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

**Update prepared by the Climate Prediction Center**
**Climate Prediction Center / NCEP**
**8 March 2021**

# Overview

- The MJO remains active, although the RMM-based MJO index remains weak. The signal is more apparent in the CPC upper-level velocity potential based index.

- Destructive interference from both the ongoing La Niña event in the Pacific and Rossby wave activity over the West Pacific are contributing to the weaker presentation.

- The convective response to the MJO event is occurring primarily off-Equator at this time, with an enhanced SPCZ the primary result.

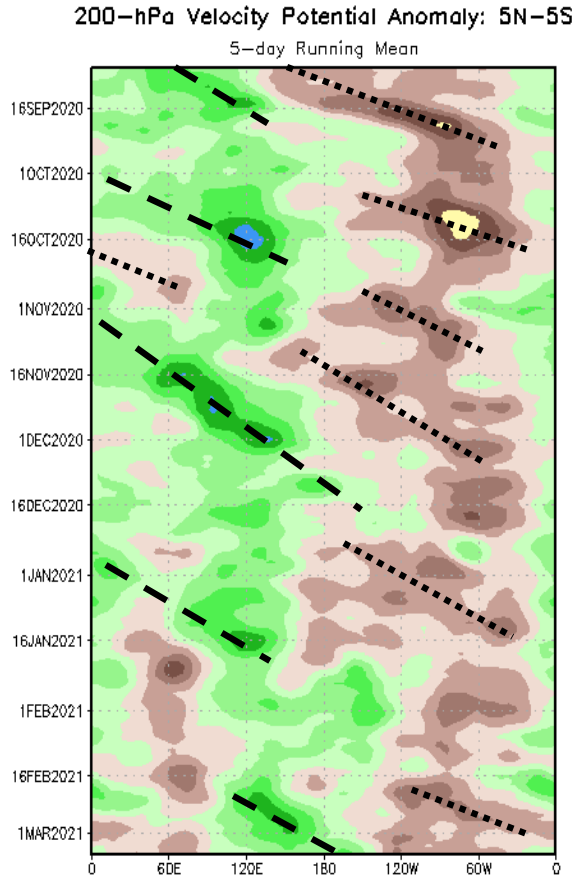
- Westerly low-level winds over the far western Equatorial Pacific are not as strong as observed in conjunction with the late February strong Rossby wave, but these westerly winds may help limit the amplitude of the upwelling phase of the ongoing oceanic Kelvin wave.

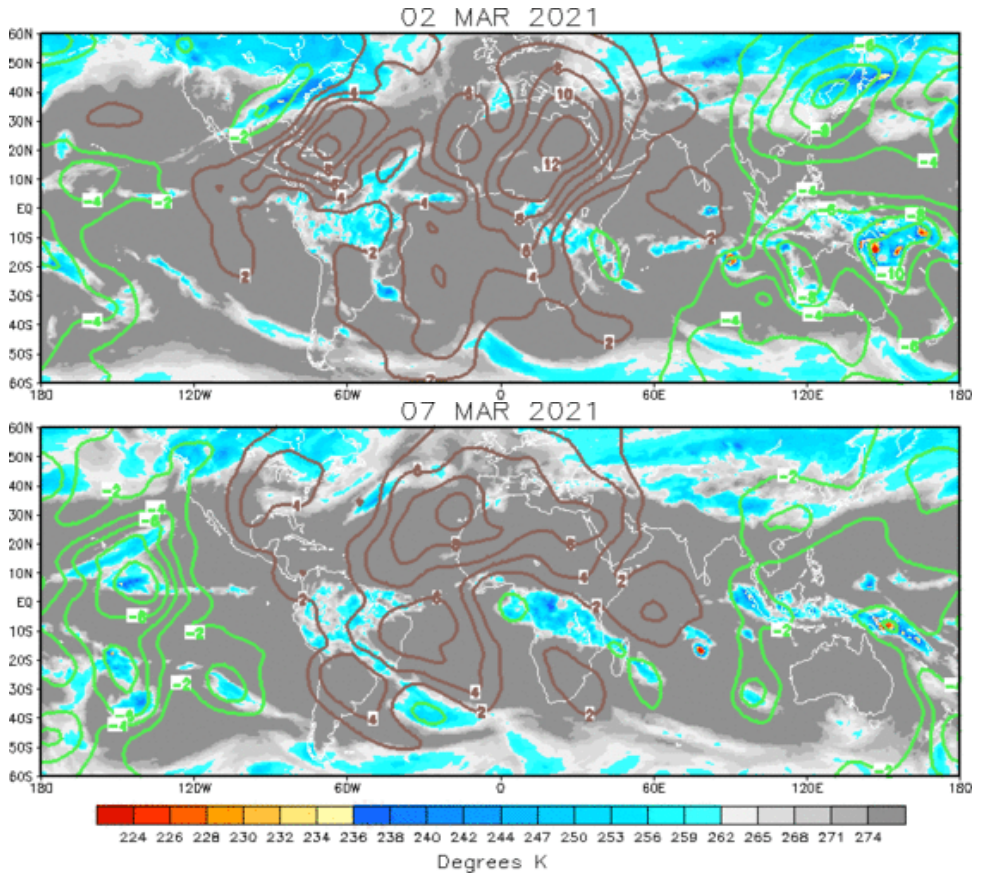
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

