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

**Update prepared by the Climate Prediction Center**
**Climate Prediction Center / NCEP**
**22 November 2021**

# Overview

- The RMM-based MJO index remains weak and reflective of enhanced convection over the Maritime Continent, which is consistent with La Niña conditions.

- There appears to be a developing MJO signal propagating from the Maritime Continent to the West Pacific – apparent primarily in the Southern Hemisphere.

- Rossby wave activity over the eastern Indian Ocean (also Tropical Storm Paddy) is interfering with the intraseasonal signal.

- Dynamical model MJO index forecasts are generally consistent with Rossby wave activity during Week-1, but both the GEFS and ECMWF depict fast eastward propagation to the Pacific during Week-2. Some ensemble members depict a strong event.

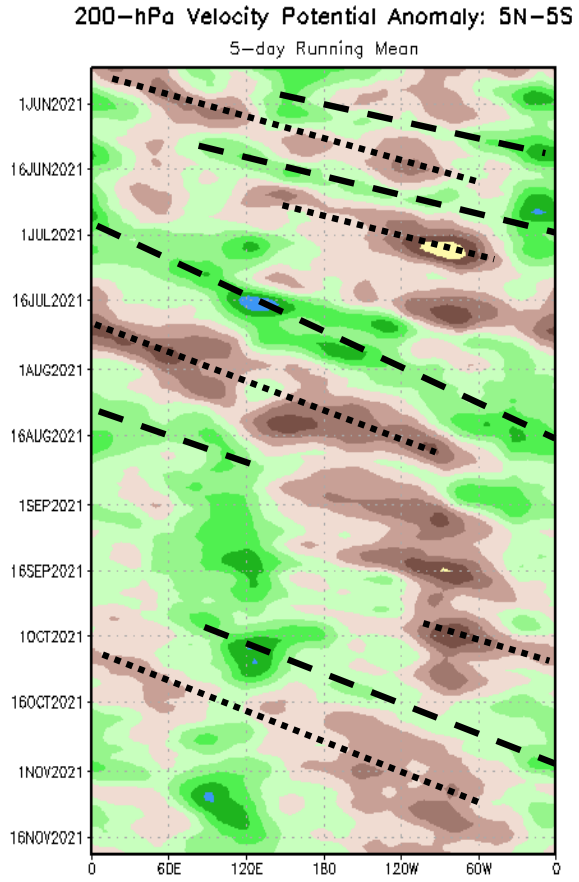
- Due to destructive interference, any emerging Pacific MJO event would likely be most pronounced over the Southern Hemisphere.

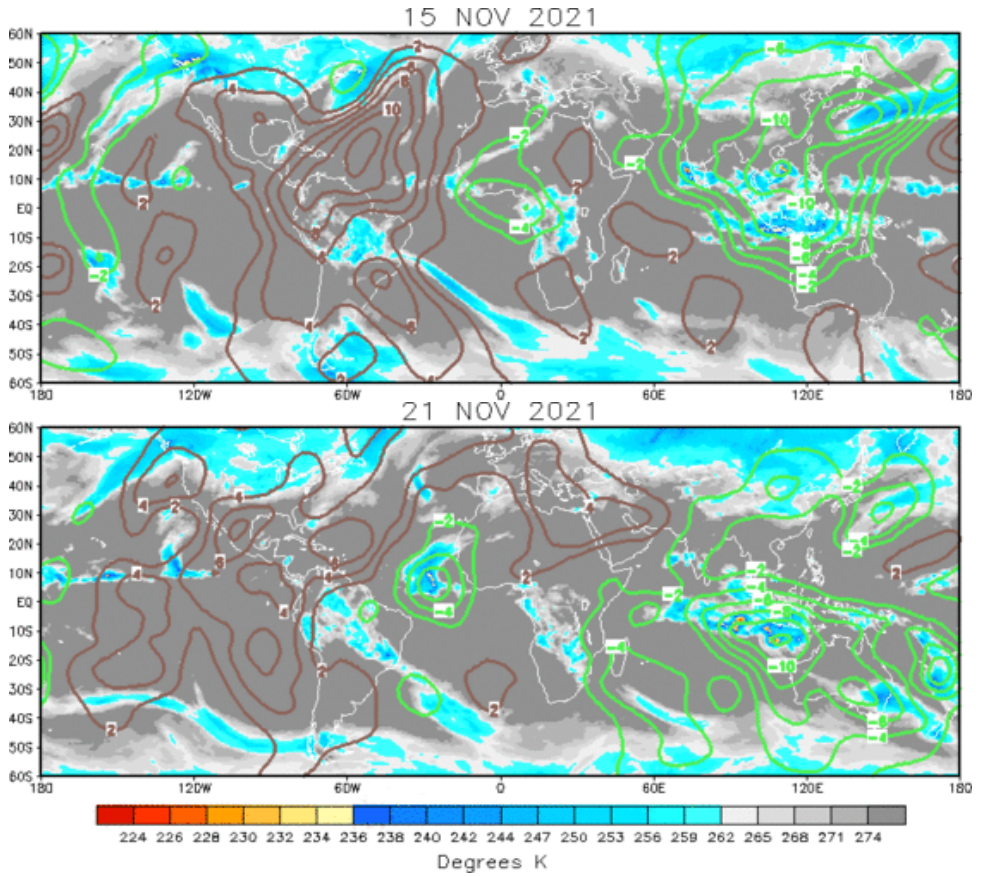
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

