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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
9 March 2020

Overview

- The upper-level pattern indicates that the enhanced phase of a fast-moving MJO propagated east from the Indian Ocean to the Maritime Continent during the first week of March.

- A low-frequency signal favoring enhanced convection near the Date Line persists, but it weakened recently due to destructive interference with the intraseasonal suppressed envelope.

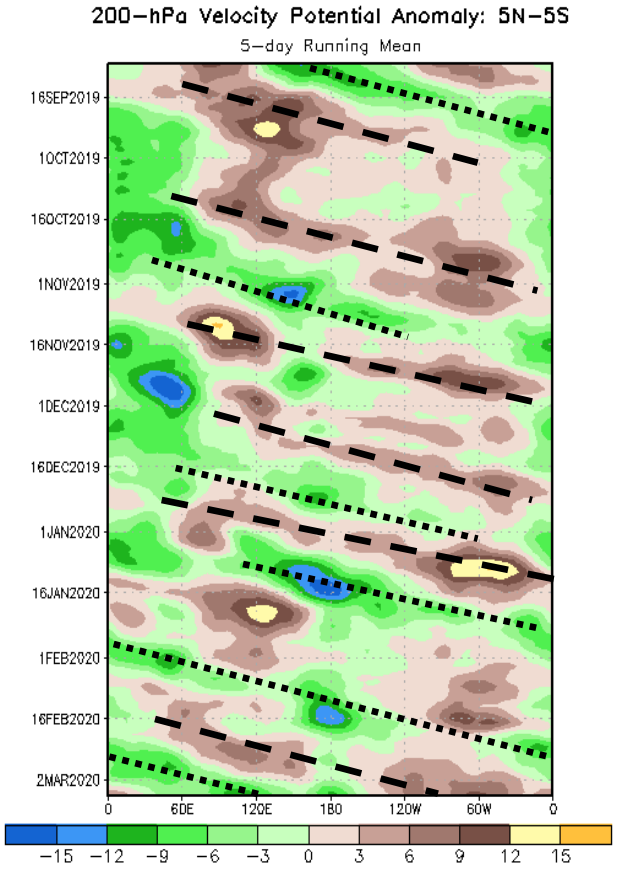
- Dynamical models feature continued eastward propagation but it is unclear whether the MJO or a Kelvin wave becomes the more dominant mode.

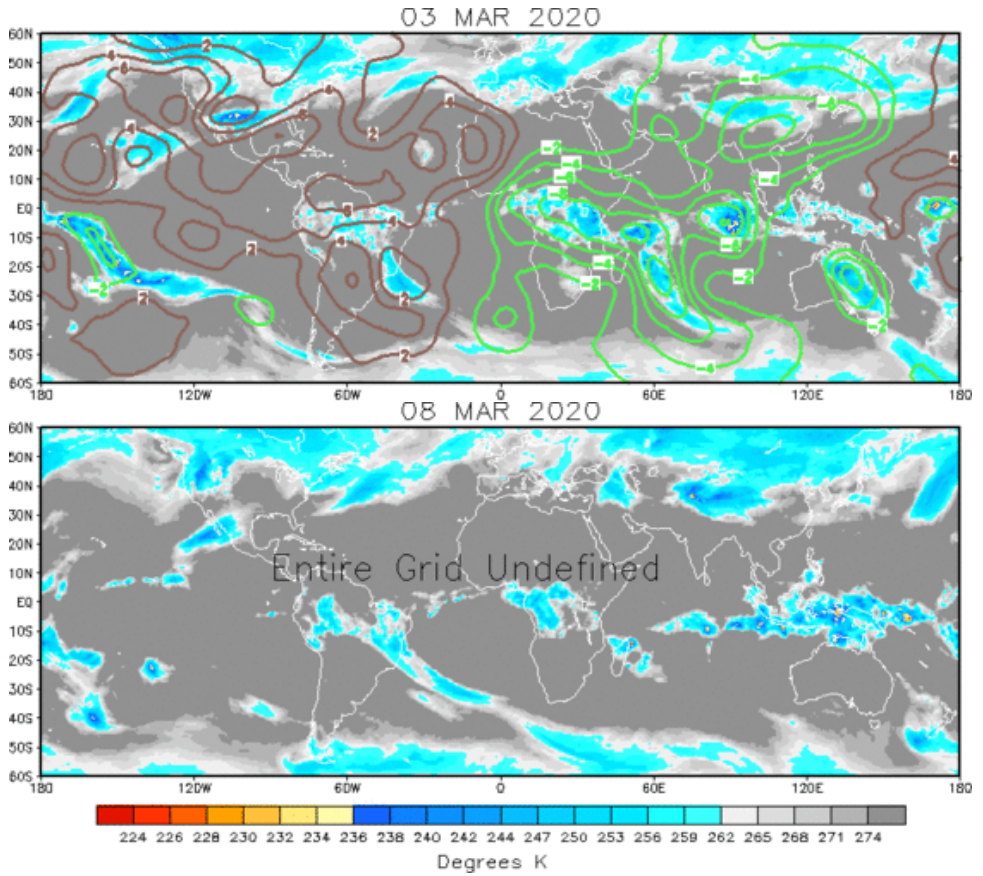
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



