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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
25 January 2021

Overview

- The RMM index indicates the intraseasonal signal has become better organized with an increase in amplitude over the western Pacific (phases 6 and 7) during the past week.

- There is still some uncertainty in the forecast regarding the recent lack of eastward propagation of the intraseasonal signal, as well as destructive interference with the low frequency La Niña footprint. However, dynamical models continue to favor a MJO event strengthening over the West Pacific during late Week-1 or early Week-2.

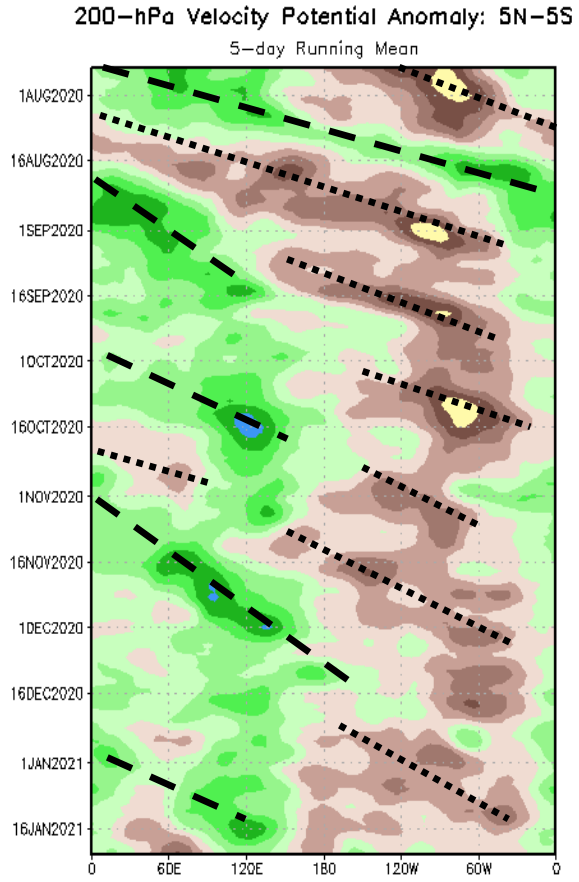
- If an active MJO becomes realized and propagates across the western Pacific, this would favor increased chances for above normal (below-normal) temperatures across the western CONUS and Alaska (eastern CONUS) during early February.

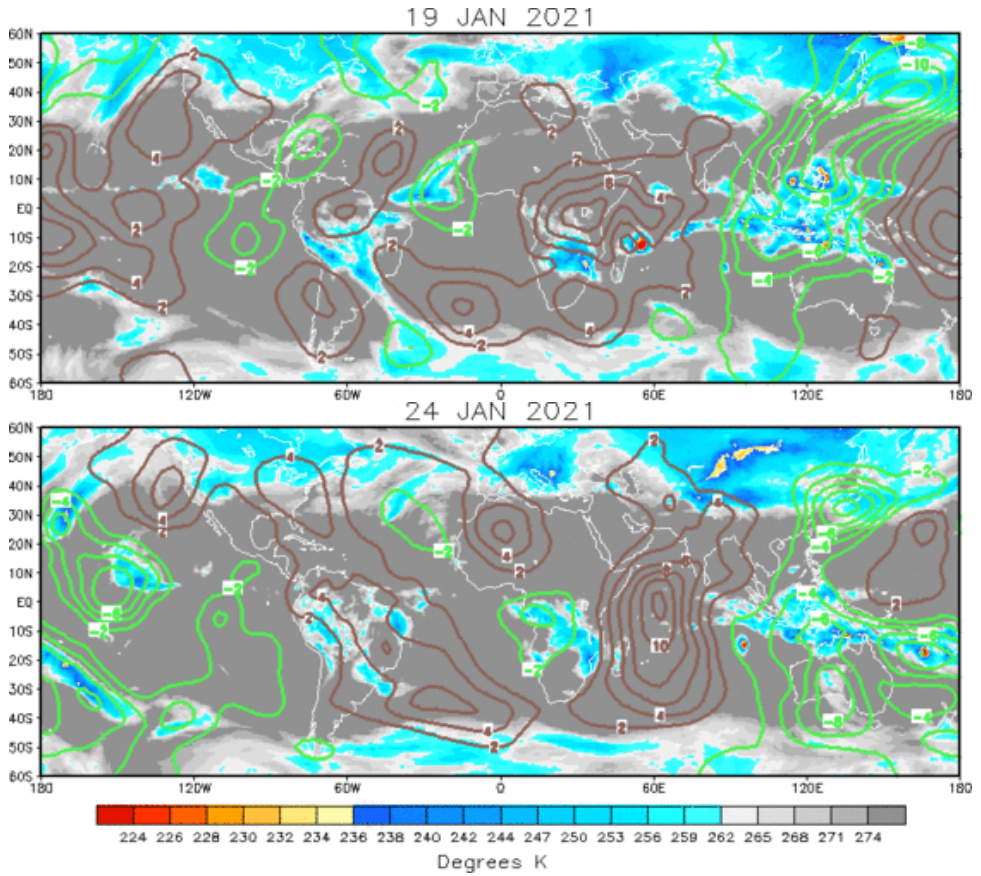
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



