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

**Update prepared by the Climate Prediction Center**
**Climate Prediction Center / NCEP**
**4 April 2022**

# Overview

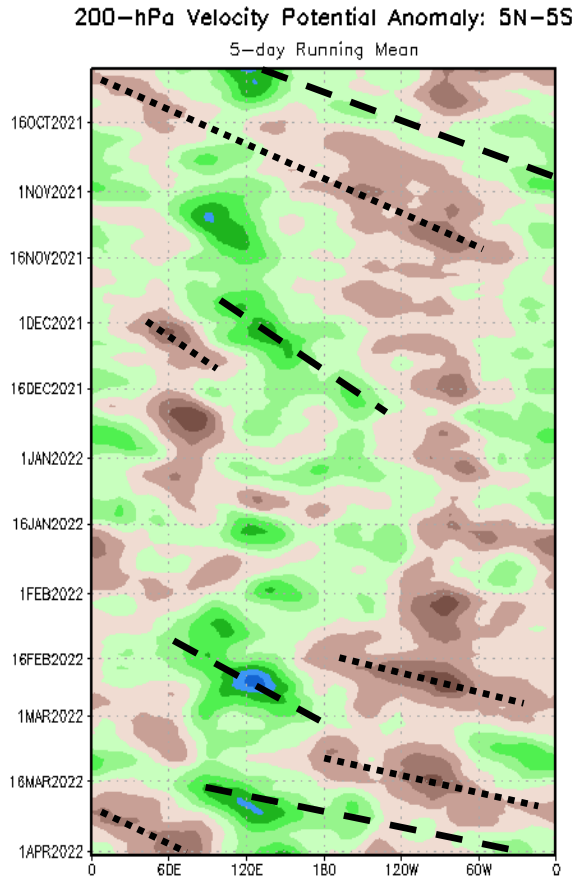
- The MJO remains weak as depicted on the RMM index.
- Remnant MJO activity over the Western Hemisphere remains evident, producing a Wave-2 pattern with the La Niña base state.
- Recent observations suggest an increased disruption of the atmospheric response to La Niña conditions.
- Dynamical model MJO index forecasts show a potential renewed activity shifting from the Maritime Continent to the West Pacific over the next two weeks. High uncertainty remains with this forecast given the potential destructive interference from the base state.

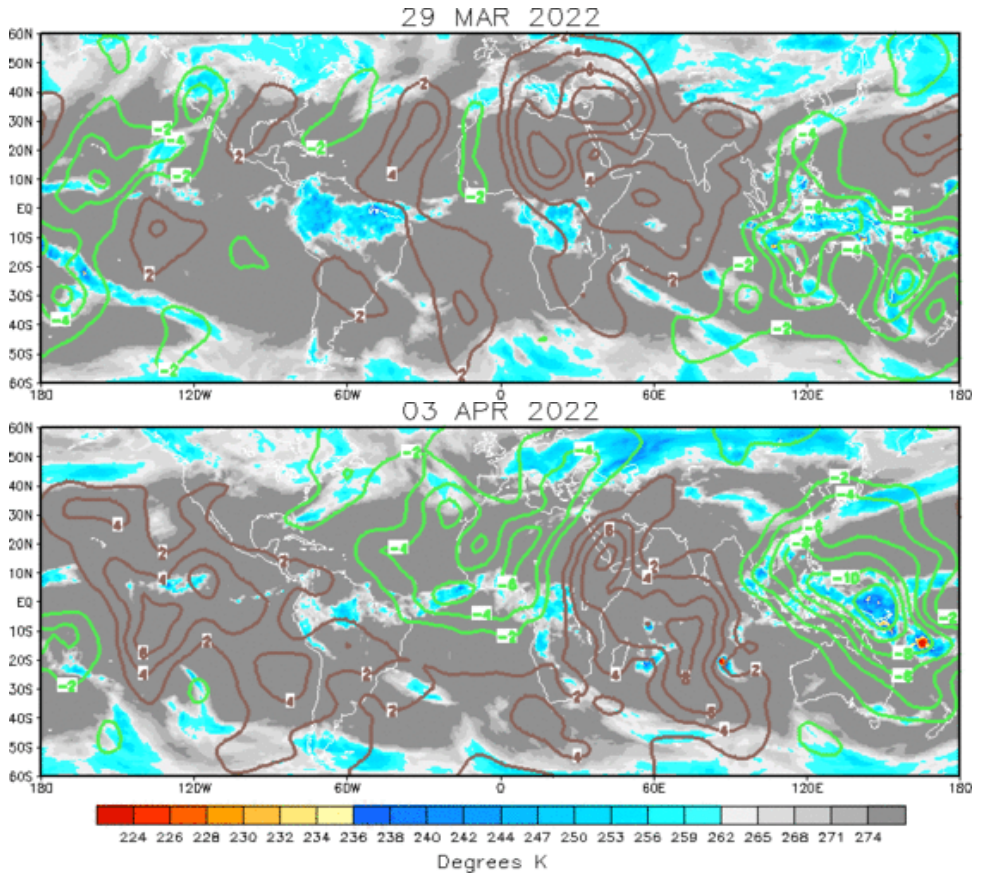
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