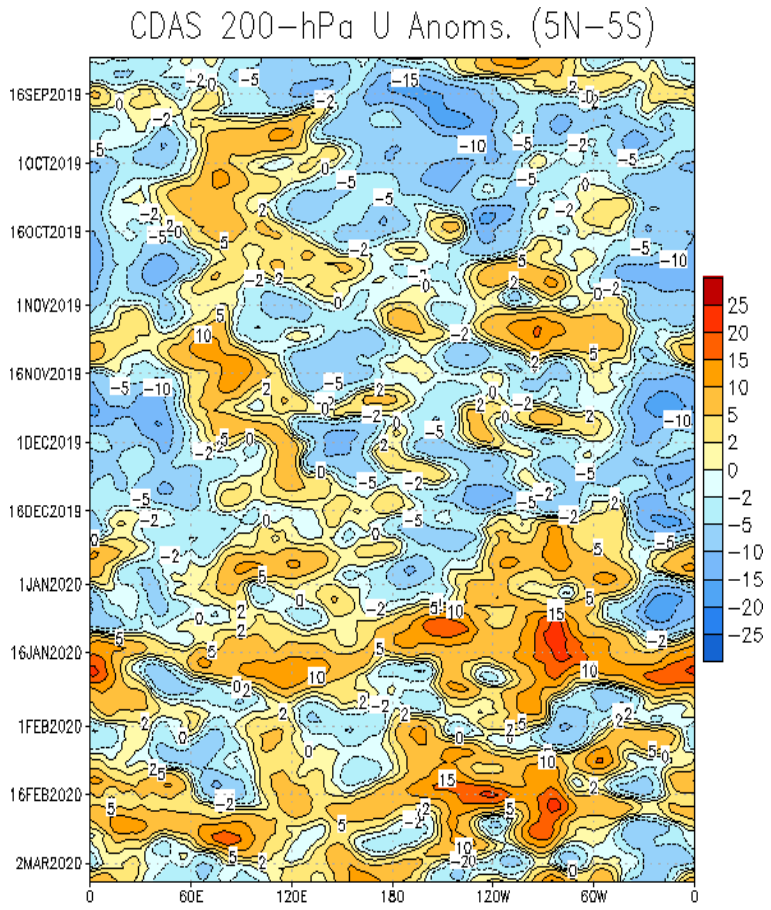


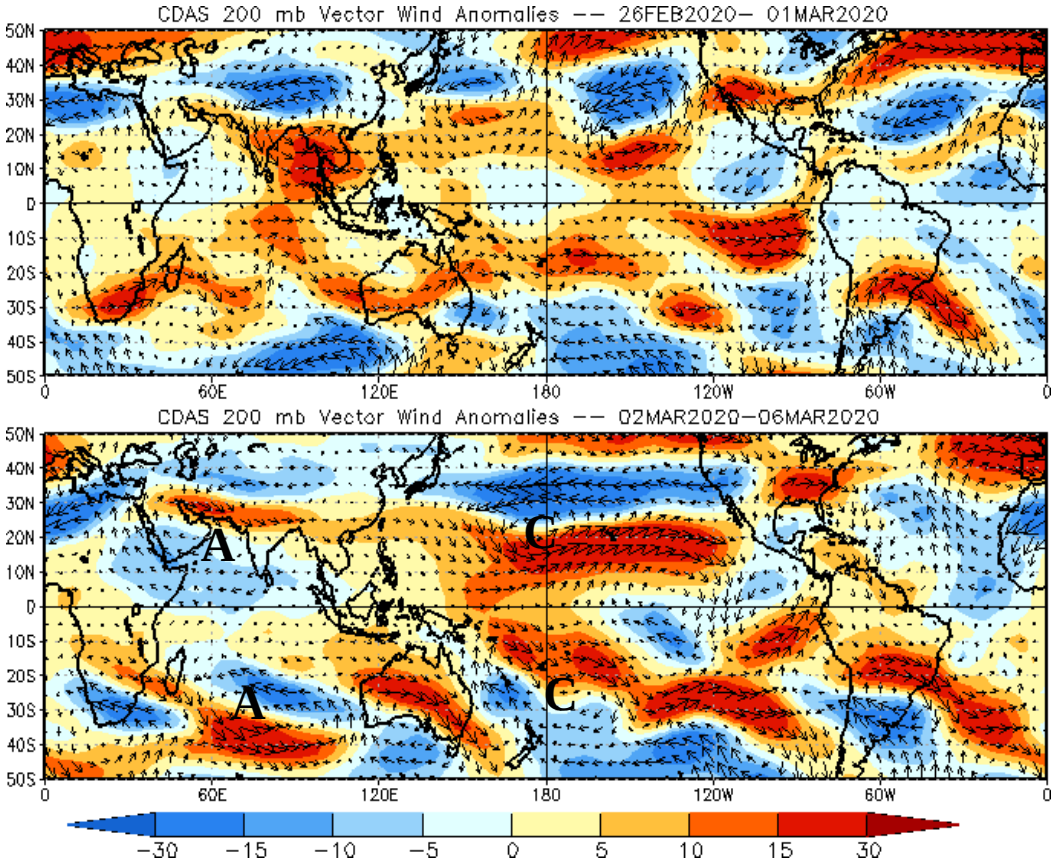
- The global convective pattern was coherent at the beginning of March with upper-level divergence (convergence) over Africa and the Indian Ocean (East Pacific and the Americas).

- Other modes continue to influence the pattern, including a low-frequency signal supporting enhanced convection at and surrounding the Date Line.

200-hPa Wind Anomalies

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



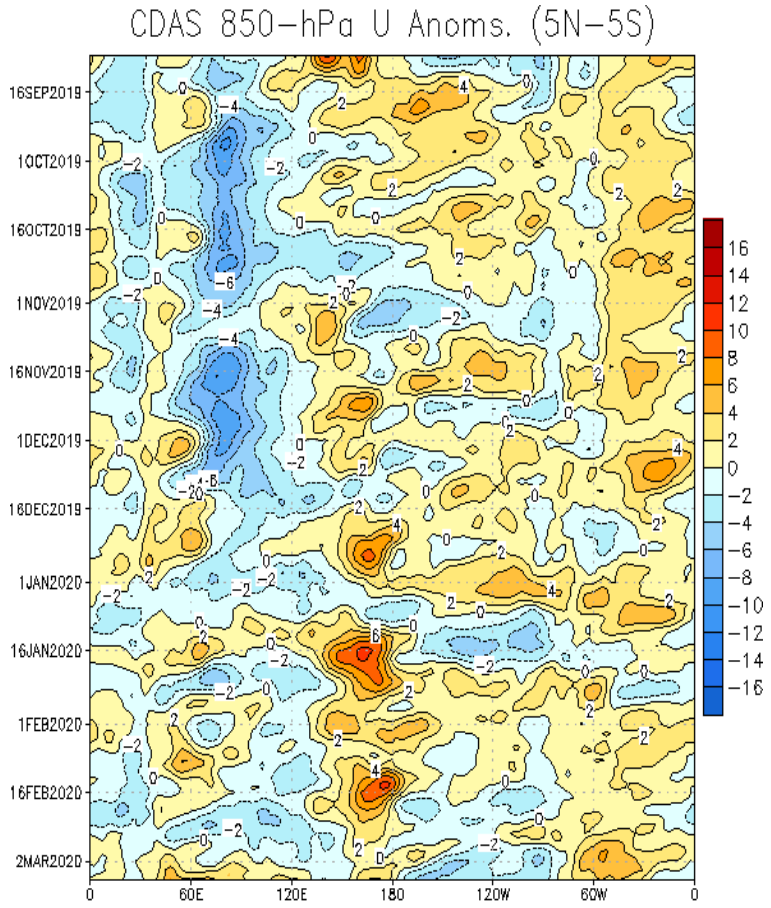


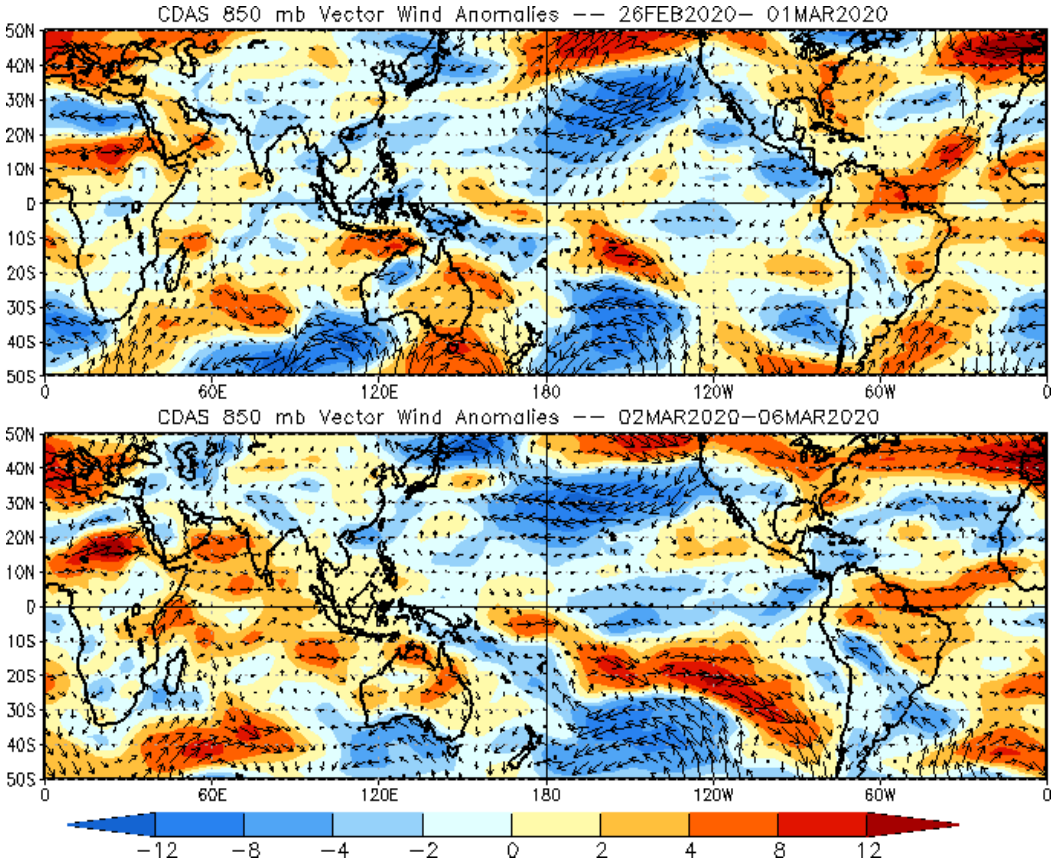
- Easterly anomalies over the western Indian Ocean coupled with strong westerly anomalies over the Pacific Ocean are contributing to enhanced convection across the Maritime Continent and northern Australia.

