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

**Update prepared by the Climate Prediction Center**
**Climate Prediction Center / NCEP**
**5 April 2021**

# Overview

- The MJO is predicted to continue its eastward propagation through at least mid-April with the enhanced phase shifting east over the Pacific Ocean.

- Dynamical MJO forecasts indicate that the MJO is likely to destructively interfere with the ongoing La Niña.

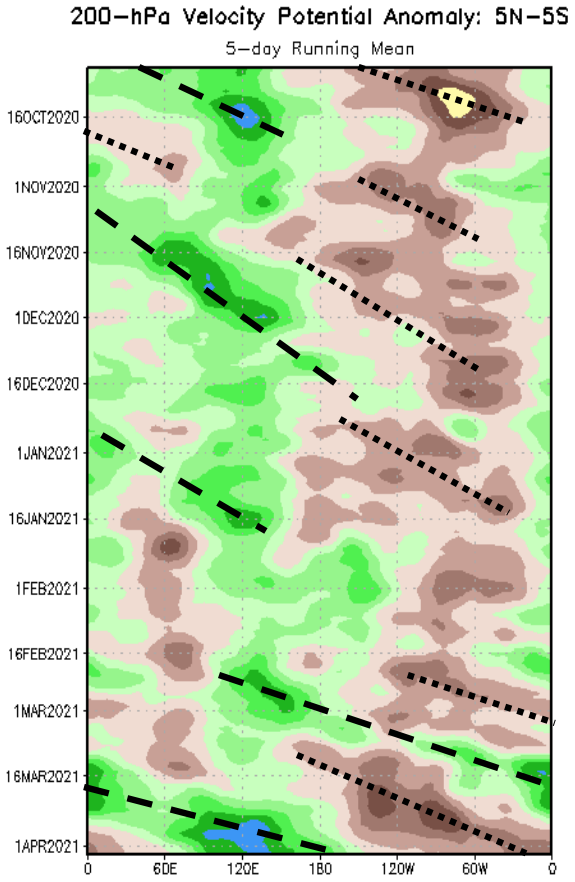
- The MJO contributed to the development of a pair of tropical cyclones over the South Indian Ocean and to the northwest of Australia during the last week. Elevated chances of tropical cyclogenesis exist across the Coral Sea (week-1) and the West Pacific (weeks 1 and 2) related to the MJO.

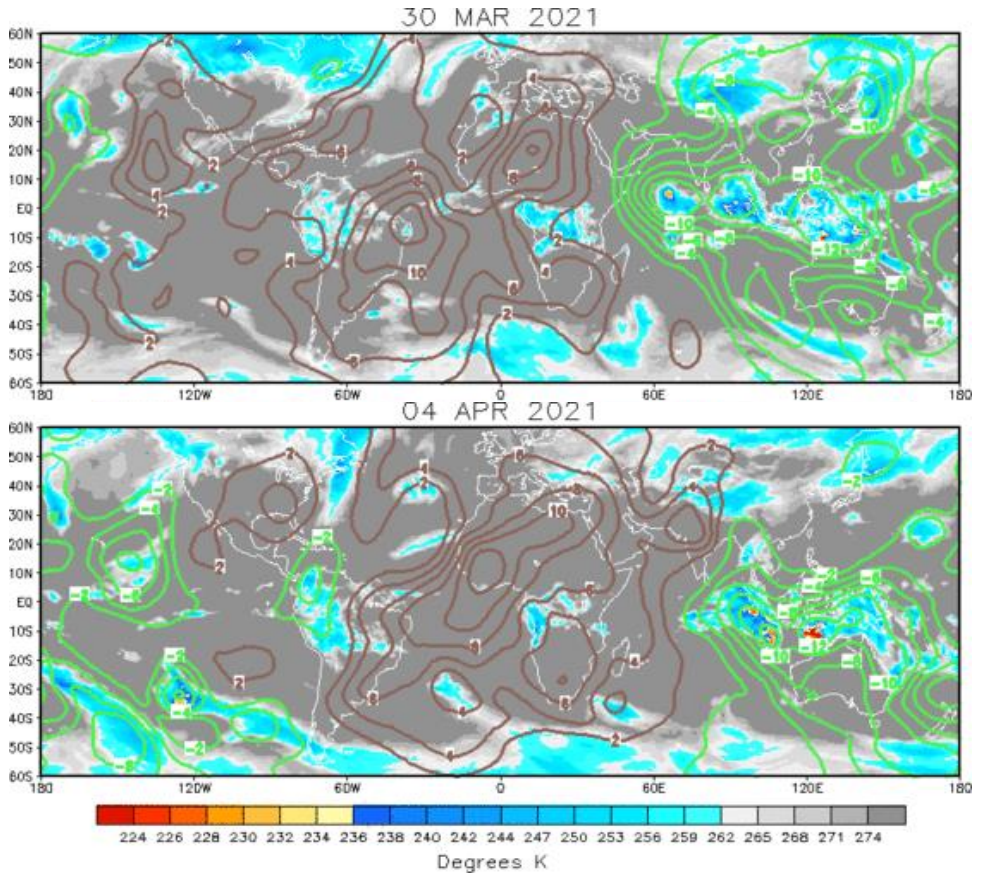
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