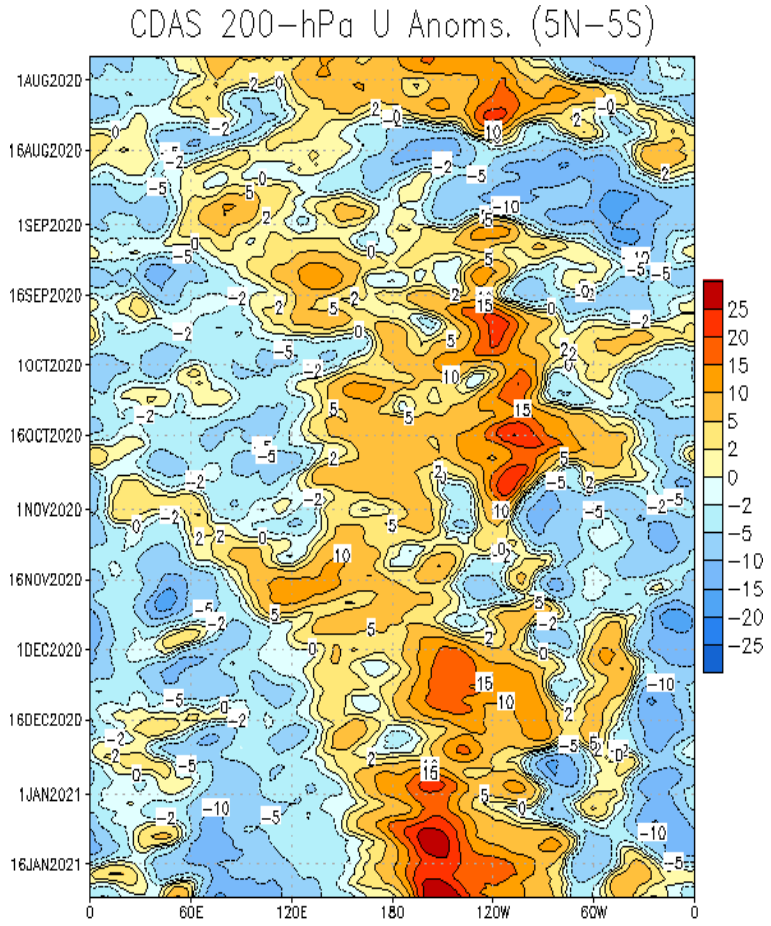


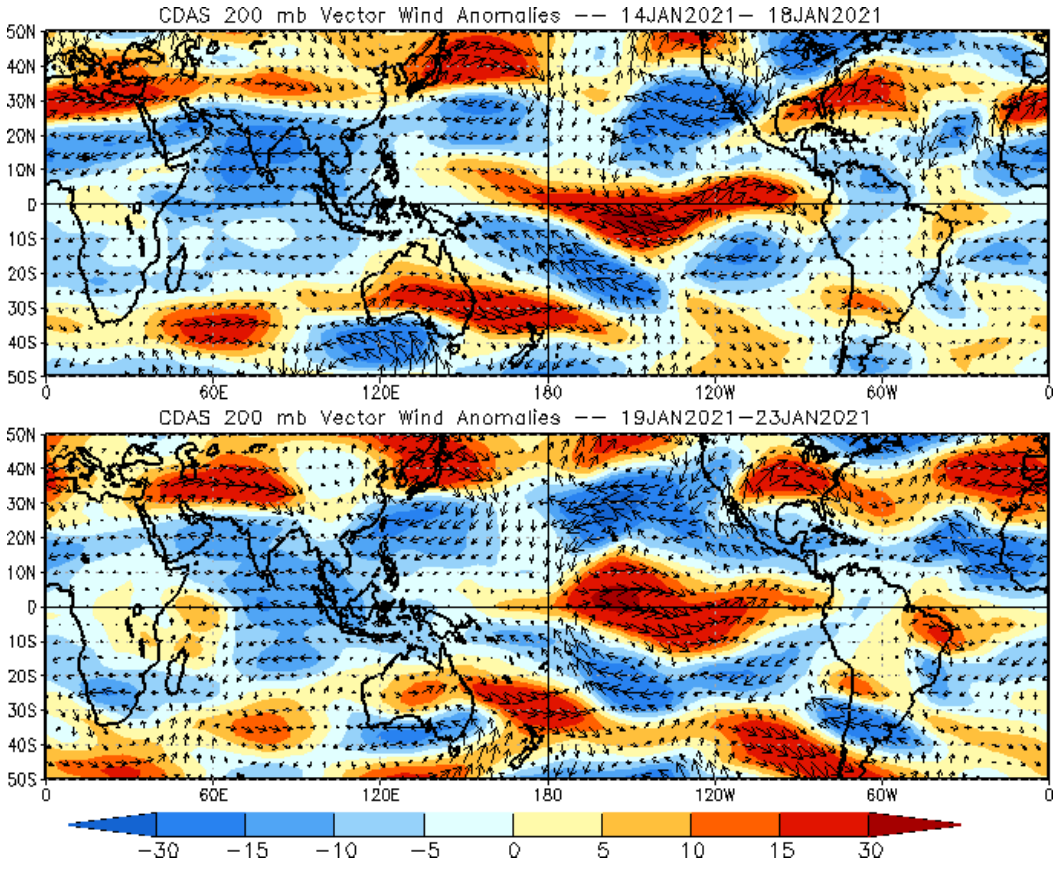
- Anomalous upper-level convergence has recently shifted eastward from Africa and strengthened over the western Indian Ocean.

- Enhanced convection has extended eastward into the western Pacific with weaker suppressed conditions to the west of the Date Line suggestive of ongoing destructive interference with La Niña.

200-hPa Wind Anomalies

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



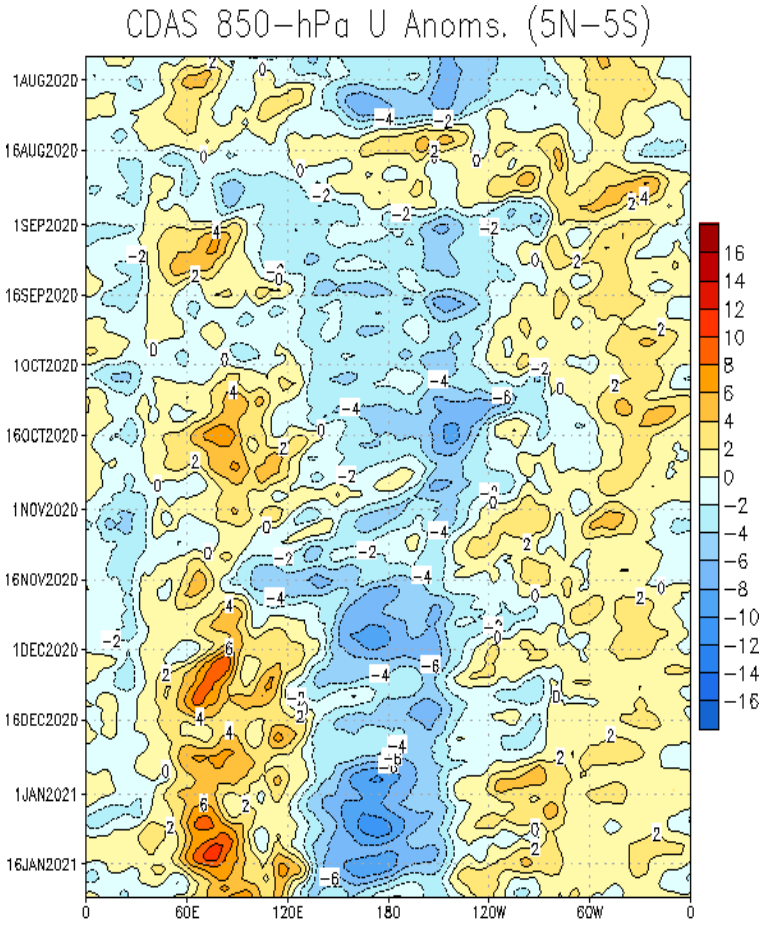


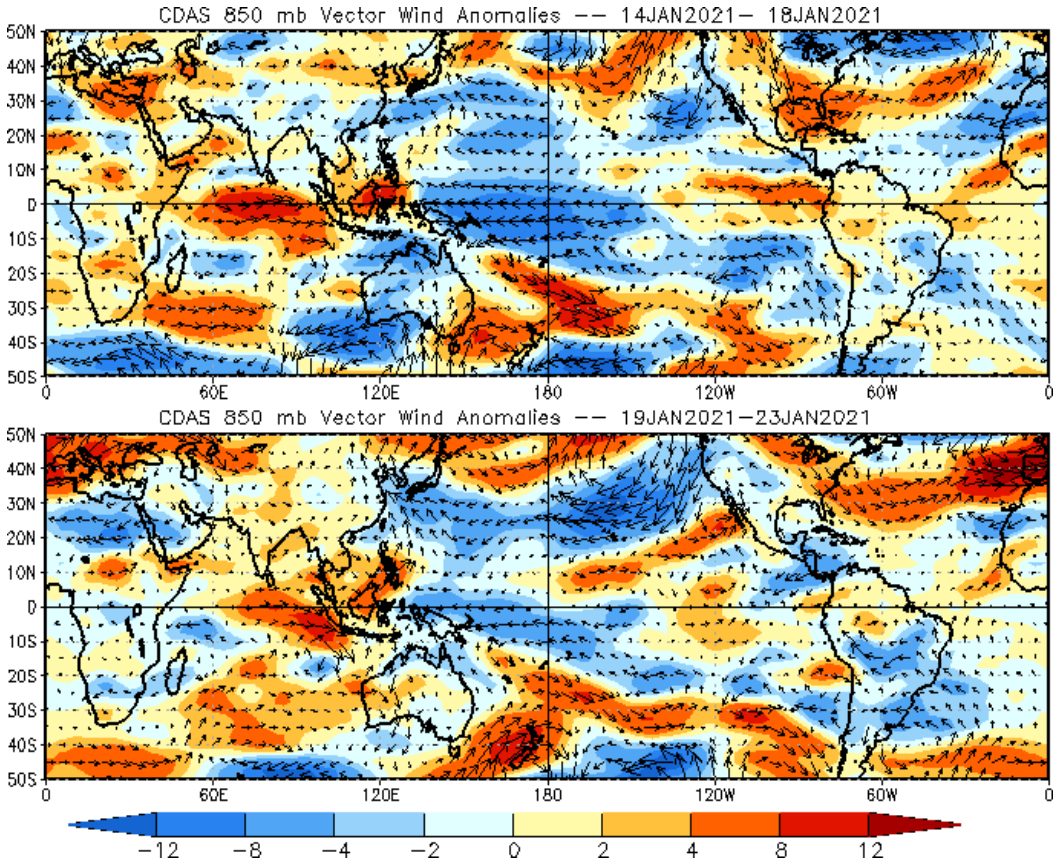
- Anomalous upper-level easterlies have strengthened over the eastern Indian Ocean and Maritime Continent, with weaker westerlies now observed to the west of the Date Line in the equatorial Pacific.