# 200-hPa Velocity Potential Anomalies

**Green shades: Anomalous divergence (favorable for precipitation).**

**Brown shades: Anomalous convergence (unfavorable for precipitation).**

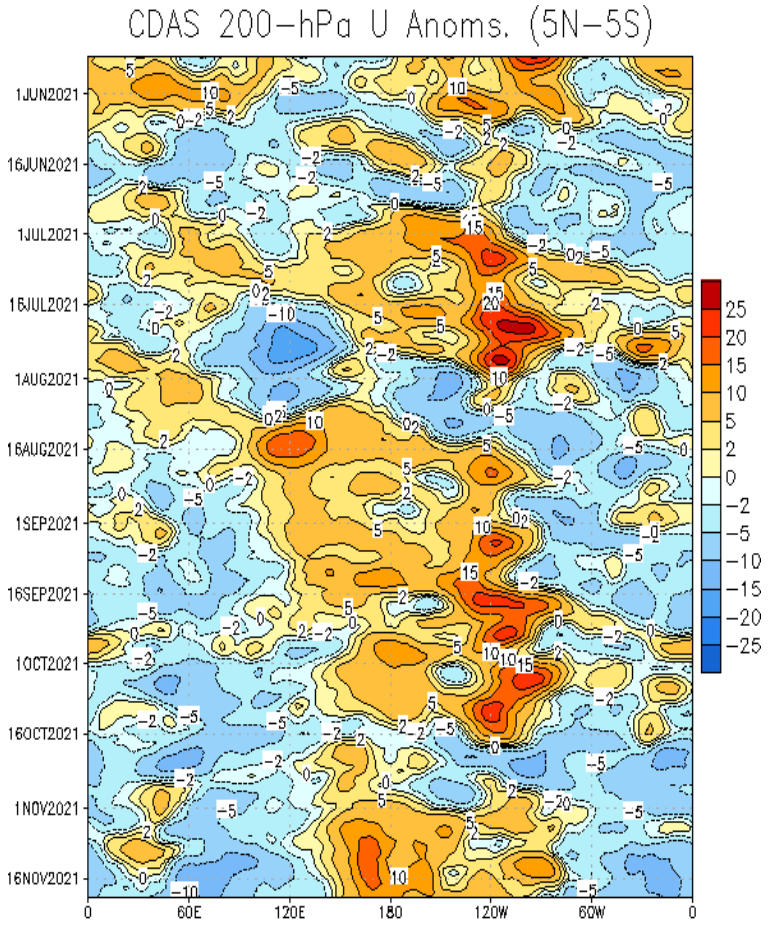


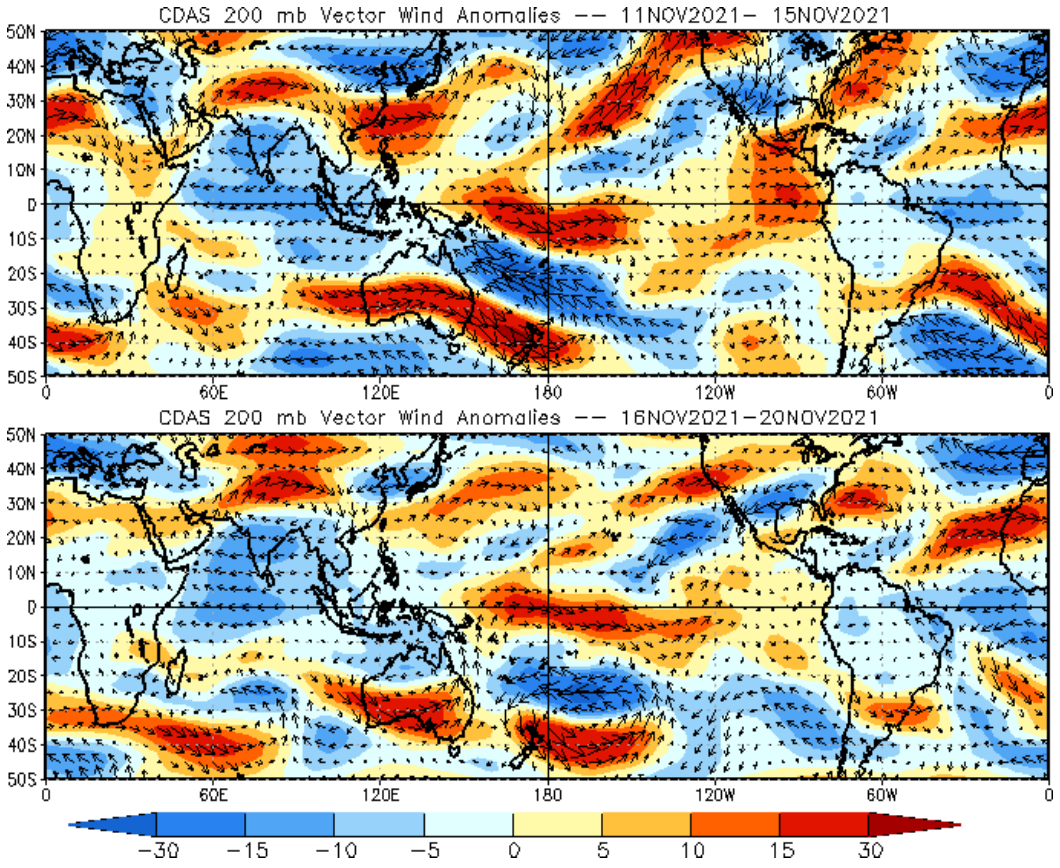




- The overall pattern remains reflective of the La Niña base state, modulated by Kelvin and Rossby wave activity.
- There is some evidence of an eastward propagating signal, with enhanced divergence shifting to the SPCZ region.