# 200-hPa Velocity Potential Anomalies

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

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

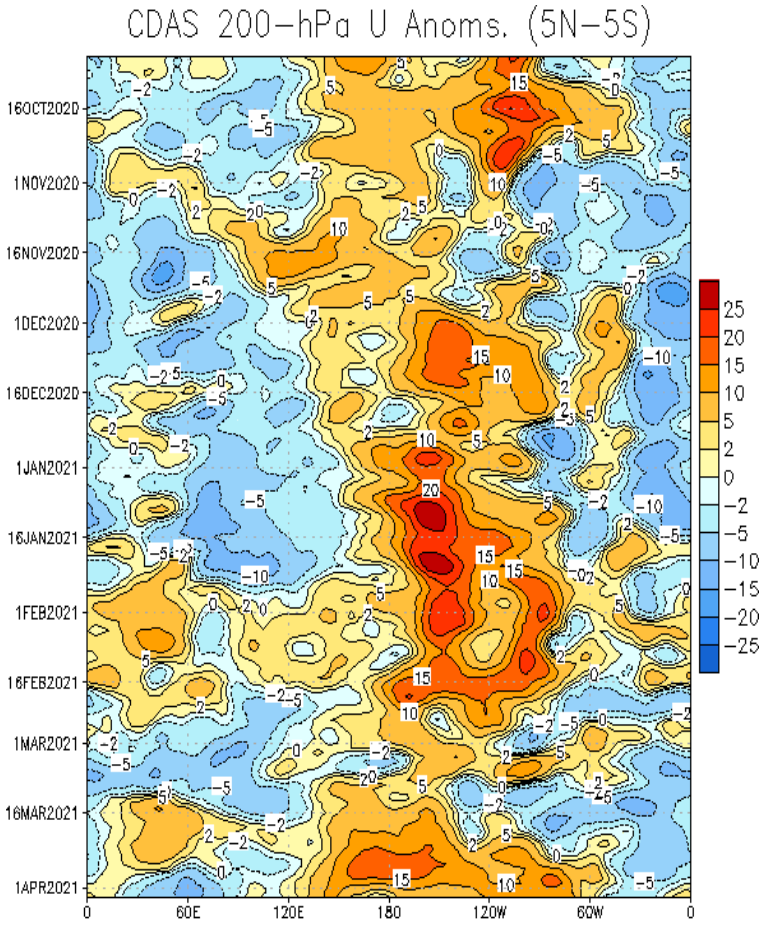


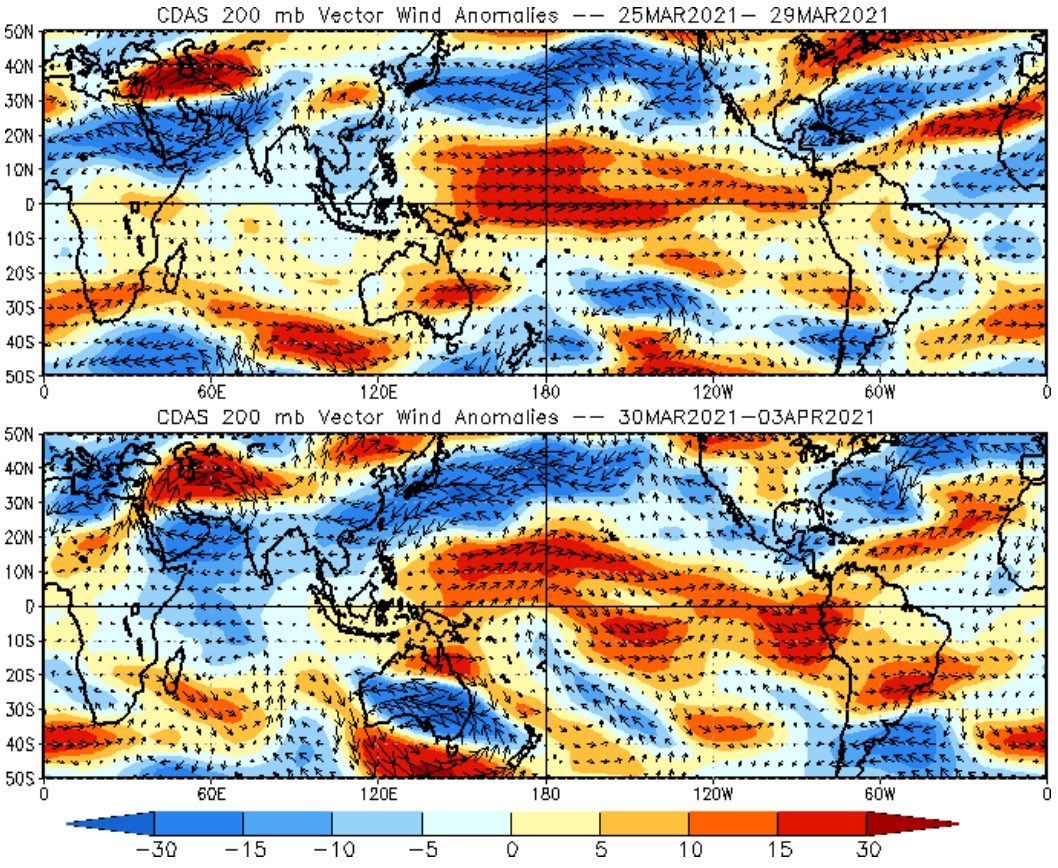




- Since March, the MJO has propagated eastward with a well-defined Wave-1 pattern in the velocity potential field. Enhanced ascent has shifted east from the Indian Ocean to the West Pacific during the past two weeks, while enhanced descent was centered over the Western Hemisphere.

