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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
10 January 2022

Overview

- The MJO remains weak, with the RMM index continuing to depict an enhanced signal meandering over the western Pacific.

- The upper-level velocity potential field exhibits small scale and weak anomaly features with little coherence.

- Dynamical models depict strong Rossby wave interference over the next two weeks, with the ECMWF showing enhanced convection shifting from the central Pacific back to the West Pacific.

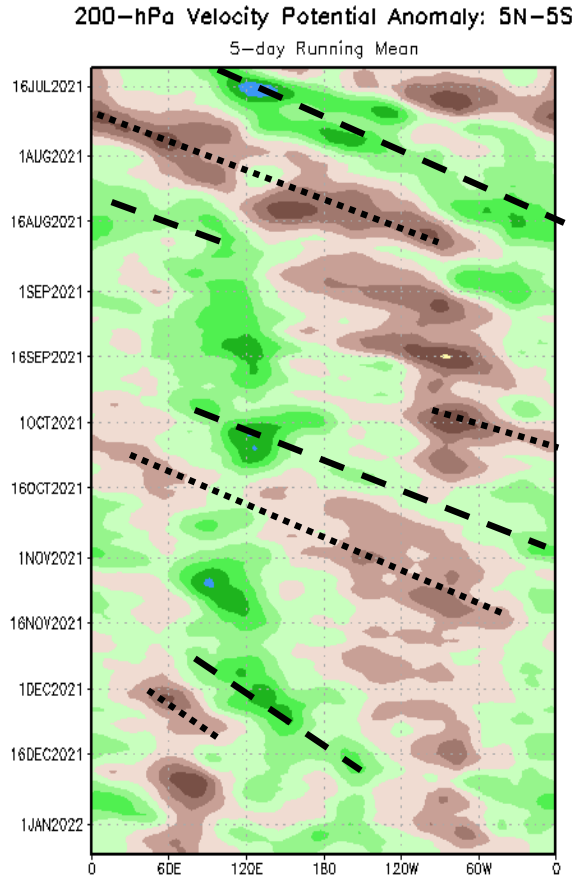
- Tropical cyclone formation is possible along the South Pacific Convergence Zone (SPCZ) during the next two weeks, with a weaker potential in the vicinity of northern Australia.

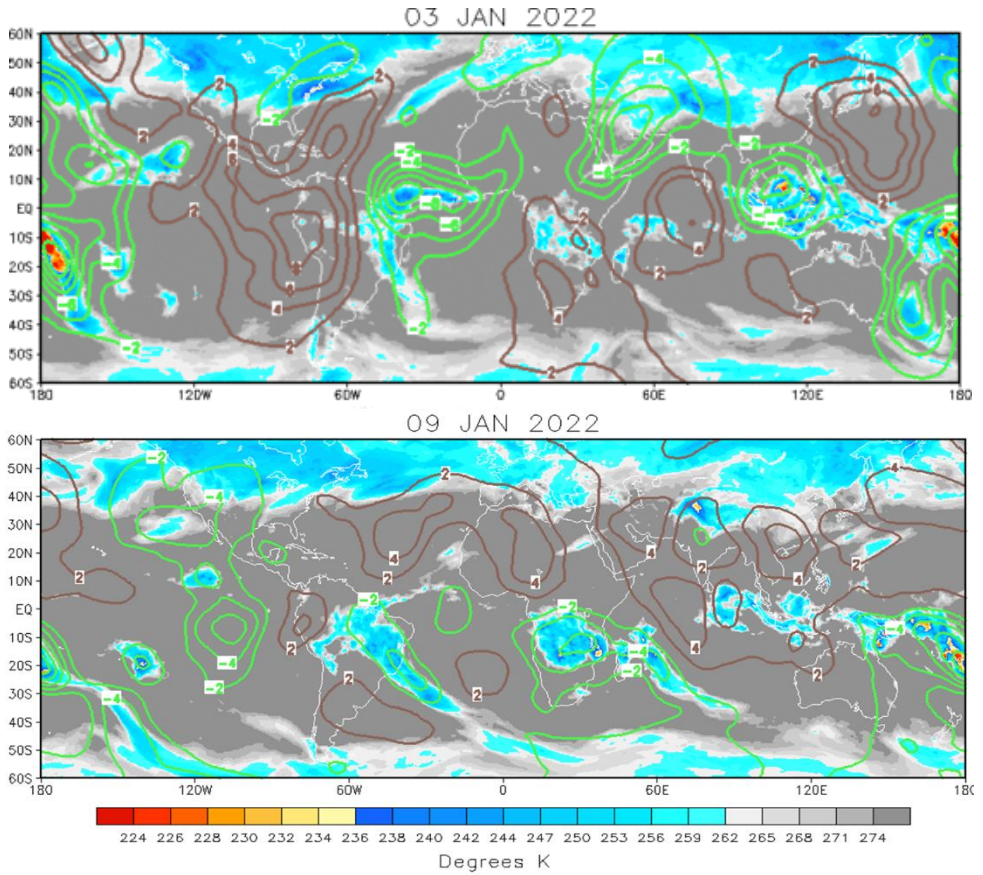
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

