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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
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Overview

- The MJO remains active, though at low amplitude, with the enhanced phase centered over the Indian Ocean.

- Dynamical Model forecasts suggests the MJO is likely to remain weak during the early to mid portions of Week-1 with possible reemergence and eastward propagation over the Indian Ocean by Week-2.

- Tropical cyclogenesis remains likely over the Western Pacific in association with forecast equatorial Rossby wave activity and over the Indian Ocean tied to the presence of the enhanced phase of 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).
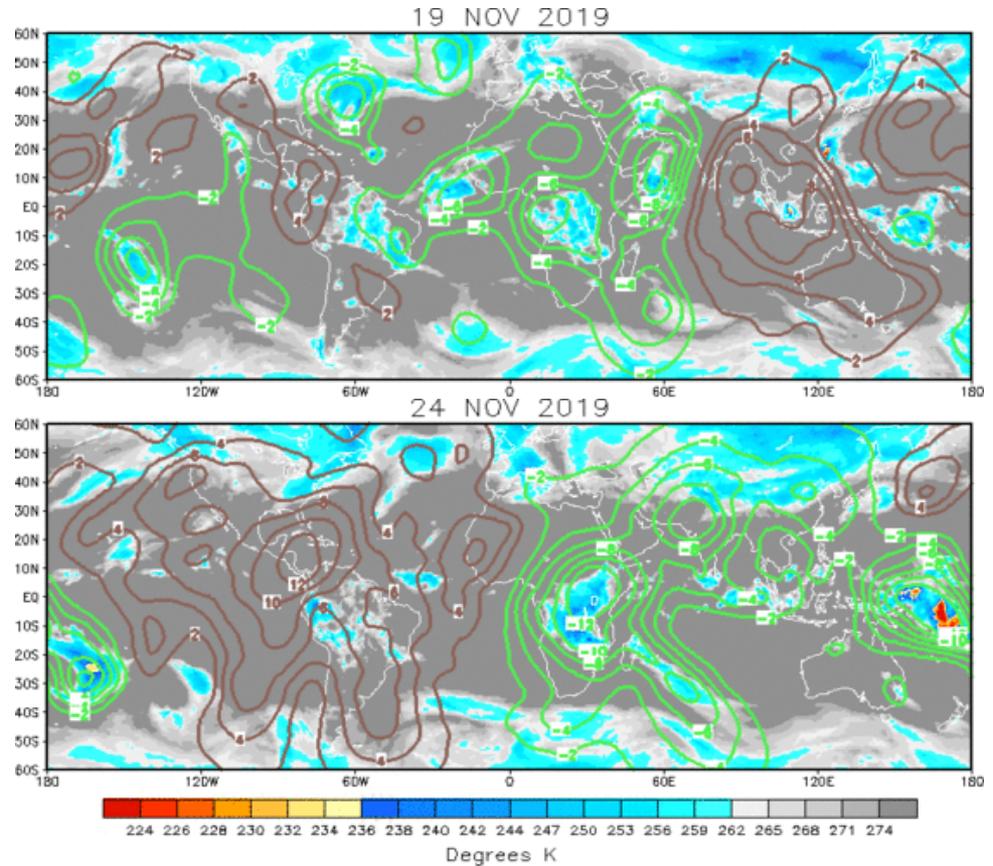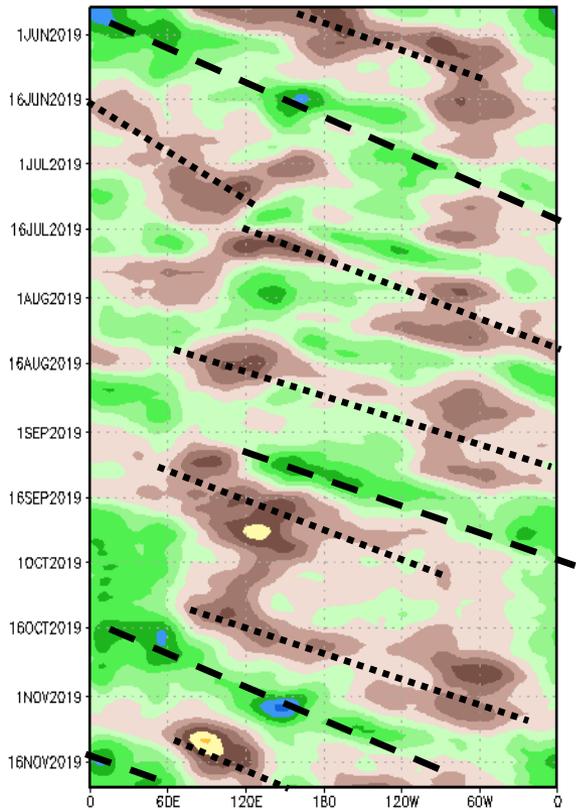
- The upper-level velocity potential field reflects more a Wave-1 pattern compared to last week. Upper-level convergence over the Maritime Continent has recently weakened.

- The strength of the anomaly field over Africa suggests constructive interference between the subseasonal MJO signal and the low frequency Indian Ocean Dipole (IOD).