# 200-hPa Velocity Potential Anomalies

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

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



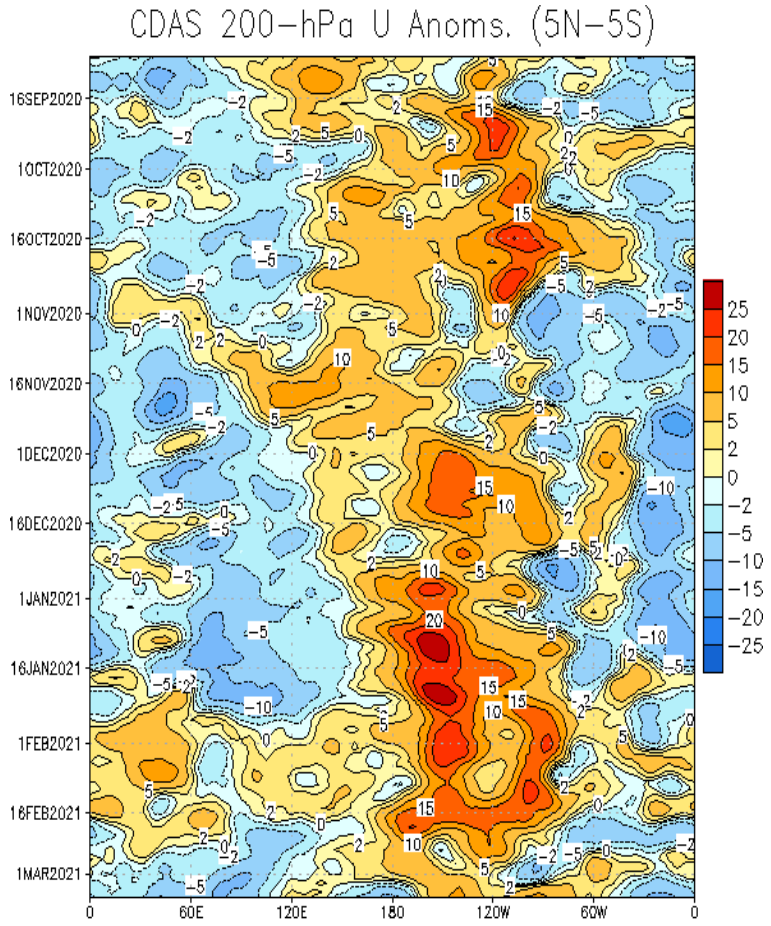



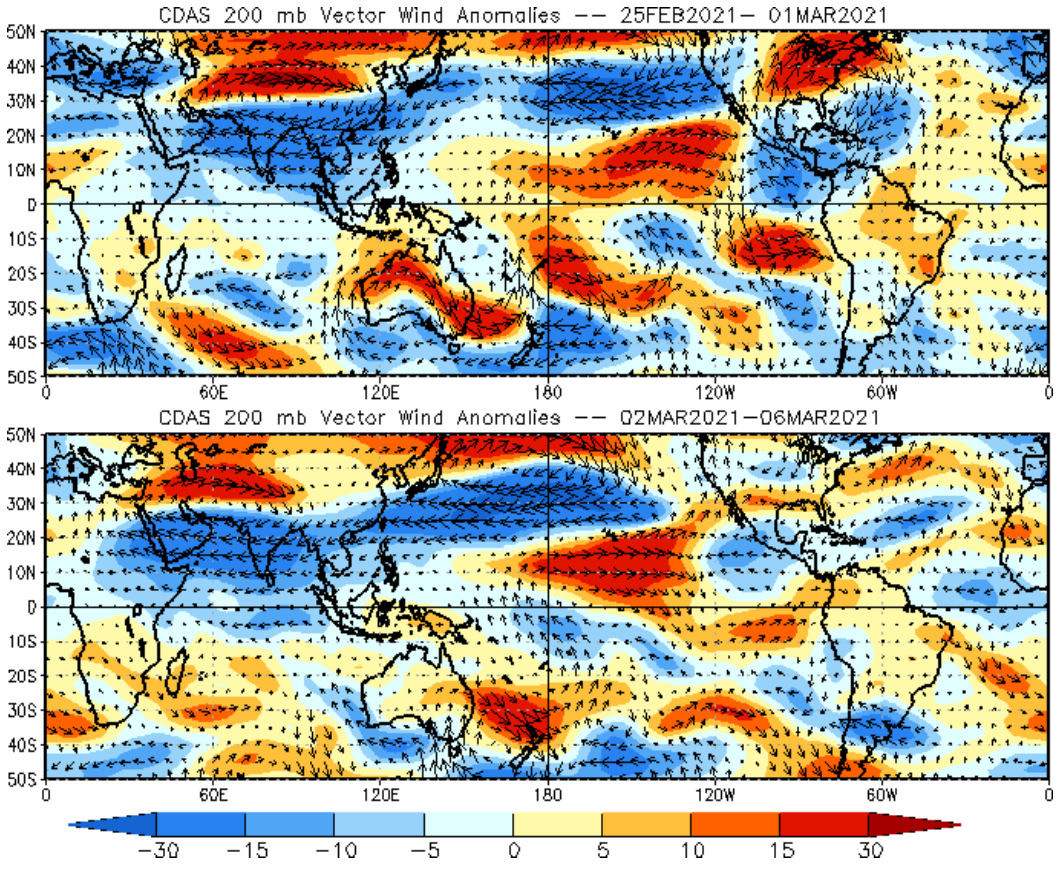

- Since mid-February, eastward propagation of a more coherent MJO signal was evident, with the enhanced phase propagating from the Maritime Continent to the West Pacific.

- Due to destructive interference with the ongoing La Niña, the negative velocity potential anomalies were weaker along the equator, with stronger convection observed in both poleward directions.