# 200-hPa Velocity Potential Anomalies

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

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



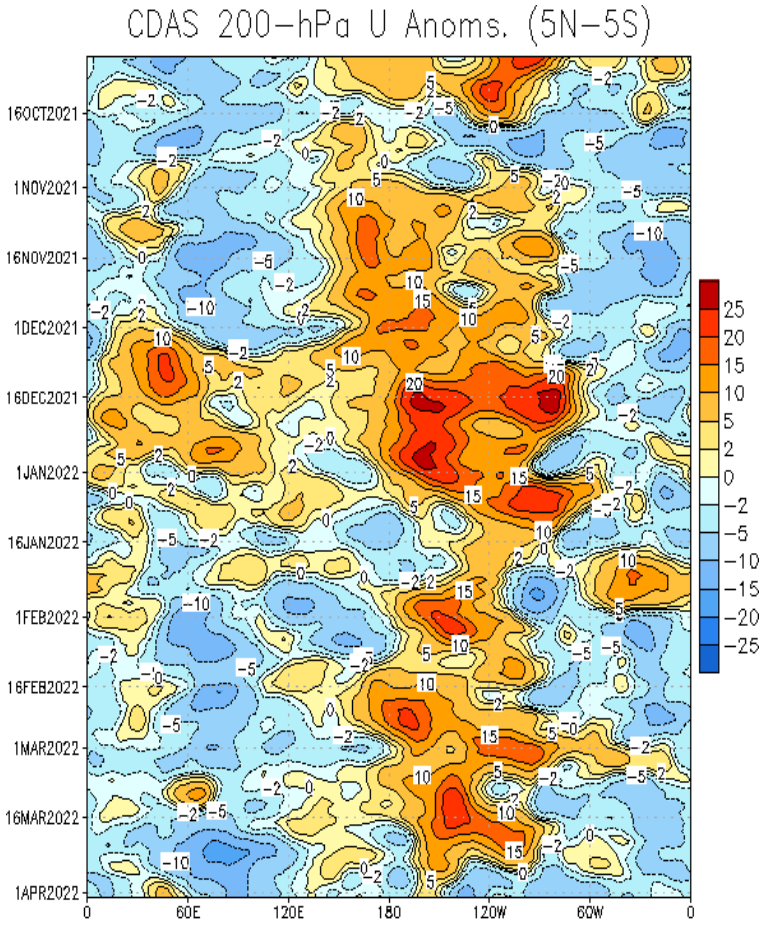



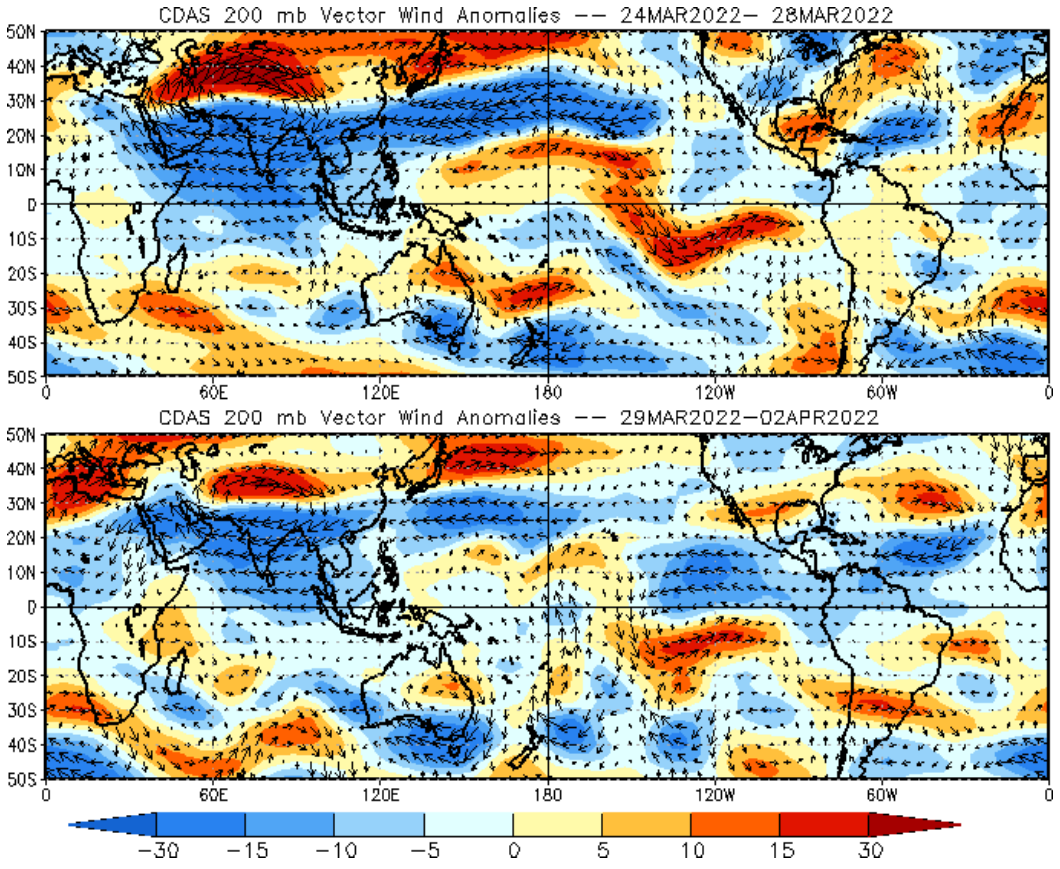

- The upper-level pattern reflects a Wave-2 pattern, with the remnant intraseasonal signal over the Western Hemisphere.

- Enhanced divergence (convergence) aloft over the Maritime Continent (central Pacific) is typically reflective of the ongoing atmospheric response to La Niña conditions, though the signal in other fields is not clear.