200-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.
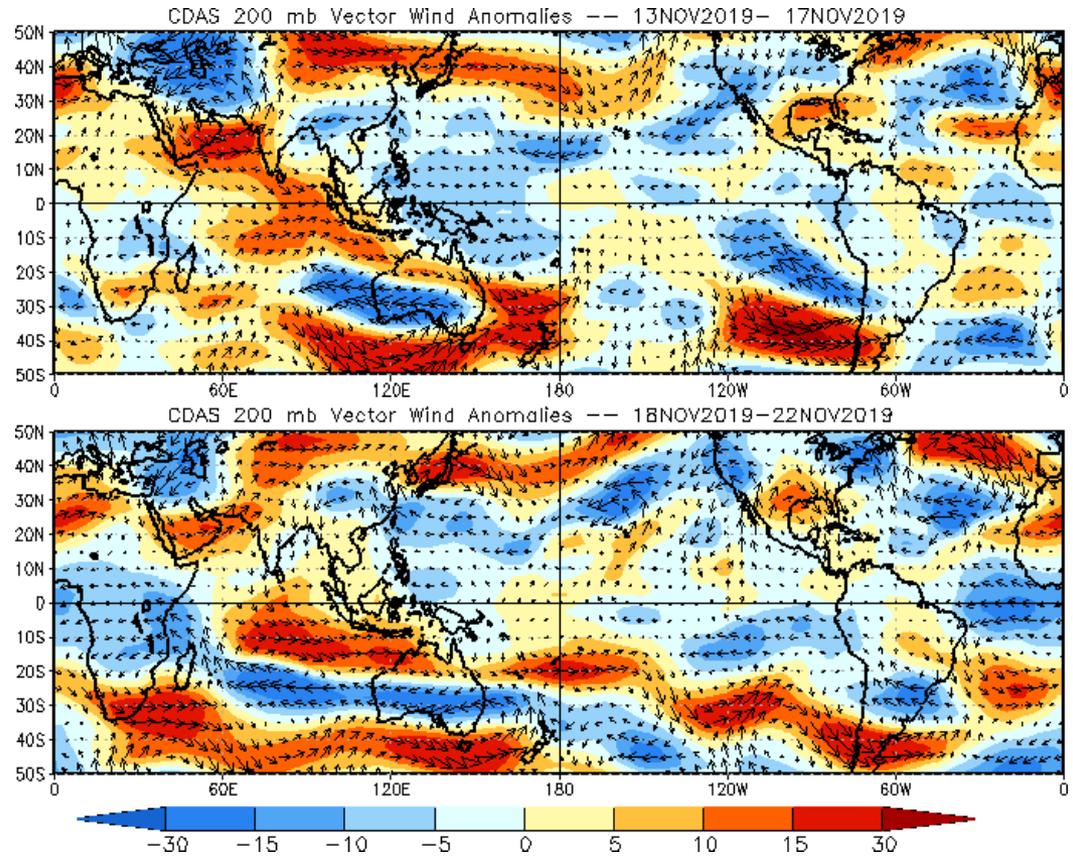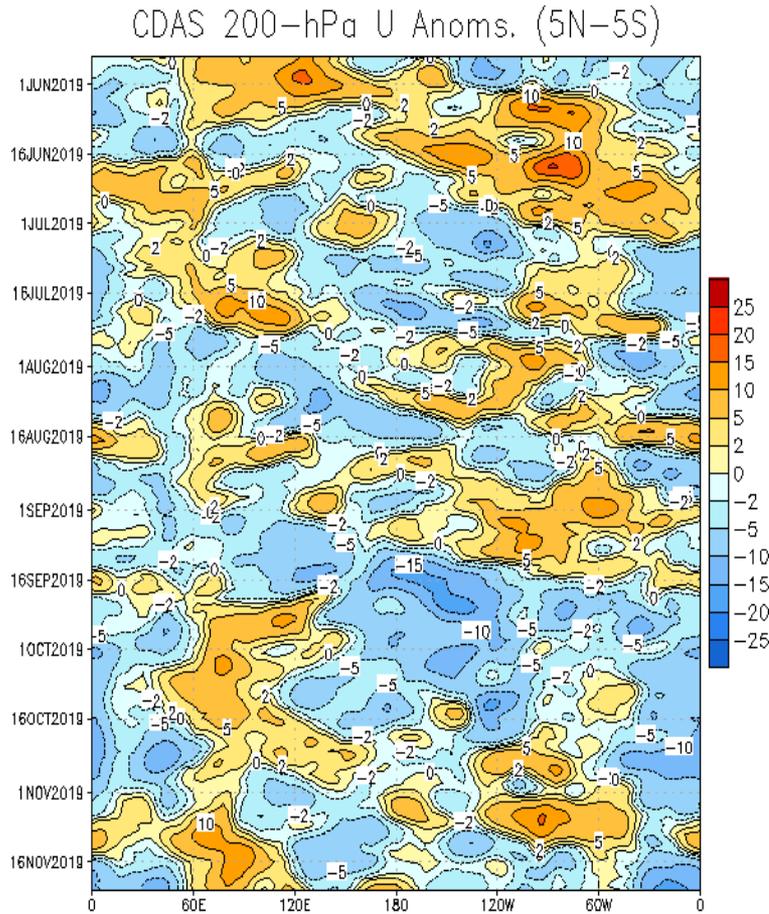
- The extension of the East Asian jet remains evident this week, with upper level westerlies also extending across the southern Hemisphere.

- Upper-level convergence (divergence) over the Maritime Continent (western Indian Ocean) is consistent with an atmospheric response to the low frequency state of the IOD.

