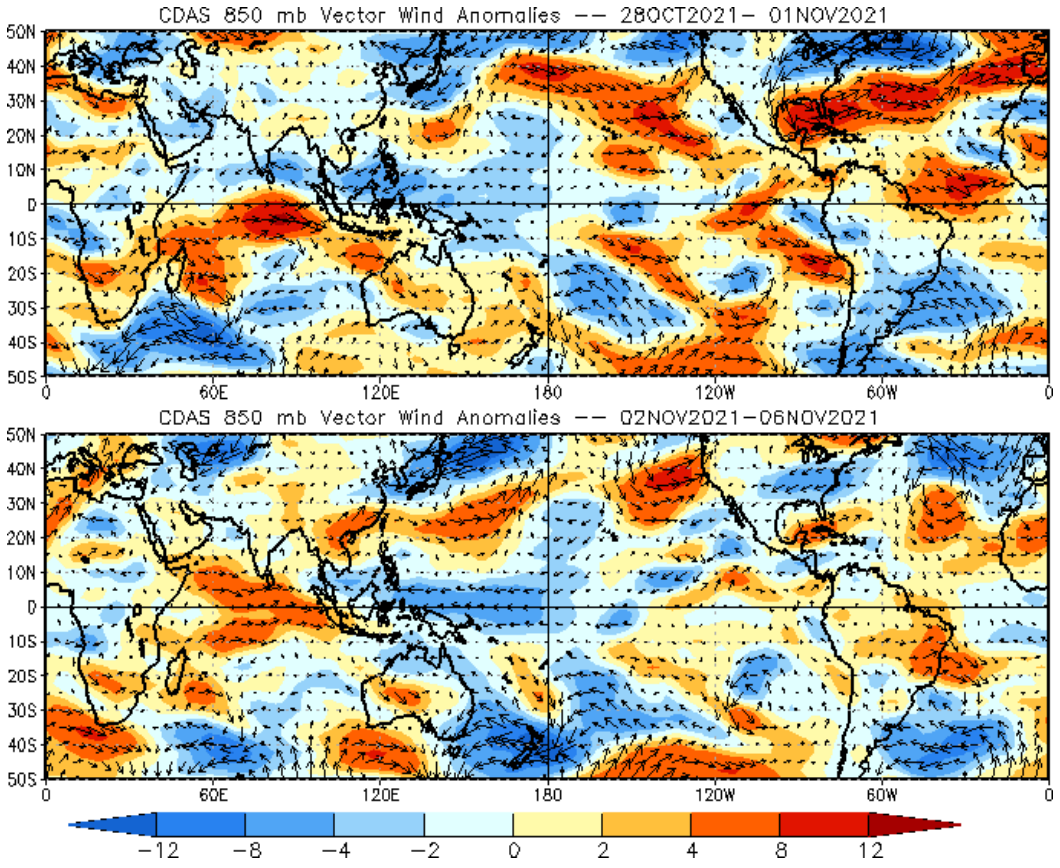
- Following the development of upper-level easterly anomalies likely tied to an eastward propagating feature last month, anomalous westerlies have since returned throughout much of the equatorial Pacific, consistent with the low frequency base state.

- An anomalous anti-cyclonic circulation aloft aided in the strengthening of anomalous westerlies across the western Pacific.

850-hPa Wind Anomalies

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





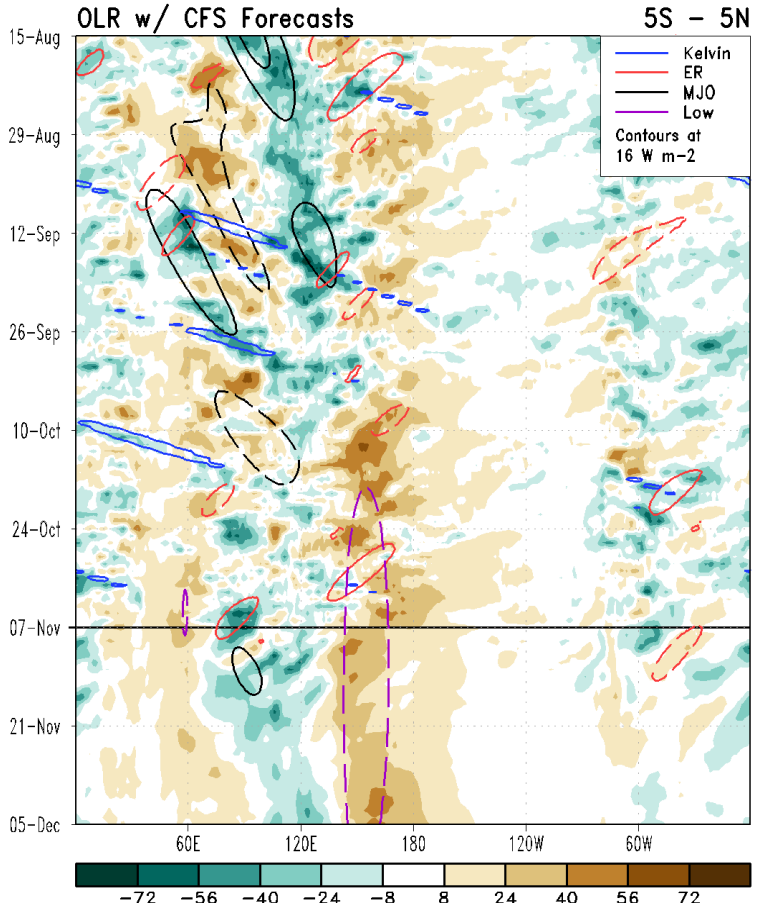
- Anomalous westerlies persist over parts of the central and eastern equatorial Pacific, as enhanced trades remain primarily to the west of the Date Line.