- Twin anticyclones aloft are present over the North and South Indian Ocean.

850-hPa Wind Anomalies

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

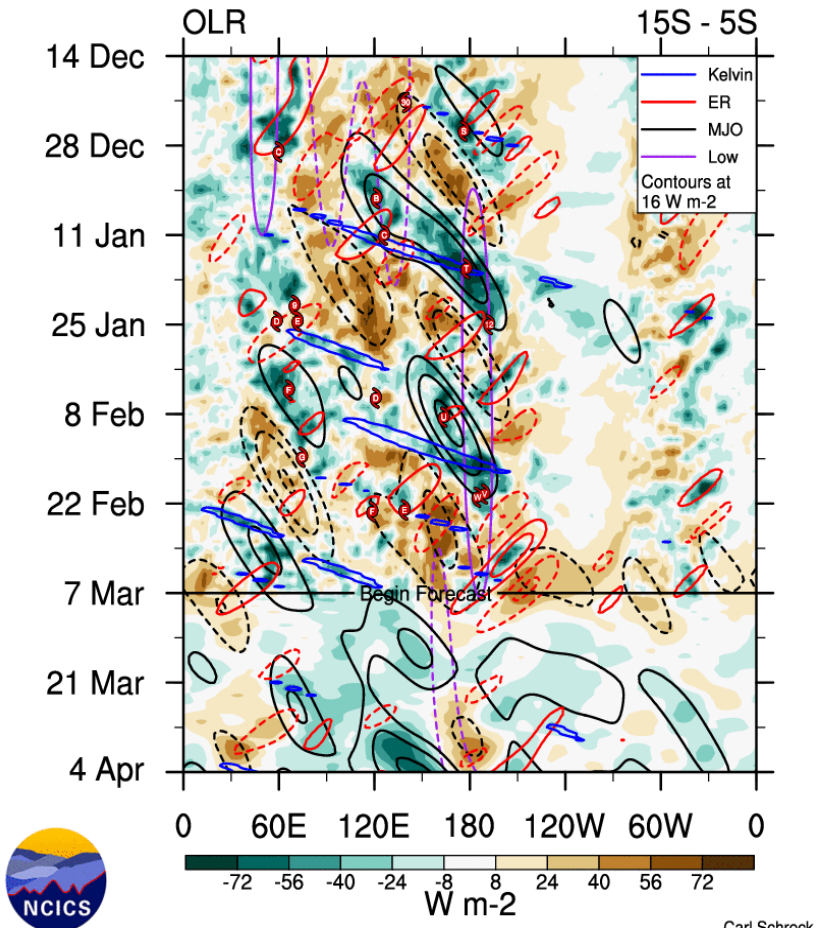


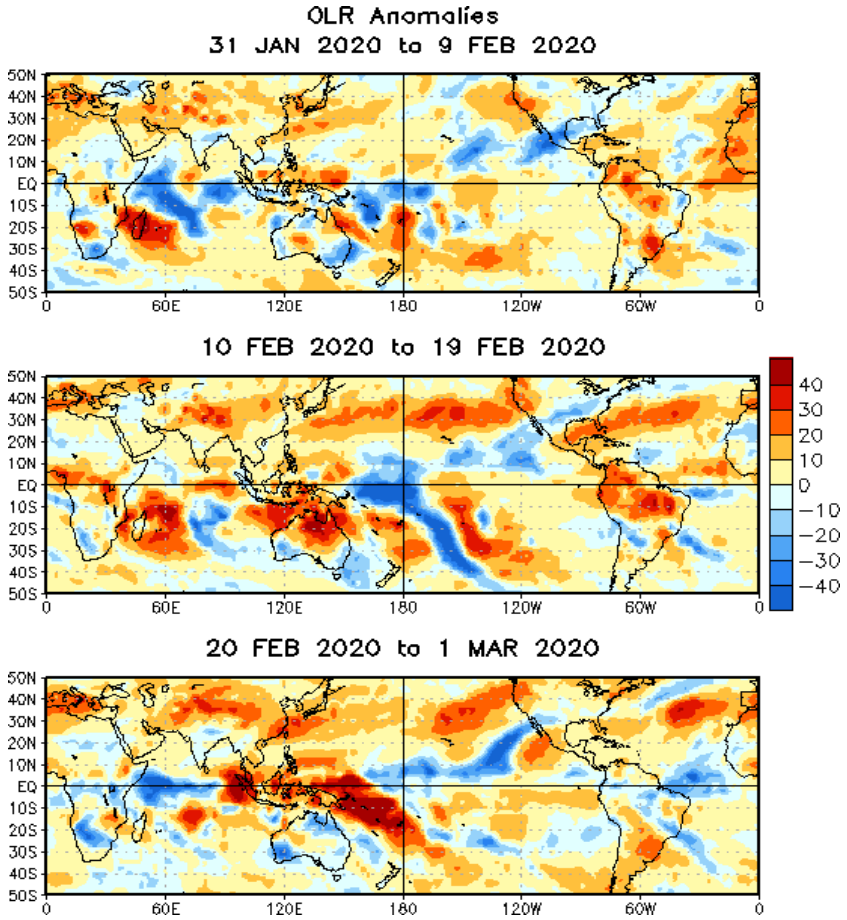


- A low-frequency signal near the Date Line that was recently associated with an enhanced SPCZ persists, albeit with a weakening trend since mid-February.
- Westerly anomalies returned to the Maritime Continent for the first time since mid-January.