850-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. <u>Blue shades: Anomalous easterlies</u>. <u>Red shades: Anomalous westerlies</u>.
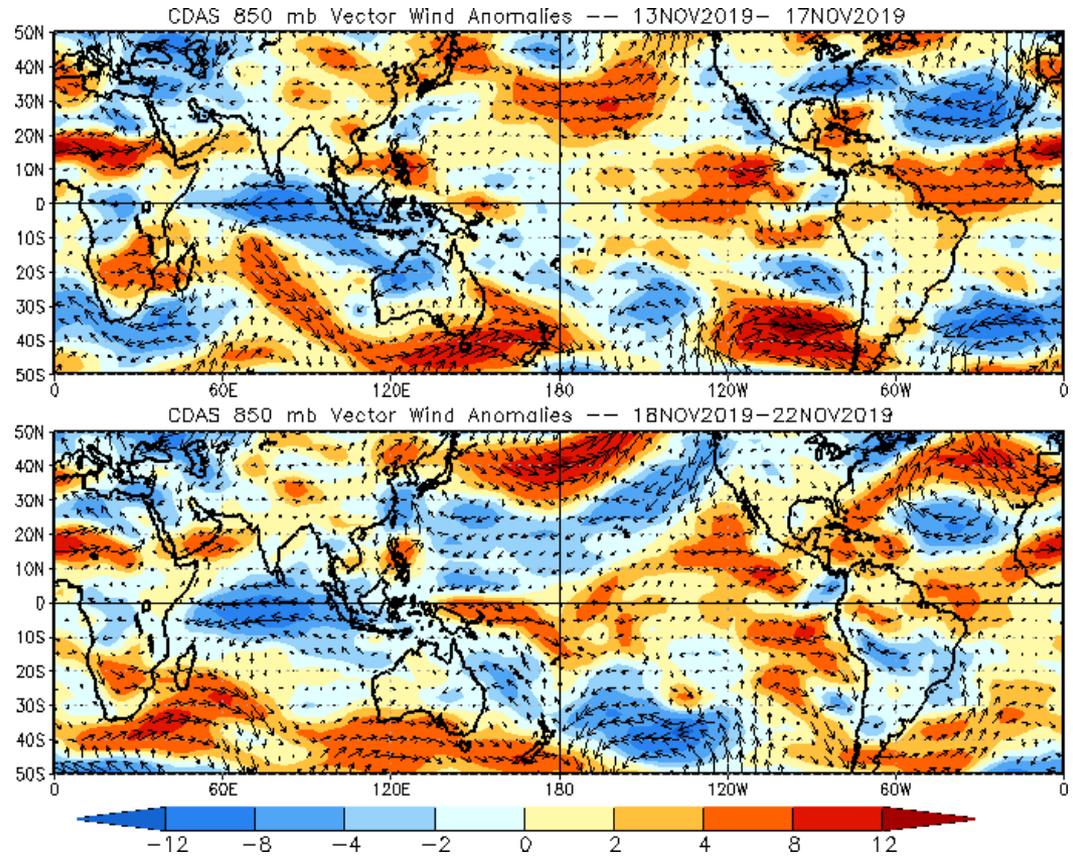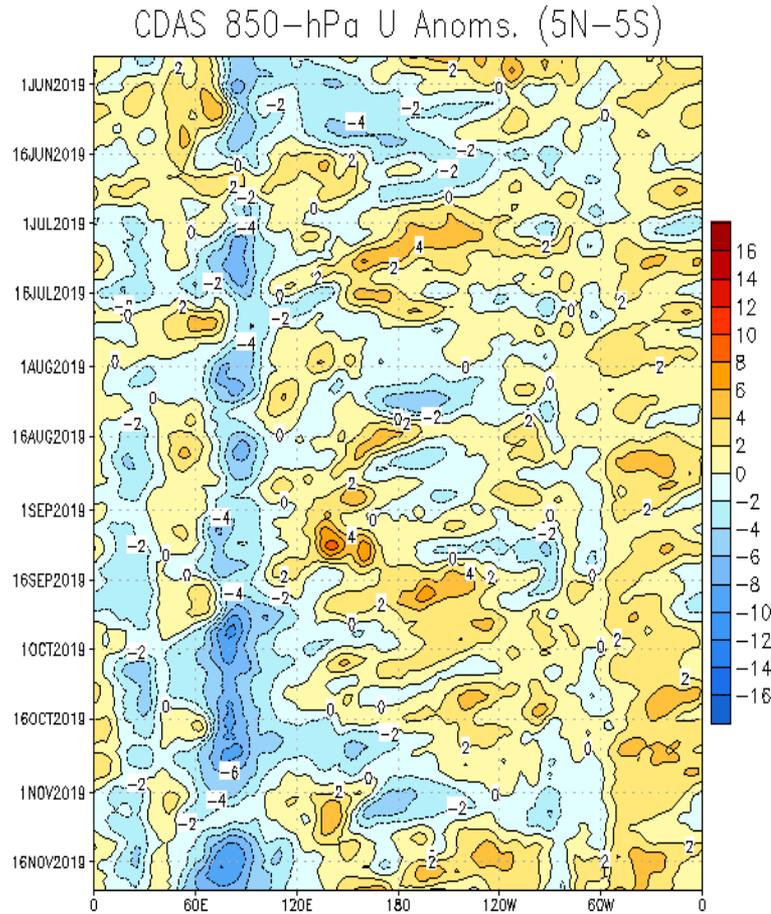

- Lower-level easterly anomalies increased over the West Pacific associated with Rossby Wave activity. Westerly wind anomalies along the equator have strengthened west of the Dateline.

- Easterly anomalies over the equatorial Indian Ocean remain notably enhanced, which is expected to help anchor convection over eastern Africa and the western Indian Ocean.