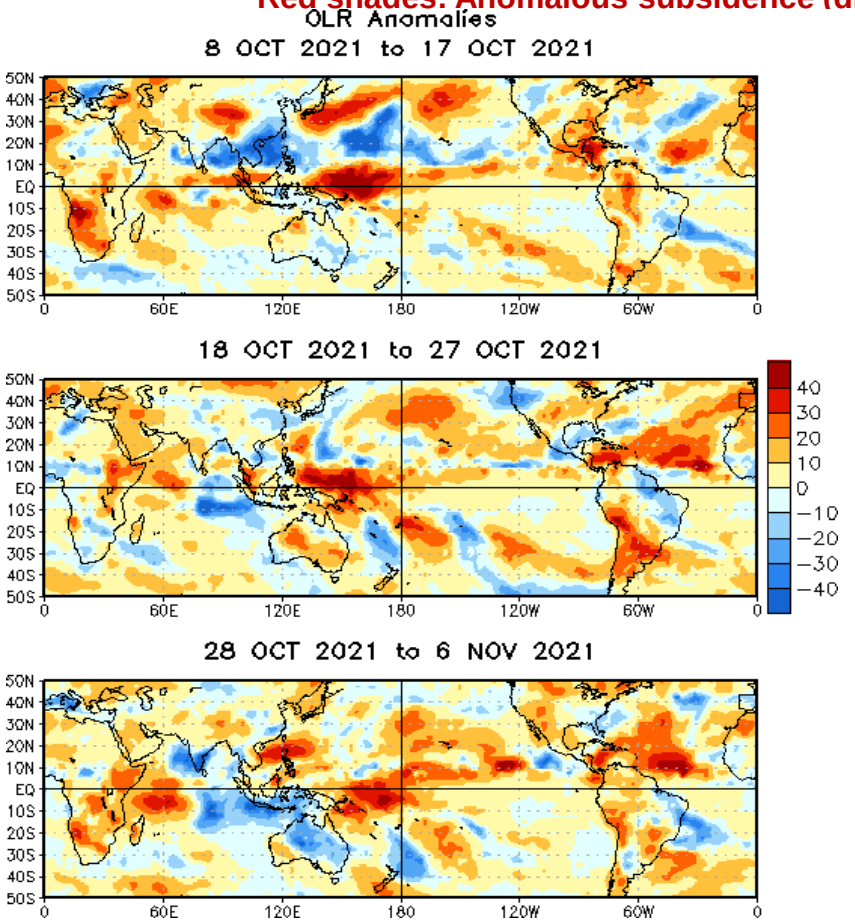
- Anomalous westerlies also persist over the equatorial Indian Ocean, and over the Atlantic Basin.

Outgoing Longwave Radiation (OLR) Anomalies

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

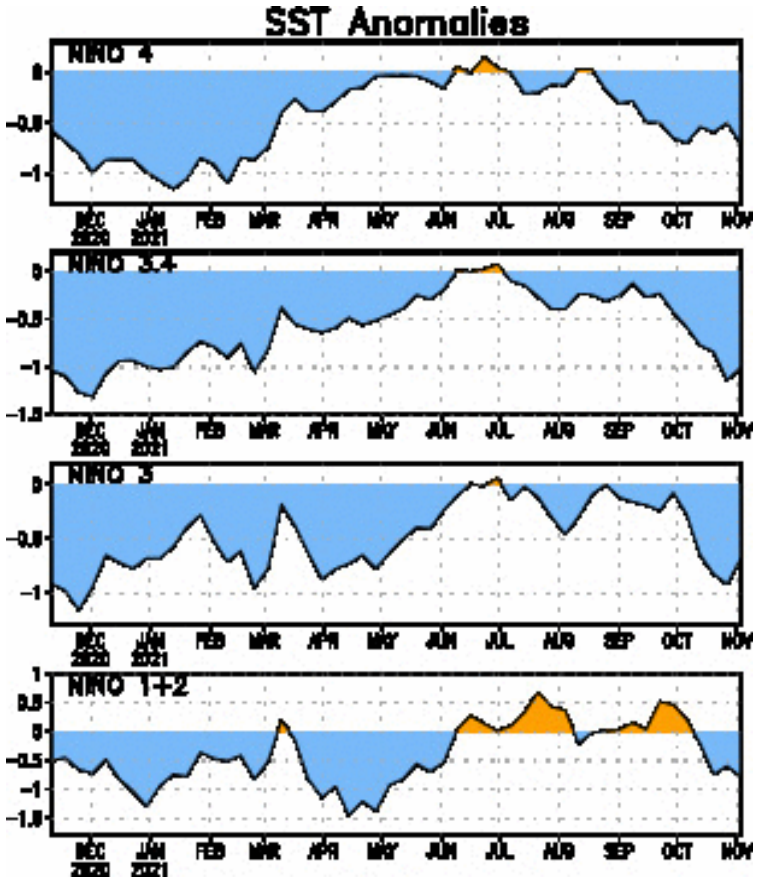
Blue shades: Anomalous convection (wetness)
Red shades: Anomalous subsidence (dryness)