Outgoing Longwave Radiation (OLR) Anomalies

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

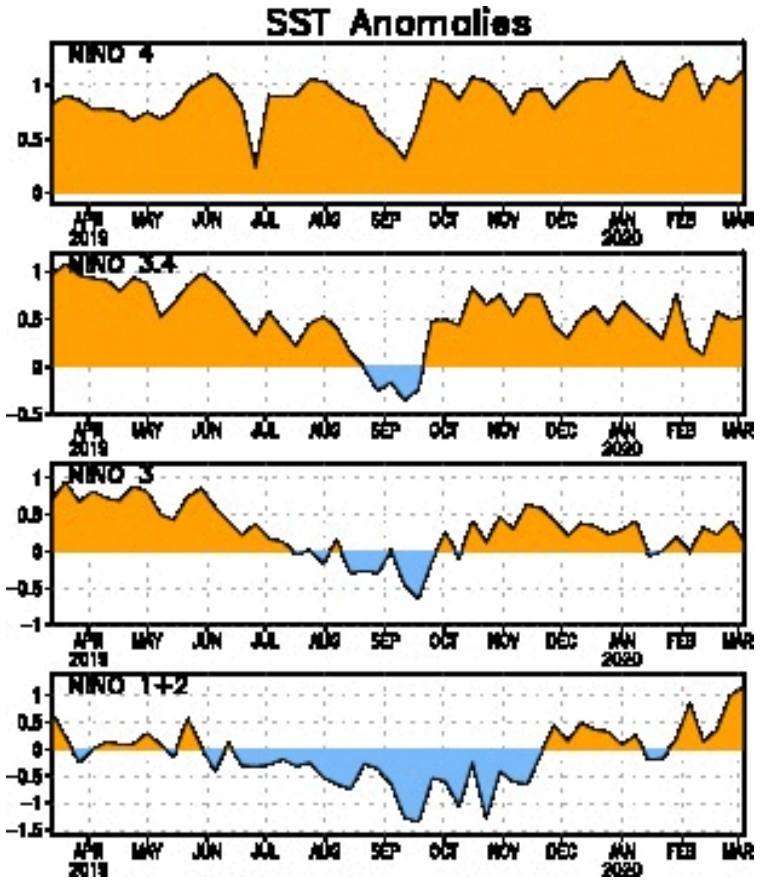


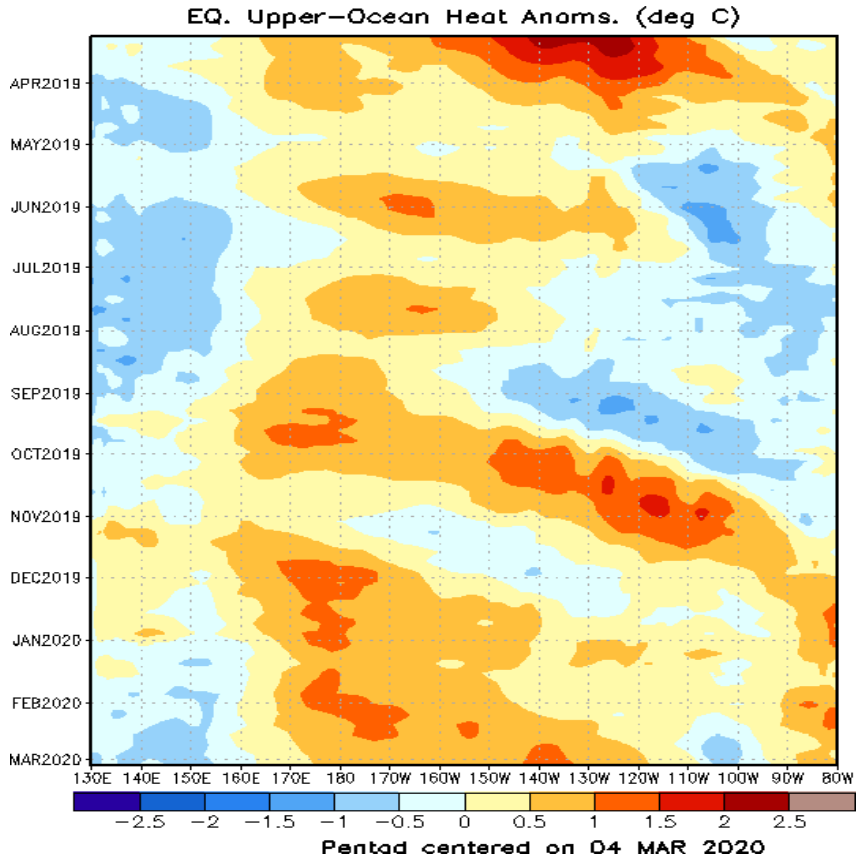


- During the final week of February and into the beginning of March, enhanced convection persisted over the North Pacific ITCZ.

- Enhanced convection, associated with the MJO, shifted east across the Indian Ocean during the first week of March.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



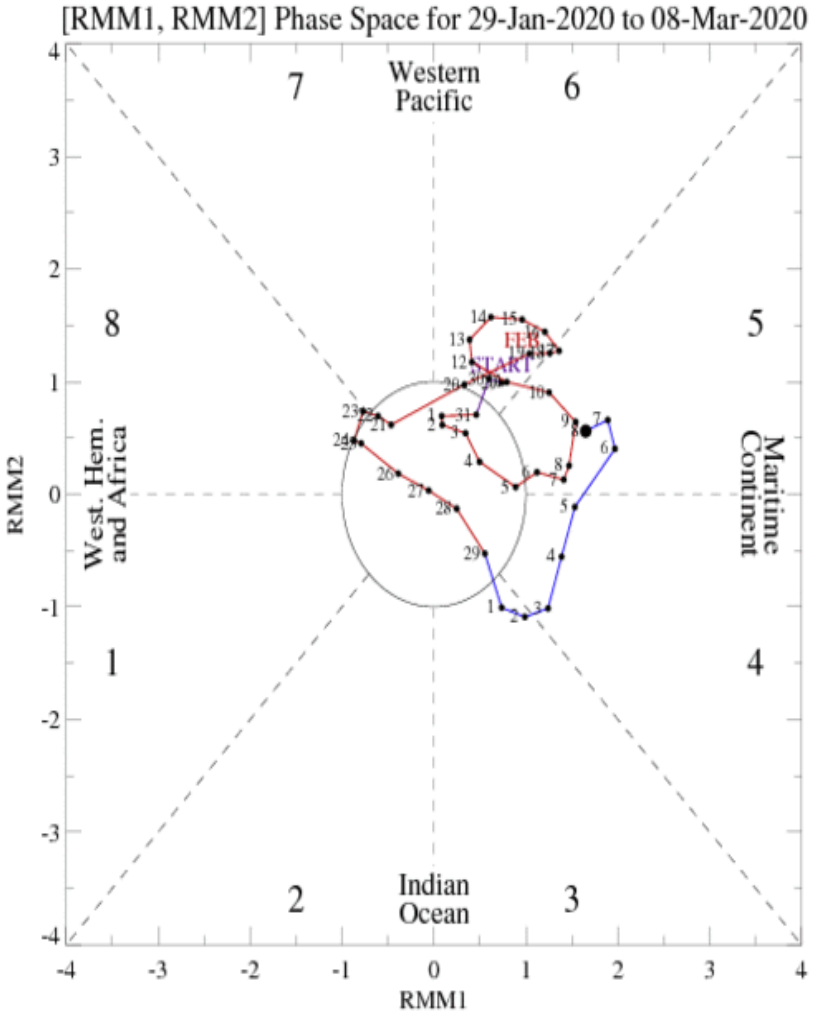


- Upper-oceanic heat content anomalies remain above-normal across most of the basin.

- Several episodes of westerly wind bursts west of the Date Line have contributed toward a downwelling event that has been ongoing since mid-December. The ongoing event seems to be contributing to a push of the highest temperature anomalies further east across the basin.