Outgoing Longwave Radiation (OLR) Anomalies

Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).
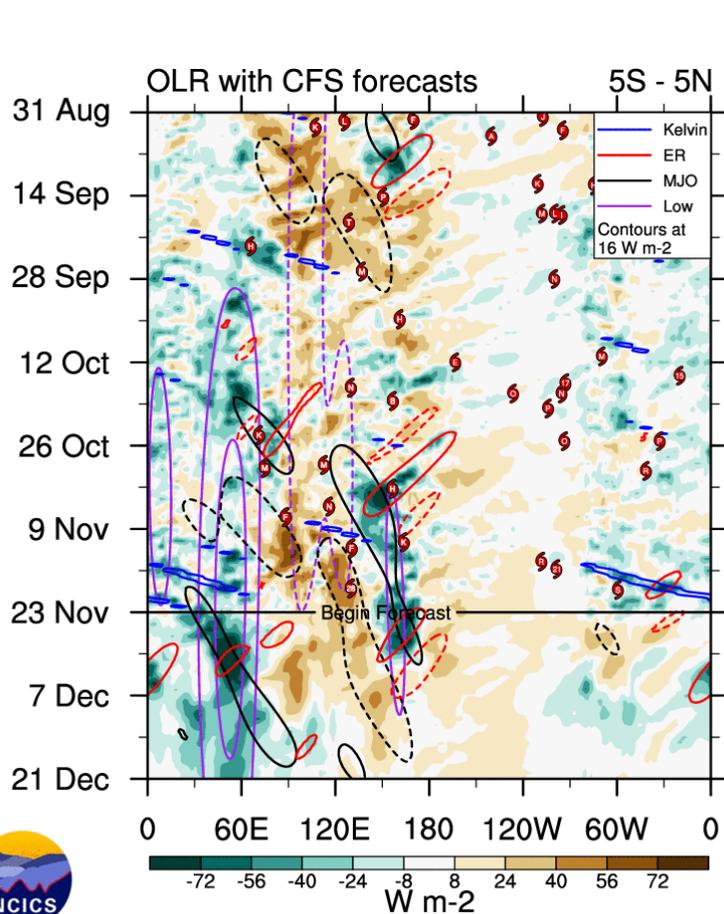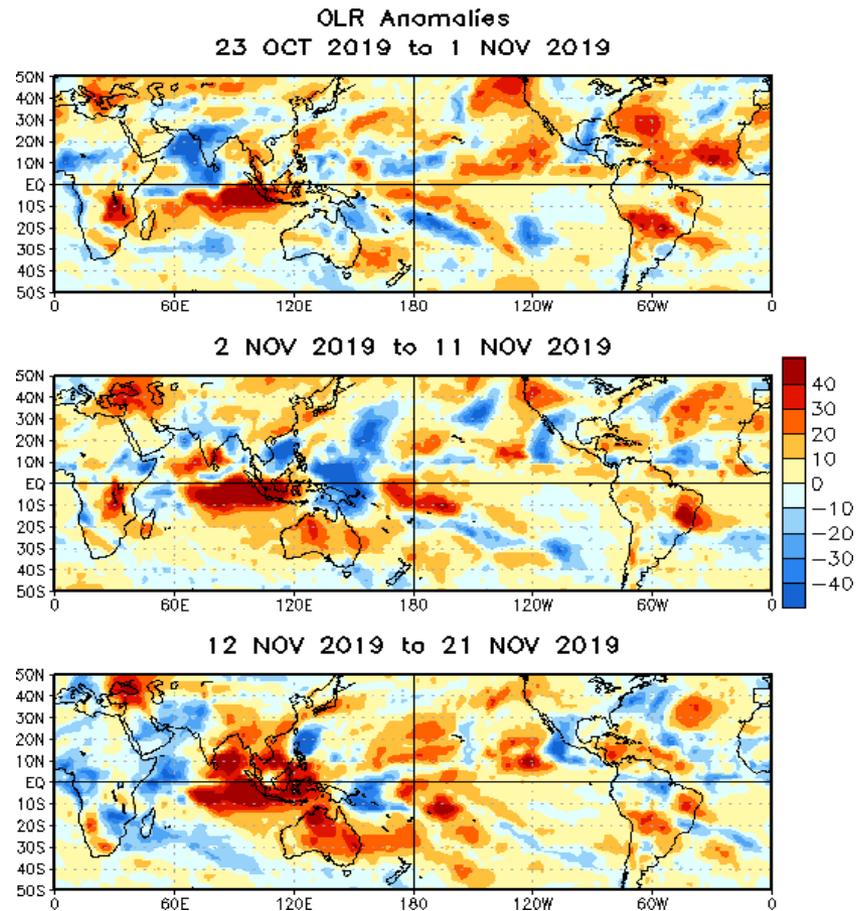
- Following the rapid MJO propagation across the Maritime Continent in late October and early November, there was little convective response due to destructive interference with the positive IOD.

- Since late October, strengthening enhanced (suppressed) convection is evident across the western Indian Ocean (Maritime Continent).

# SSTs and Weekly Heat Content Evolution in the Equatorial Pacific
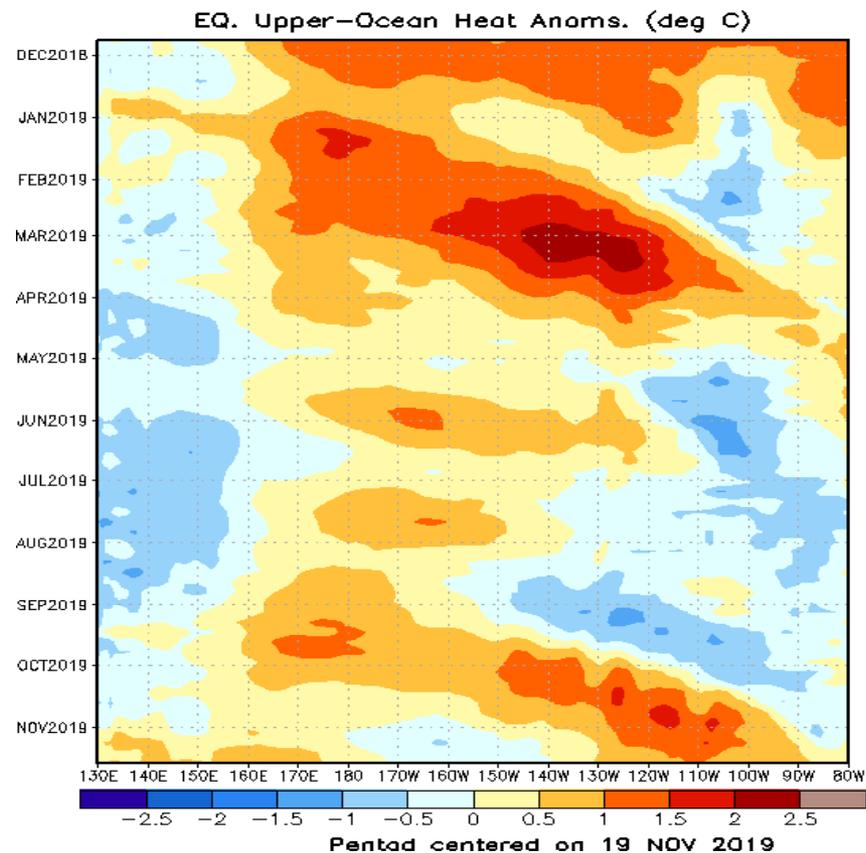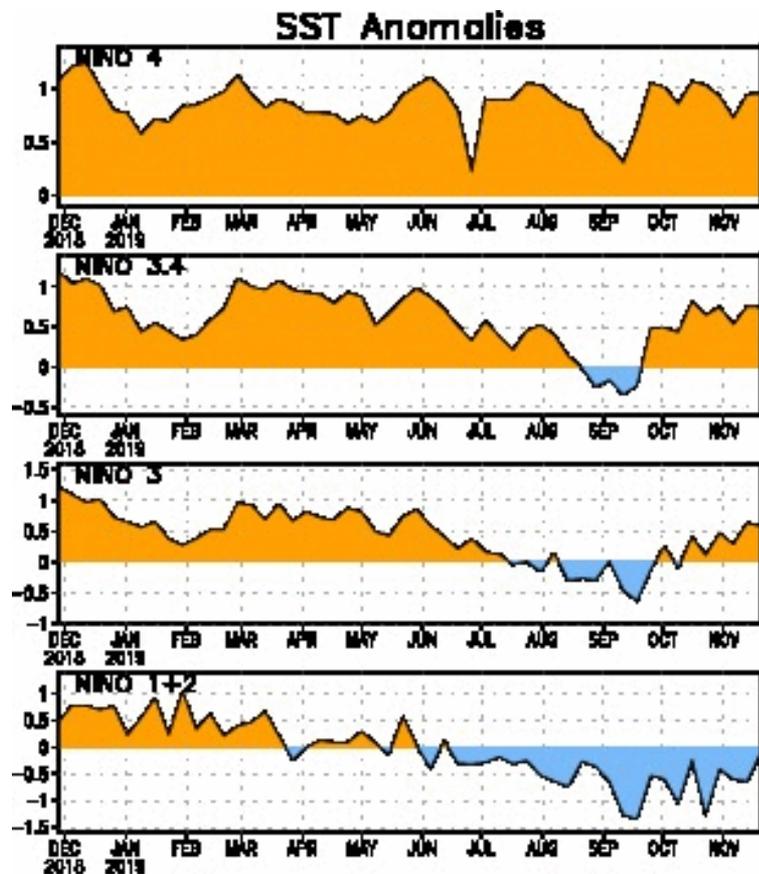
- Little changes have been observed with SSTs in the East Pacific and Pacific Niño 3.4 regions remain above normal following a downwelling Kelvin wave event that initiated in September.