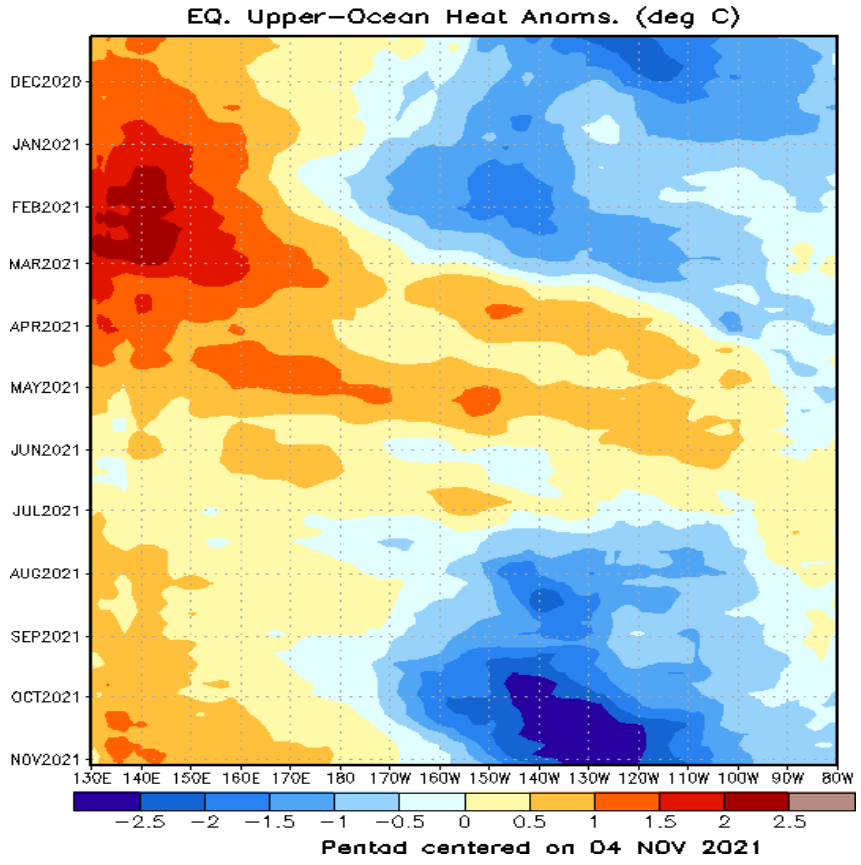




- The low frequency convective footprint near 120E was disrupted during October following an uptick in intraseasonal activity, however enhanced convection is favored to prevail over the region in the model guidance.
- Suppressed convection remains fairly robust to the west of the Date Line along the equator, which is likely to impede continued eastward propagation of the MJO.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



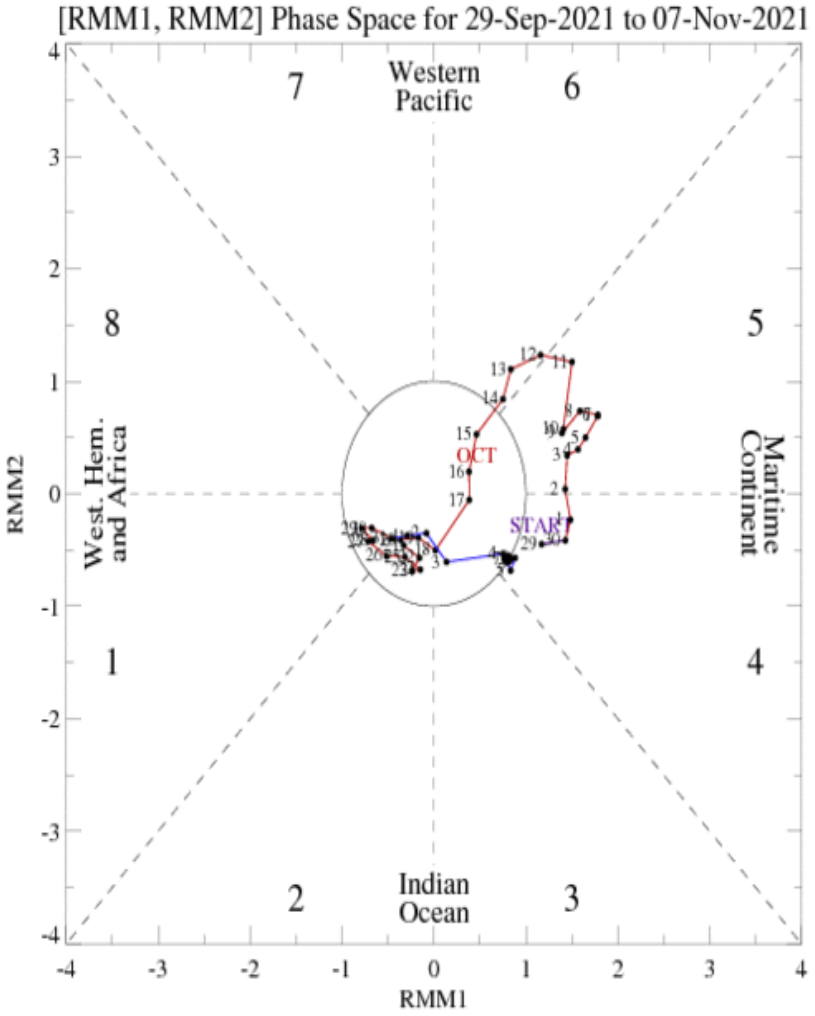


- Upper-ocean heat content is markedly below average across much of the central and eastern equatorial Pacific, as this sub-surface cooling has expanded eastward since early October.

- Consistent with the development of La Niña, below-normal sea surface temperatures are now observed within all Niño regions, where Nino 3 and 3.4 values have significantly cooled during the last month.