# 200-hPa Wind Anomalies

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



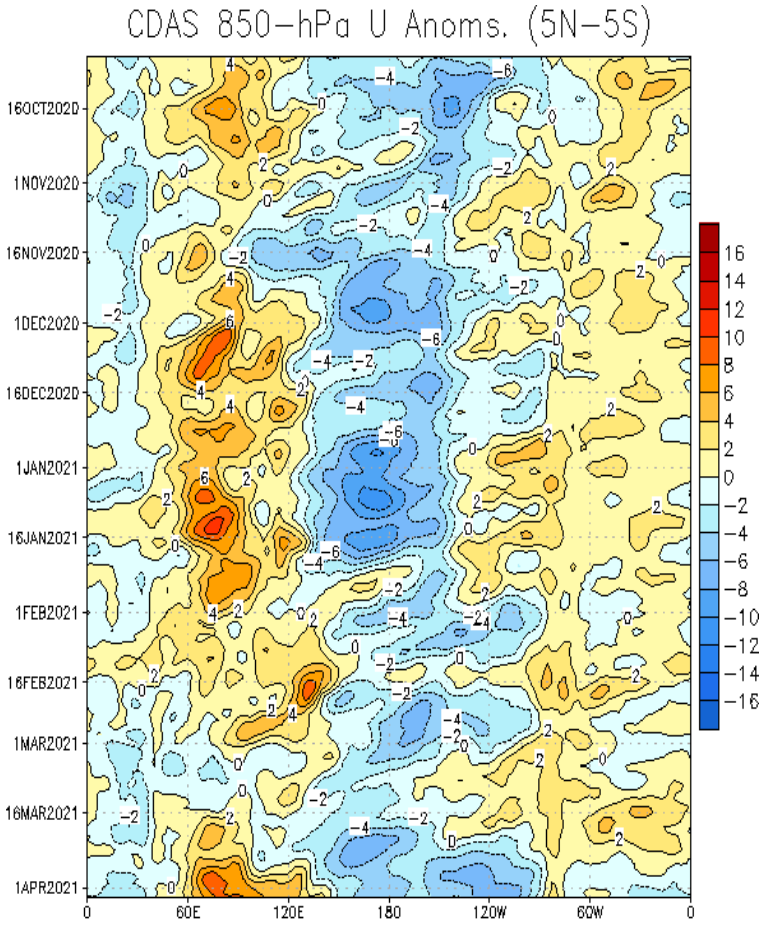



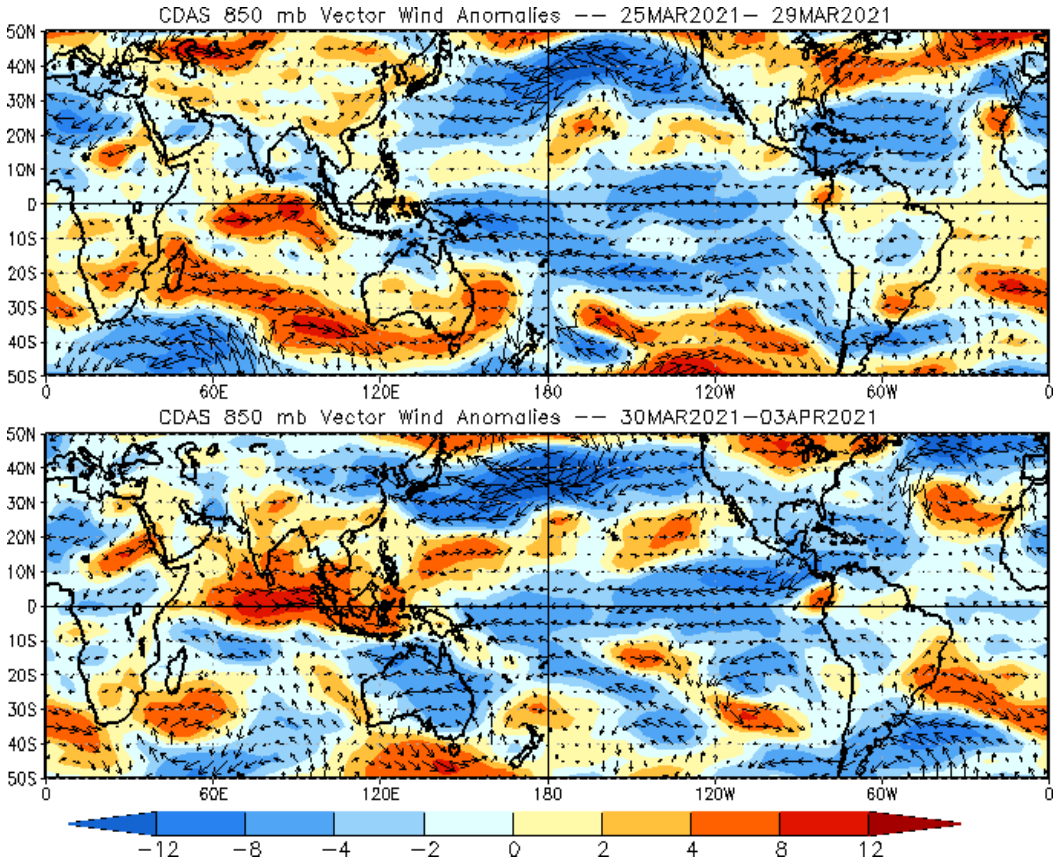

- Anomalous westerlies over the central Pacific are consistent with a La Niña signal. An anomalous upper-level cyclonic circulation in the South Pacific recently contributed to a weakening of the westerlies to the west of the Date Line.

- Anomalous easterlies shifted east to the Indian Ocean as a result of the MJO.