- Wave breaking continues to inject mass from the North Pacific into the tropics to help reinforce anomalous westerlies to the east of the Date Line which remain considerably strong.

850-hPa Wind Anomalies

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



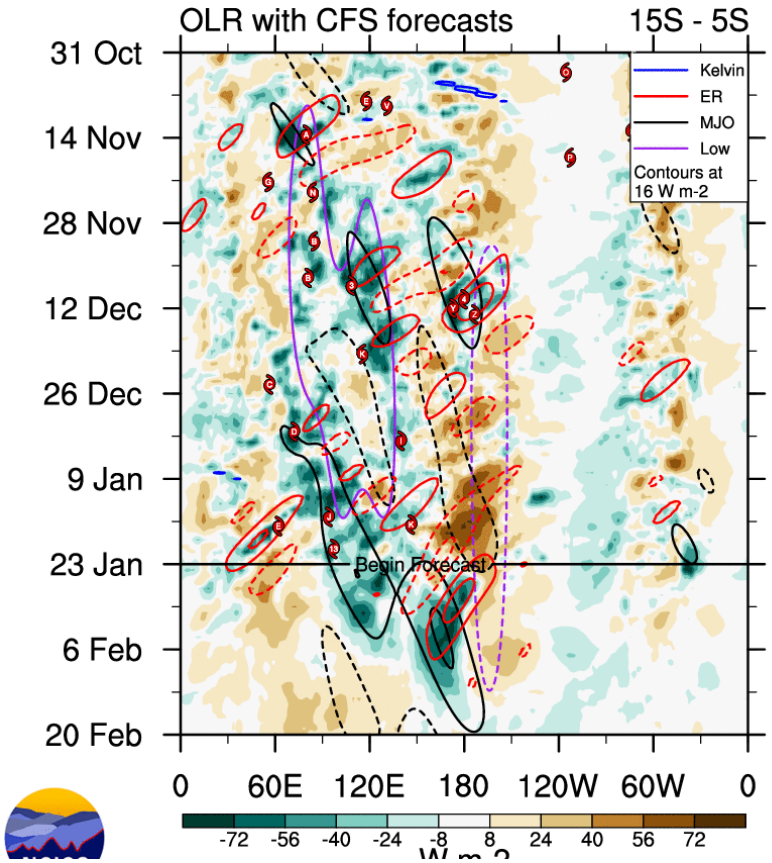


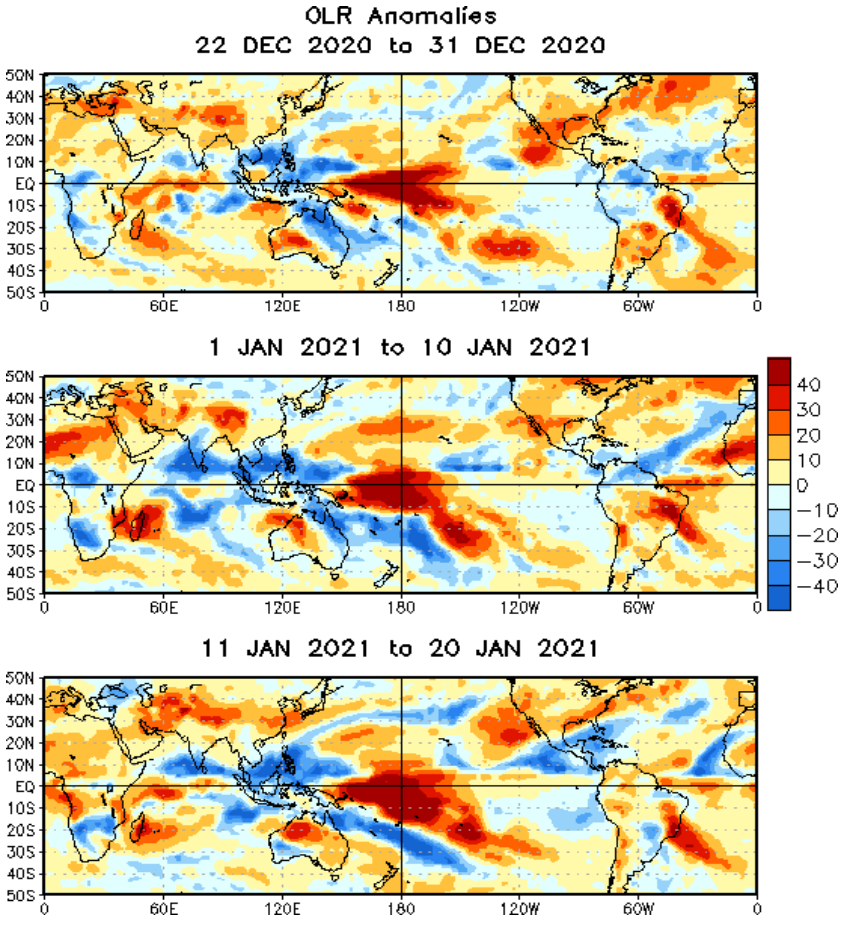
- Compared to the winds aloft, there appears to be little to no eastward shift in the lower level wind pattern with persistent lower level convergence over the Maritime Continent tied to the low-frequency La Niña state.

- However, anomalous westerlies (easterlies) have decreased over the western Indian Ocean (western Pacific) during the past week.