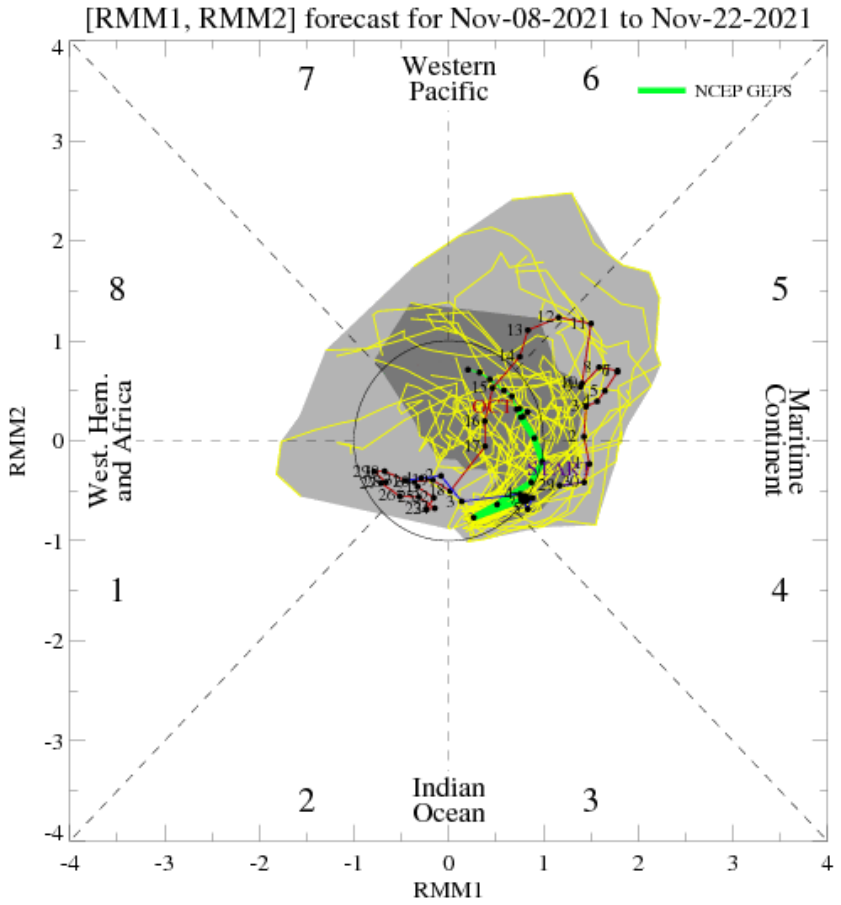
MJO Index: Recent Evolution

- The RMM index indicates the intraseasonal signal has recently returned to the Maritime Continent at a low amplitude.
- The eastward evolution of this signal is likely tied to a convectively coupled Kelvin wave during the last week.