# 200-hPa Wind Anomalies

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

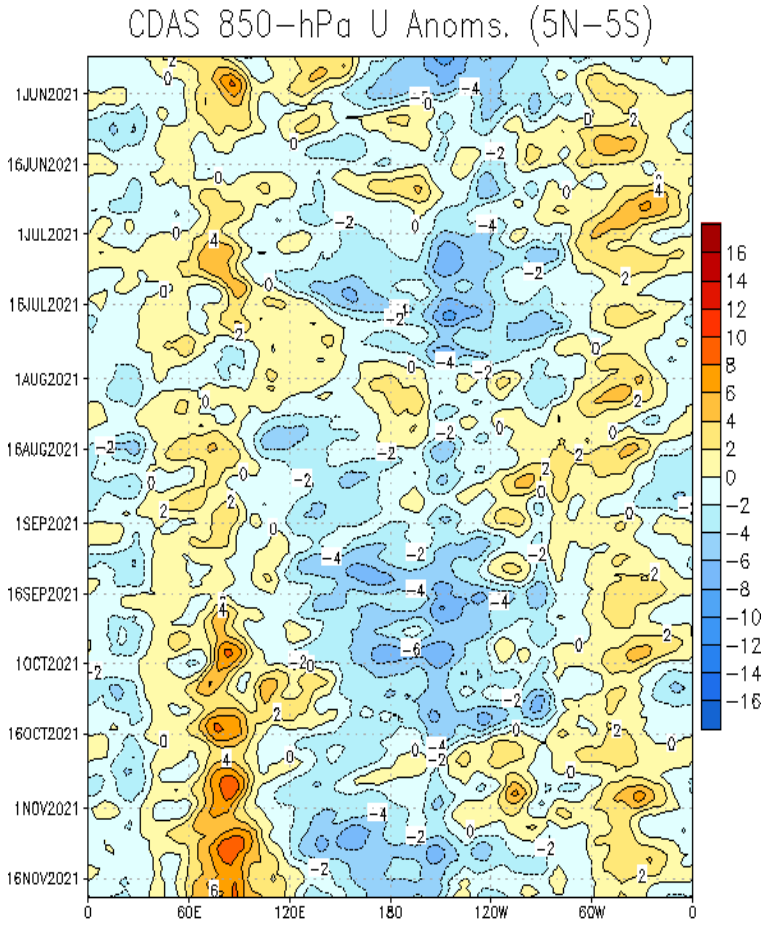


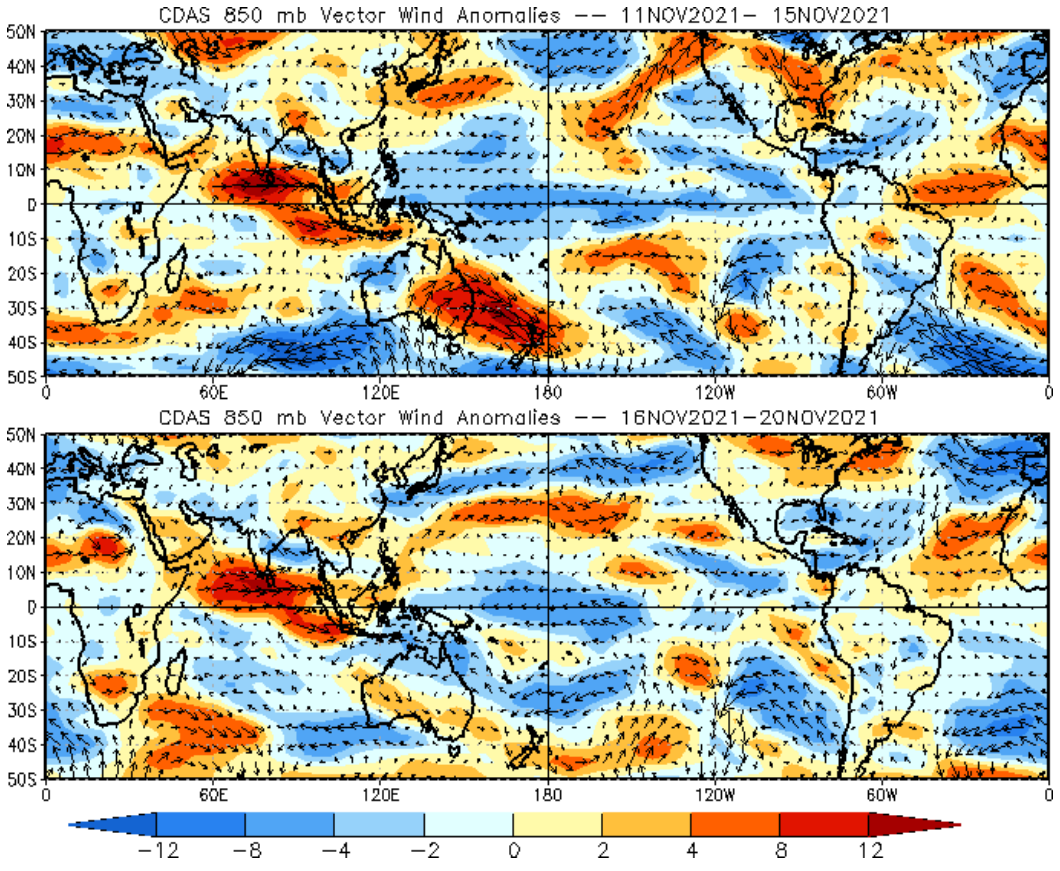




- Strong easterly anomalies aloft remain entrenched over the Pacific.
- The upper-level pattern appears to be driven primarily by the La Niña base state.

# 850-hPa Wind Anomalies

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



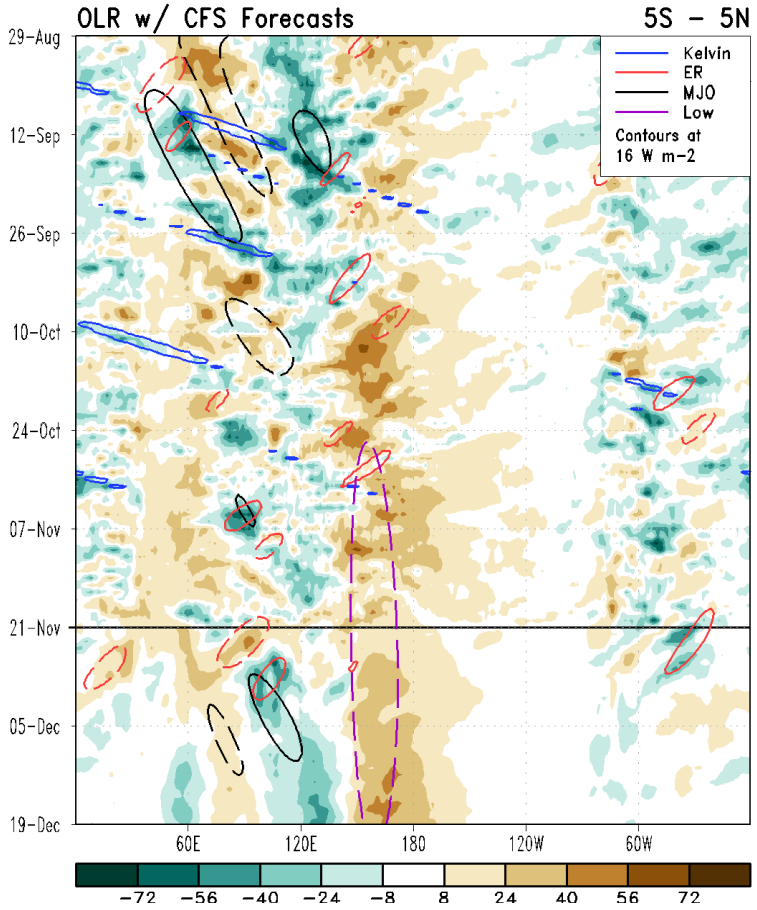

- Low-level westerlies (easterlies) persisted over the Indian Ocean and western Maritime Continent (Pacific) through mid-November, reflective of the low frequency base state.

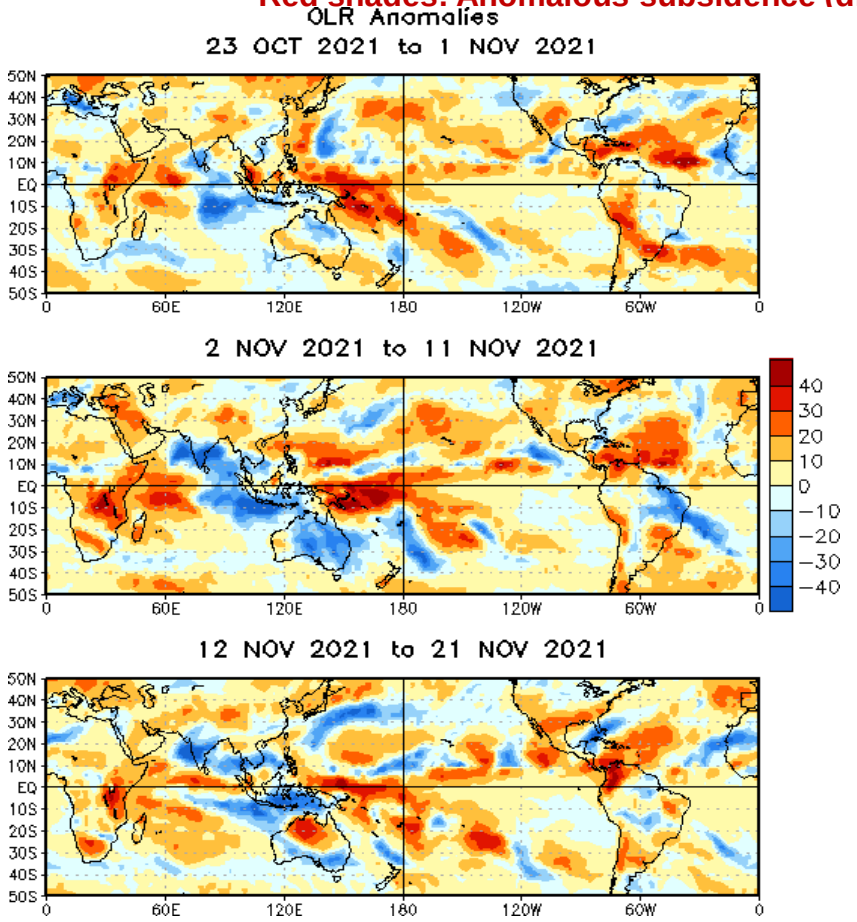
- While enhanced trades remain robust near the Equator, some westerly anomalies have developed along the SPCZ region.