# 200-hPa Wind Anomalies

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

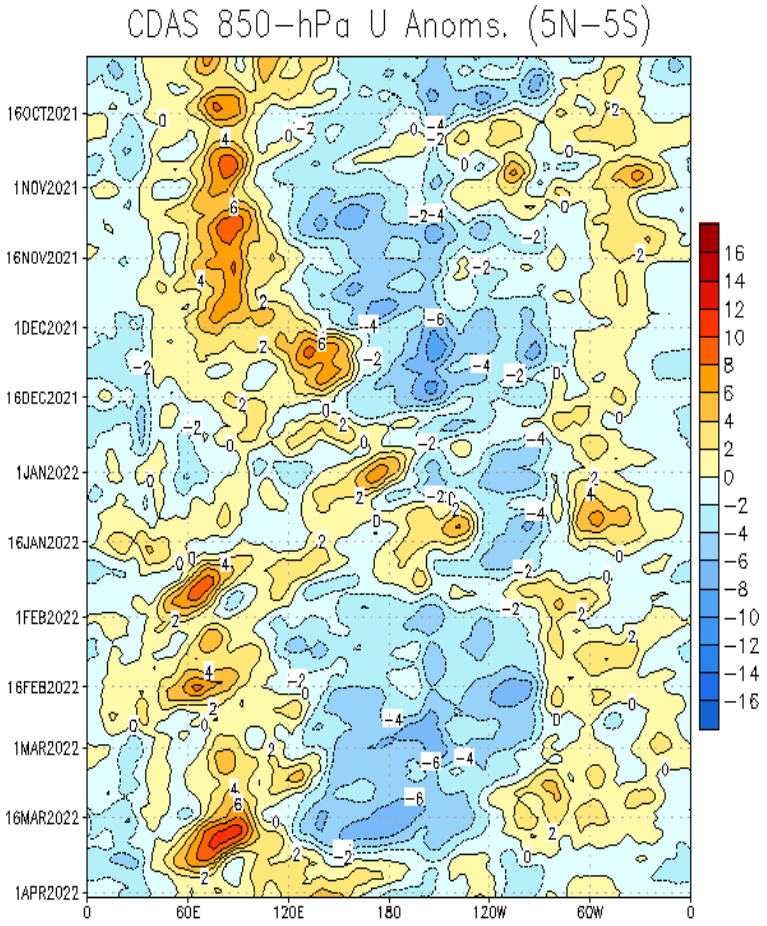


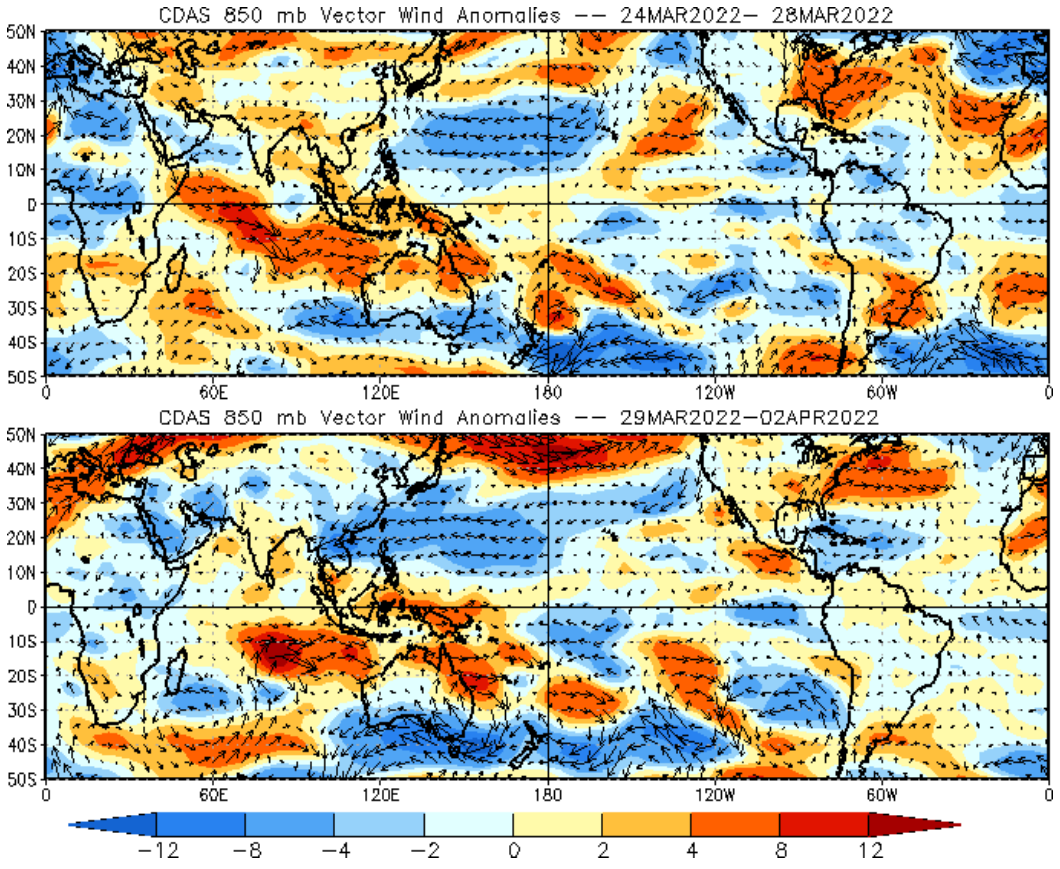




- Westerly anomalies aloft have broken down across the Pacific, with a more chaotic pattern and considerable cross-equatorial flow observed.
- Widespread easterly anomalies persist over the Indian Ocean, mainly north of the Equator.

# 850-hPa Wind Anomalies

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



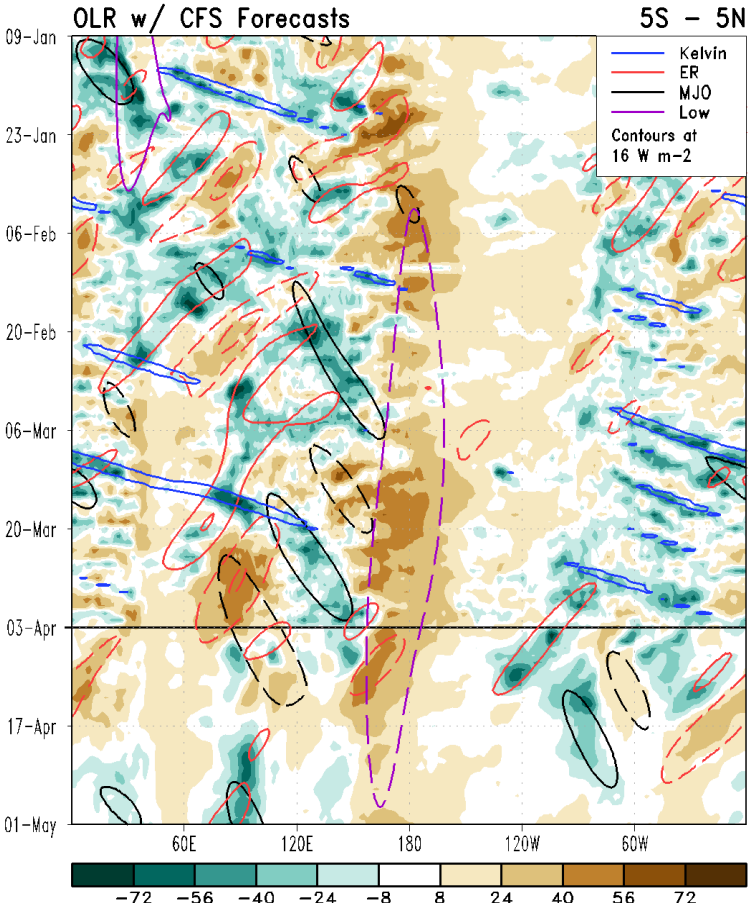



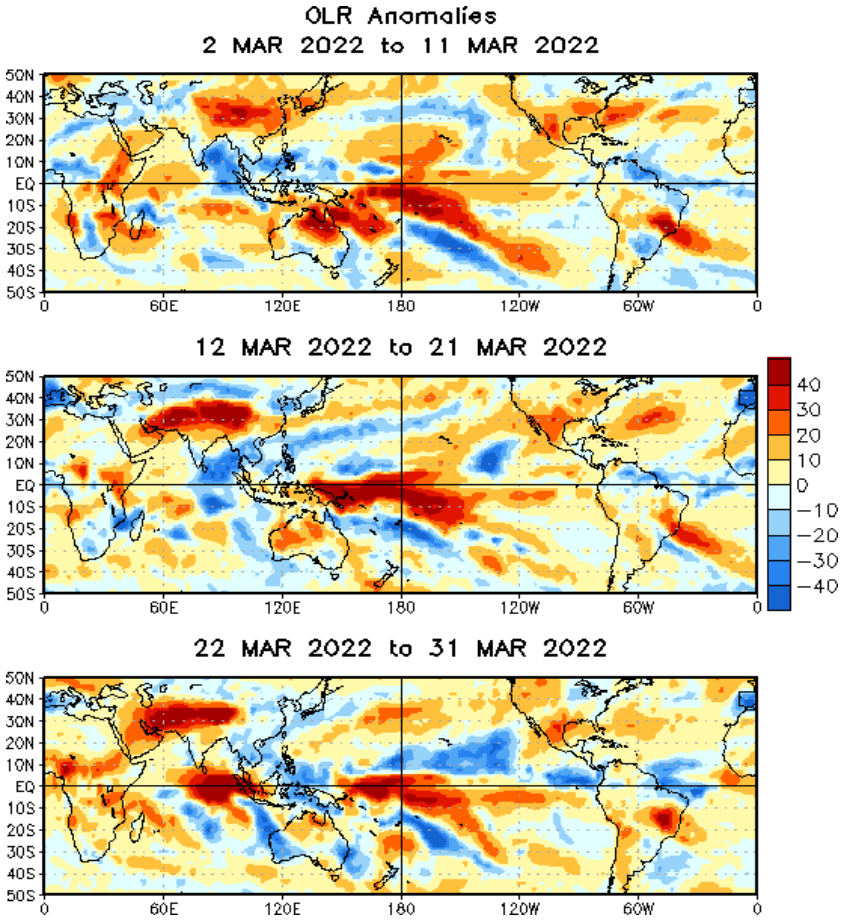

- The La Niña fueled enhanced trade wind regime remains fairly disrupted across the central Pacific, though easterly anomalies are beginning to re-strengthen near the Date Line.

- Strong westerly anomalies remain prevalent over the Maritime Continent, likely tied to Rossby wave activity.