Outgoing Longwave Radiation (OLR) Anomalies

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

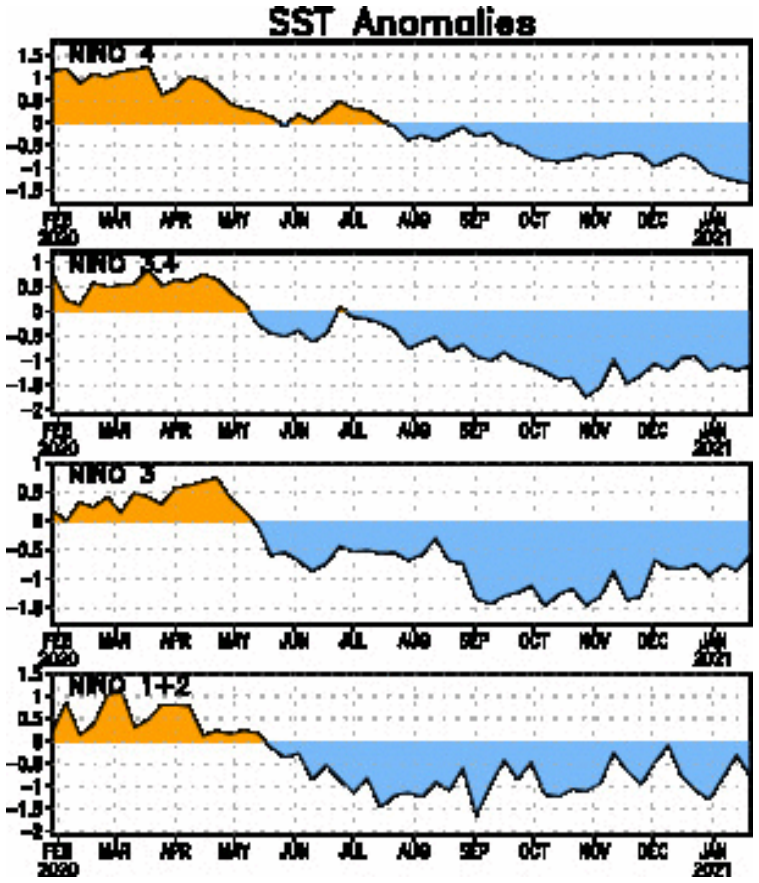


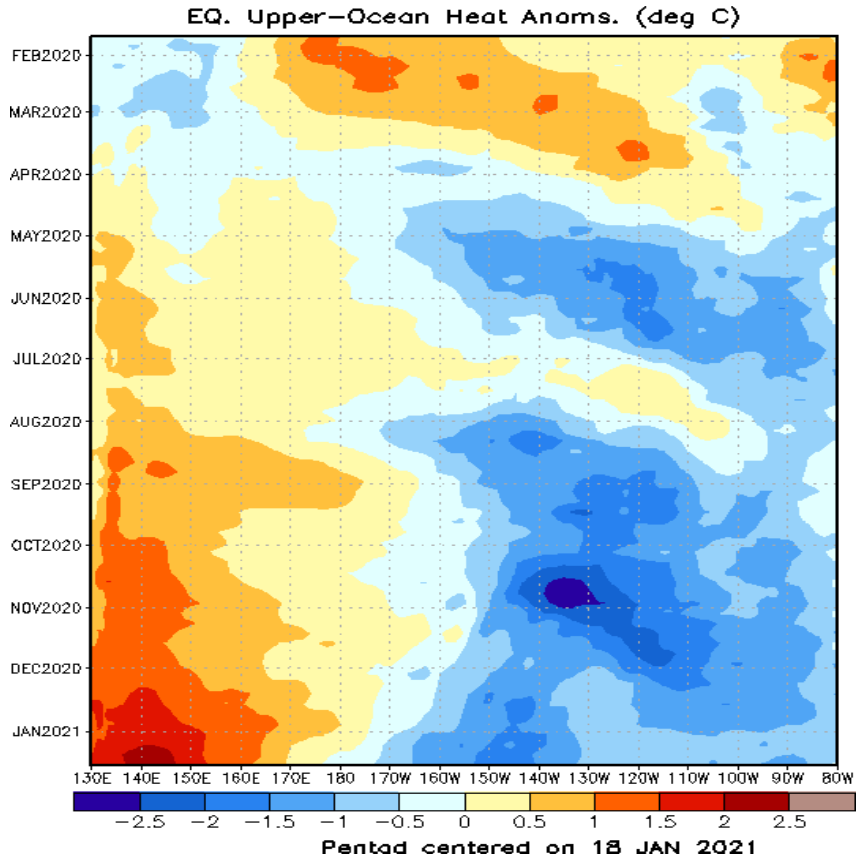


- Convection has been established over the Maritime Continent since mid-December in association with warm sea surface temperatures and the ongoing La Niña.

- Enhanced convection is favored to increase over the western Pacific to the west of the Date Line during the next two weeks also tied to Rossby wave activity in the region.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



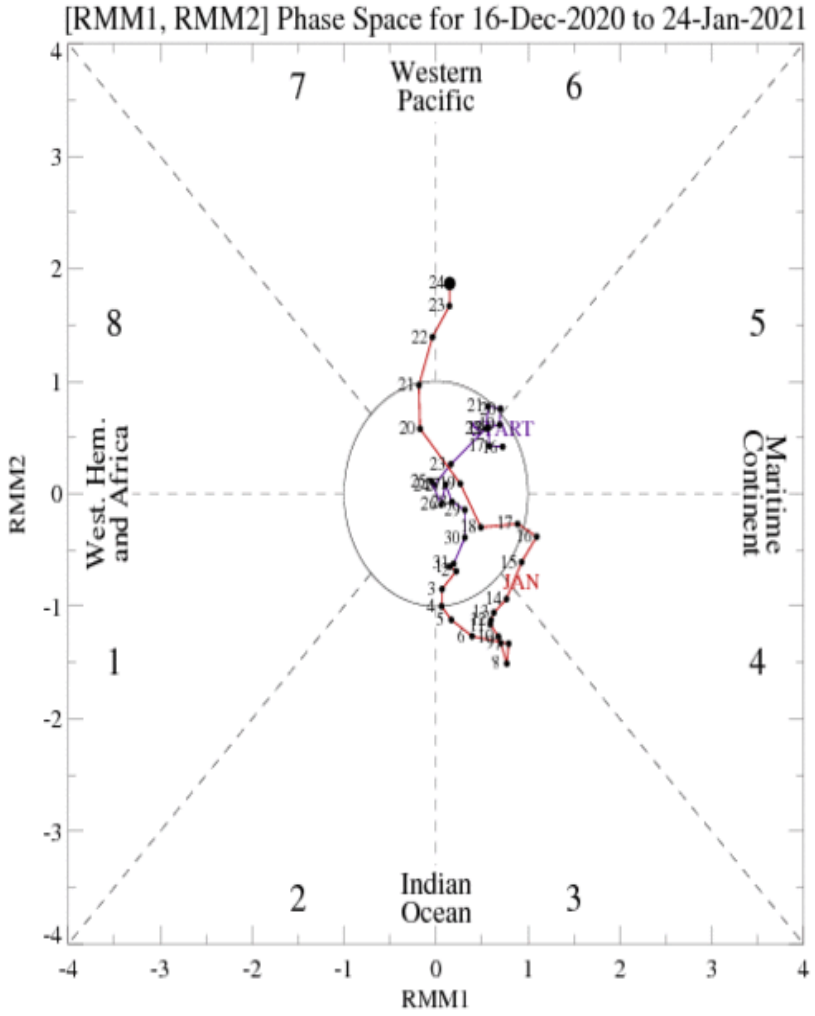


- Following destructive interference with the base state by a downwelling Kelvin wave during July, the subsequent upwelling phase pushed the Pacific into La Niña conditions.

- Negative upper ocean heat content departures have somewhat weakened over the eastern equatorial Pacific since early January, while the anomalous cold has continued to strengthen and shift westward across the central Pacific .