# 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)**

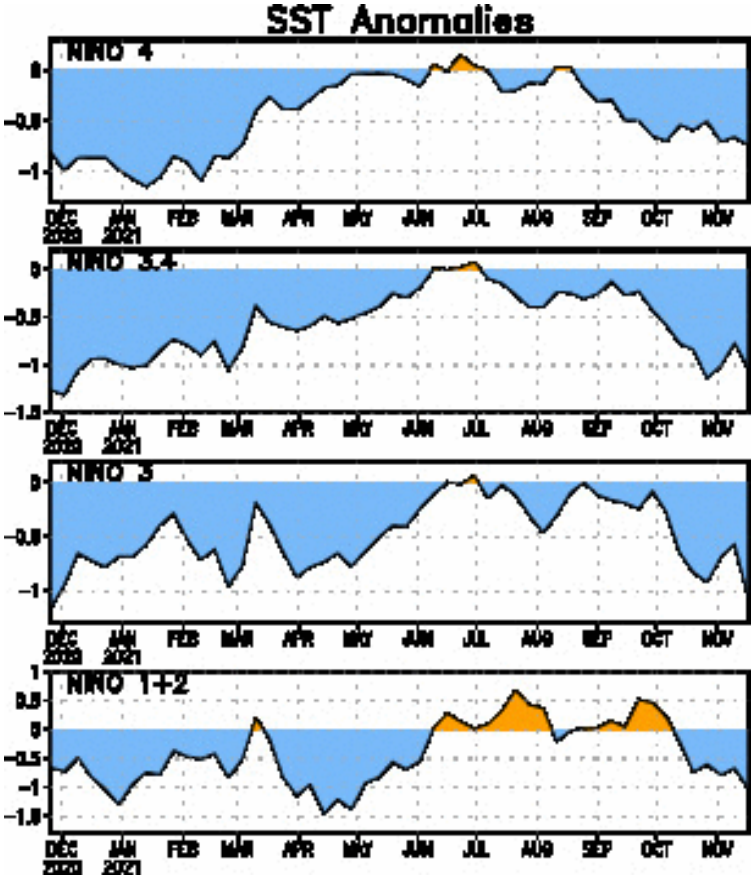


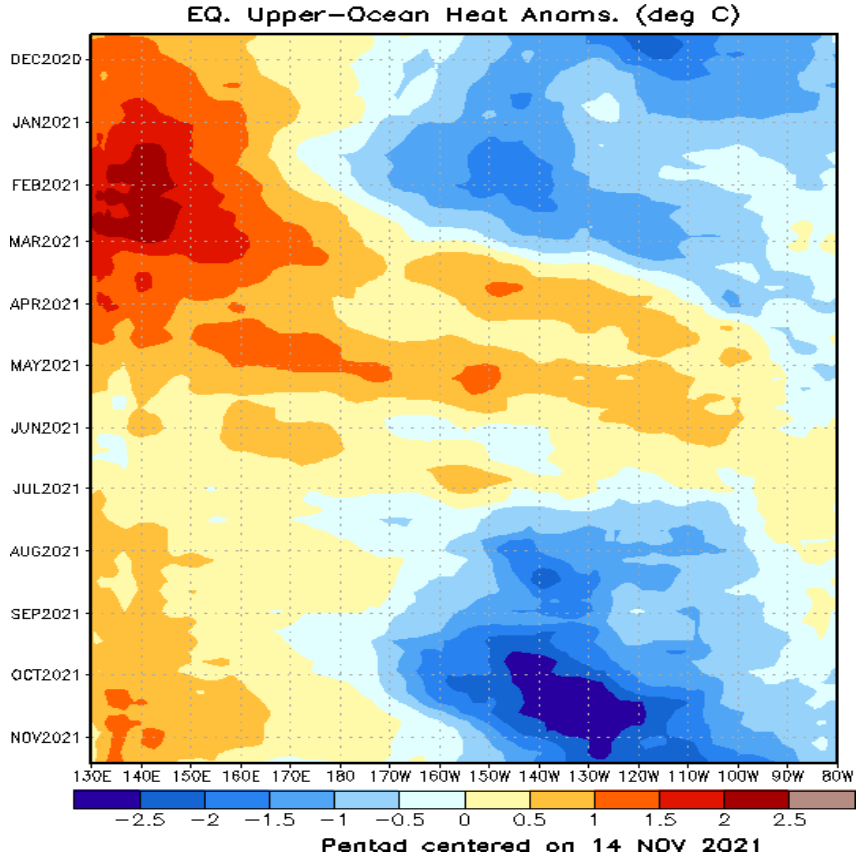




- Convection remains suppressed just west of the Date Line as the low frequency state prevents any substantial response to the weak intraseasonal signal.

- The CFS favors a slow eastward shift to the enhanced signal over the Maritime Continent, with enhanced precipitation developing west of 60E.

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

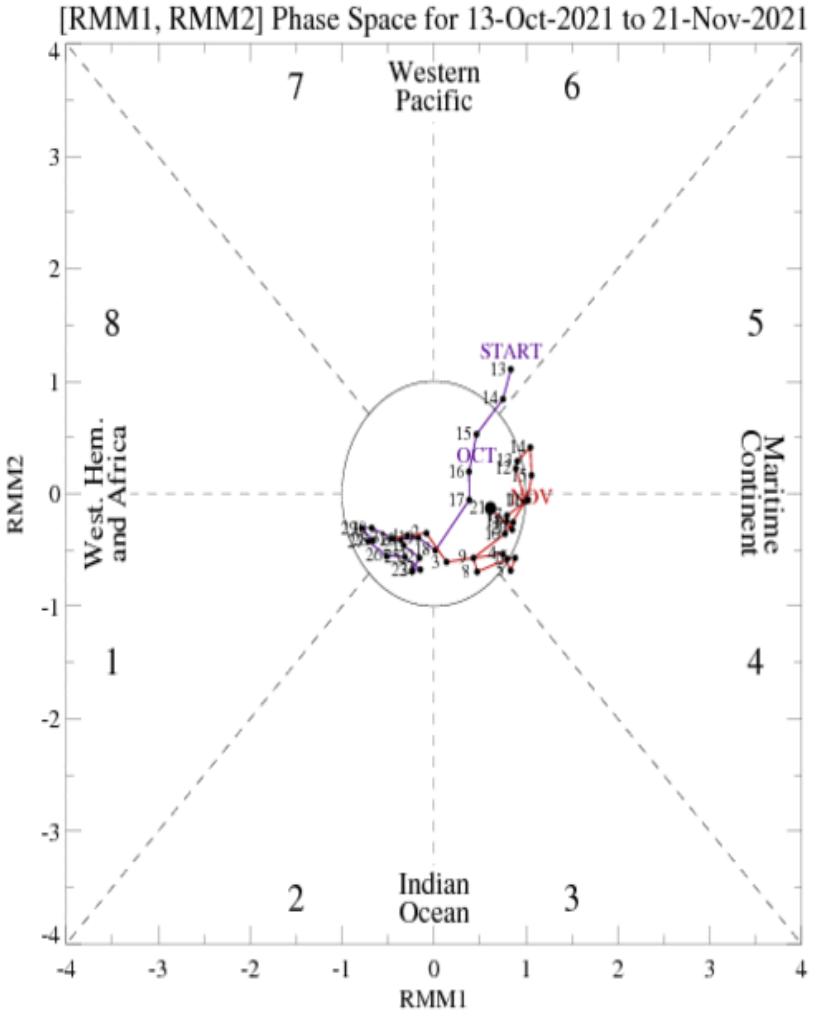



- Upper-ocean heat content is markedly below average across much of the central and eastern equatorial Pacific, as this sub-surface cooling has expanded eastward since early October.
- Consistent with La Niña, below-normal sea surface temperatures (SSTs) continue to be observed within all Niño regions, with SSTs holding steady or decreasing during November.