# Outgoing Longwave Radiation (OLR) Anomalies

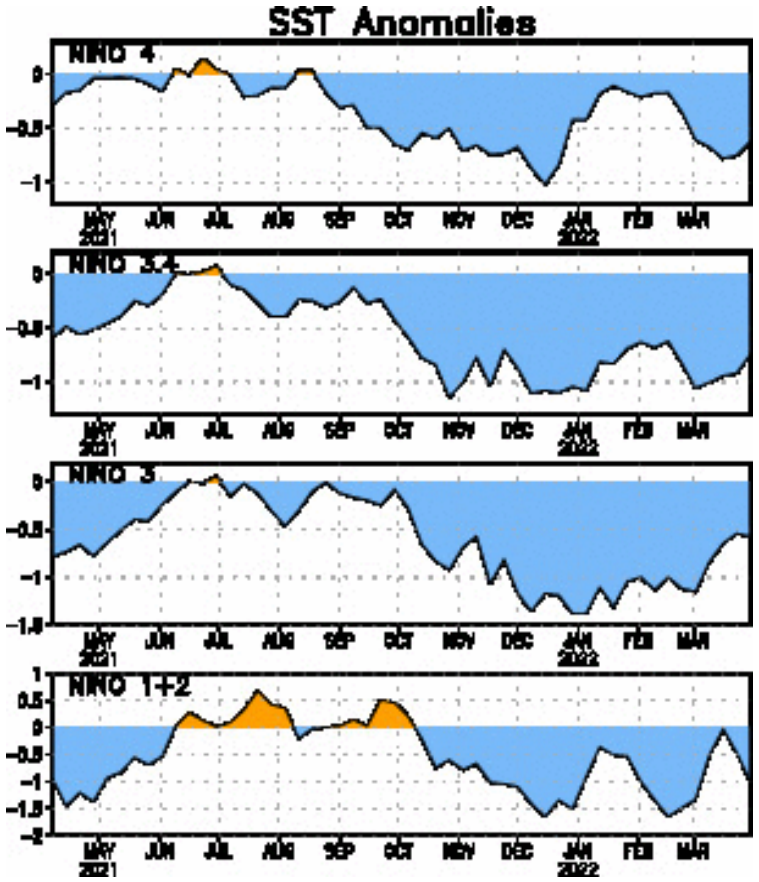
**Green shades: Anomalous convection (wetness)**
**Brown shades: Anomalous subsidence (dryness)**

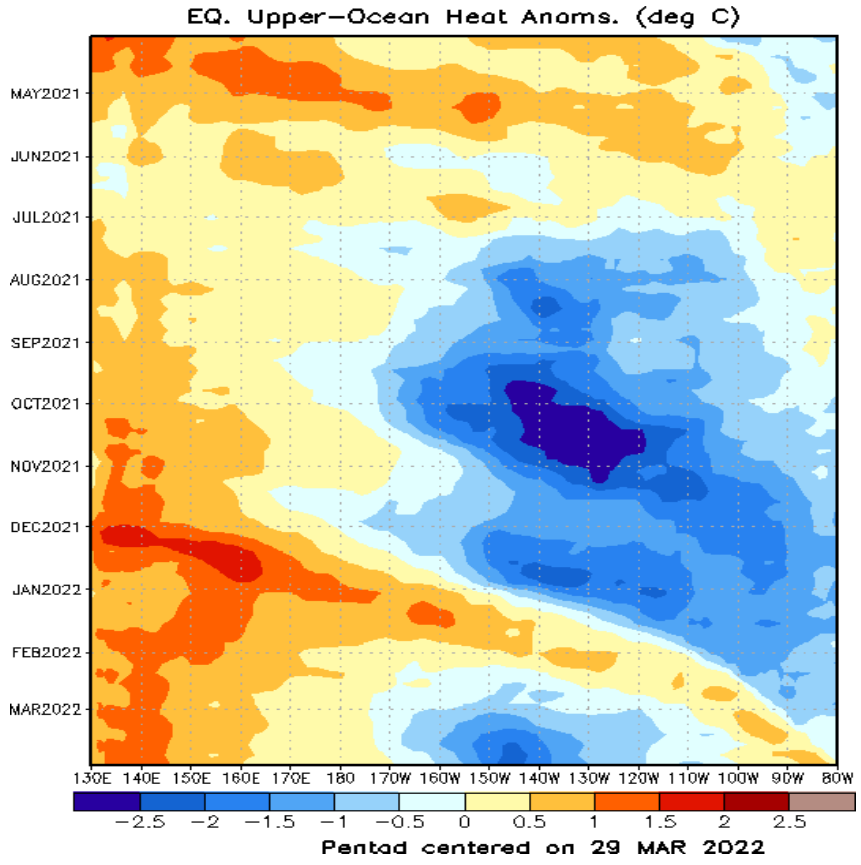



- Suppressed convection over the Pacific associated with the ongoing La Niña remains the most prominent feature in the OLR field over the past several months. Intraseasonal activity has not been able to overcome this signal.
- Enhanced (suppressed) convection over the Maritime Continent (Indian Ocean) is projecting as MJO activity on the objective filtering, though Rossby wave activity is also impacting the pattern.

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



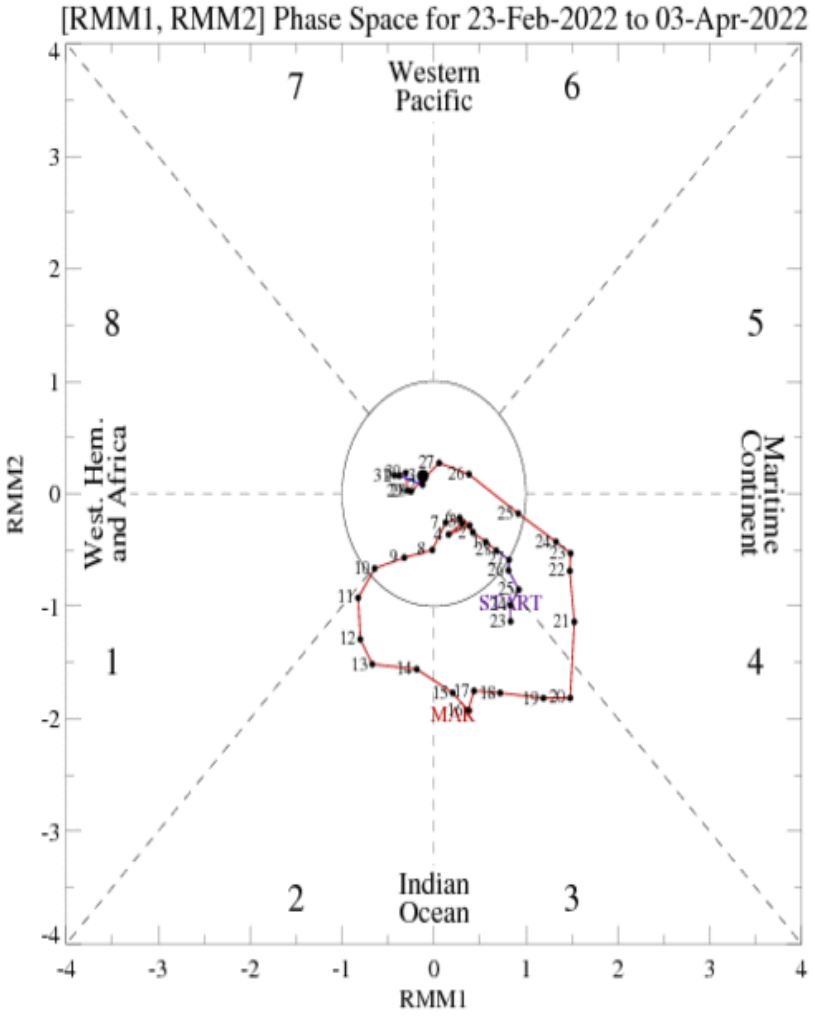




- Following the passage of a robust downwelling oceanic Kelvin wave that was generated in response to a significant westerly wind burst in December, negative upper-oceanic heat content anomalies have redeveloped between 170W and 120W.

- Negative SSTs remain in place across all Nino regions; with recent warming trends on the east side of the basin slowed towards the end of March.