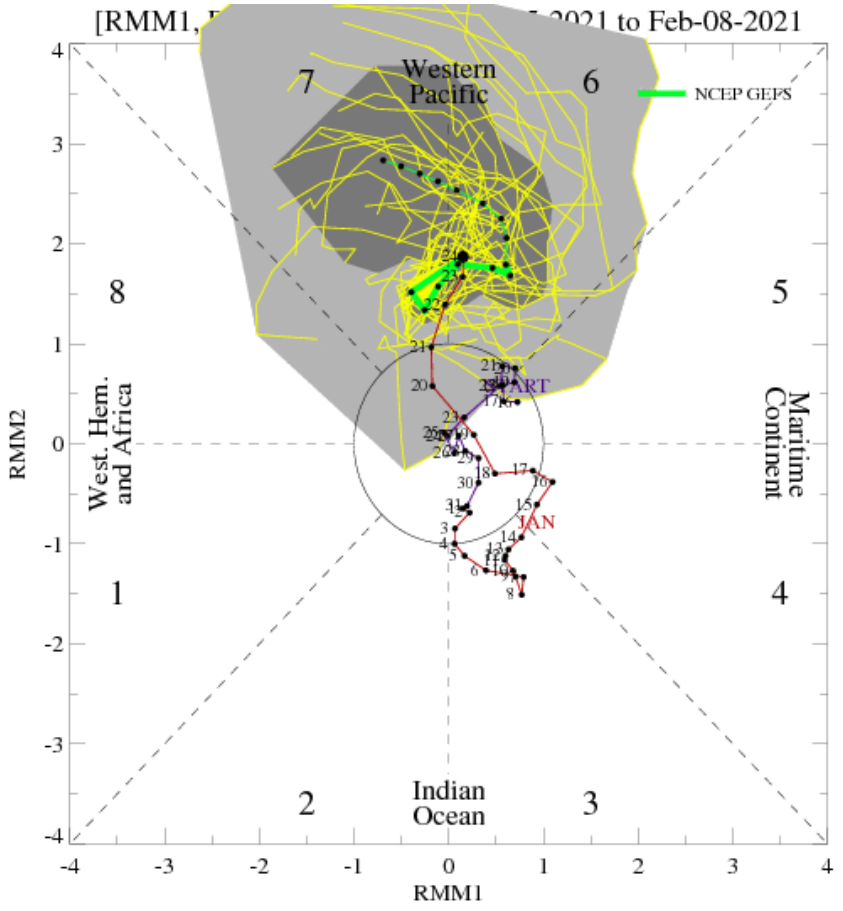
MJO Index: Recent Evolution

- The tropical convection and wind patterns are projecting more strongly onto the RMM index with a notable increase in RMM2 values during the last week.