# 200-hPa Wind Anomalies

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



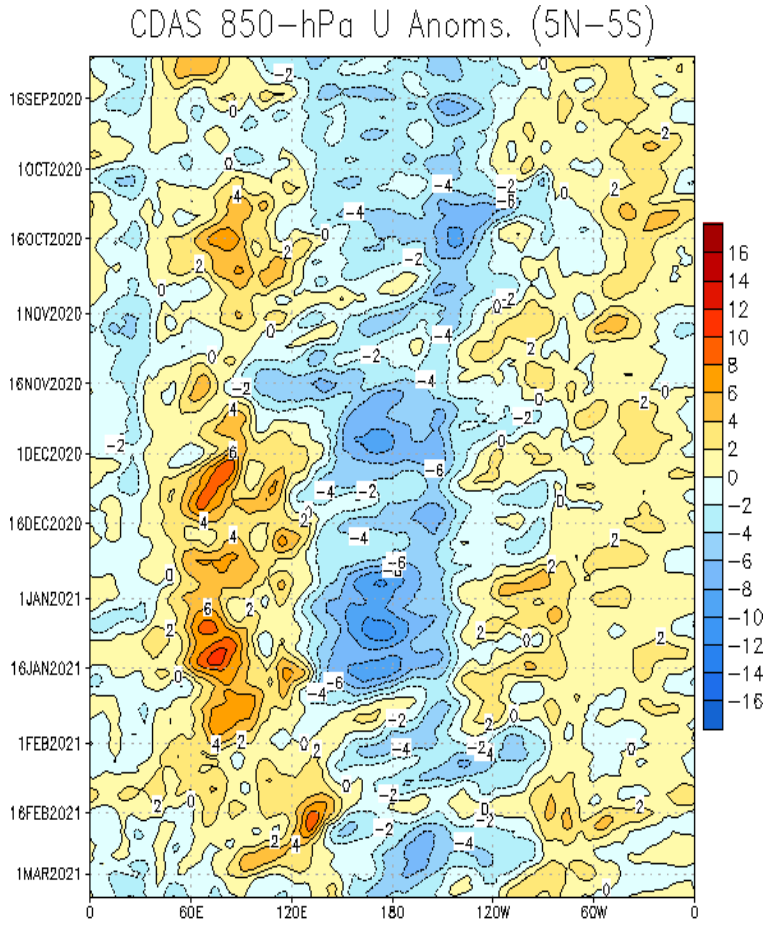



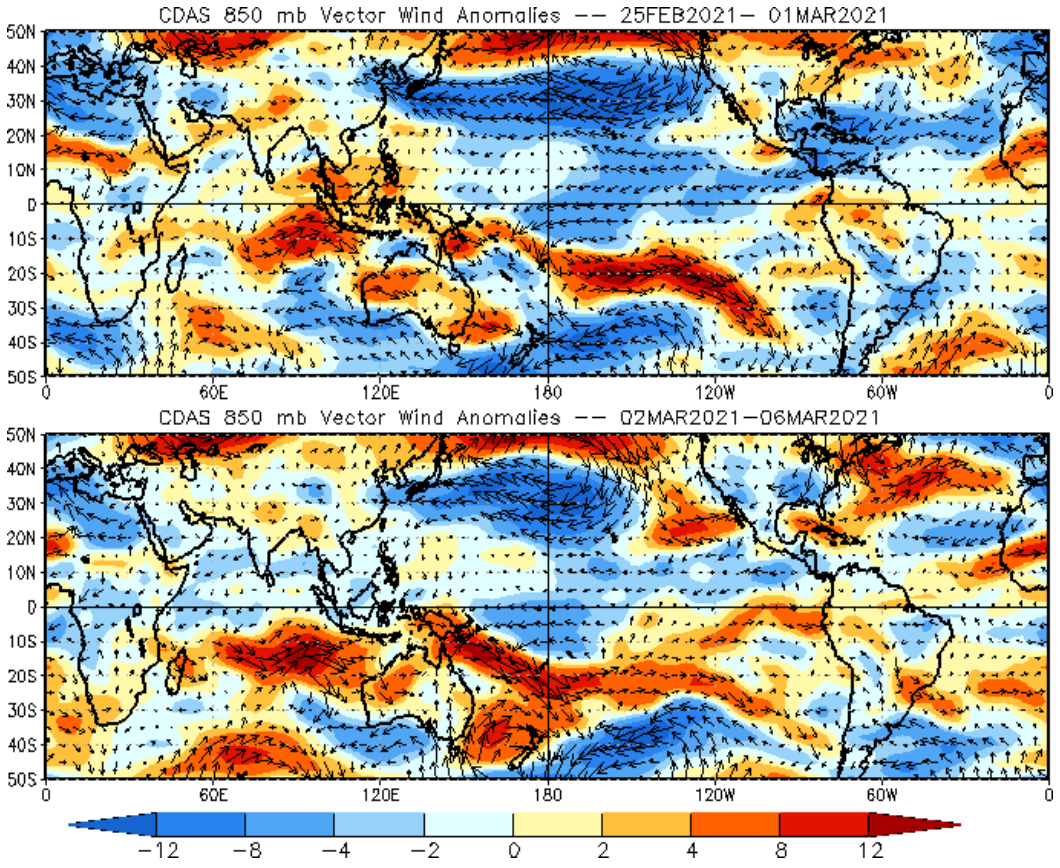

- During early March, enhanced SPCZ convection has helped engender robust southerly cross-equatorial flow west of the Date Line.

- The anomalous anti-cyclonic circulation over the South Pacific near the Date Line is inconsistent with a canonical La Niña response, and is due to destructive interference from the intraseasonal signal.

# 850-hPa Wind Anomalies

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

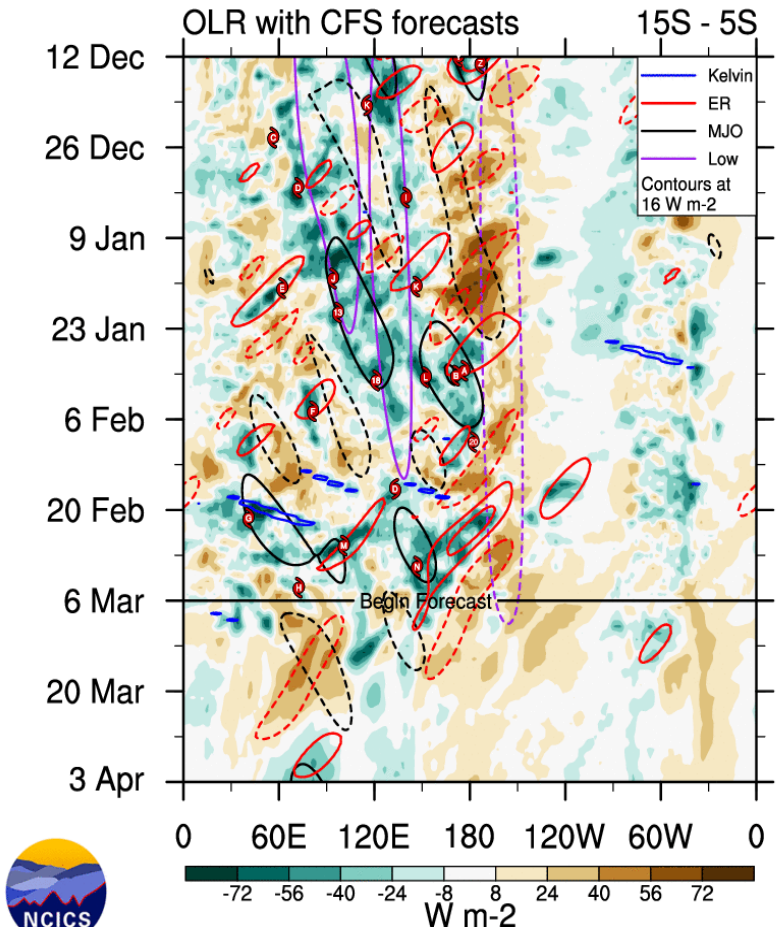


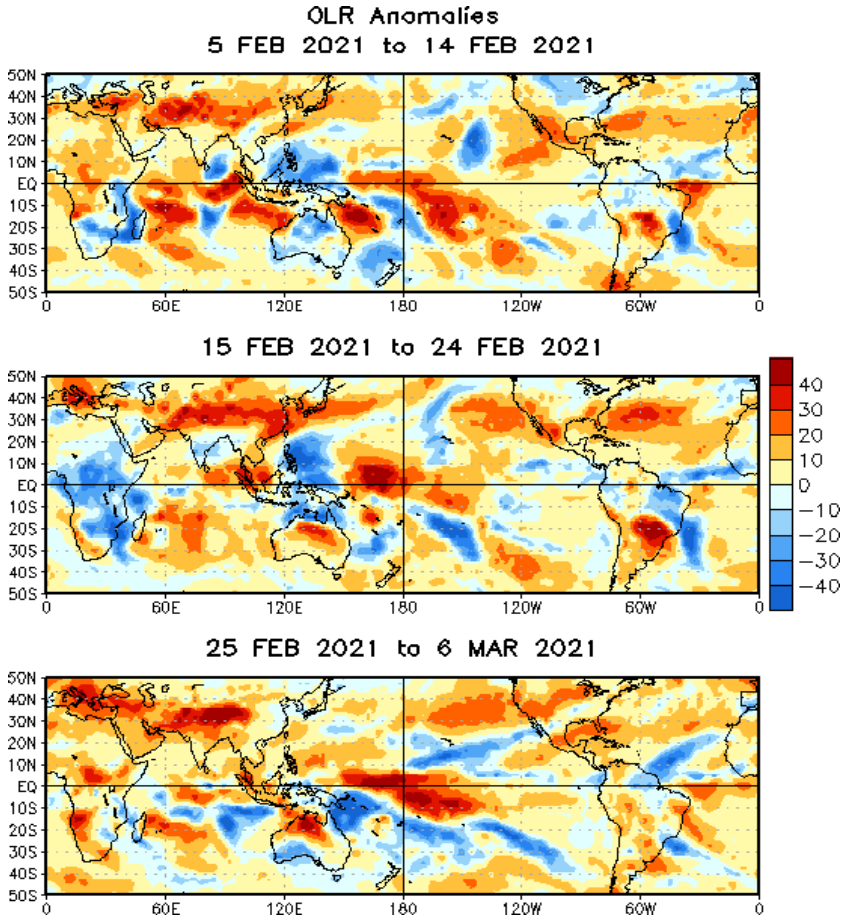




- Westerly winds increased over the SPCZ region in association with the intraseasonal signal.
- Enhanced trade winds associated with the low frequency La Niña base state persisted near and west of the Date Line close to the Equator.