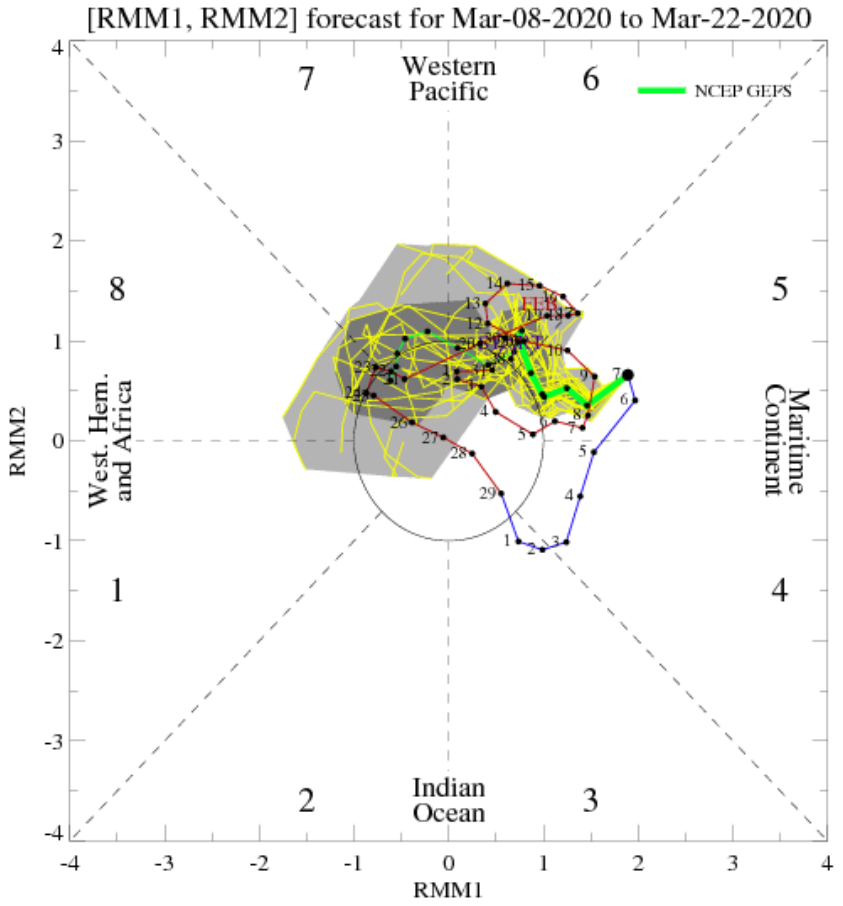
MJO Index: Recent Evolution

- A RMM-based MJO signal that emerged over the eastern Indian Ocean, shifted east to the Maritime Continent during the first week of March.