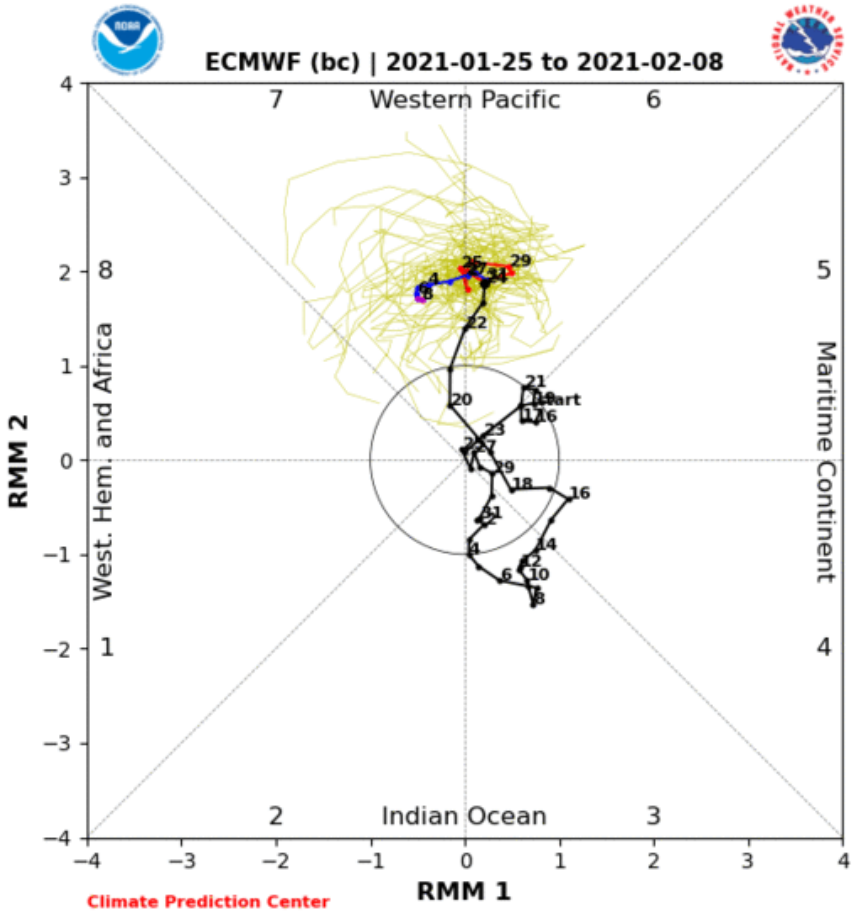


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

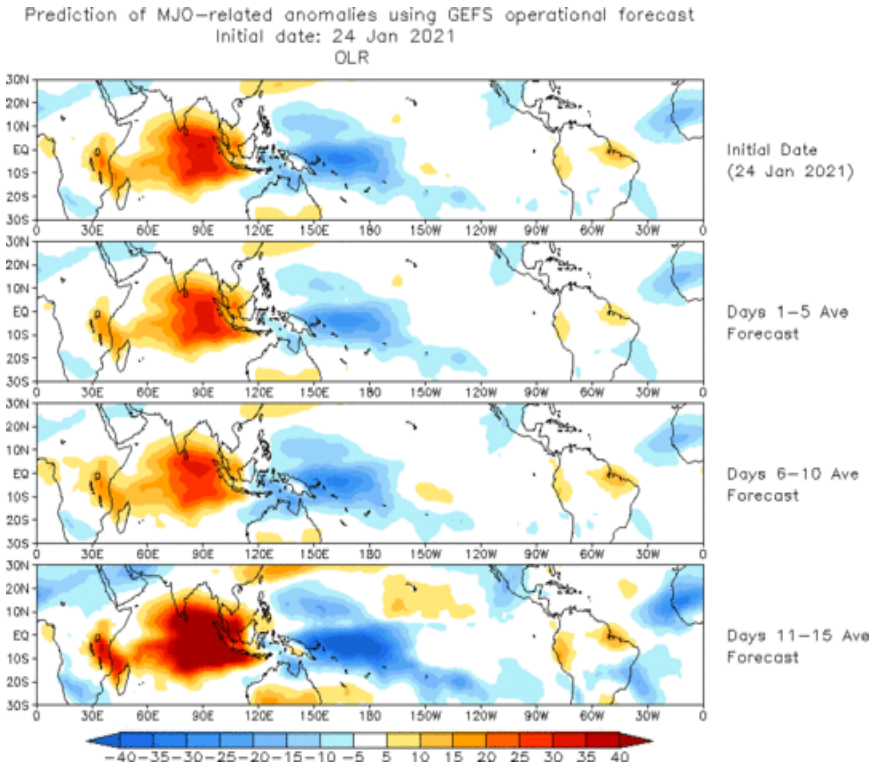


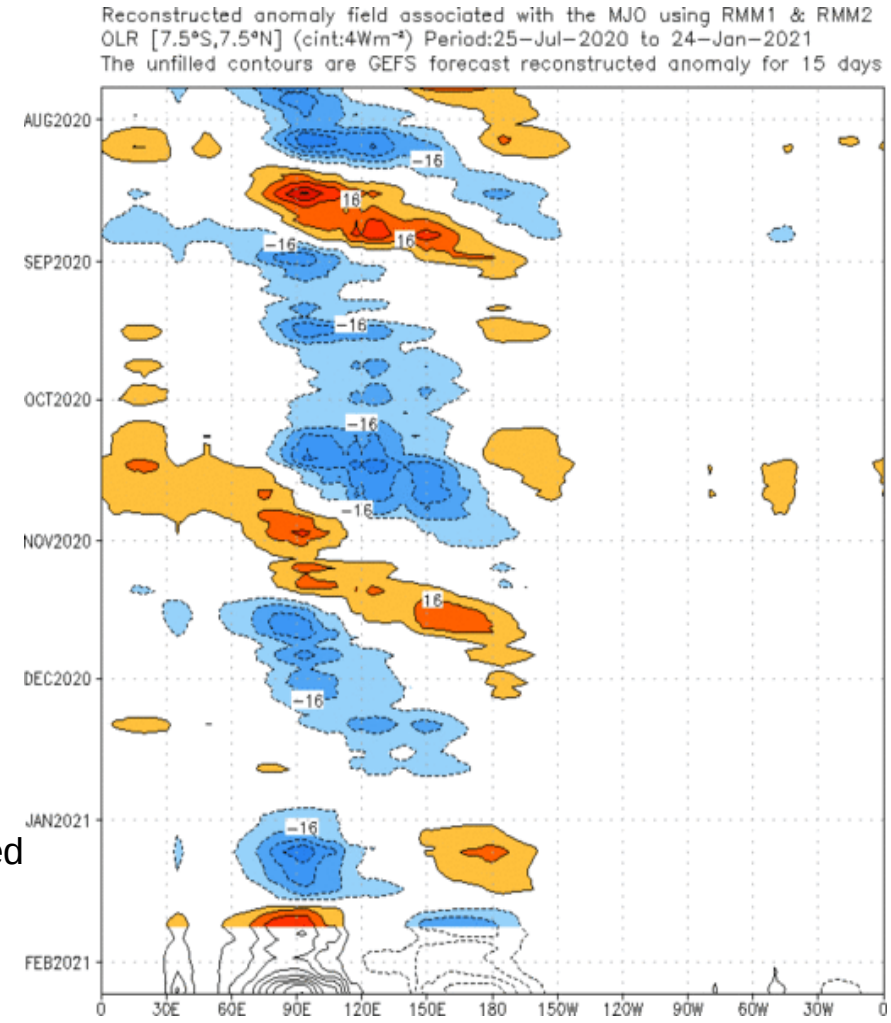
ECMWF Forecast

- There is fair agreement in the dynamical models which favor a quasi-stationary propagation of the intraseasonal signal over phases 6 and 7 during week-1, followed by an eastward propagating signal indicative of an active MJO during week-2.
- Ensemble spread is less pronounced compared to previous forecasts, with several members indicating a robust MJO event across the western Pacific by early February.

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.)