# Outgoing Longwave Radiation (OLR) Anomalies

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

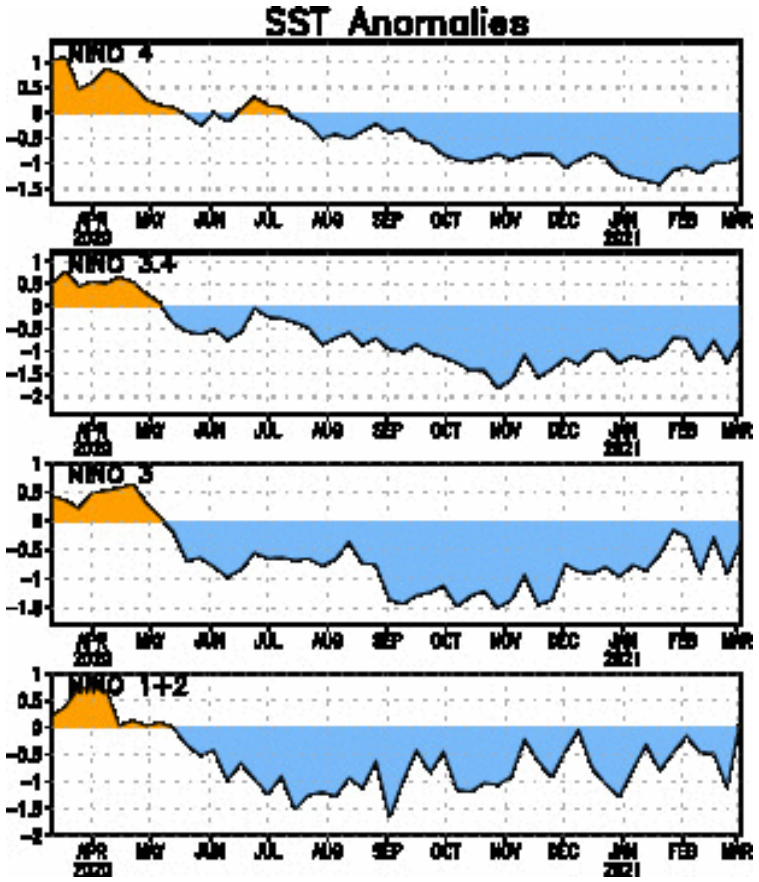


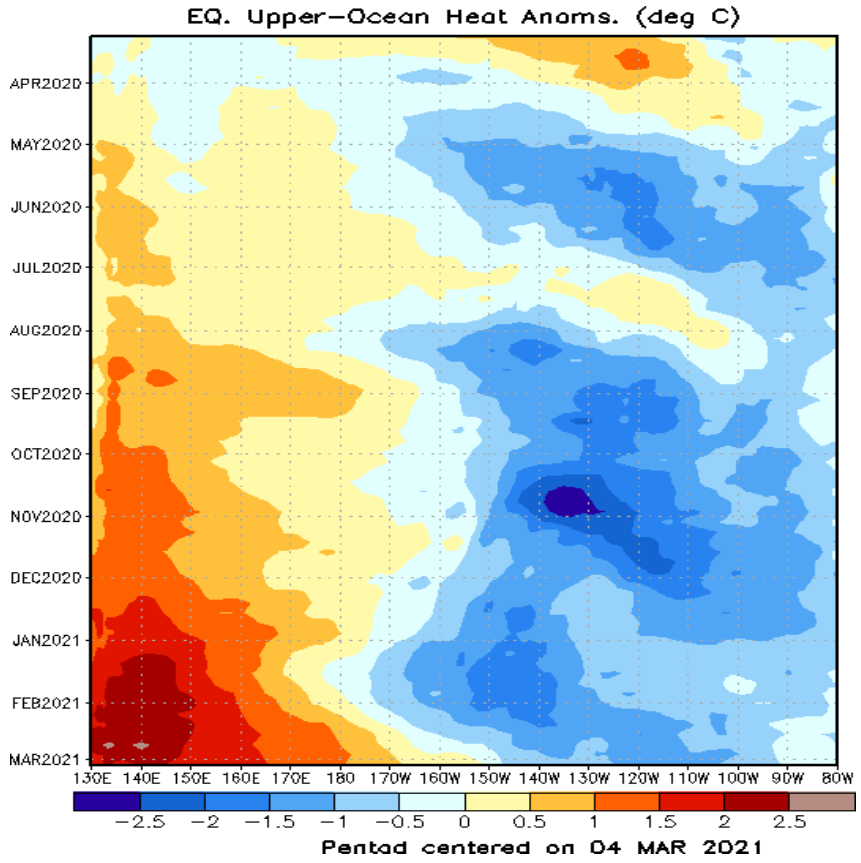




- During early March, convection over the southwestern Pacific increased, while large-scale suppression of convection remained entrenched along the Equator.

- Rossby wave activity over the West Pacific is evident in the OLR field.

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



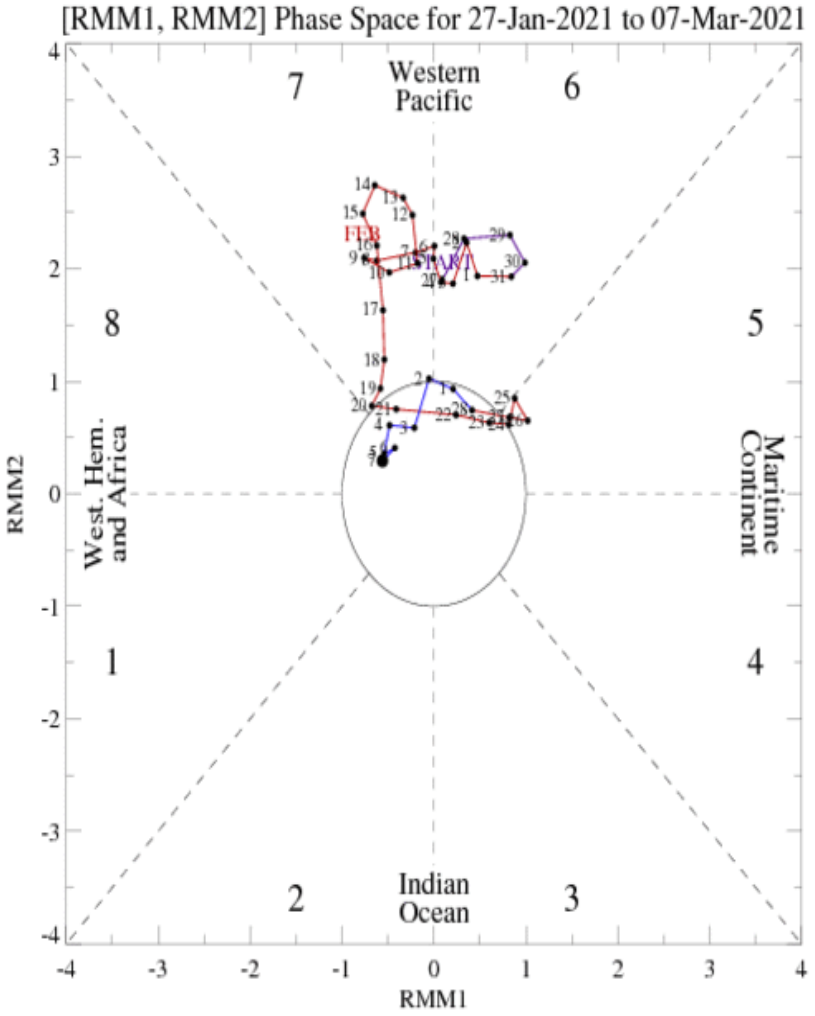

- La Niña conditions have been present since August 2020.

- 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 has been pushing warmer water east of the Date Line.