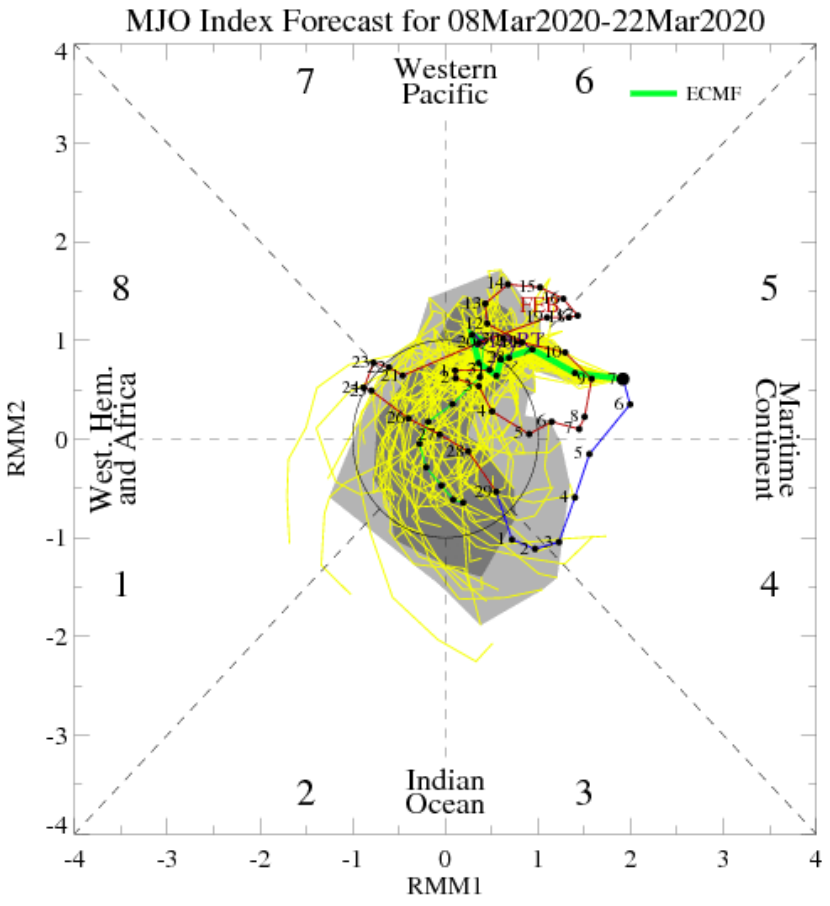


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

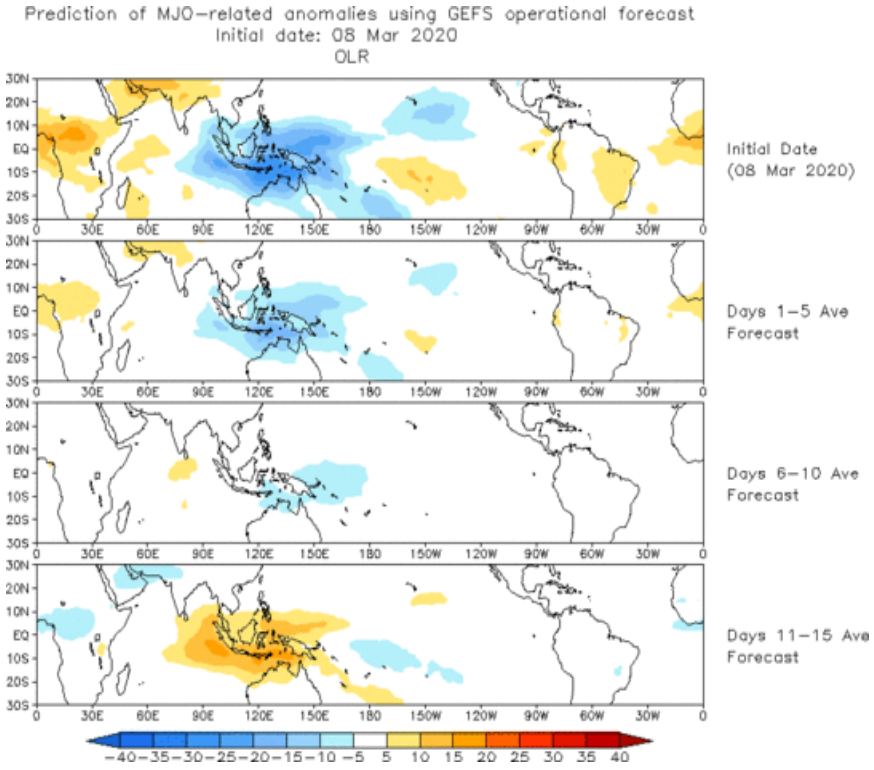


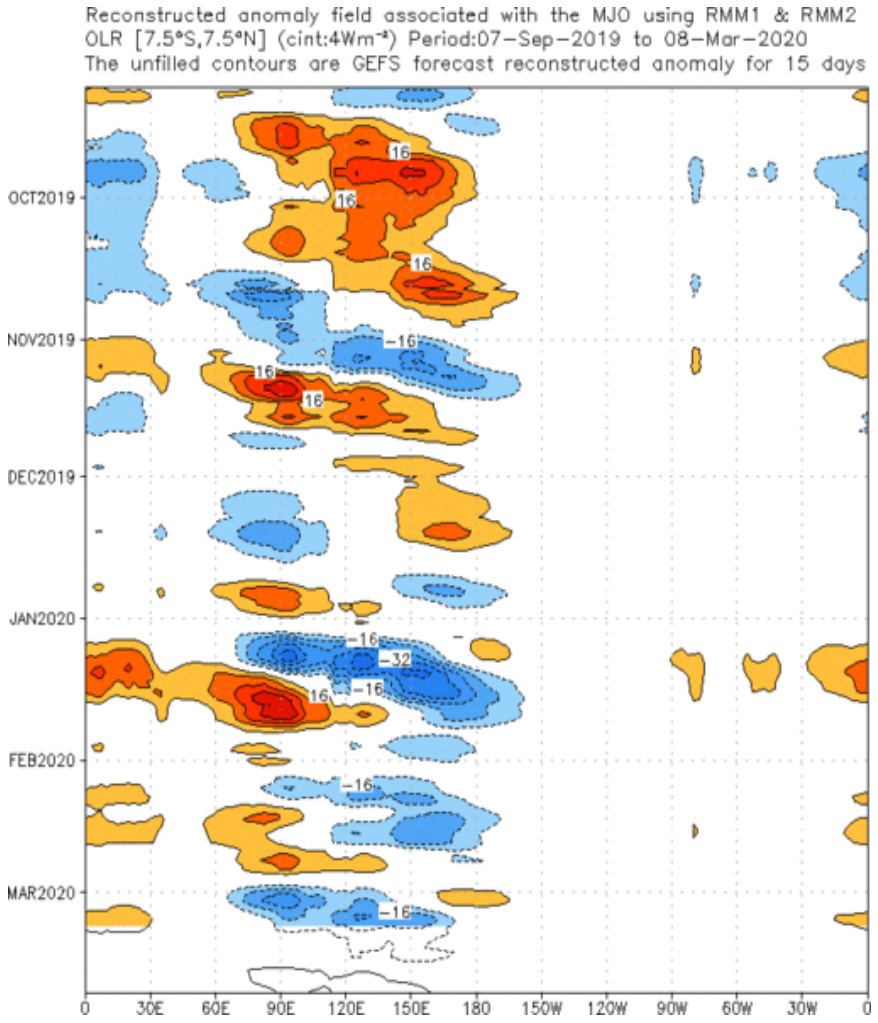
ECMWF Forecast

- Many of the GFS ensemble members indicate a weak MJO propagating east across the Pacific during mid-March.
- However, the ECMWF model favors a rapid eastward propagation which implies that a Kelvin wave would be the more dominant mode.

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.)

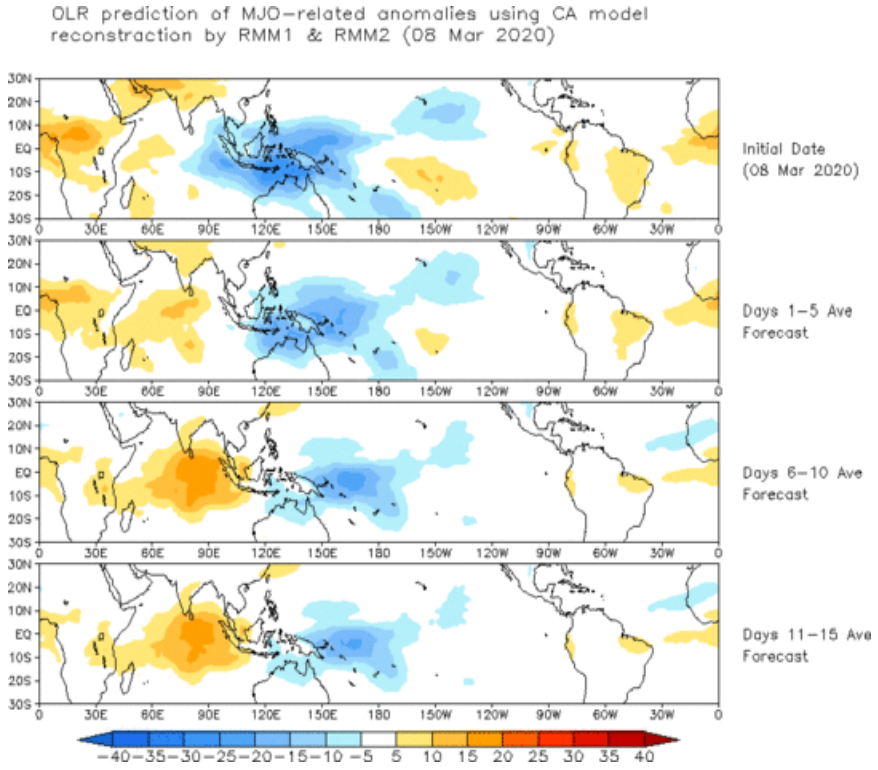


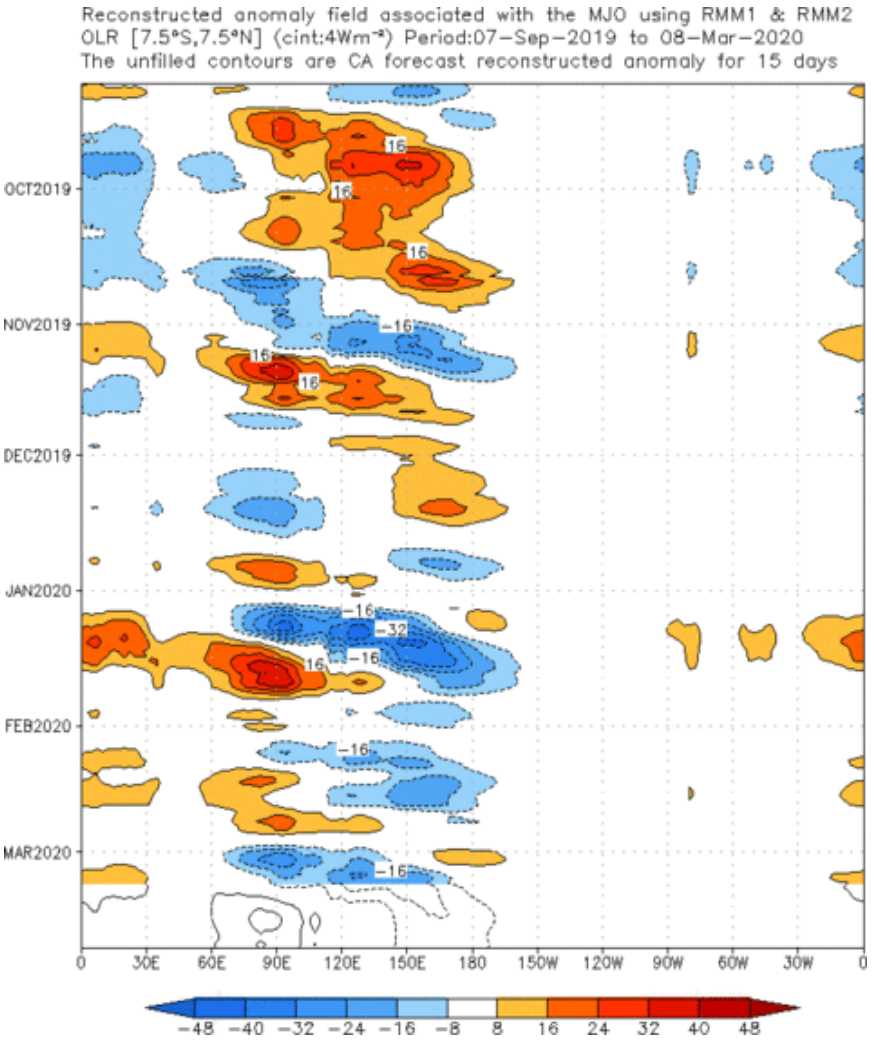


- The GEFS RMM-index based spatial forecast depicts suppressed convection returning to the Maritime Continent and northern Australia later in Week-2.