- Another downwelling Kelvin event may be occurring west of the Dateline associated with strengthening lower level westerly anomalies in the region.

MJO Index: Recent Evolution

- Following a rapidly propagating MJO since late October, the RMM index shows a slowing and weakening MJO signal during the past week over the Indian Ocean.

[RMM1, RMM2] Phase Space for 16-Oct-2019 to 24-Nov-2019
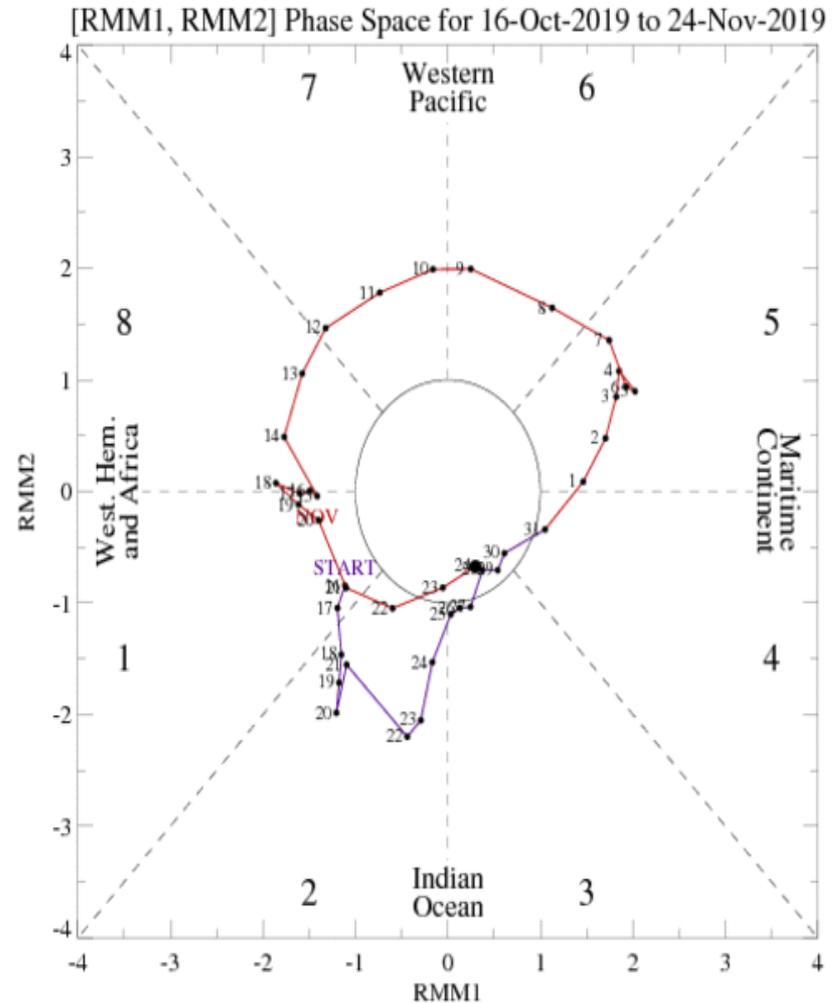
For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution
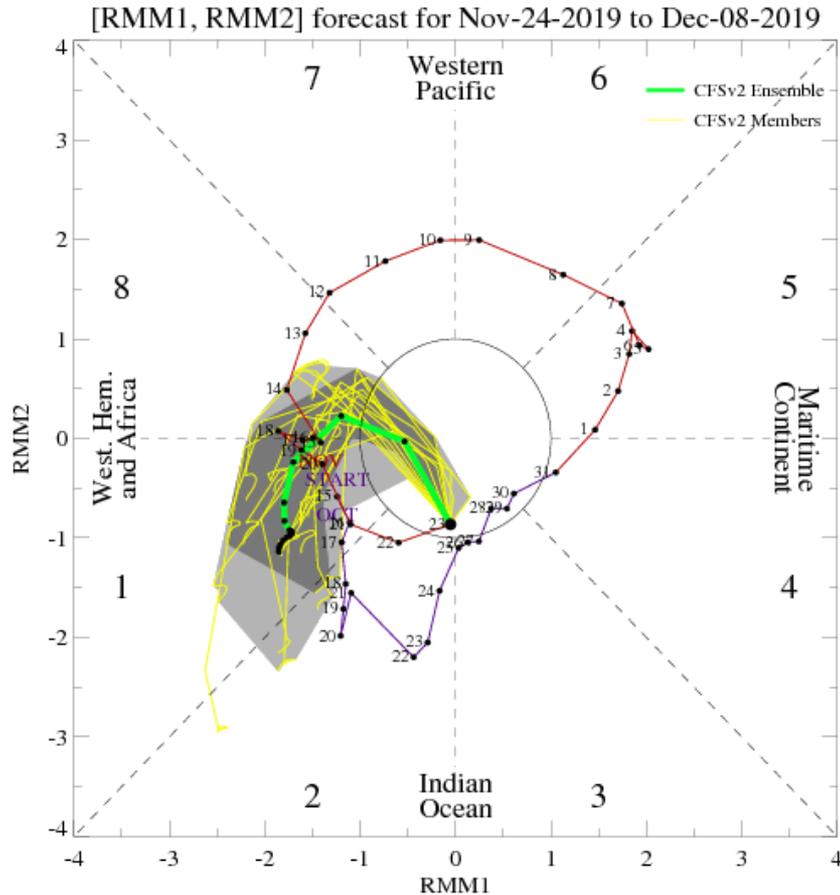