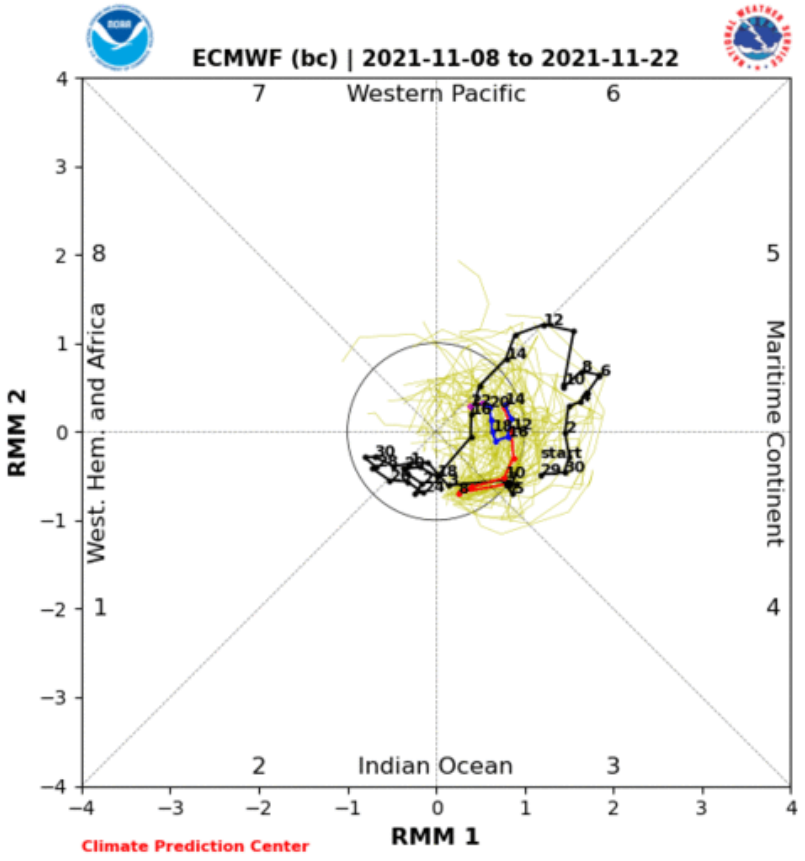


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



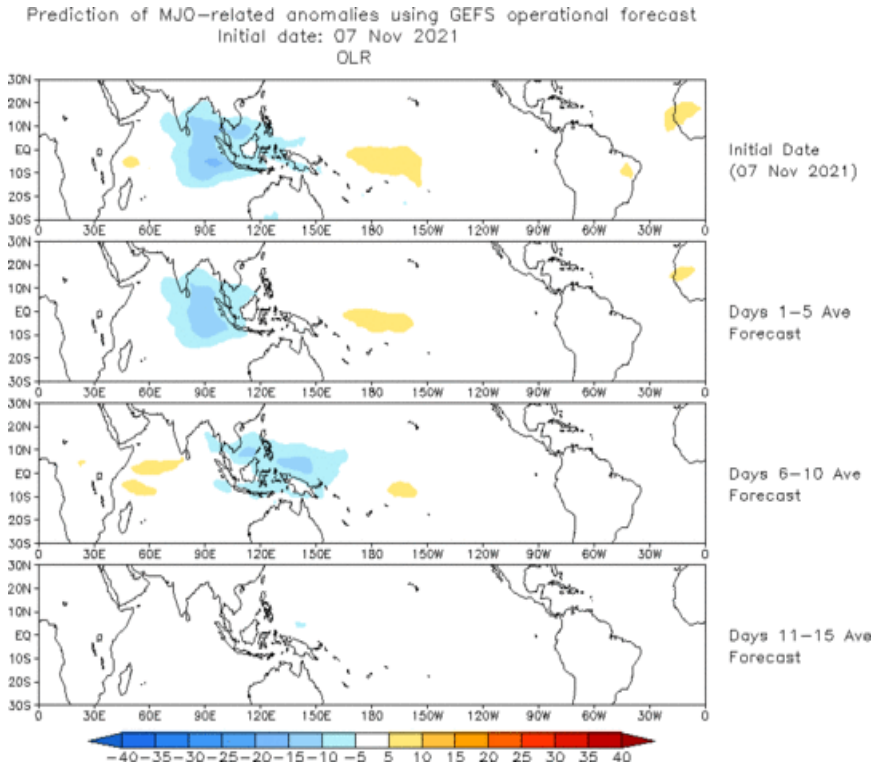
ECMWF Forecast

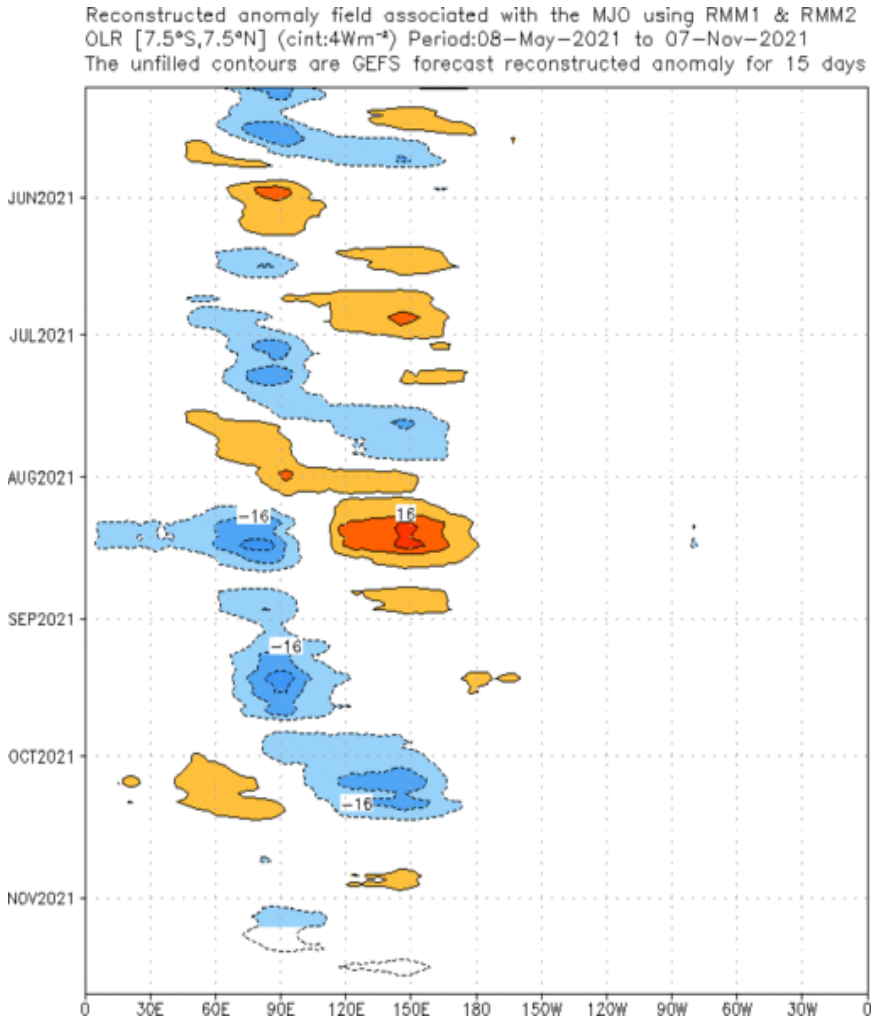
- There is general agreement in the dynamical models favoring a westward shift of the signal likely tied to Rossby wave activity in the Indian Ocean in the near-term, followed by eastward propagation back into the Maritime Continent at a low amplitude during the next two weeks.

- Ensemble spread remains high contributing to uncertainty in the outlook. Some ensemble members point to the emergence of a high amplitude event reaching the Western Pacific, however confidence is low in this realization given the La Niña base state.

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.)