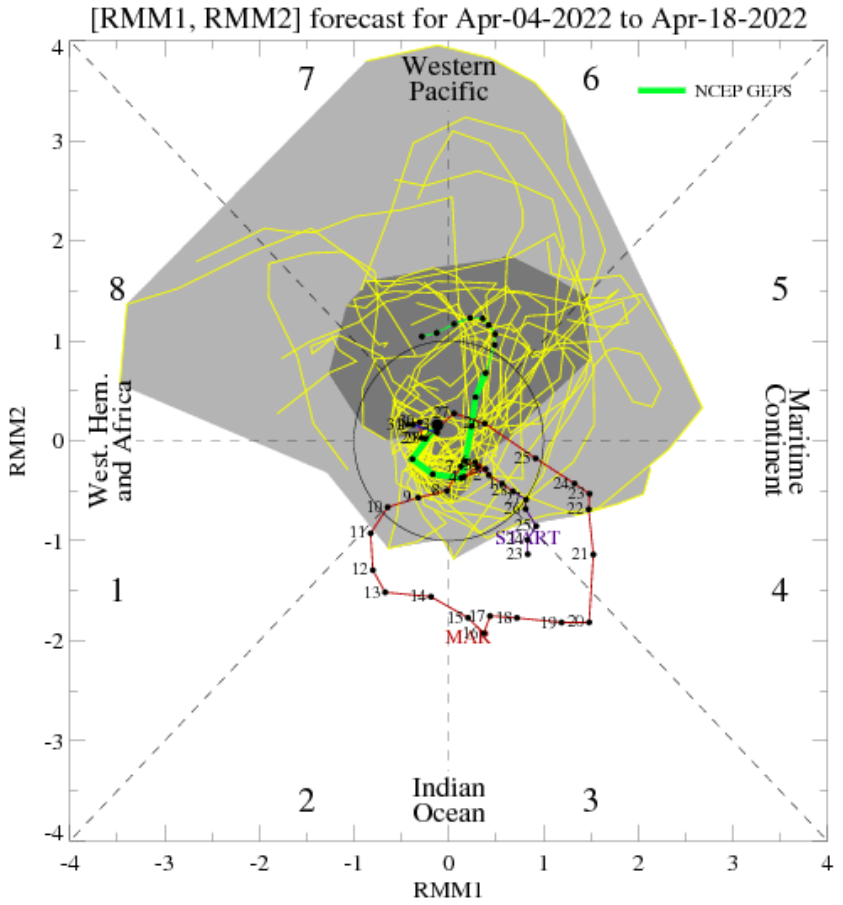
# MJO Index: Recent Evolution

- During late March, the RMM-based MJO index crashed inside the unit circle, reflecting a weakening intraseasonal signal.
- Destructive interference between the MJO signal and the La Niña base state likely played a role in the weakening signal.