CFSv2 Forecast
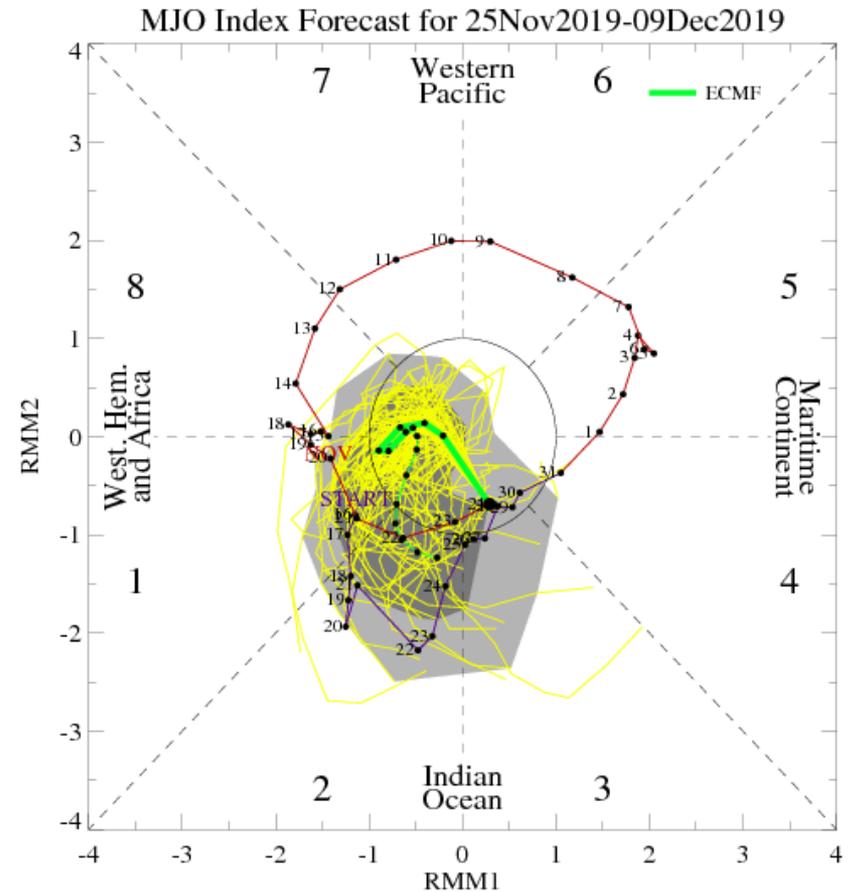
ECMWF Forecast

- Dynamical model MJO index forecasts are in fair agreement with a continued weakening of the MJO before re-emerging in Phase-8/1 during the next week. The CFS maintains a faster solution compared to the ECMWF.

- A strengthening of the low frequency IOD may be pulling the index back towards Africa, destructively interfering with the MJO signal.

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 shows continued weakening before re-strengthening late in Week-2 with enhanced convection reemerging over the Indian Ocean.

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.)