# 850-hPa Wind Anomalies

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

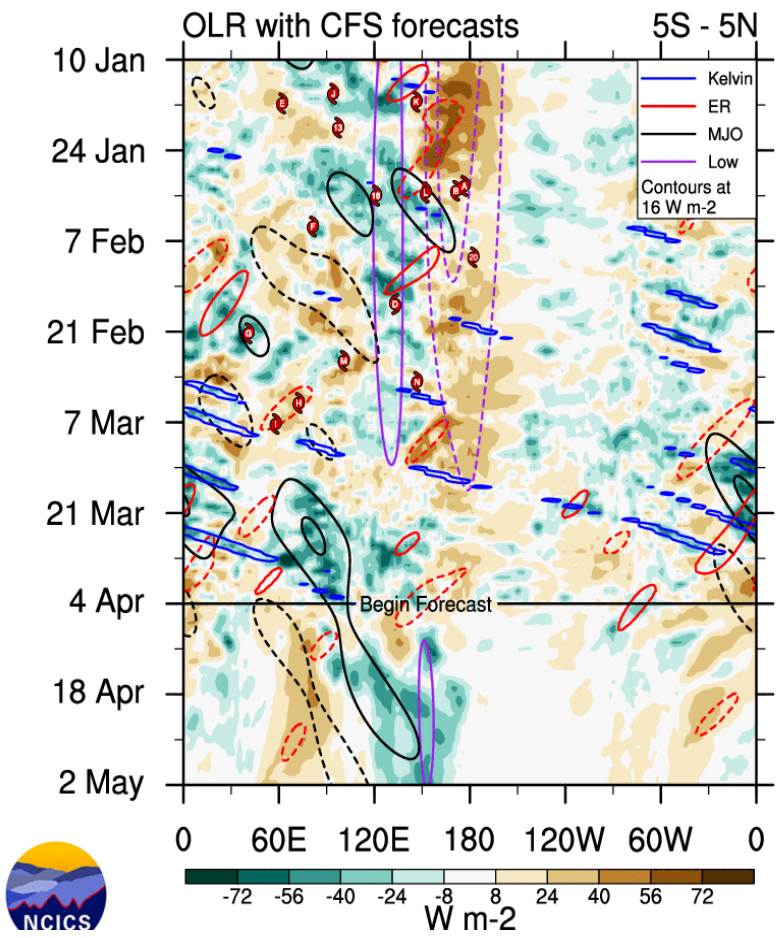


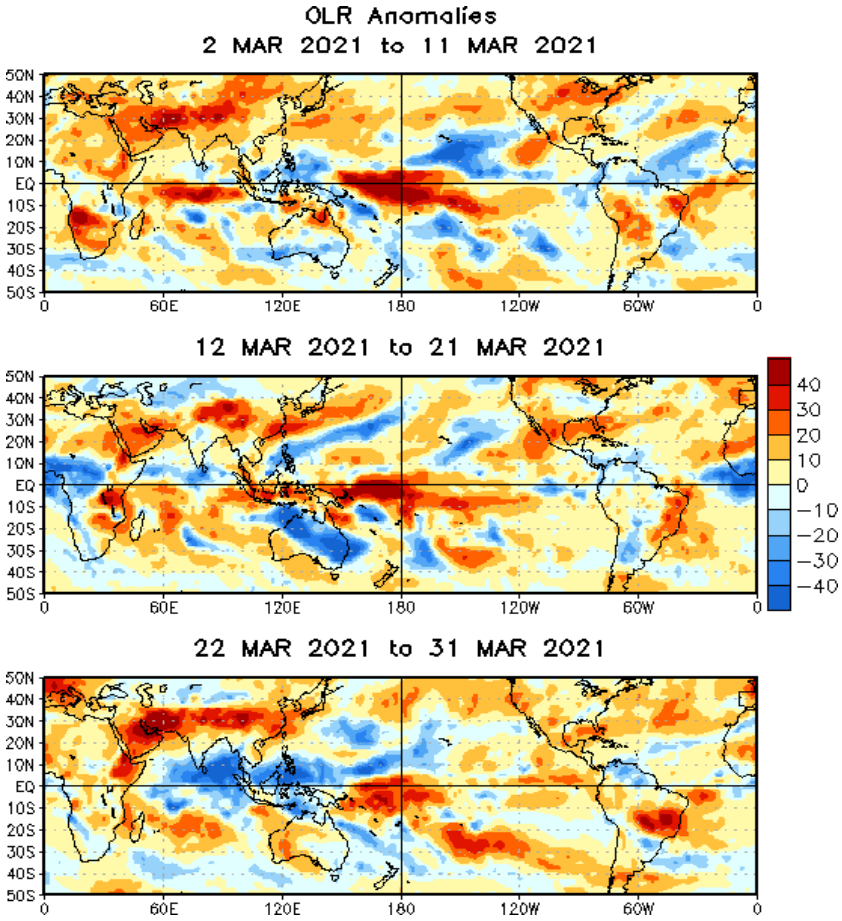




- The trade winds remain enhanced throughout the equatorial Pacific, consistent with the current La Niña.
- Anomalous low-level westerlies overspread the Maritime Continent by the beginning of April.

# Outgoing Longwave Radiation (OLR) Anomalies

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

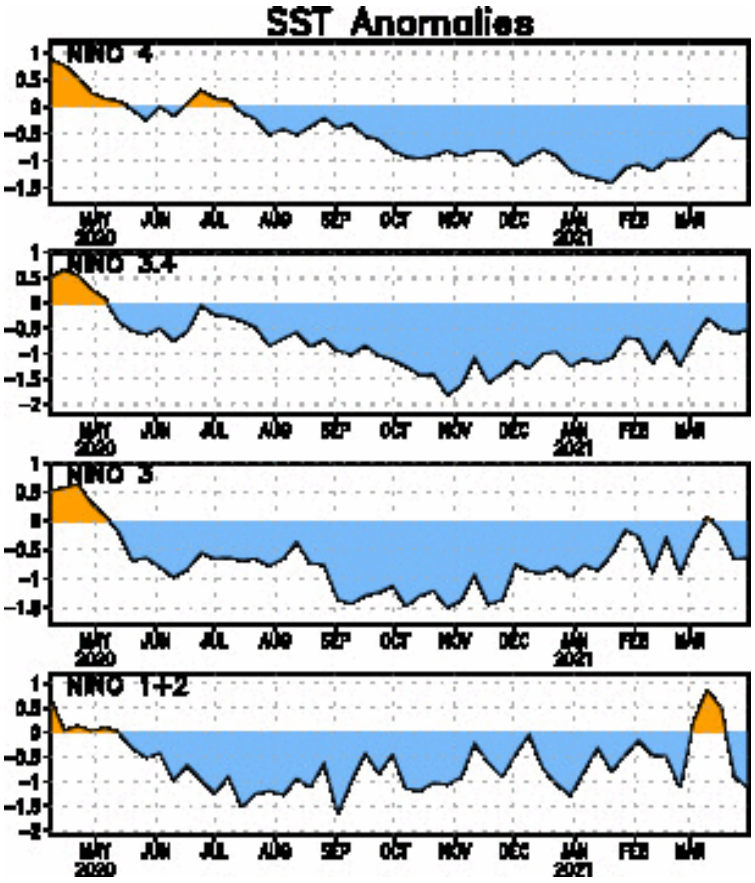


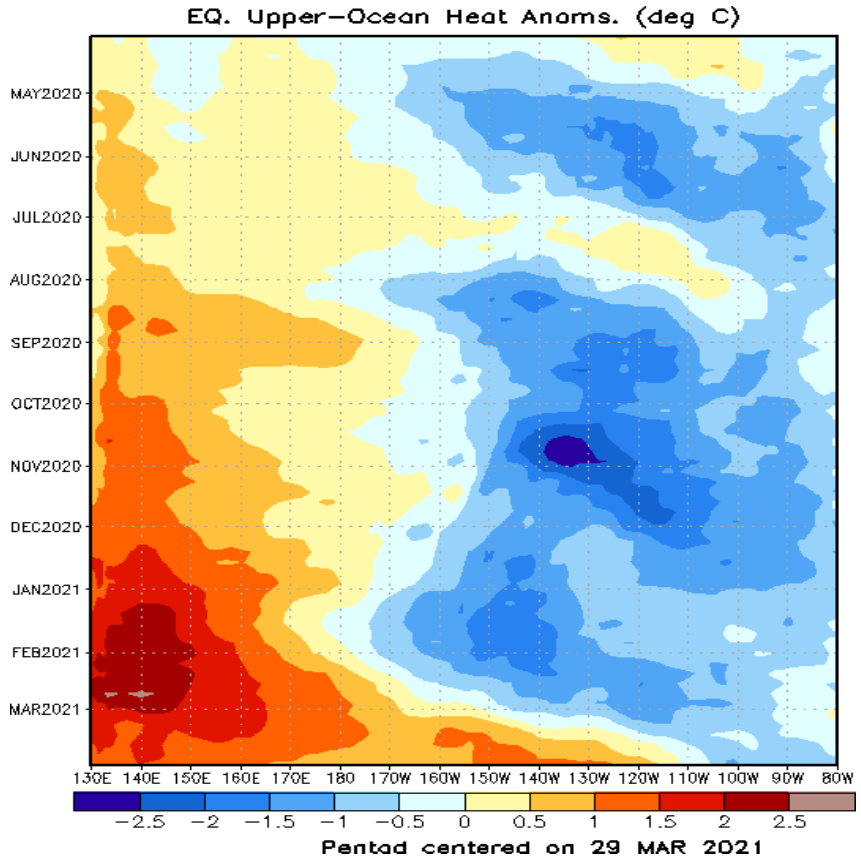




- During late March, the superposition of a strong Kelvin wave over the Indian Ocean within the MJO resulted in enhanced convection at 60 degrees E.

- Suppressed convection tied to the low frequency state remains anchored over the equatorial Central Pacific.