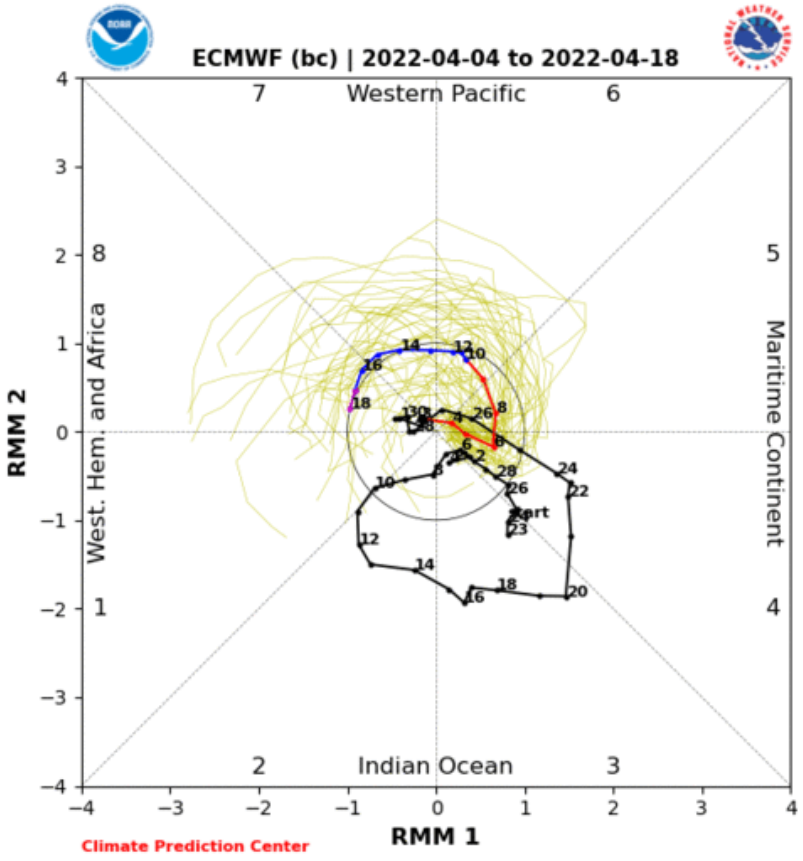



For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

# MJO Index: Forecast Evolution




GEFS Forecast



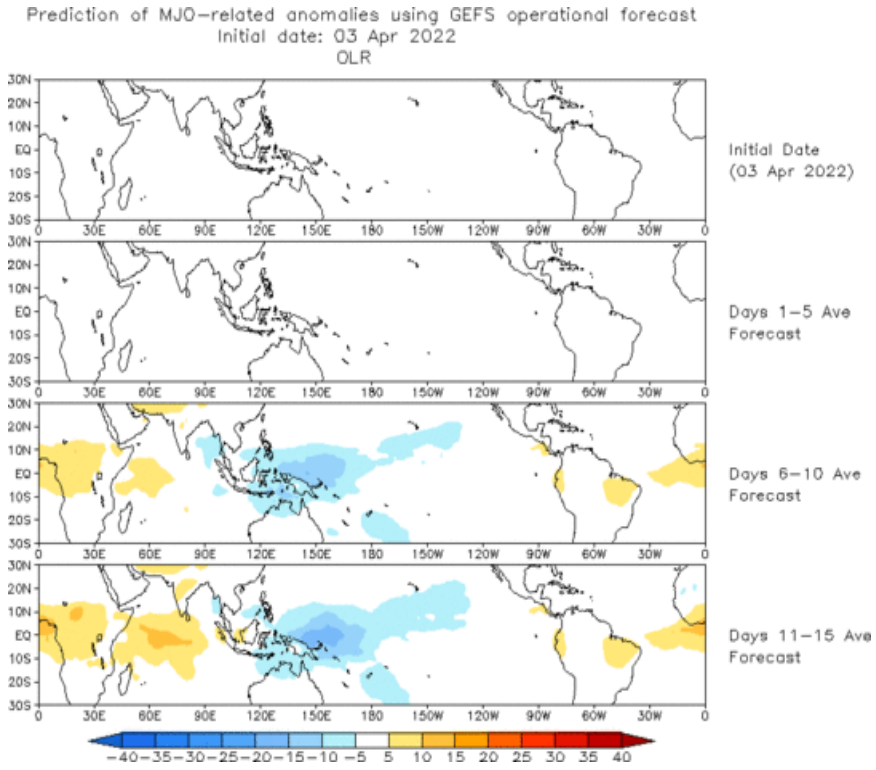

ECMWF Forecast

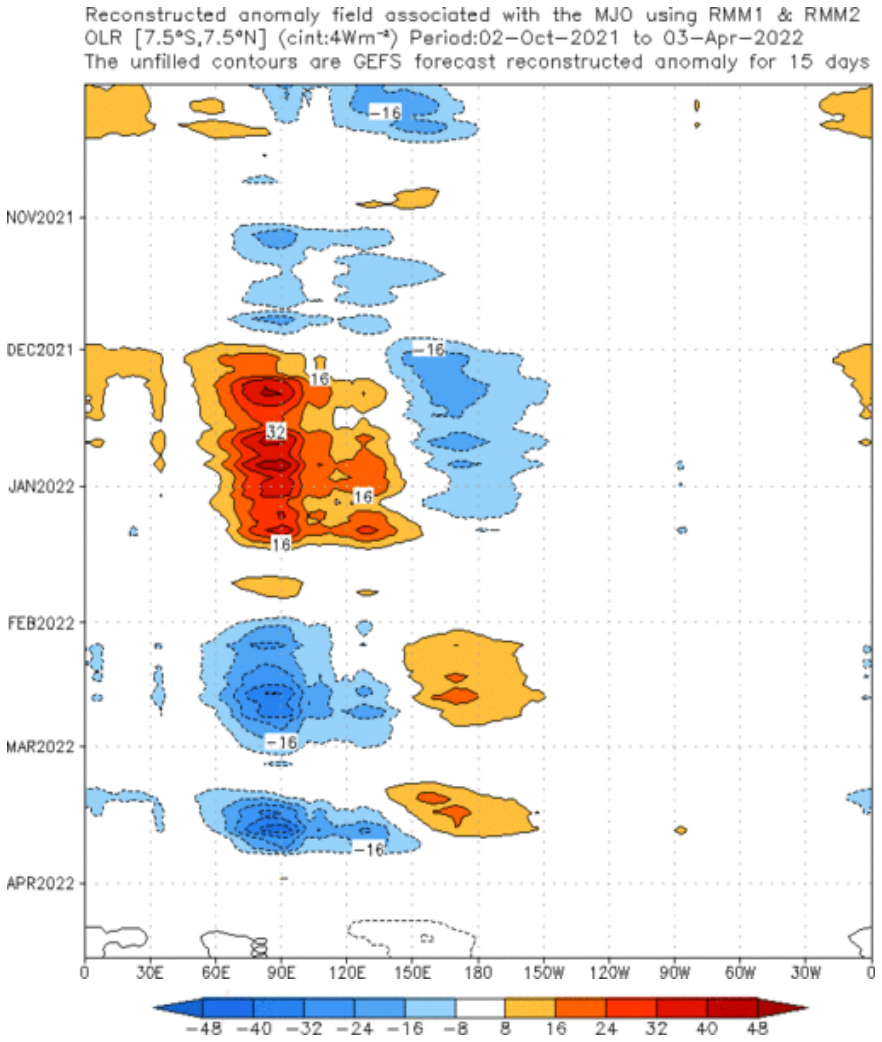
- Both the GEFS and the ECMWF depict renewed MJO activity over the next two weeks, with a large number of ensemble members crossing the West Pacific.

- Robust MJO activity over the West Pacific would be difficult to materialize given the low frequency signal, though the atmospheric response has been more chaotic over the past week.

# 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.)

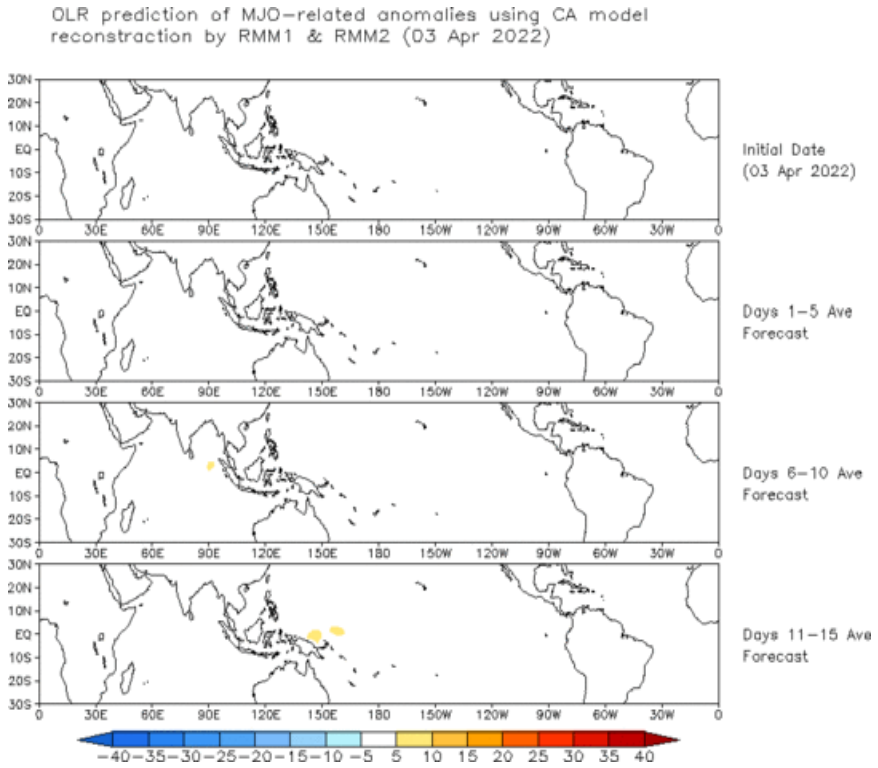


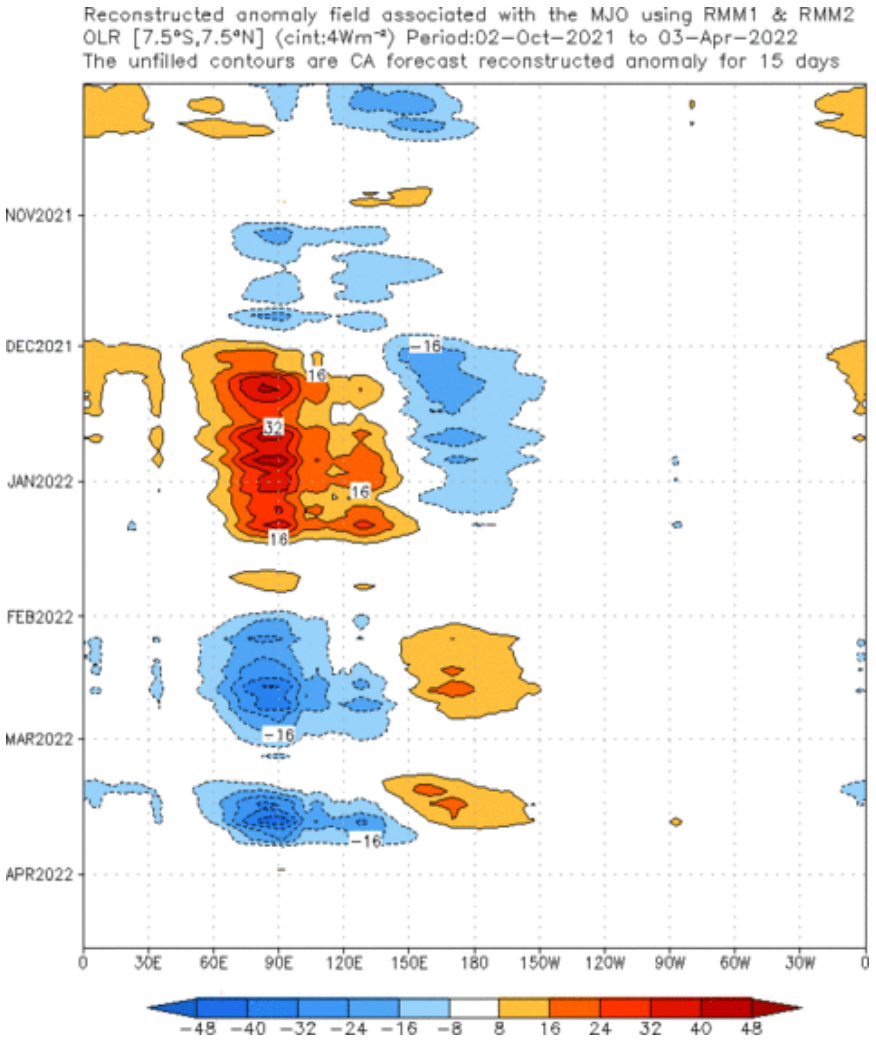




- The GEFS RMM-based OLR field depicts weak convective anomalies during Week-1, with a robust West Pacific signal emerging during Week-2.