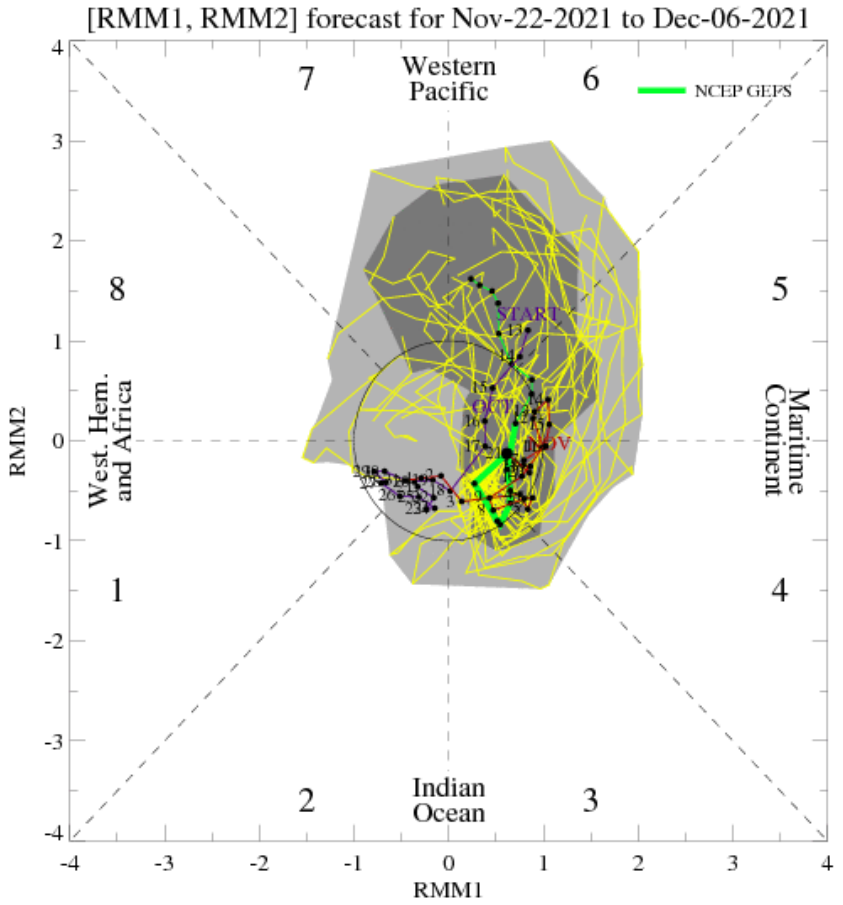
# MJO Index: Recent Evolution

- The RMM based MJO index remains weak and reflective of a somewhat enhanced Maritime Continent.
- Little eastward propagation is evident, reflective of the La Niña base state.