# MJO Index: Recent Evolution

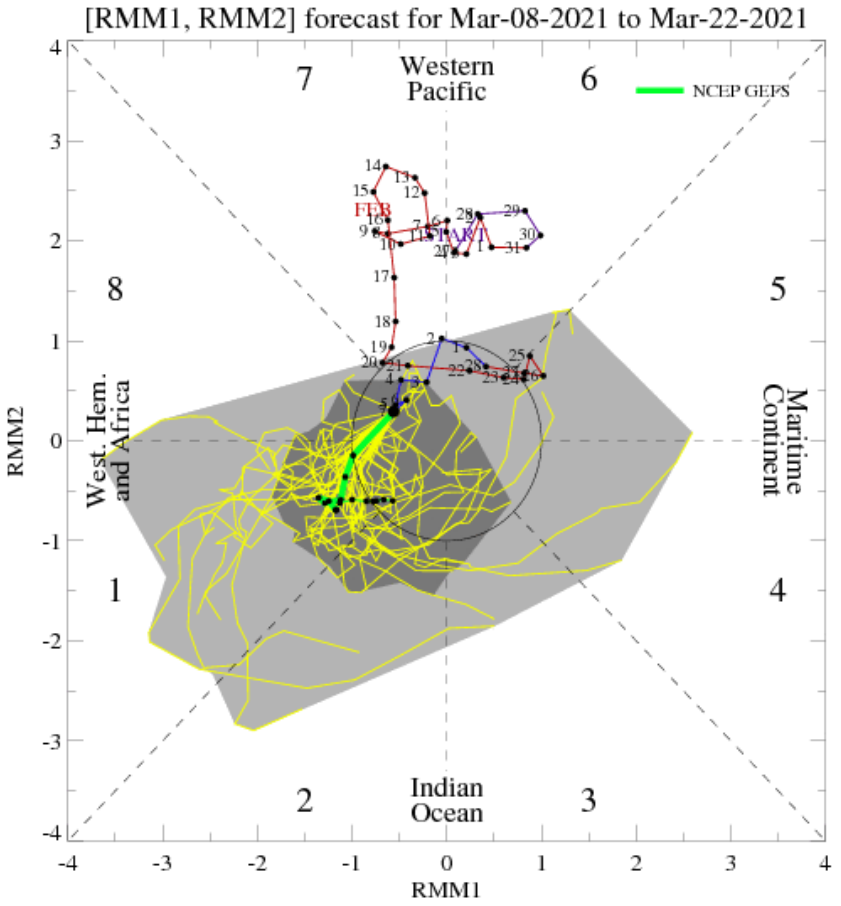
- The RMM index remains weak as the La Niña and Rossby wave activity interfere with the primary eastward-propagating intraseasonal signal.

- Despite the ongoing interference, there is some evidence of eastward propagation of the MJO signal.