OLR prediction of MJO-related anomalies using CA model reconstraction by RMM1 & RMM2 (24 Nov 2019)
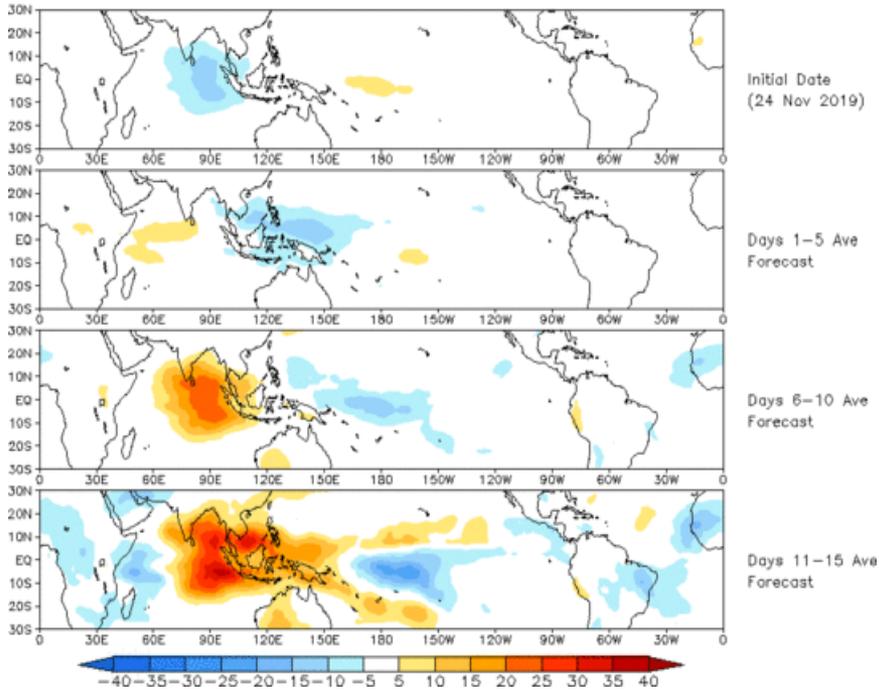
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:25-May-2019 to 24-Nov-2019
The unfilled contours are CA forecast reconstructed anomaly for 15 days
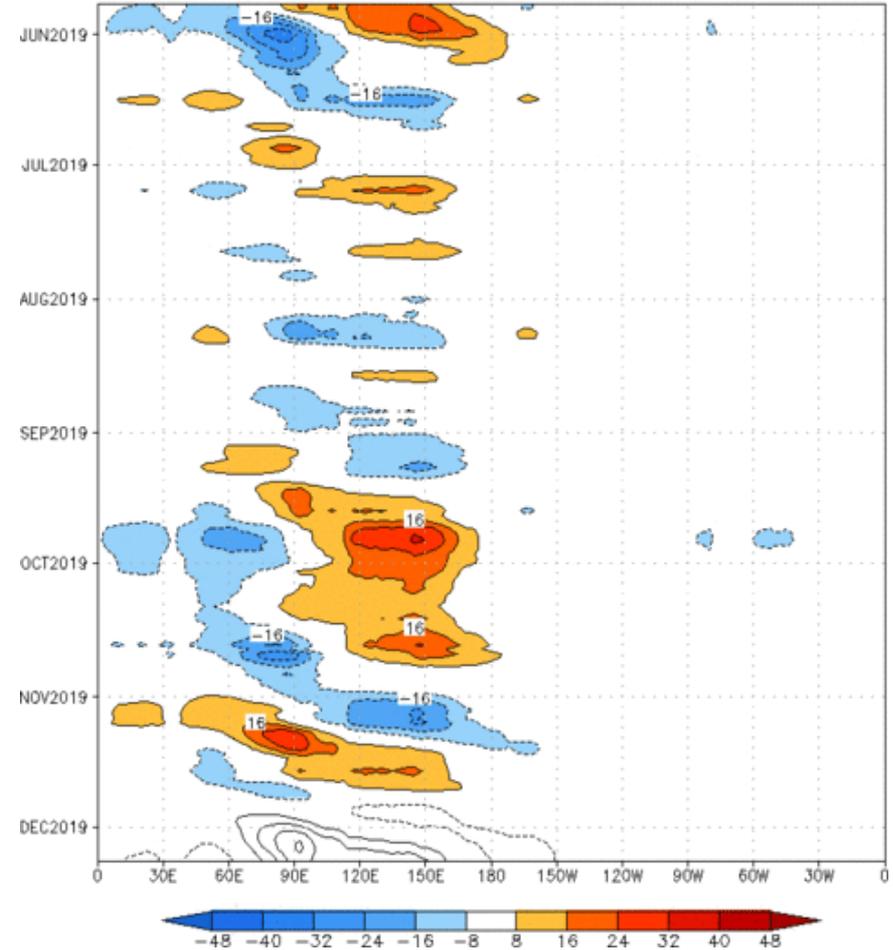
- The constructed analog shows an increase in suppressed convection across the eastern Indian Ocean/Maritime Continent with a more canonical eastward propagation of the enhanced MJO envelope from the eastern Indian Ocean to Pacific over the next 2 weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and
Wind Anomalies
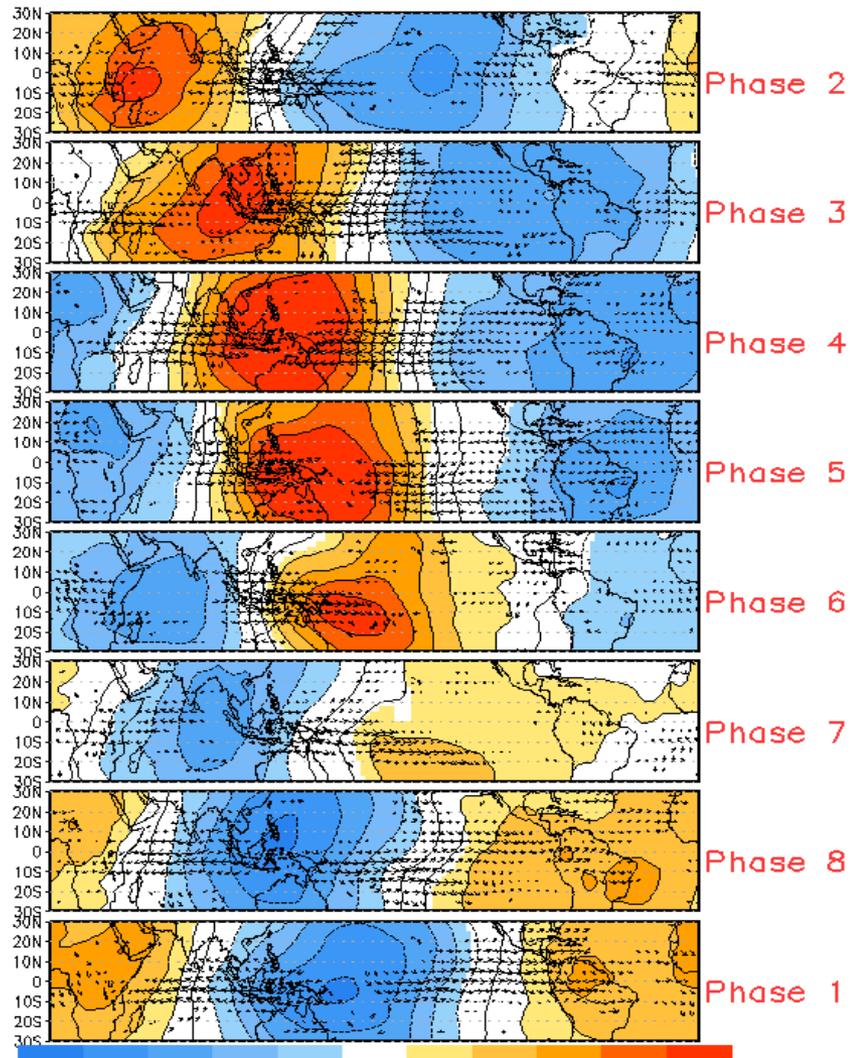
Precipitation Anomalies
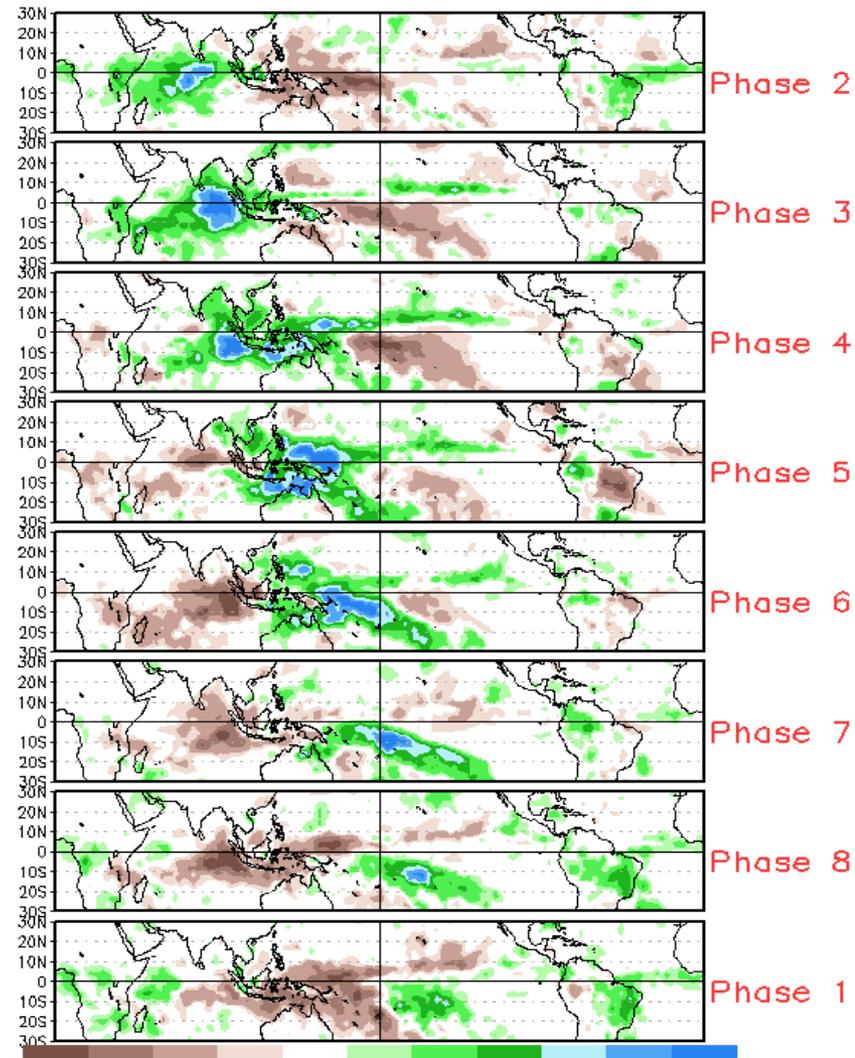
MJO: CONUS Composite Maps by RMM Phase - Temperature