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



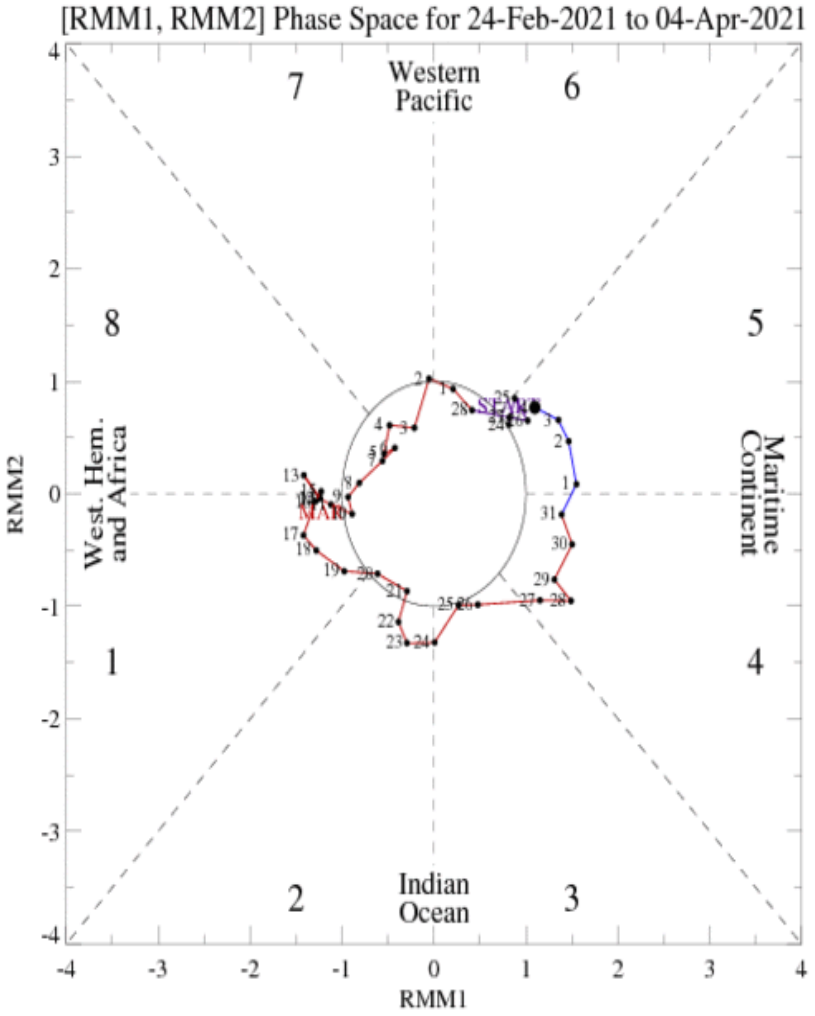




- La Niña conditions have been present since August 2020.

- Strong Rossby wave activity over the West Pacific in February generated a westerly wind burst that initiated a downwelling oceanic Kelvin wave. This Kelvin wave continues to push warmer water within the upper-ocean across the Central and East Pacific.

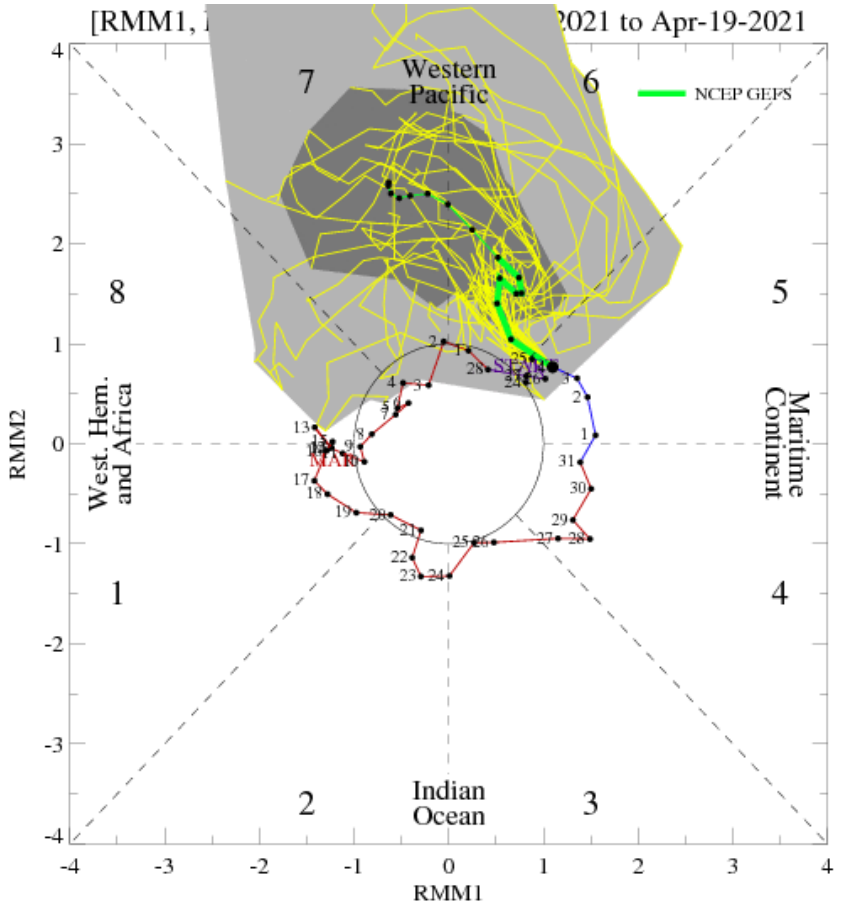
# MJO Index: Recent Evolution

- The RMM index depicts the MJO propagating eastward from the Indian Ocean to the Maritime Continent from late March to the beginning of April.