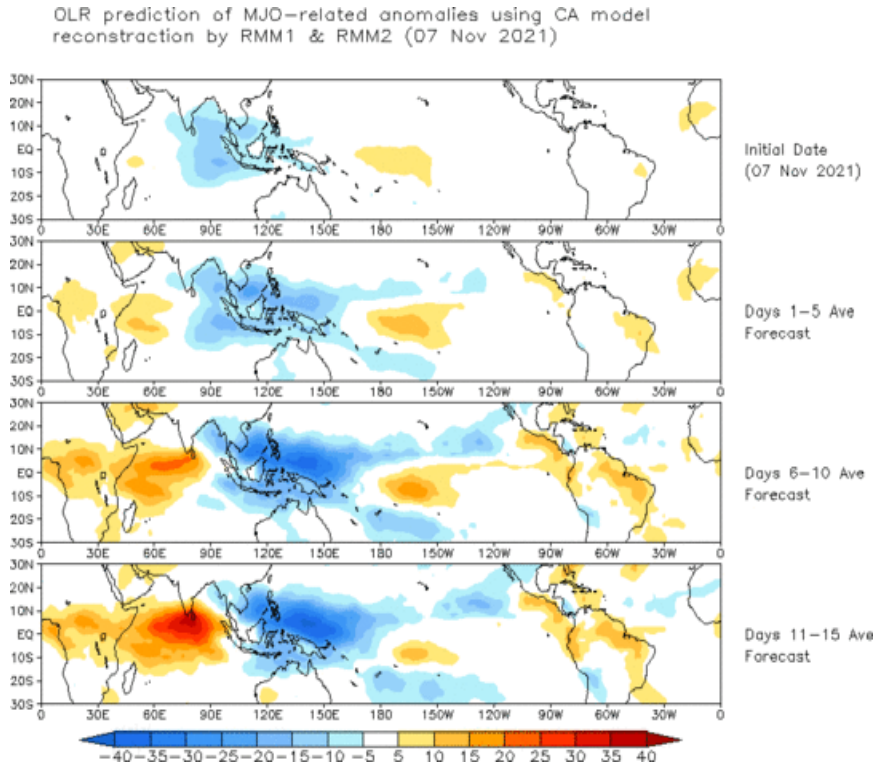


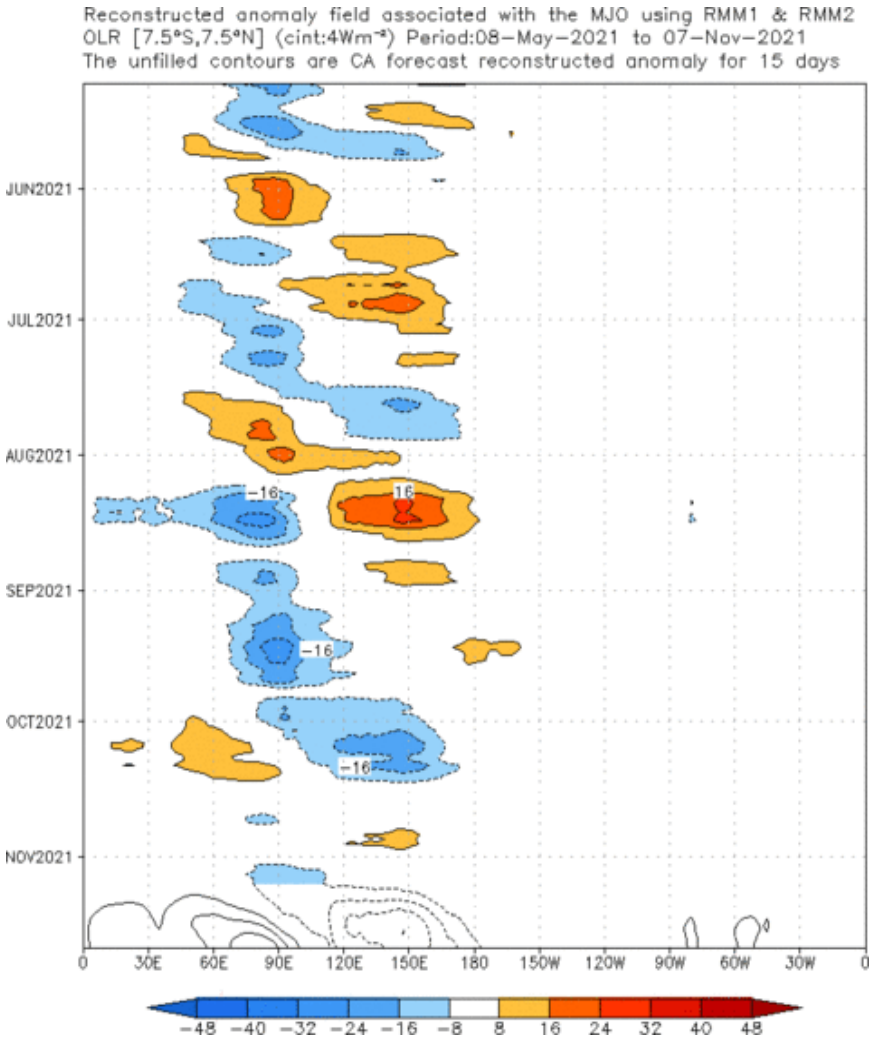


- The GEFS RMM-based OLR anomaly forecast features enhanced convection shifting eastward with time, but rapidly weakens by the end of week-2. Convective anomalies appear tenuous over the Western Hemisphere during the next two weeks.

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.)