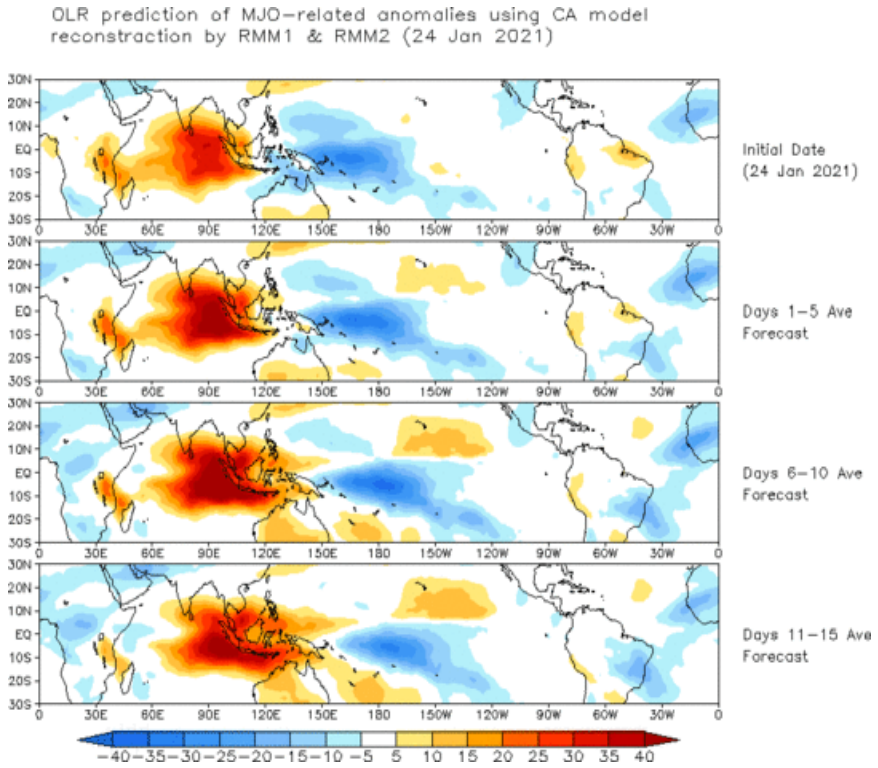


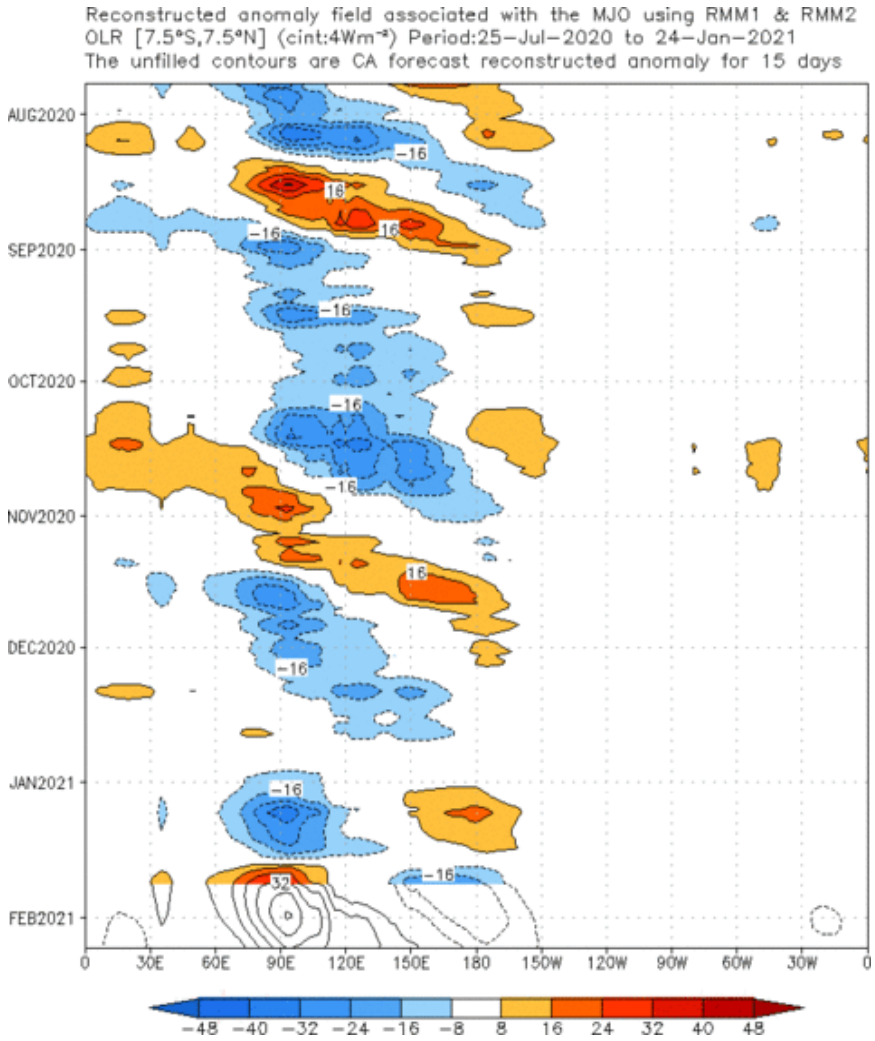


- The GEFS predicts a stationary pattern of enhanced (suppressed) convection over the Pacific (Indian Ocean) during the next two weeks.

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.)

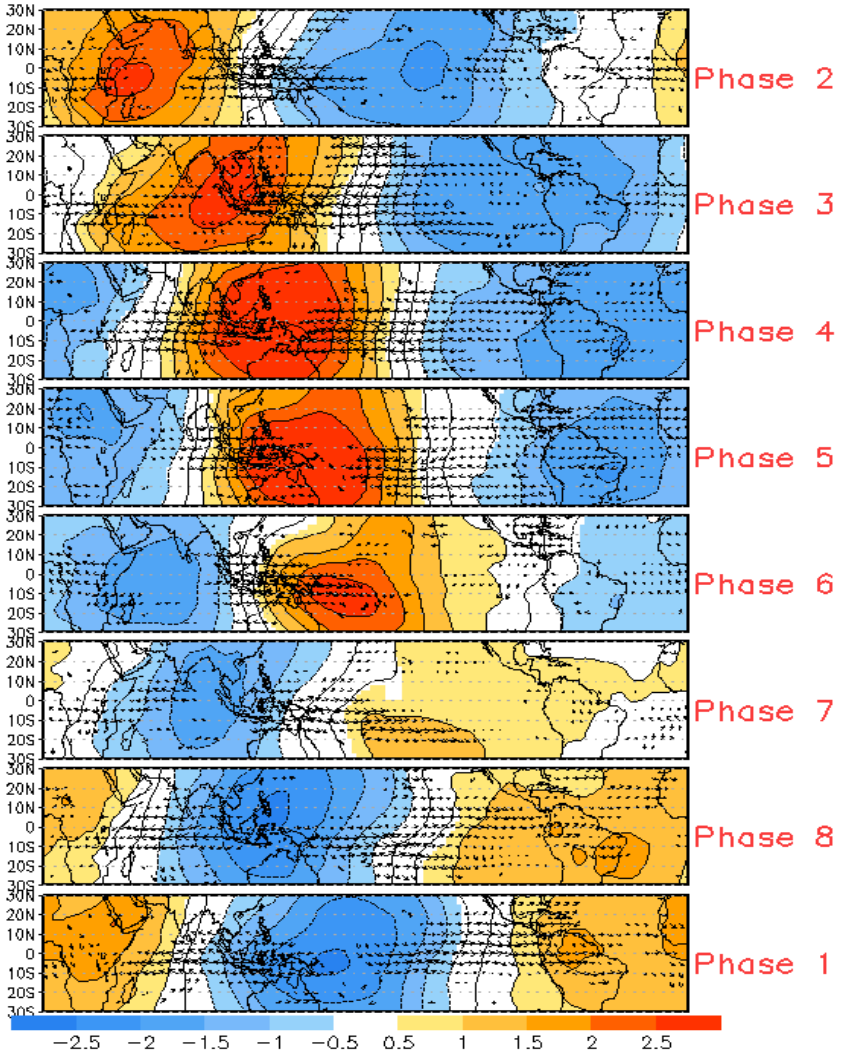




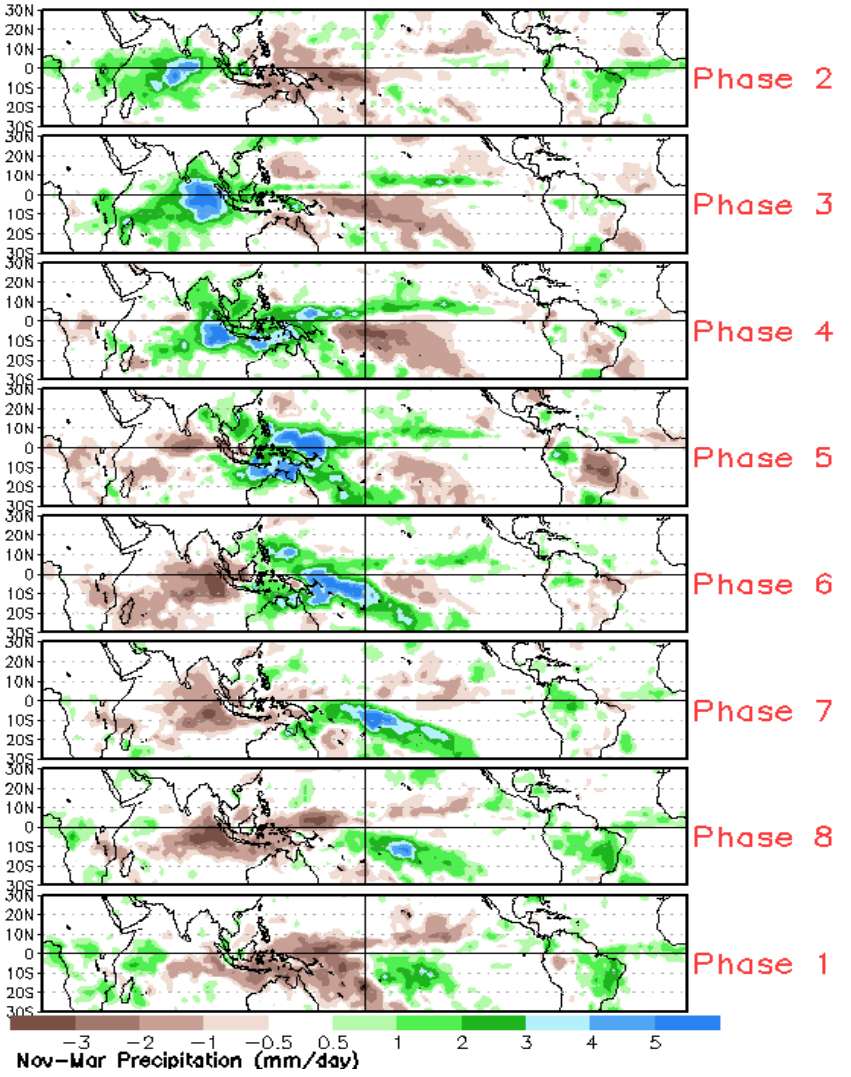
- The constructed analog resembles more of eastward propagating MJO event compared to the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