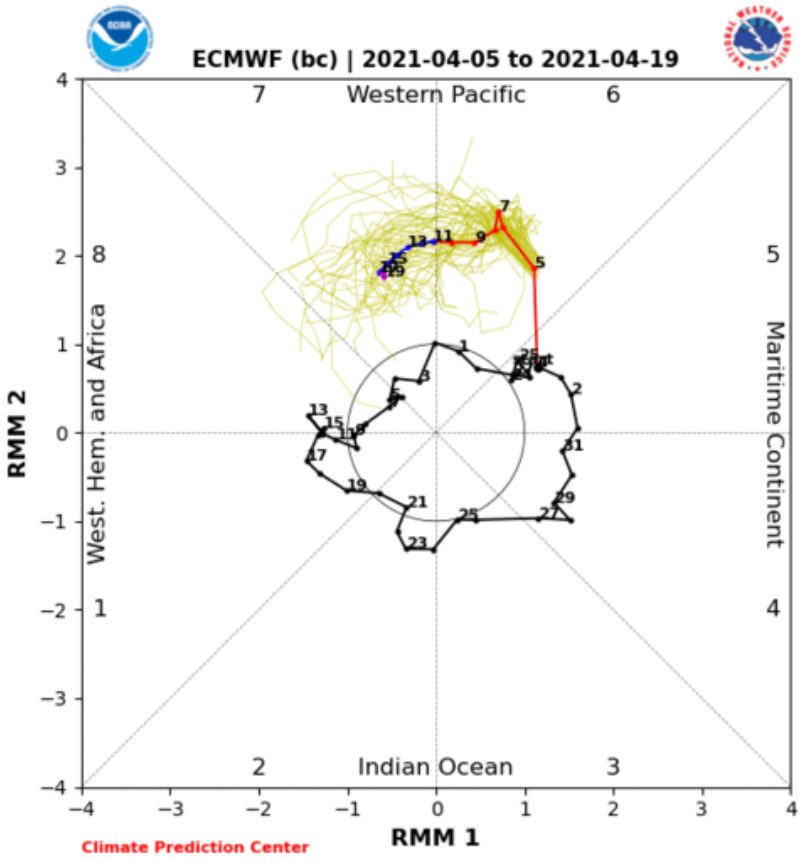



For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

# MJO Index: Forecast Evolution




GEFS Forecast



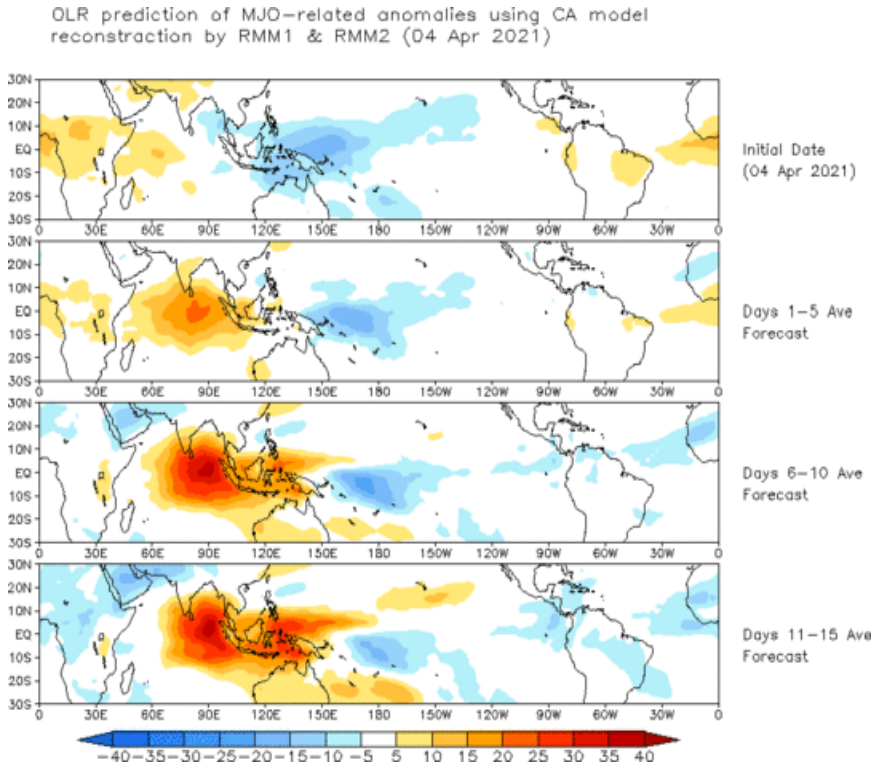

ECMWF Forecast

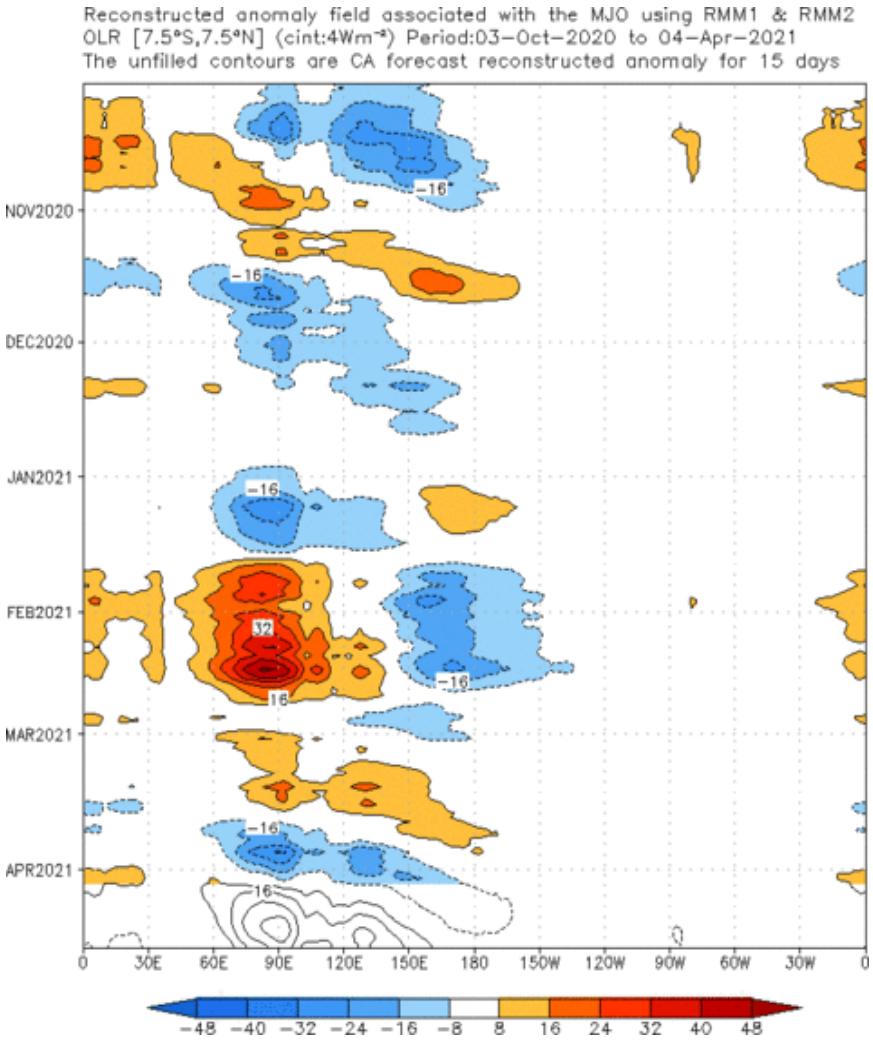
- The GEFS and ECMWF models predict the MJO to propagate east over the Pacific during the next two weeks.

- Although there is large spread among the GFS ensemble members on the amplitude, both ensemble means continue to indicate a strengthening of the intraseasonal signal with eastward propagation.