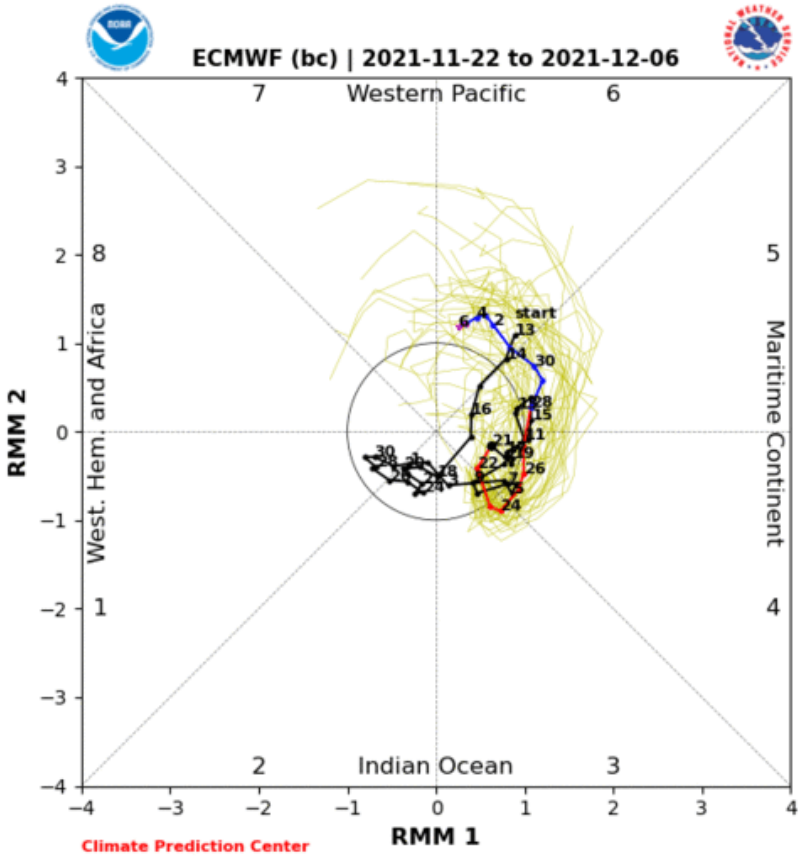



For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

# MJO Index: Forecast Evolution




GEFS Forecast

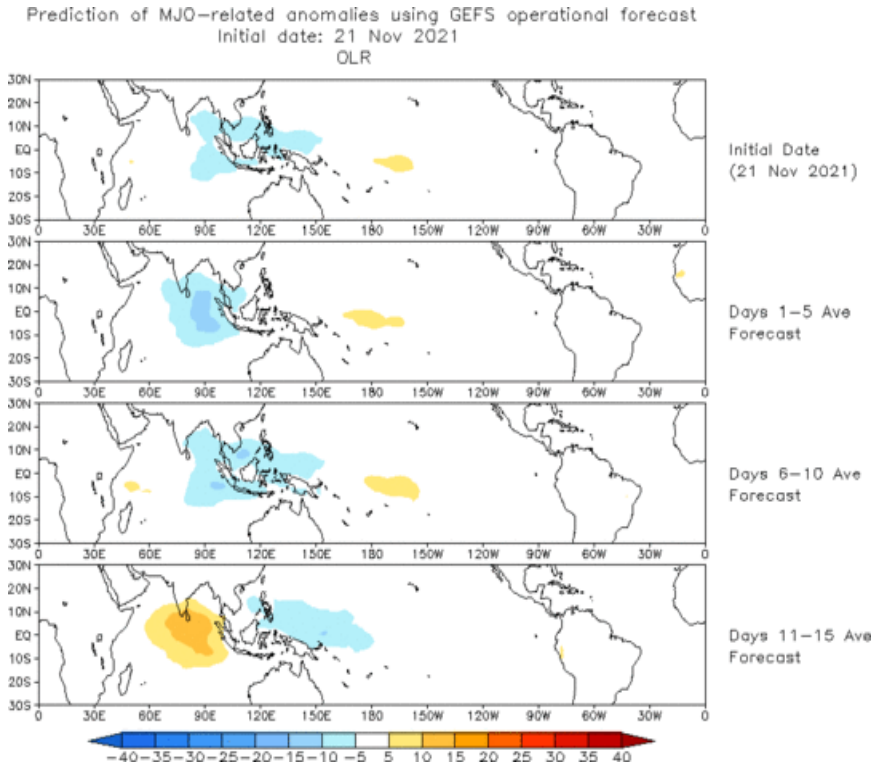


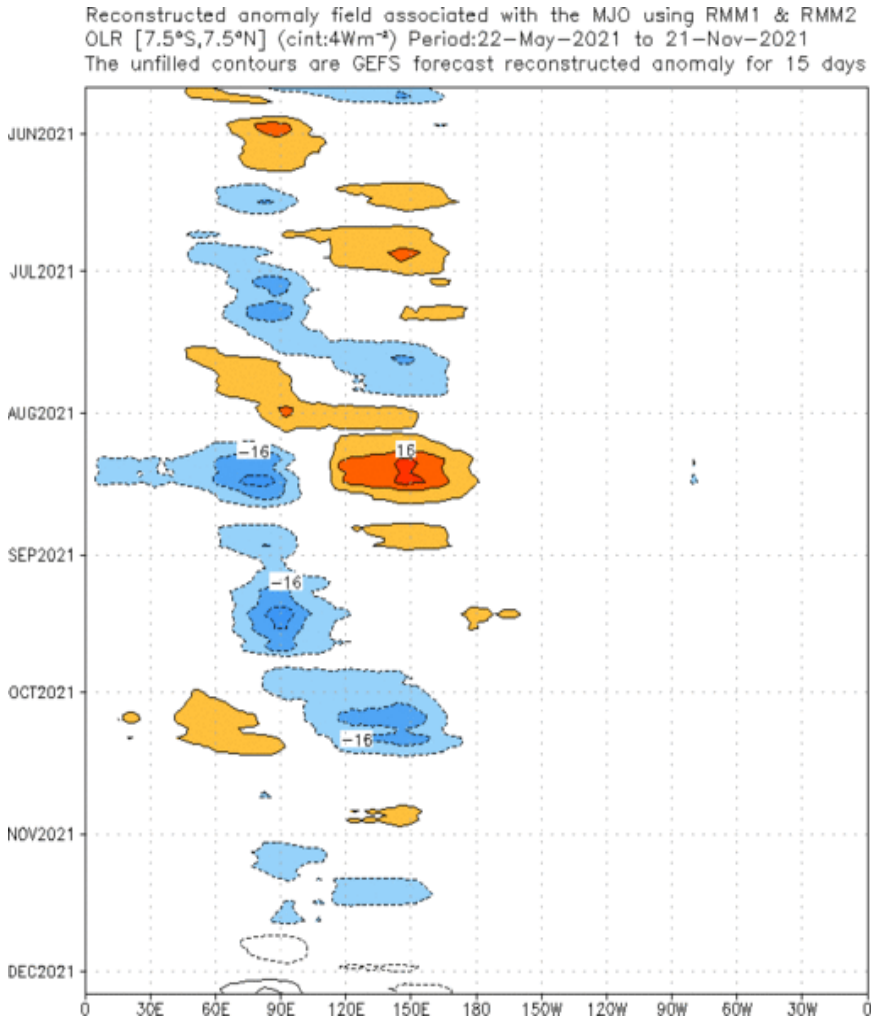

ECMWF Forecast

- The GEFS and ECMWF both depict little movement of the signal during Week-1, with some evidence of Rossby wave activity, followed by rapid eastward propagation to the Pacific during Week-2.
- The robust signal and model consistency indicates a potential for renewed MJO activity destructively interfering with the base state, but given the ongoing La Niña conditions, significant convection over the central Pacific remains fairly unlikely.

# 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.)

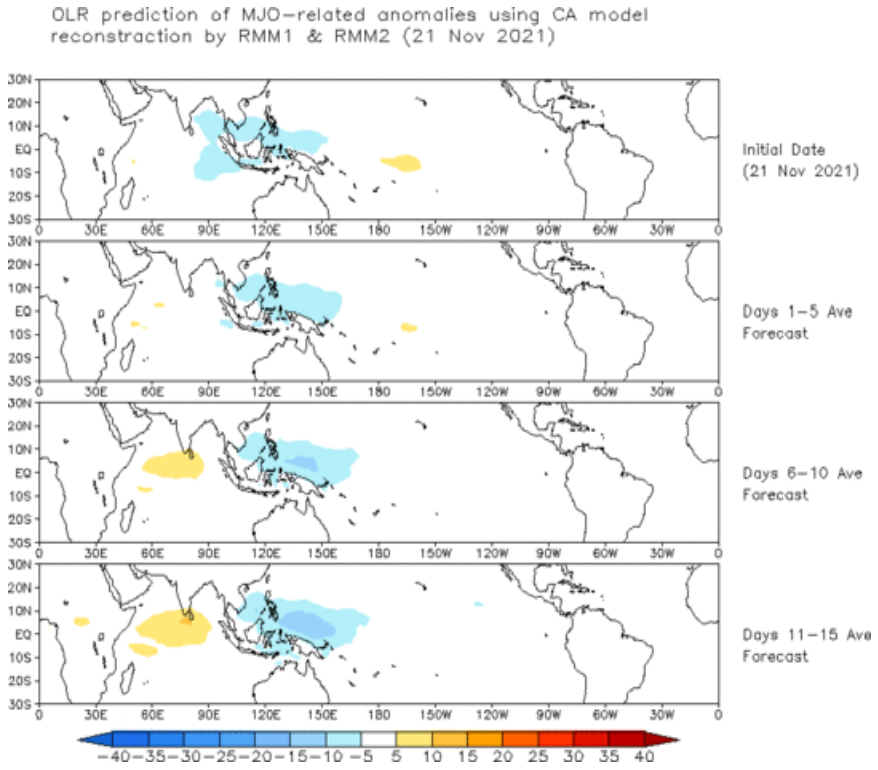


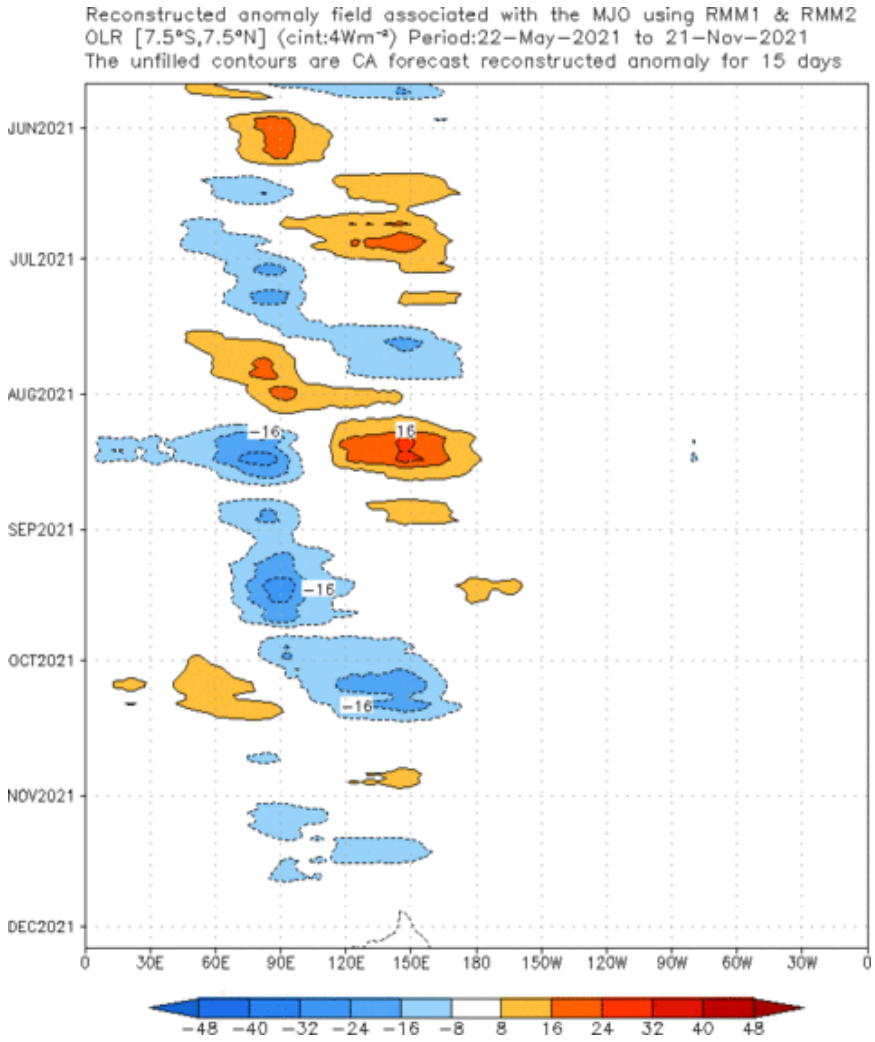




- The GEFS RMM-based OLR anomaly forecast depicts amplifying convection over the eastern Indian Ocean early in the two-week period, followed by a rapid transition to a West Pacific MJO event.