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.)

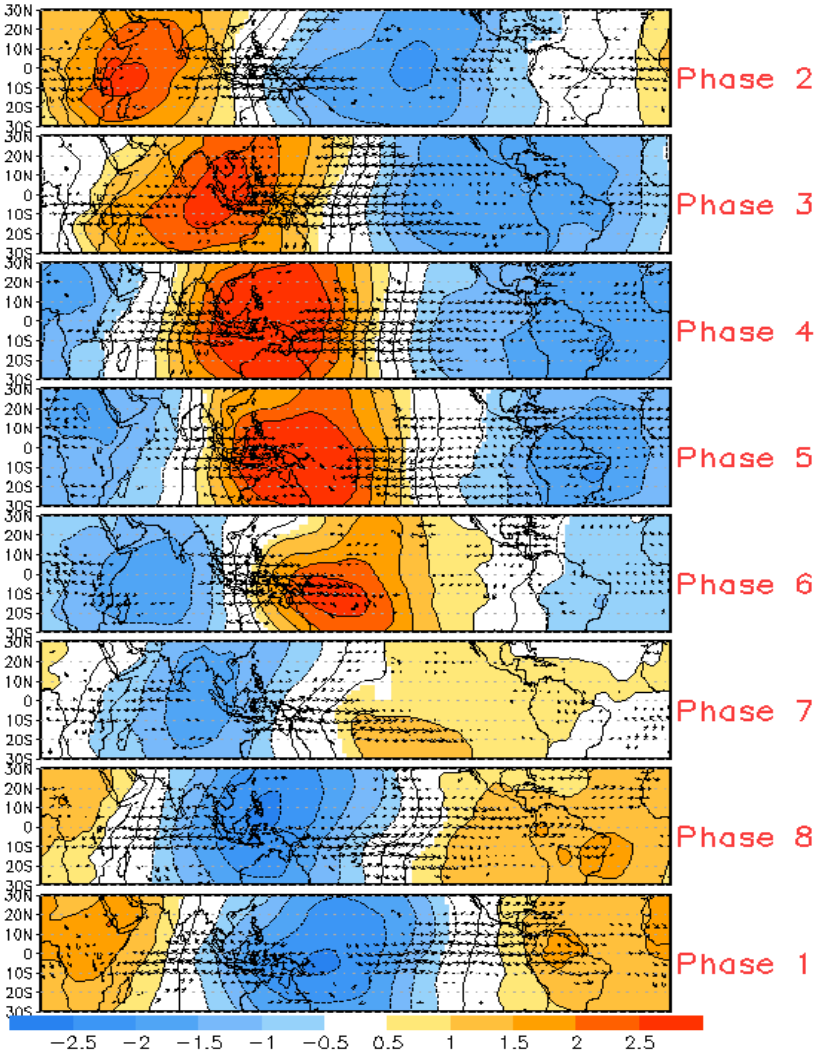




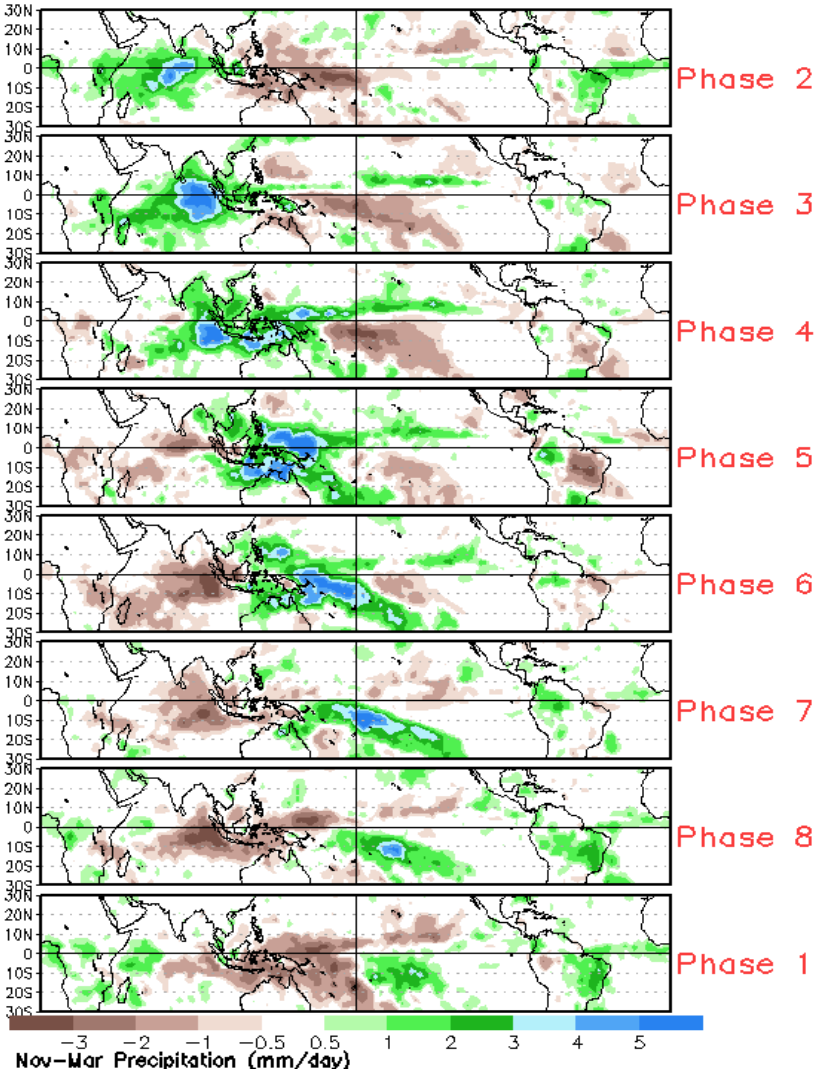
- The constructed analog forecast depicts enhanced convection shifting east from the Maritime Continent to the Pacific, with suppressed convection overspreading the Indian Ocean.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