# 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.)

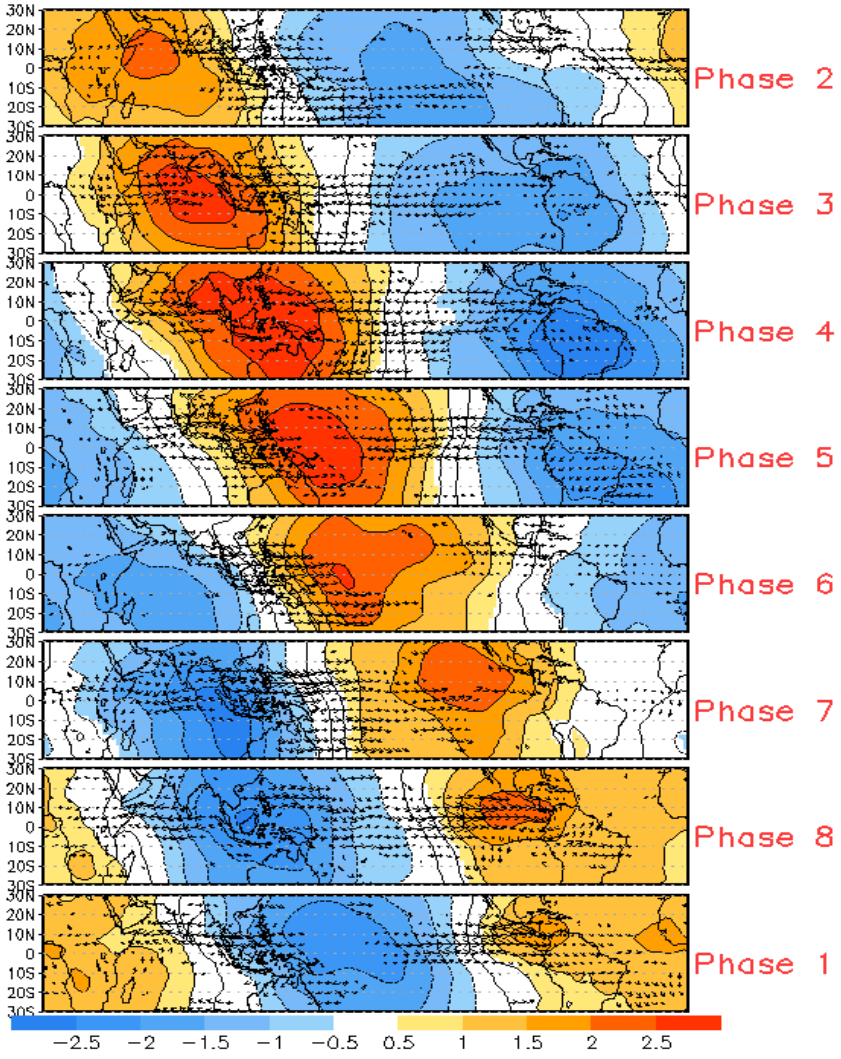


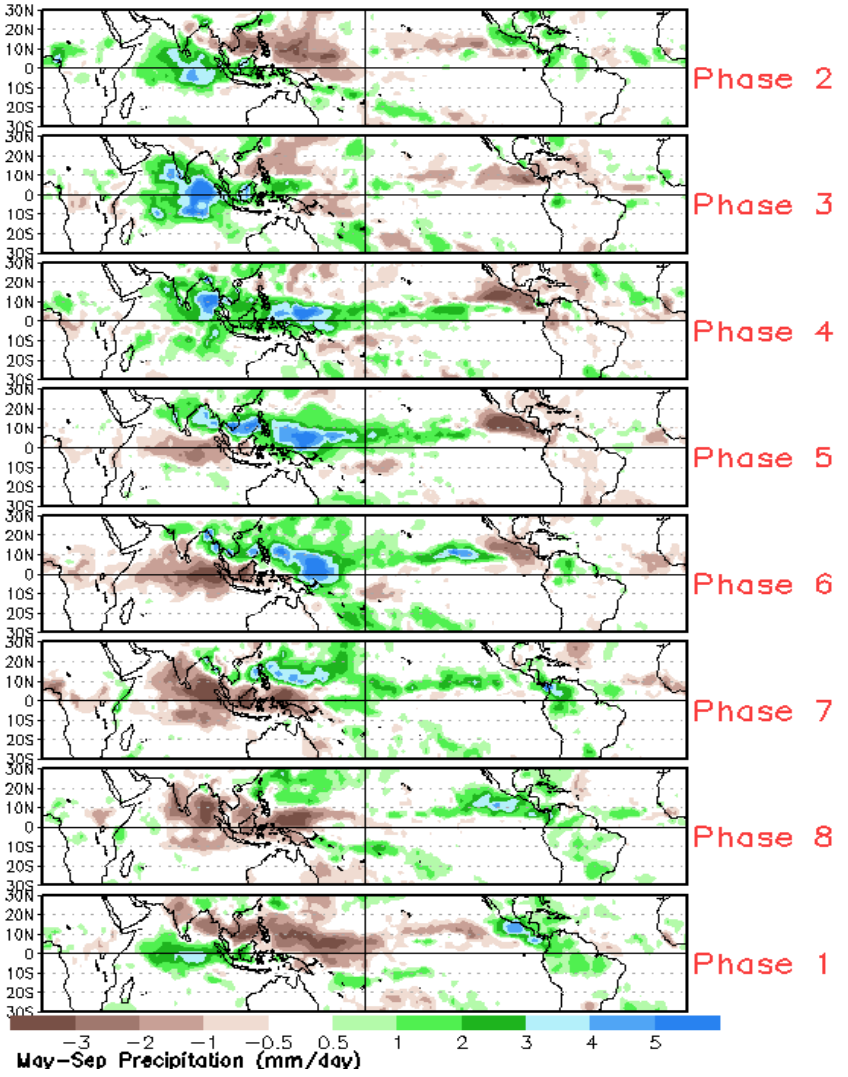

- The constructed analog forecasts an MJO evolution consistent with the GEFS and ECMWF RMM forecasts.