# 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.)

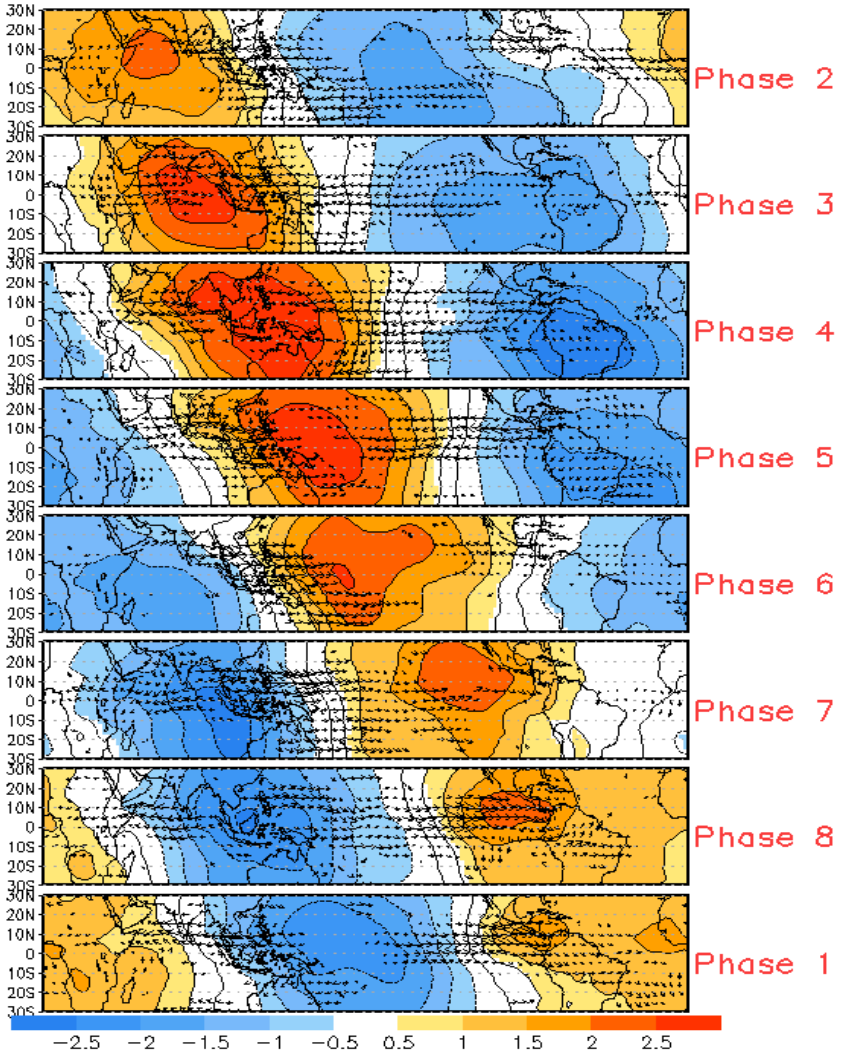


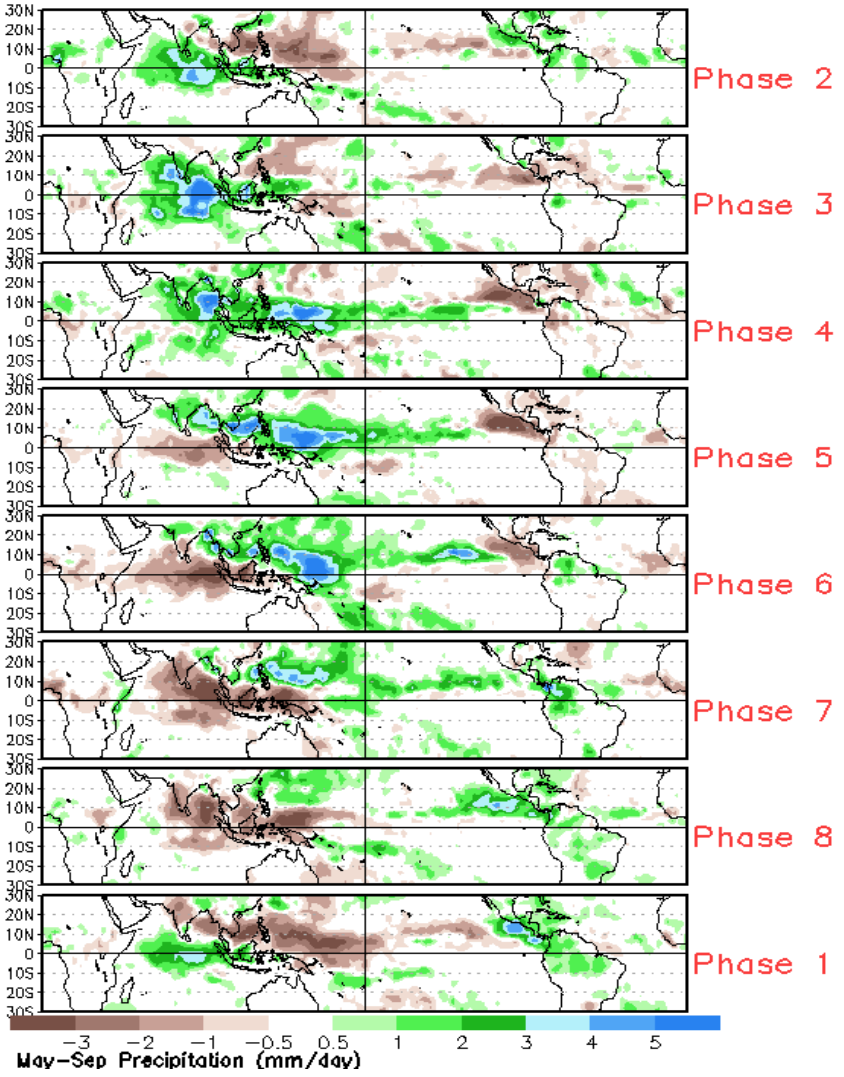

- The constructed analog forecast of RMM-based OLR anomalies is weak throughout the two week period.