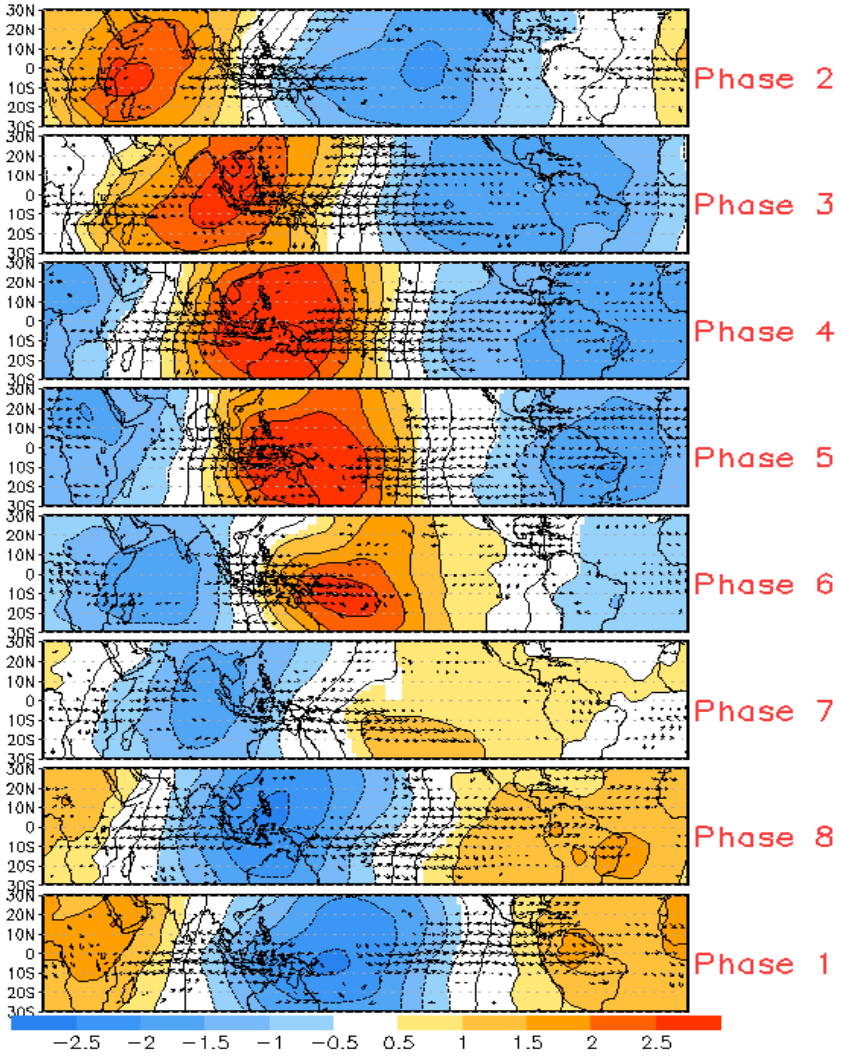




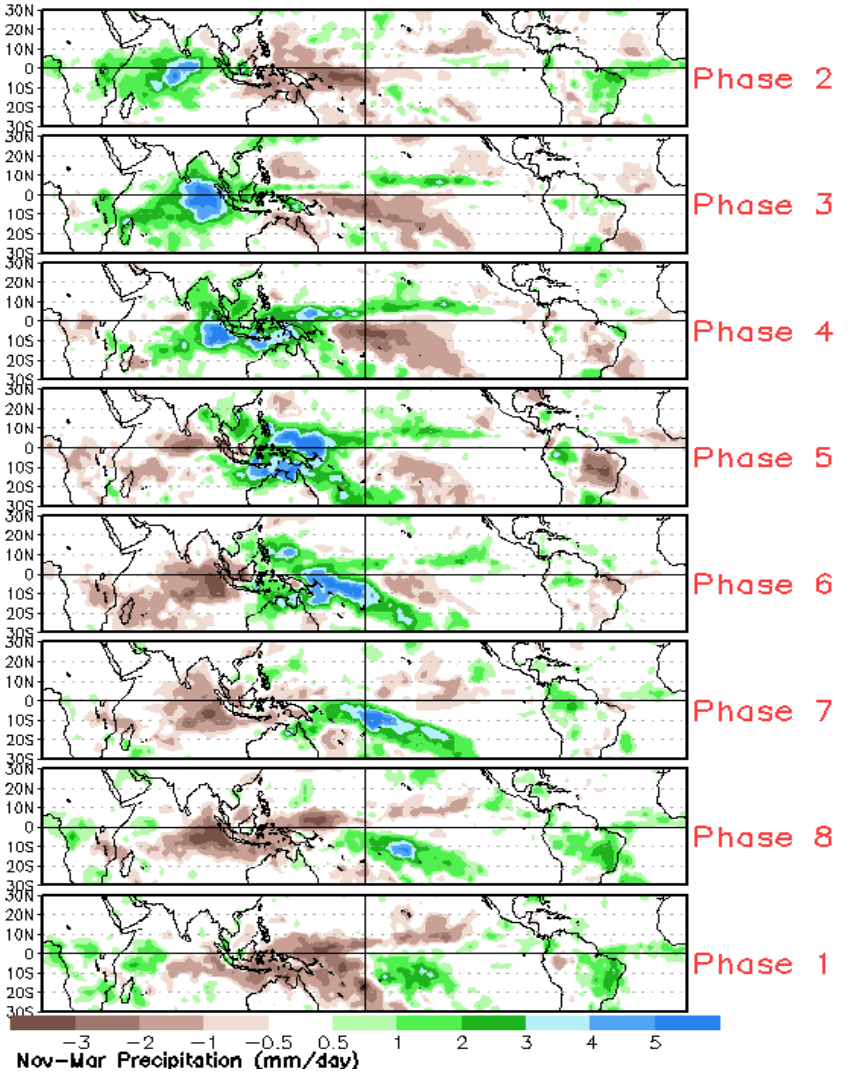
- The constructed analog depicts a similar evolution of the convective pattern to that of the GEFS, but is much more robust in regards to magnitude and spatial extent, particularly across the Western Pacific during week-2.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