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



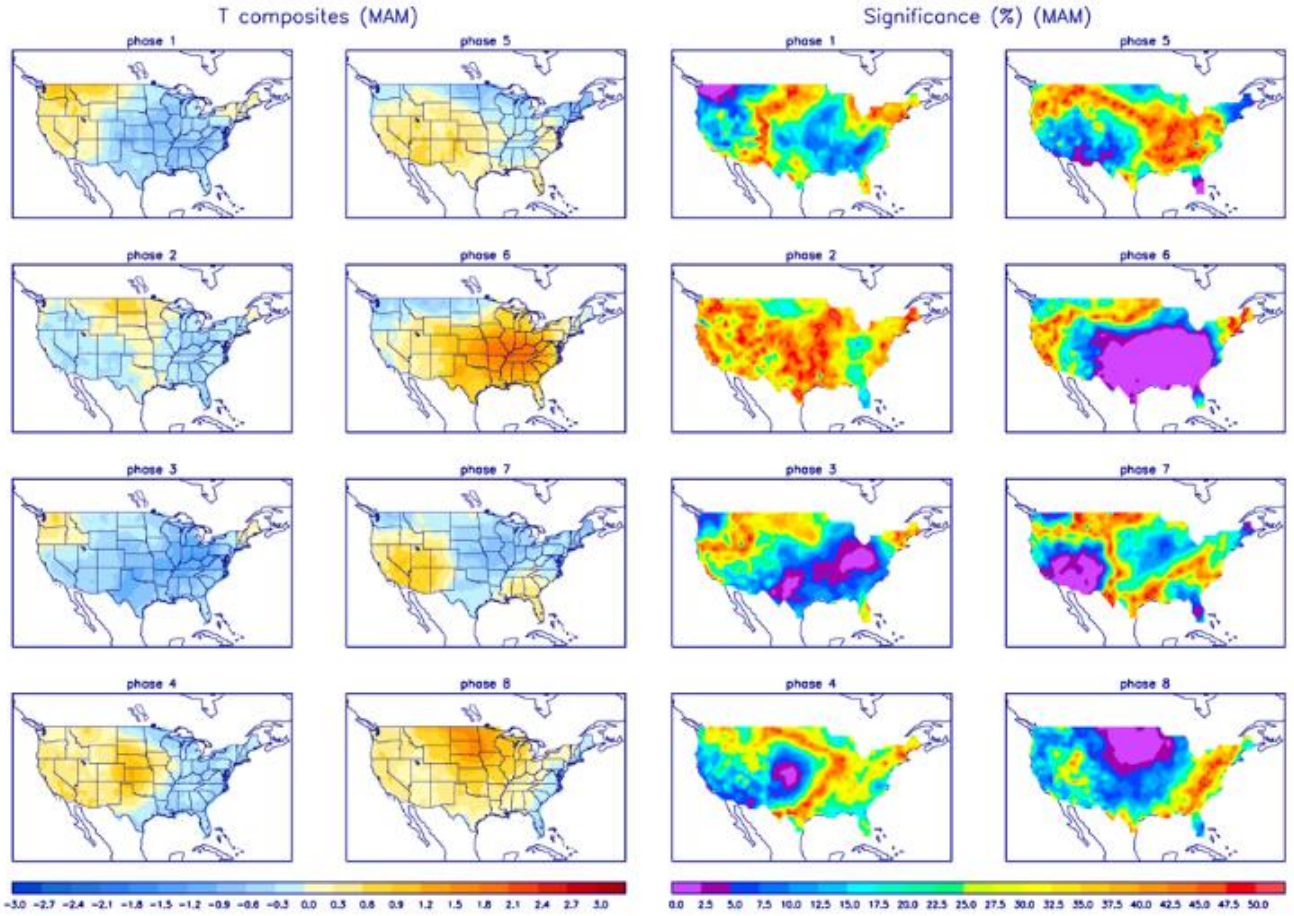

Precipitation Anomalies



# 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.

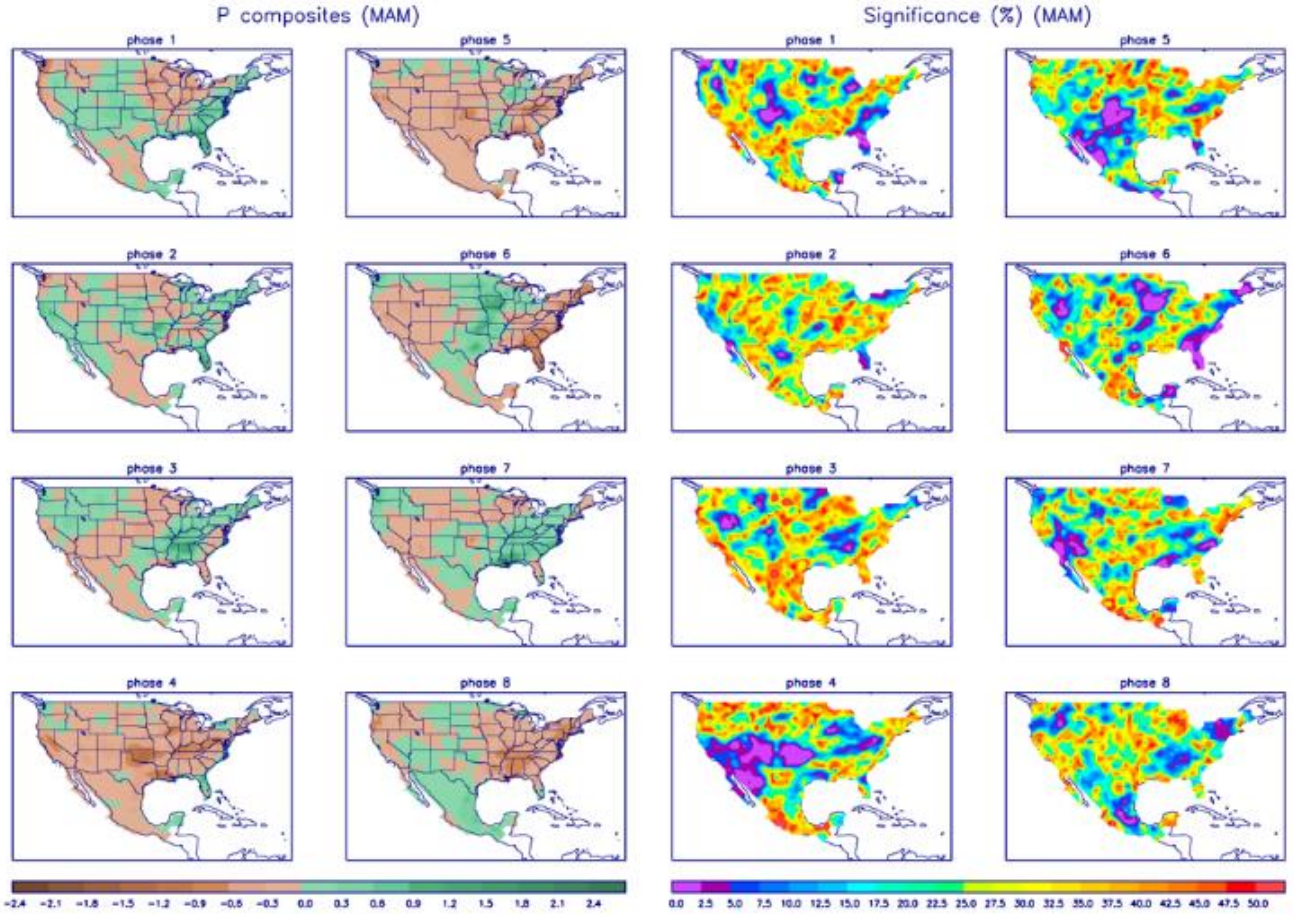



More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

# 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