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



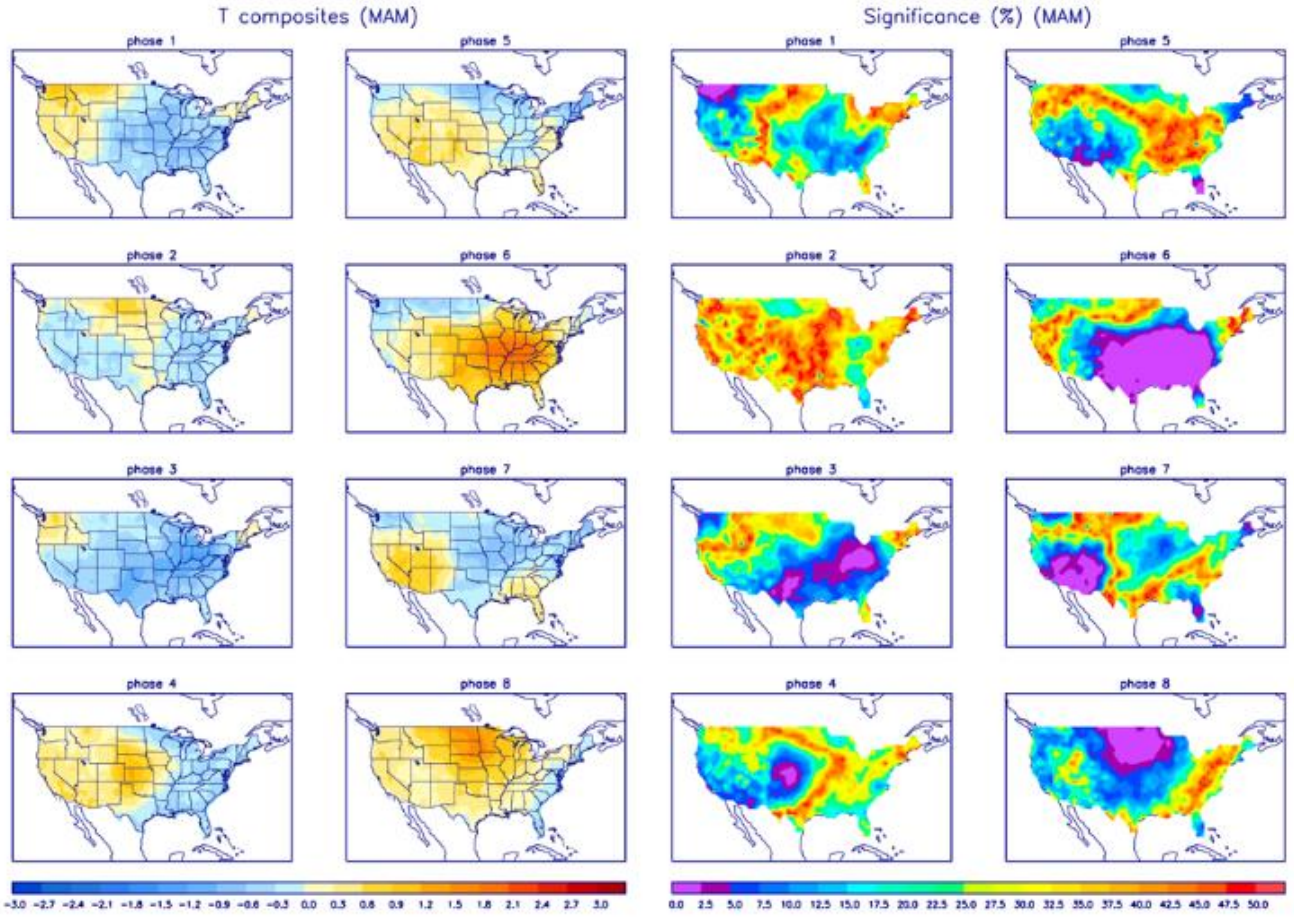

Precipitation Anomalies



# 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.

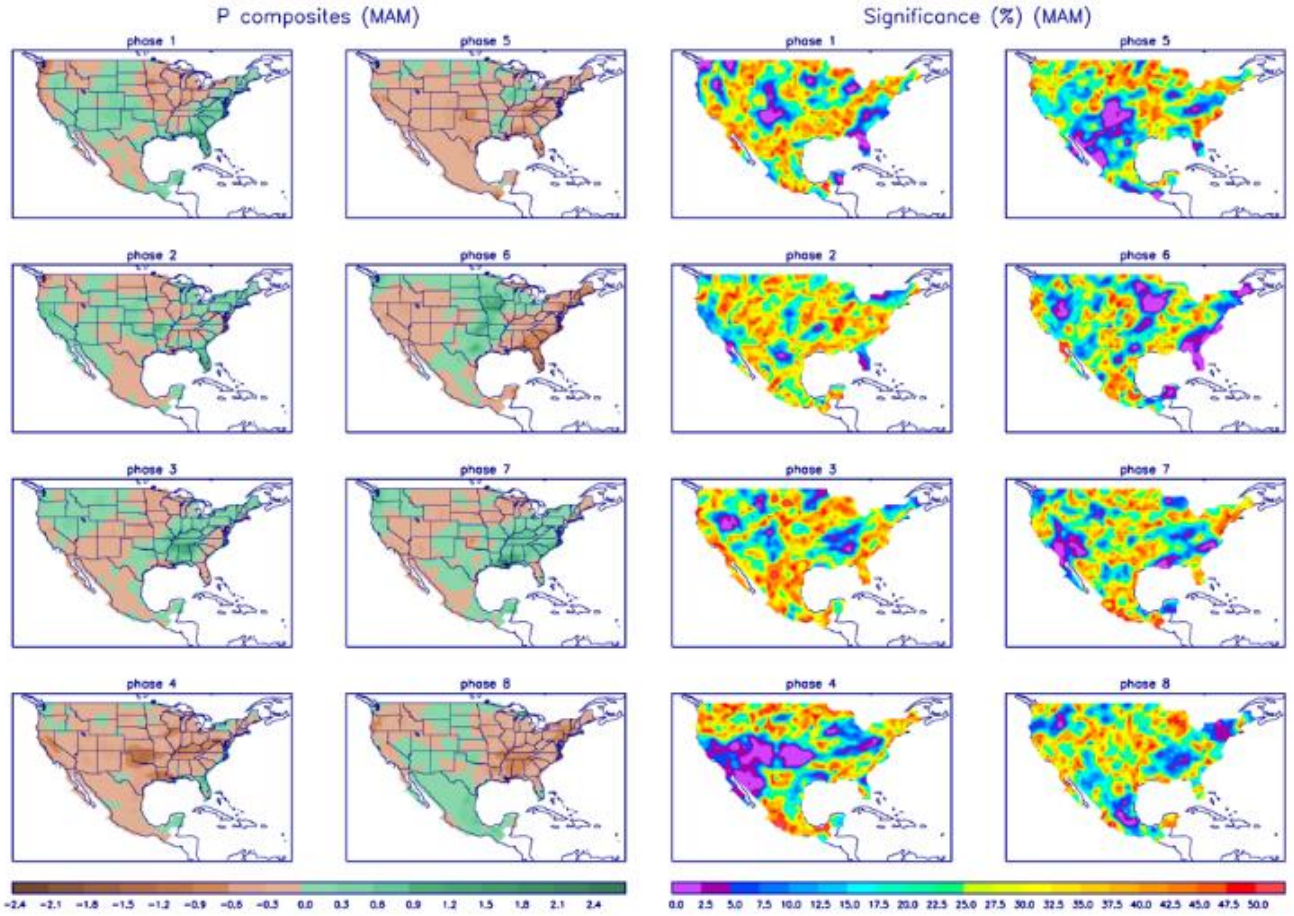



More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

# 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.




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