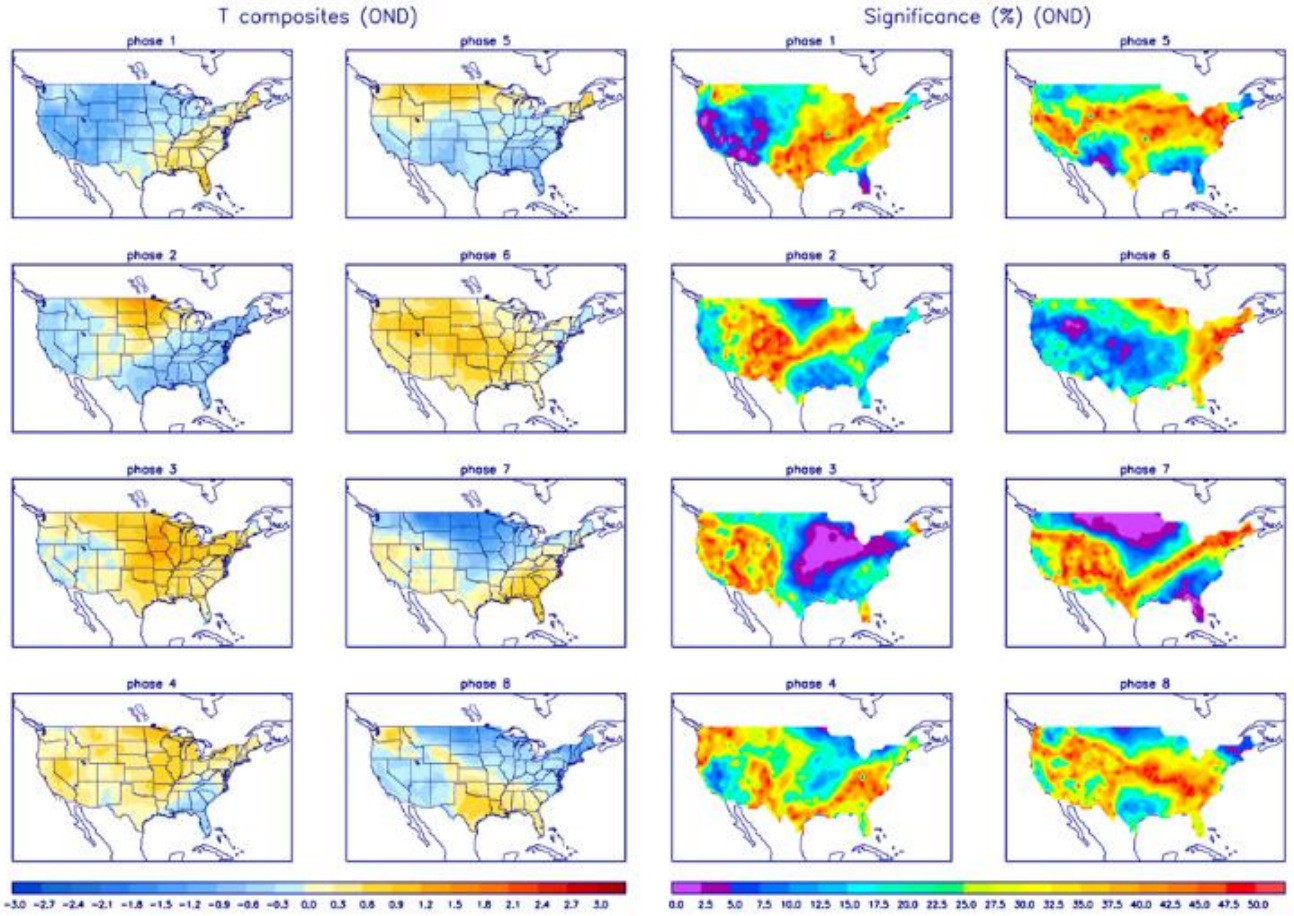
Precipitation Anomalies



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.

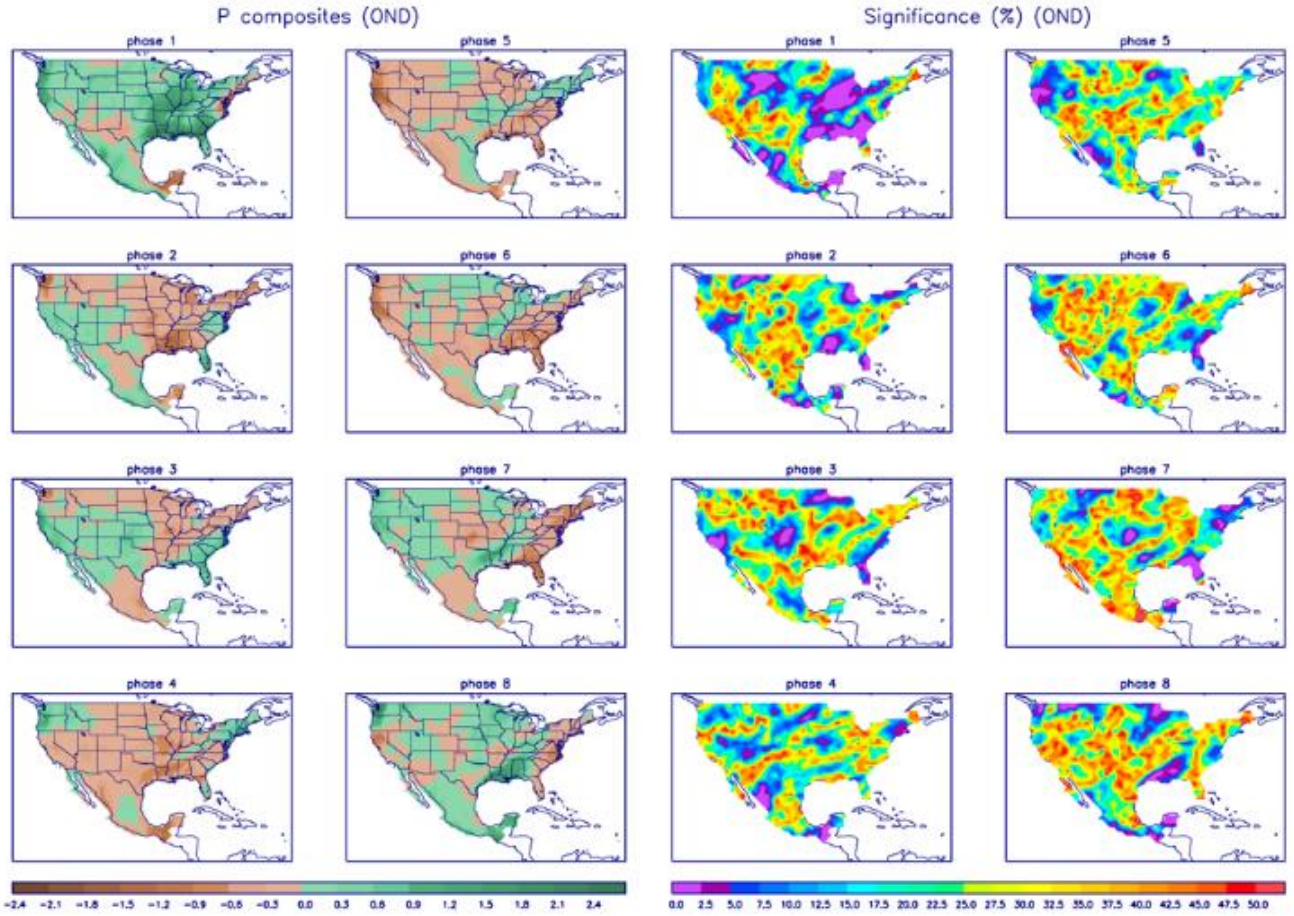


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - 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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