# 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.)

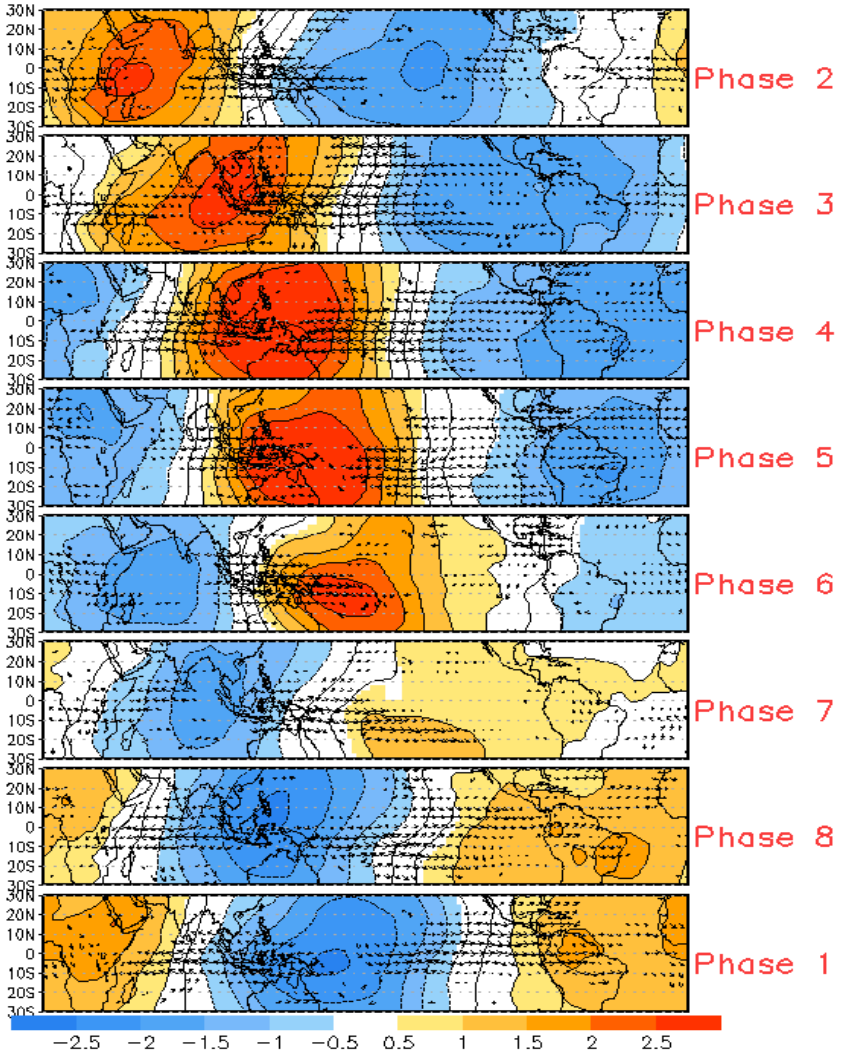


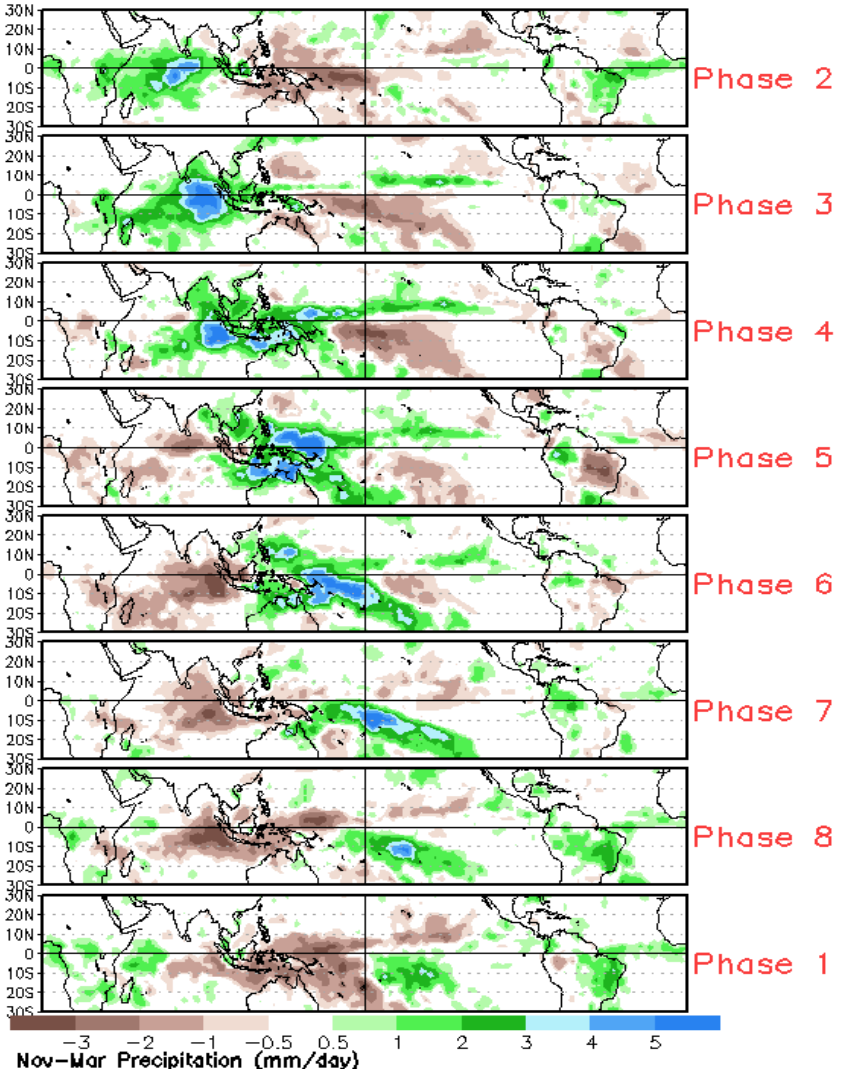

- The constructed analog depicts a slightly slower and weaker eastern propagation to the West Pacific.