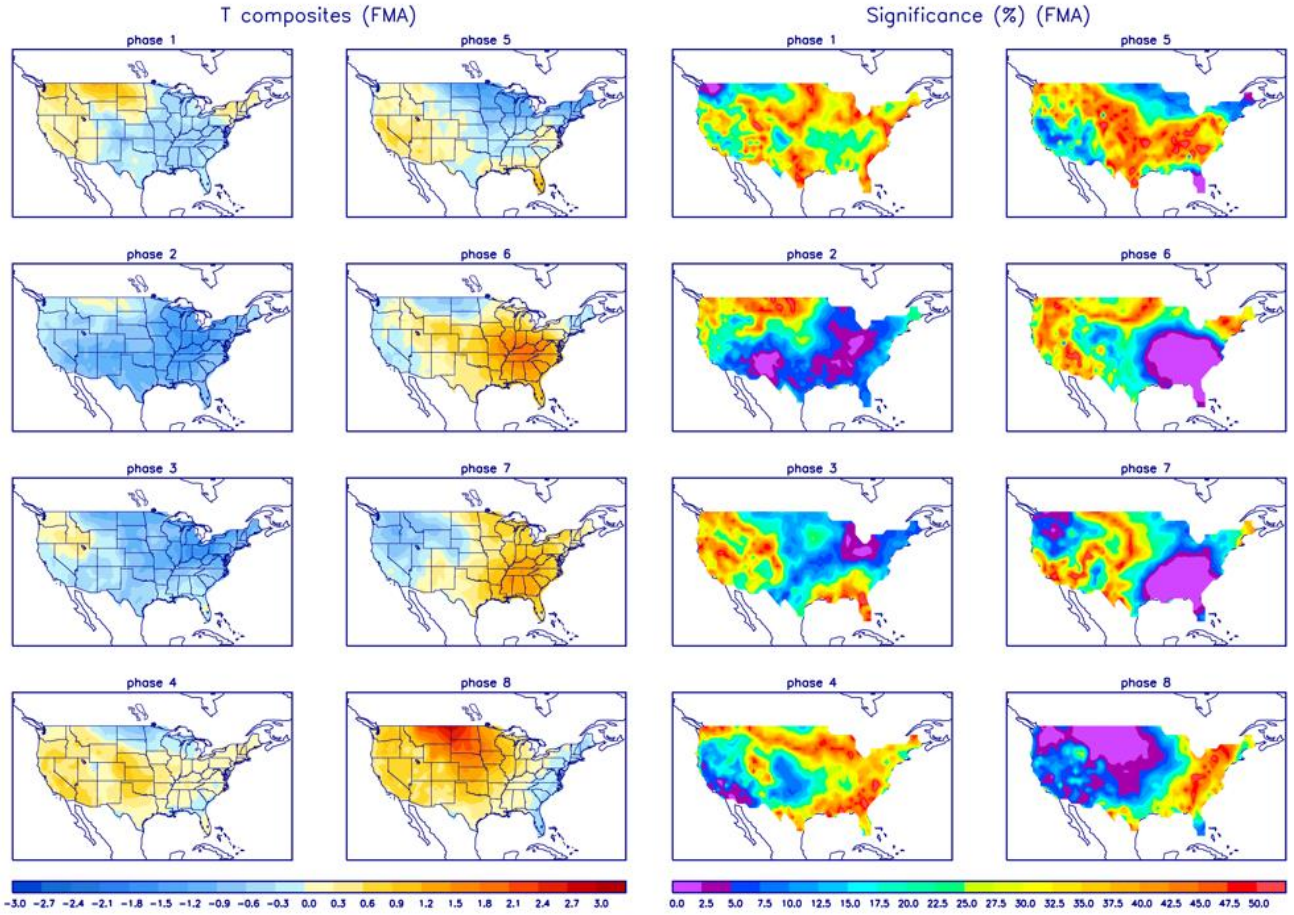
Precipitation Anomalies



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.

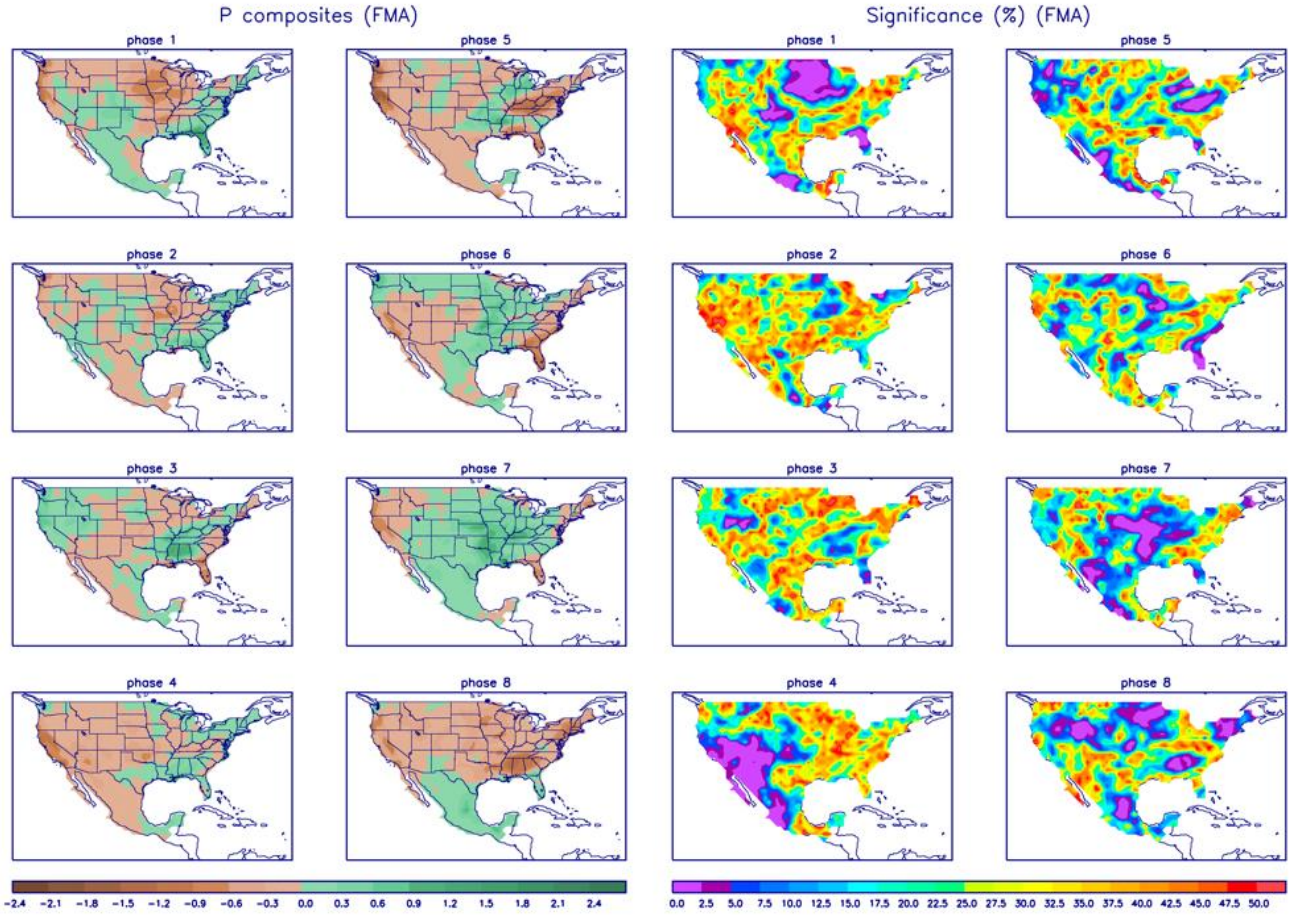


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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