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
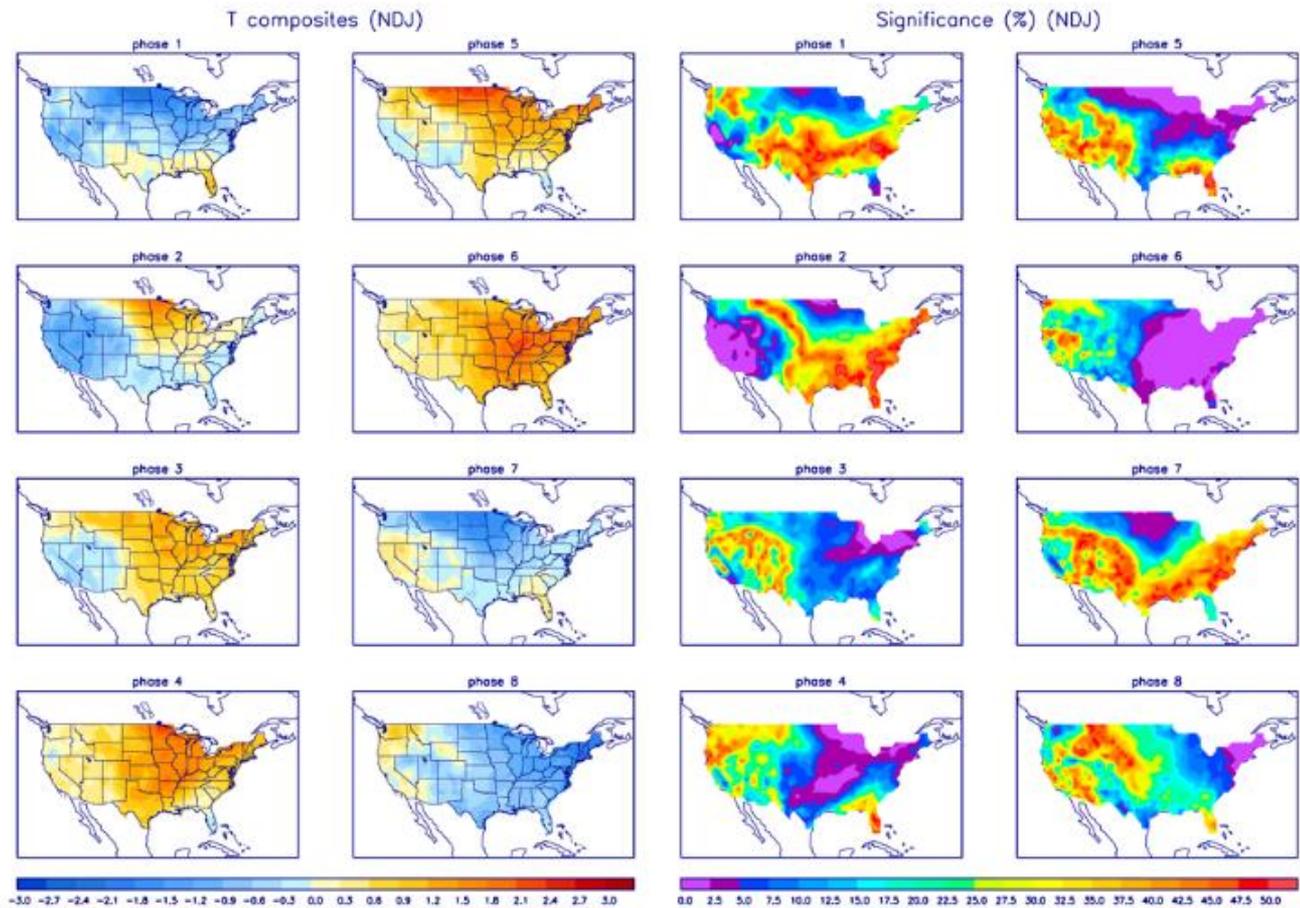
MJO: CONUS Composite Maps by RMM Phase - Temperature

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