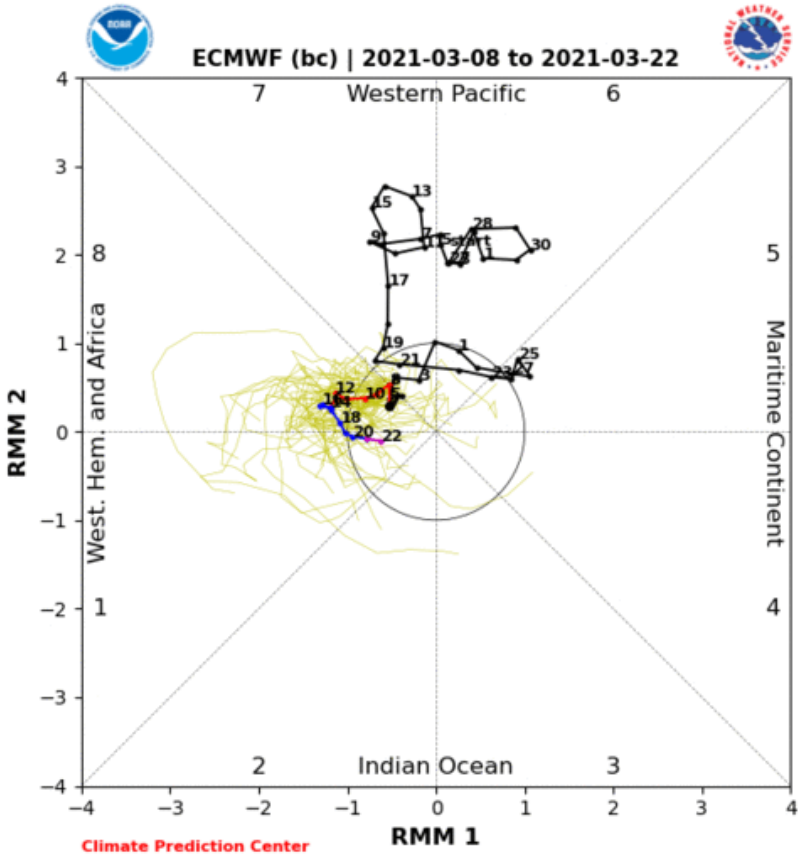



For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

# MJO Index: Forecast Evolution




GEFS Forecast



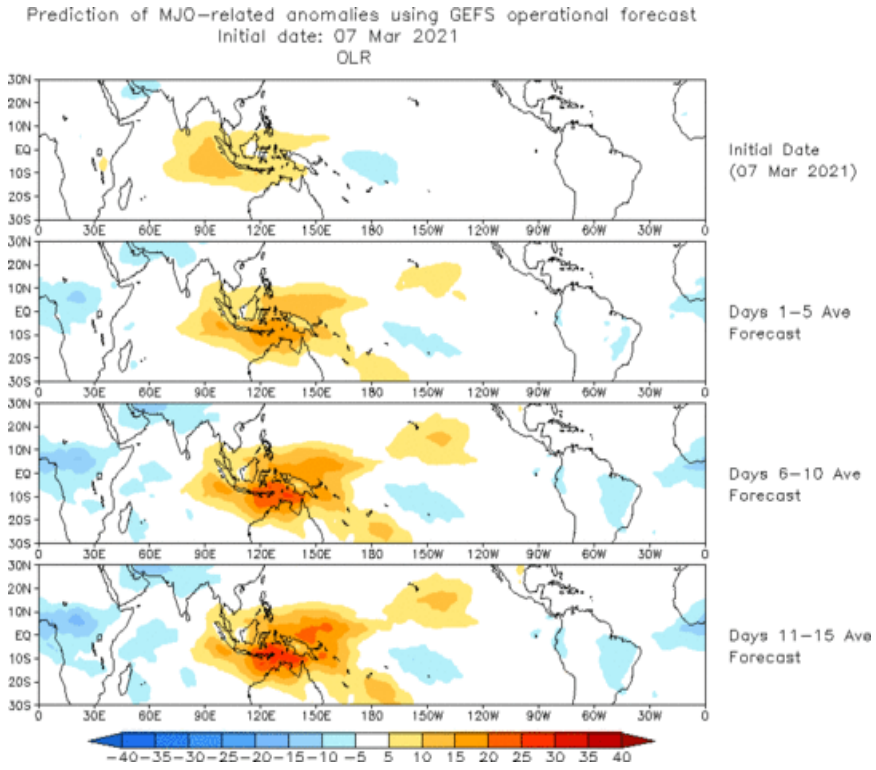

ECMWF Forecast

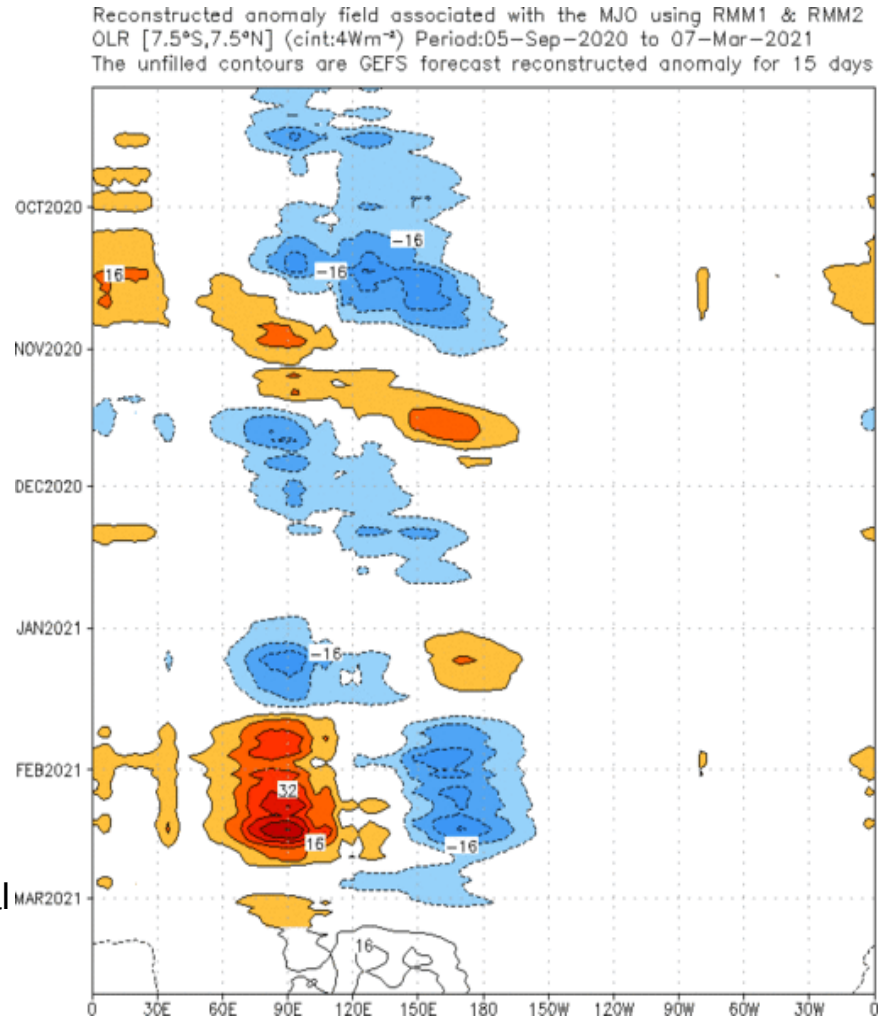
- The GEFS forecast generally depicts a gradual increase in MJO amplitude as the enhanced signal reaches the Western Hemisphere. Several ensemble members depict a strong event evolving, while others show the signal remaining fairly weak.

- The ECMWF ensembles also depict an increase in MJO amplitude over the East Pacific or Western Hemisphere, with a generally slower eastward propagation than the GEFS.

# 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.)

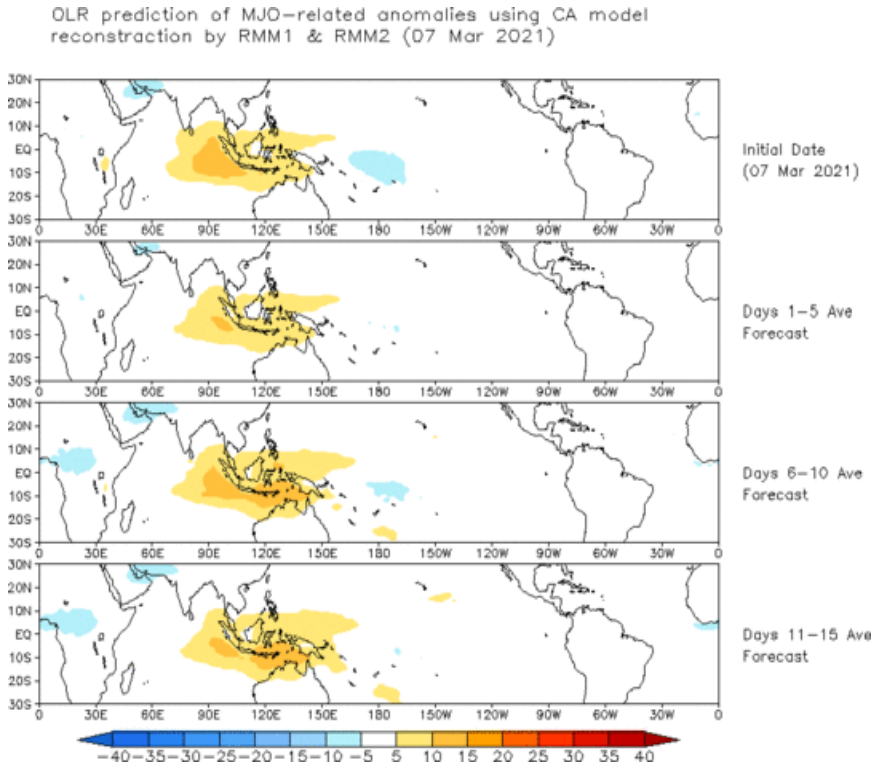


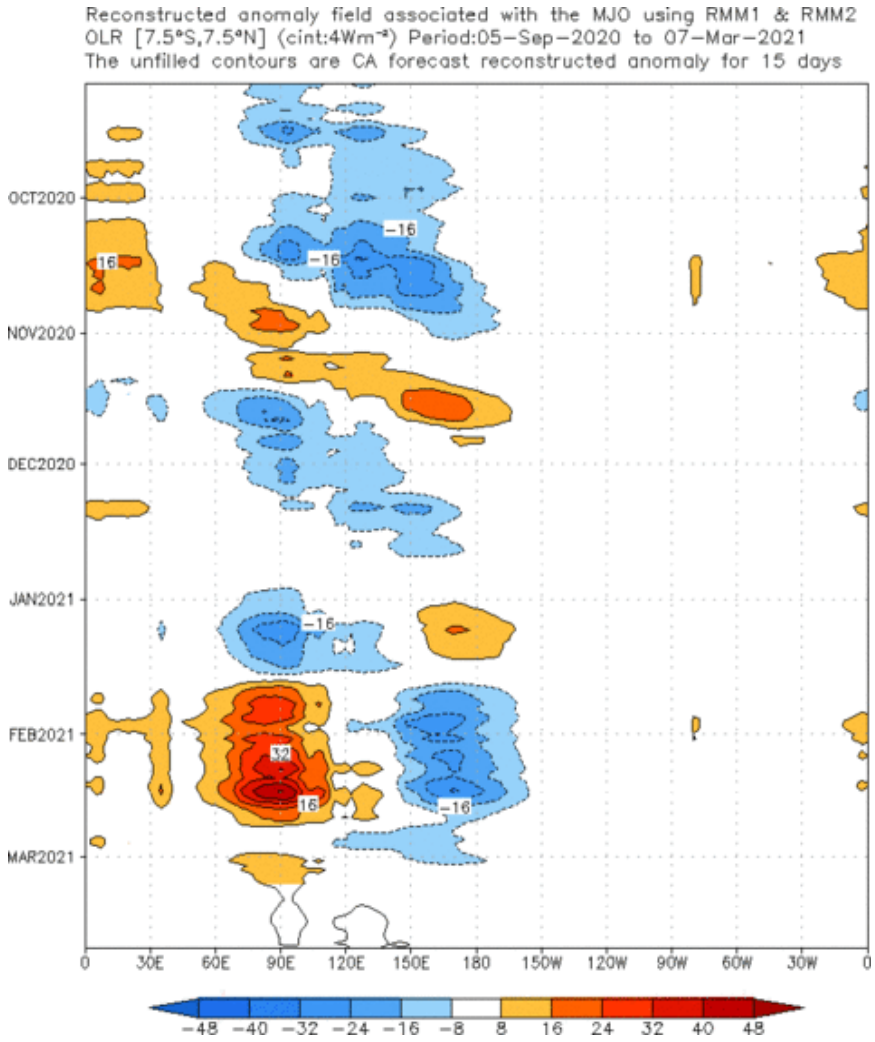




- The GEFS RMM forecast based OLR anomalies show an eastward propagating signal with a gradual increase in the amplitude of the anomaly field.