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



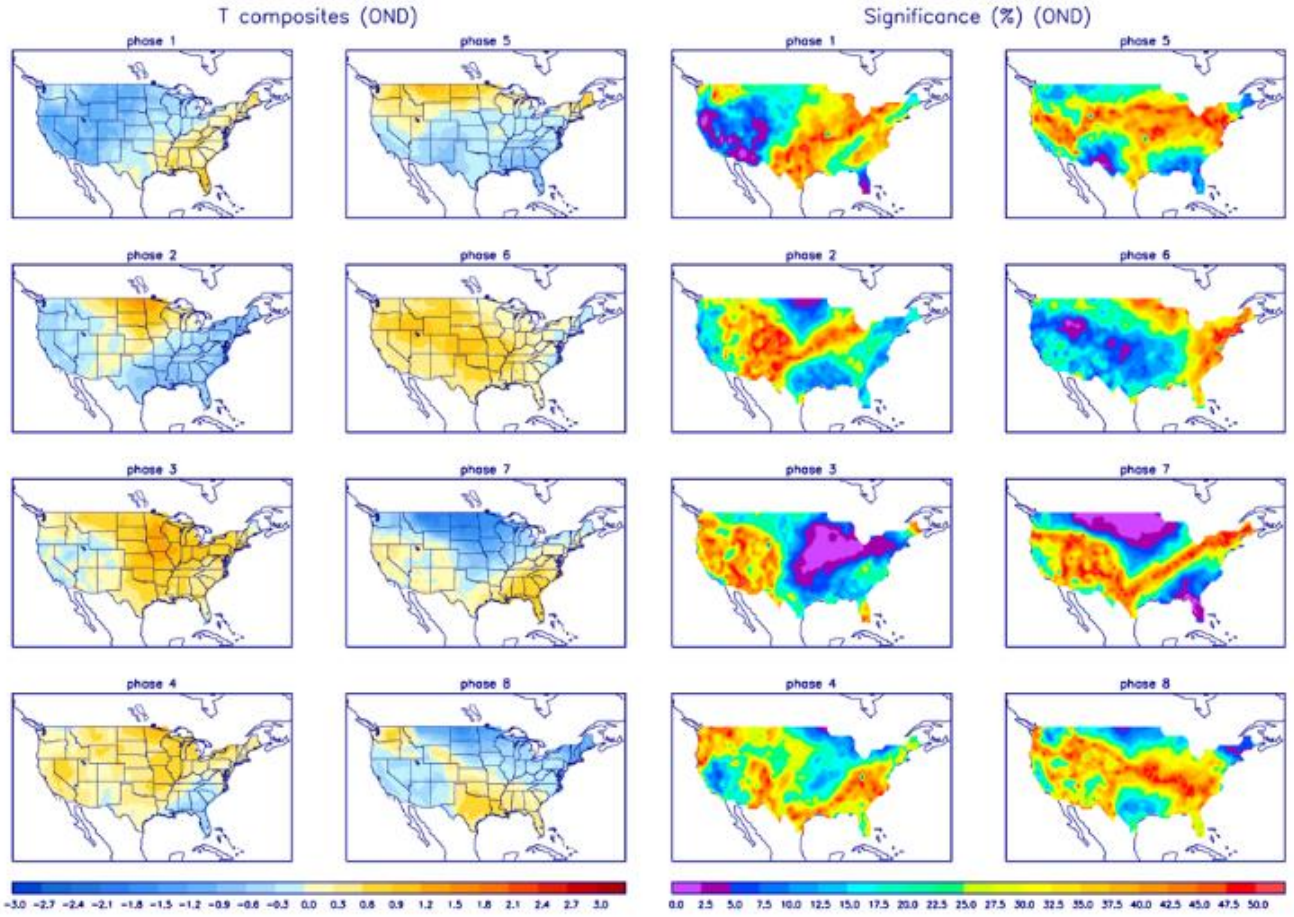

Precipitation Anomalies



# 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.

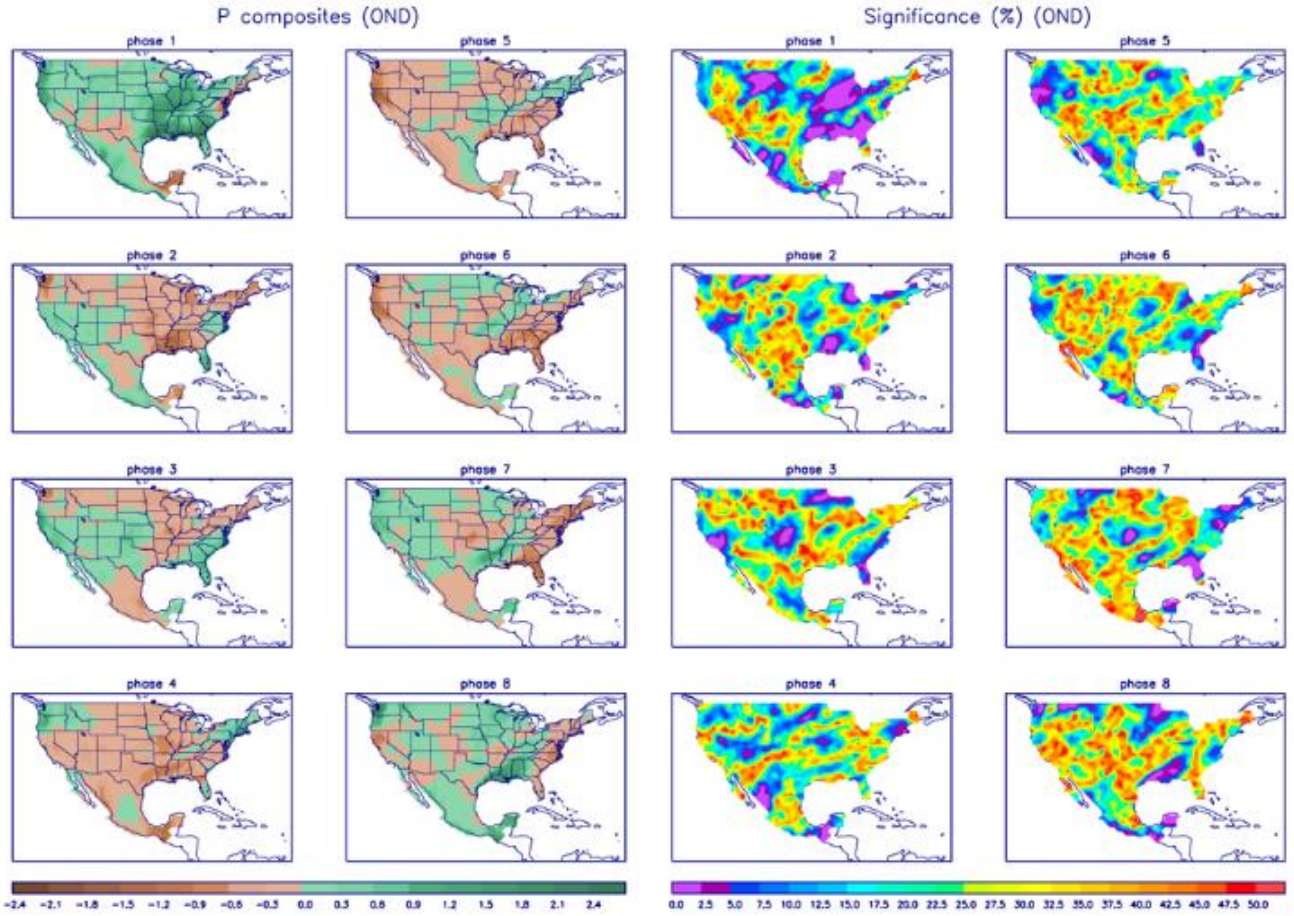



More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

# 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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