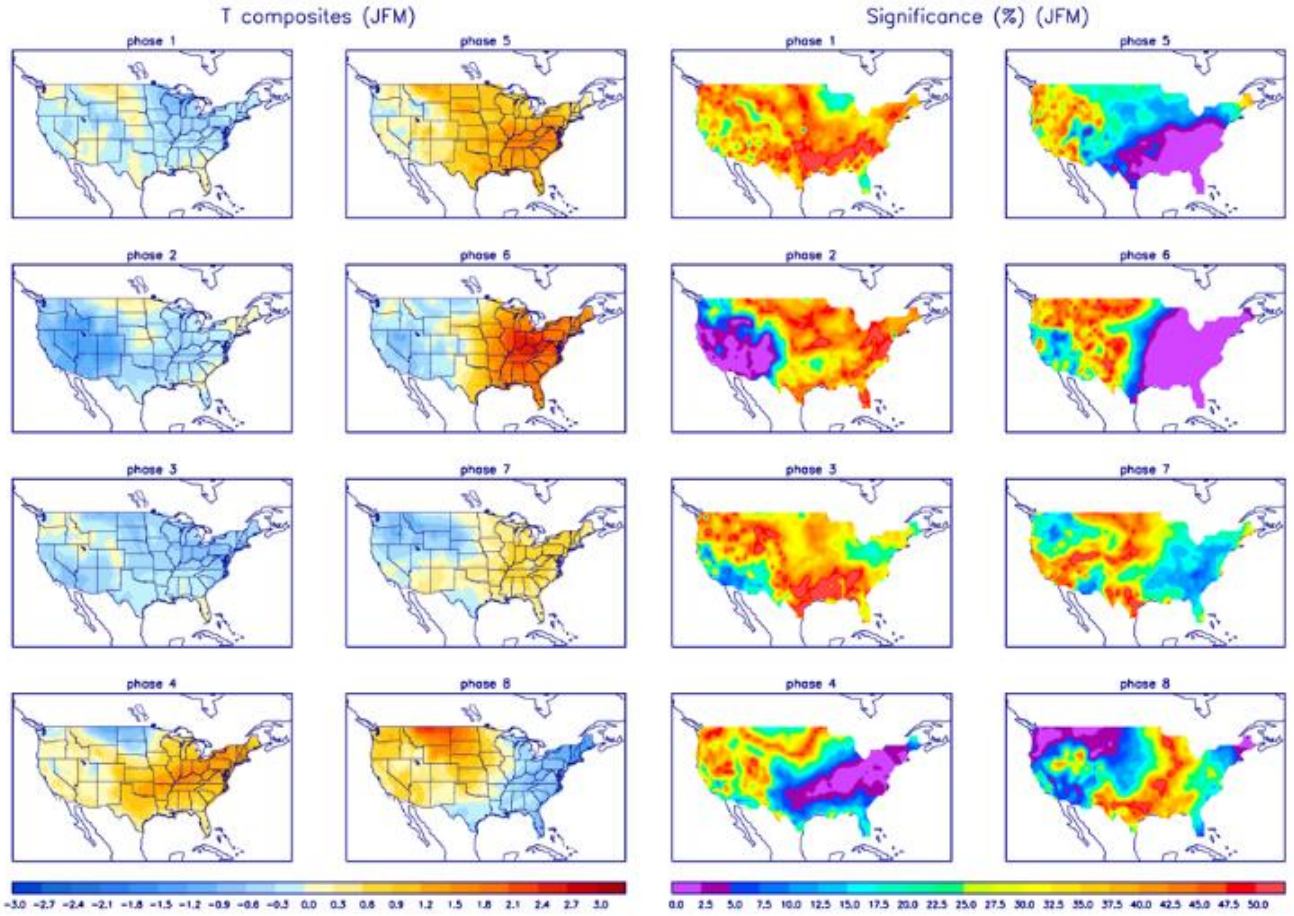
Precipitation Anomalies



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.

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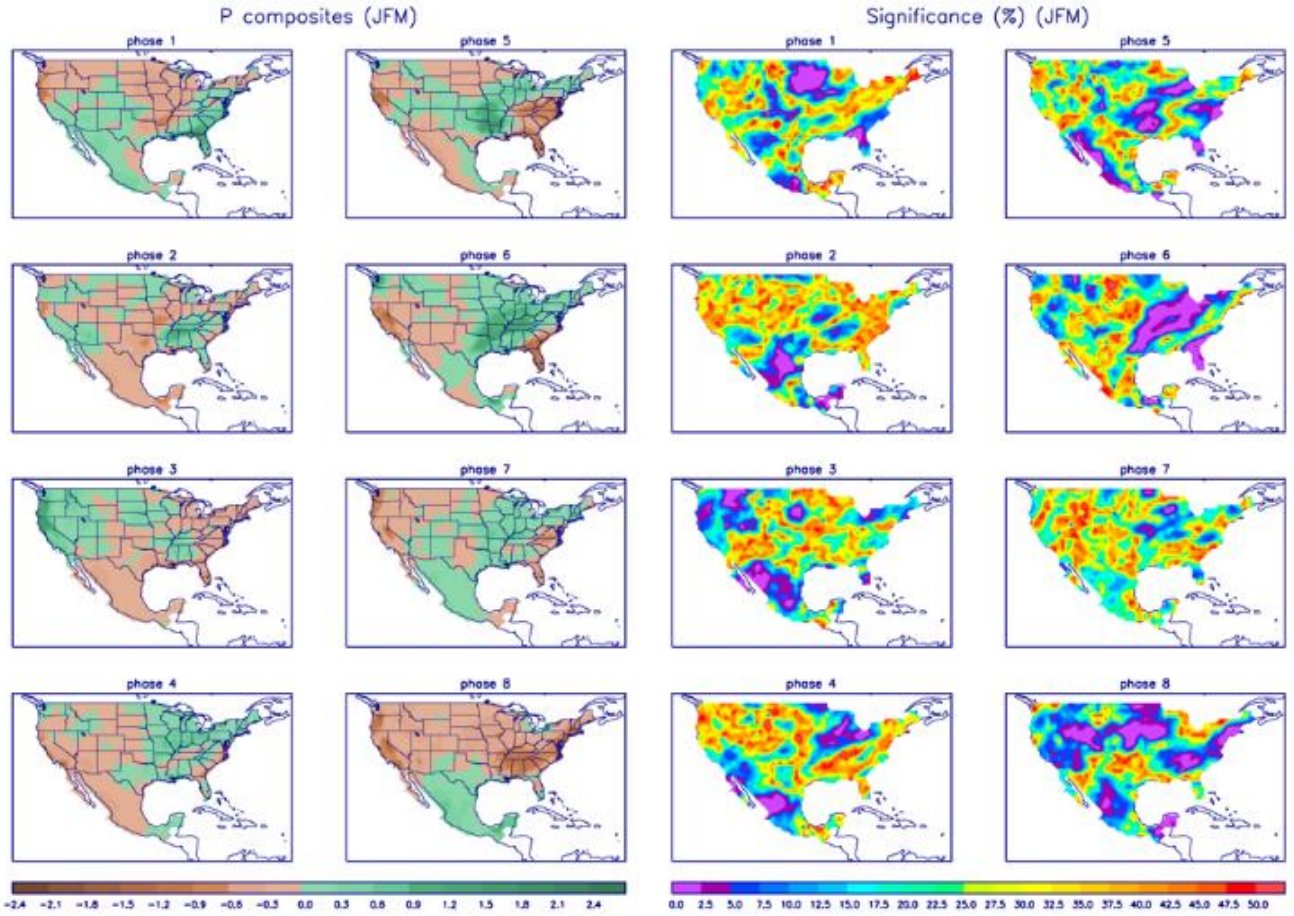

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