# 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.)

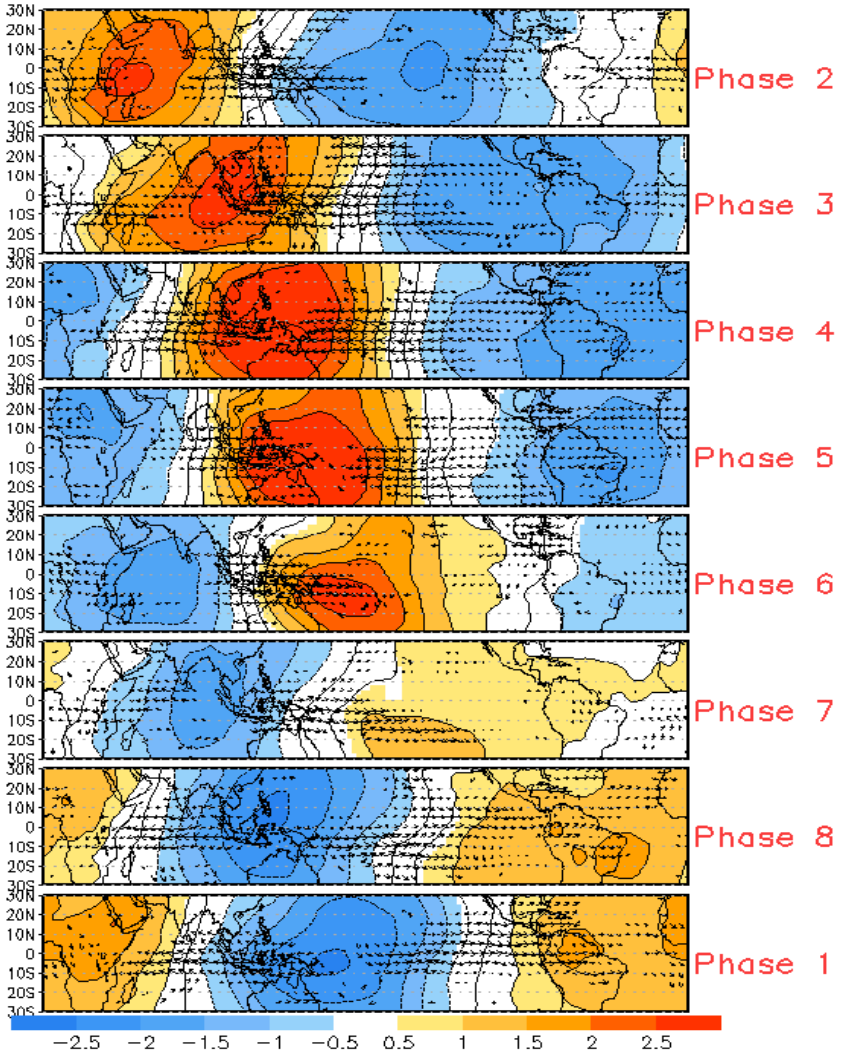


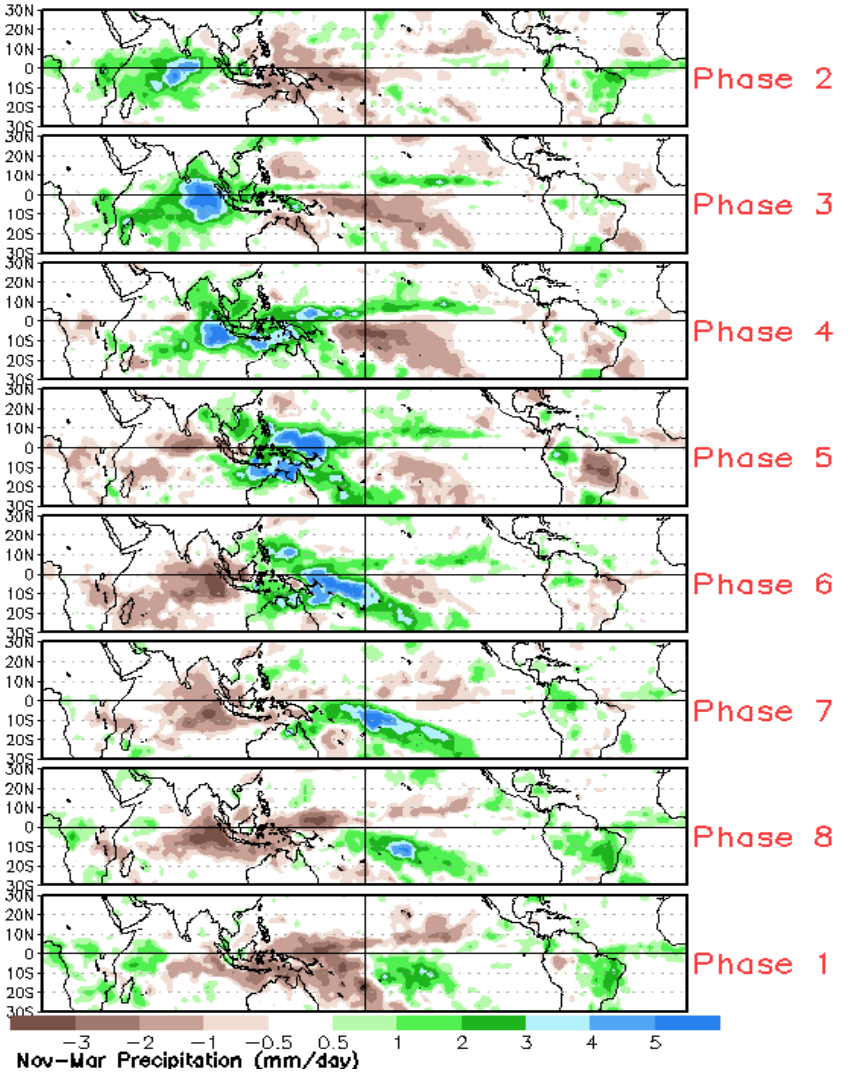

- The constructed analog predicts a fairly stationary pattern with little change in the amplitude of the anomaly field.

# MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



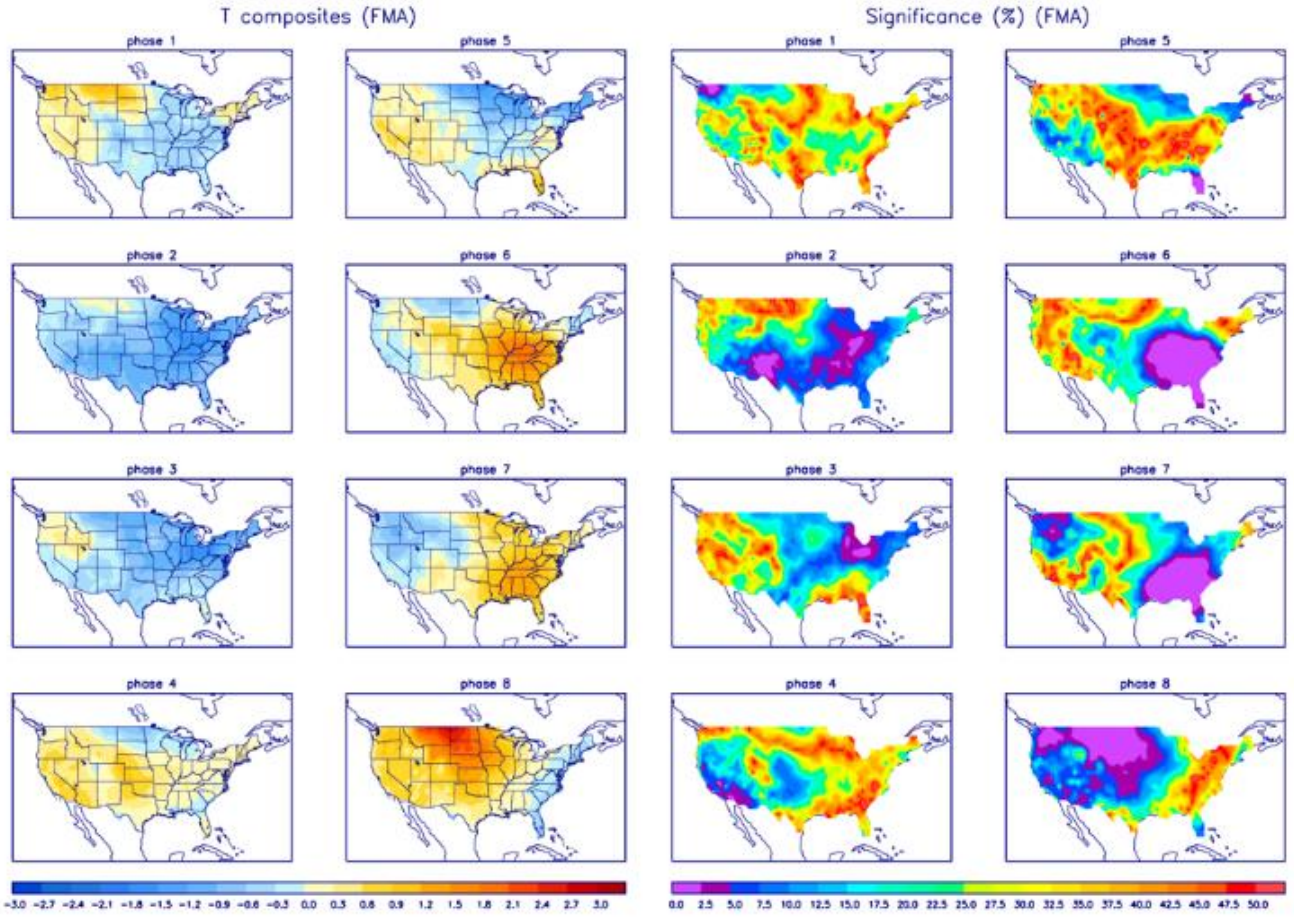

Precipitation Anomalies



# 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.

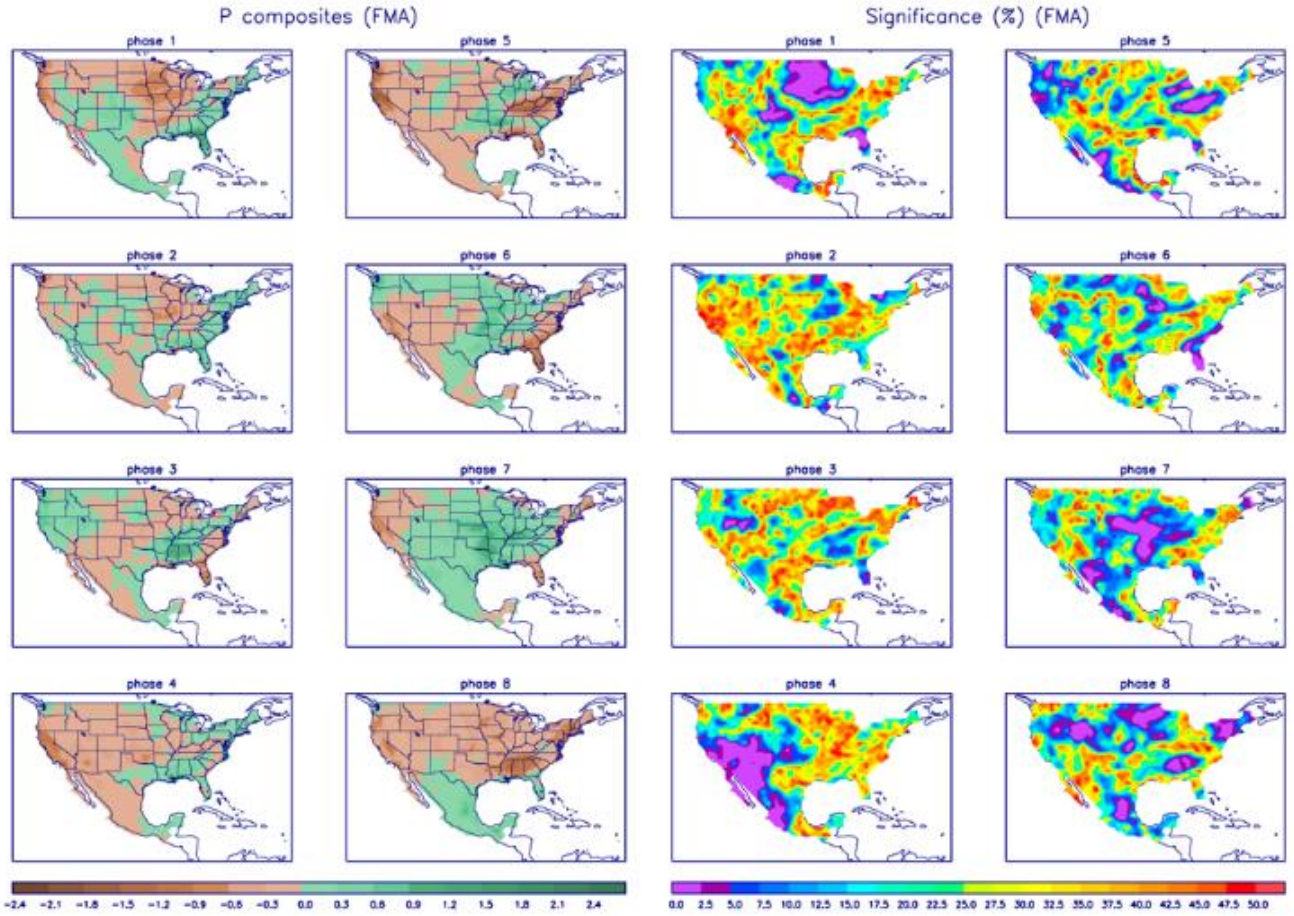



More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

# 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