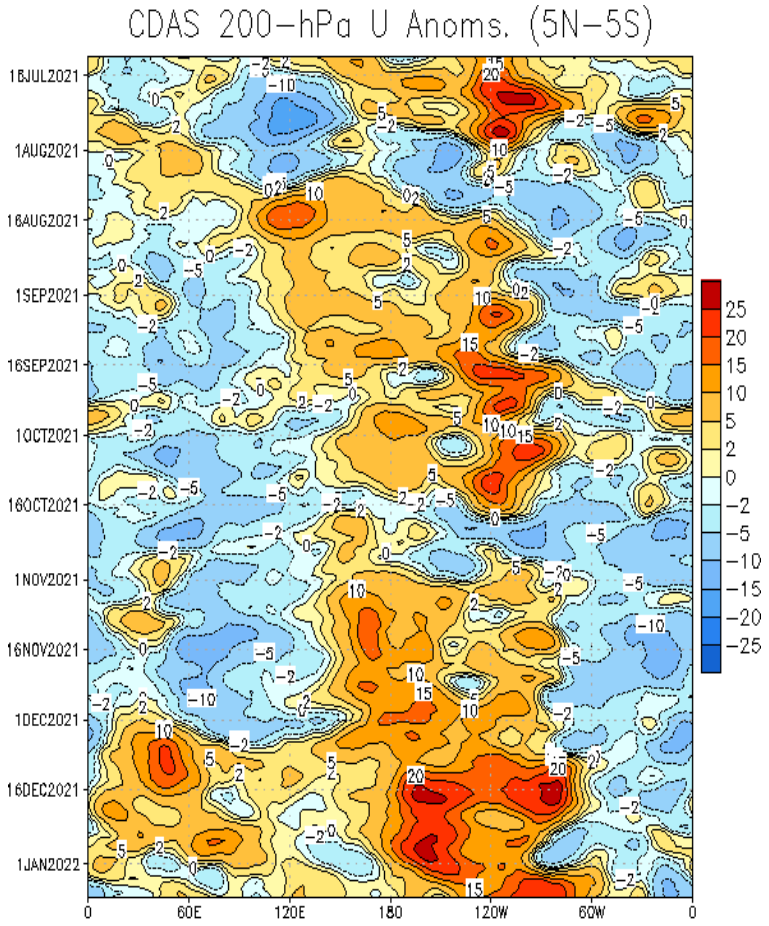


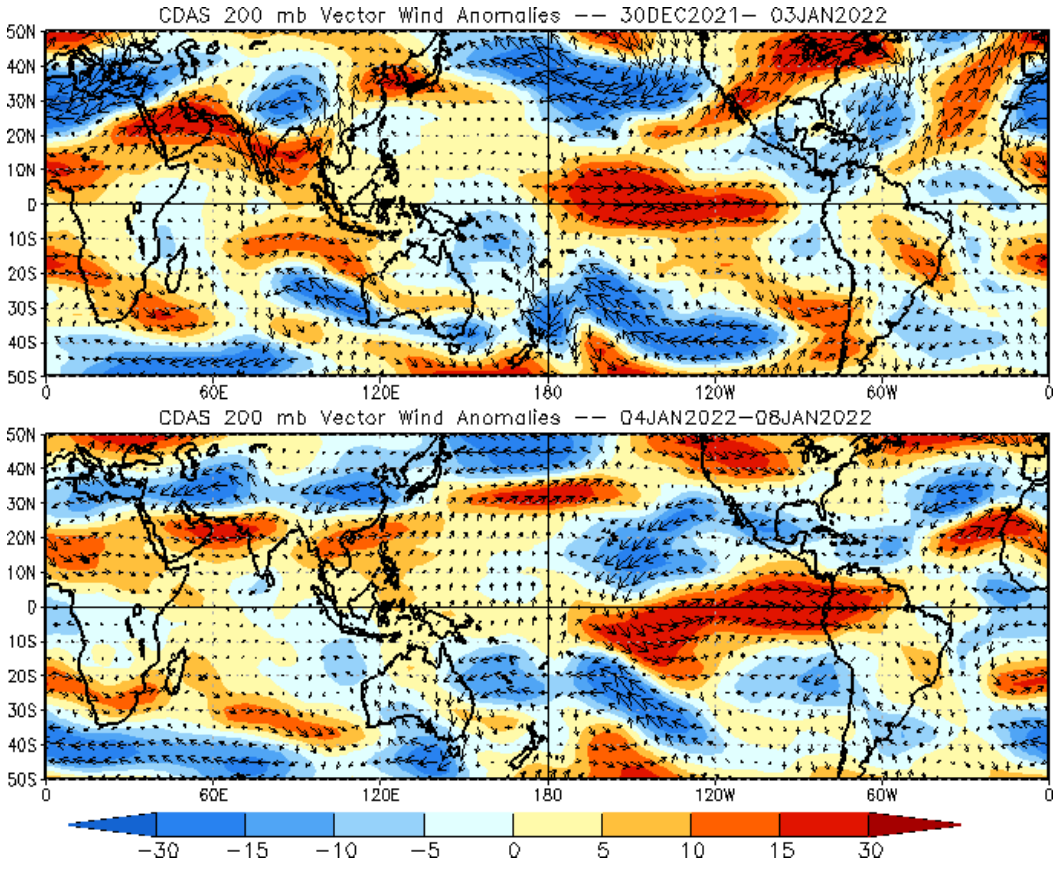


- Following a robust eastward propagation to the West Pacific in early December, the intraseasonal signal has become more incoherent.
- The upper-level velocity potential anomaly field is weak
- Enhanced convection remains persistent along the South Pacific Convergence Zone (SPCZ).

200-hPa Wind Anomalies

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

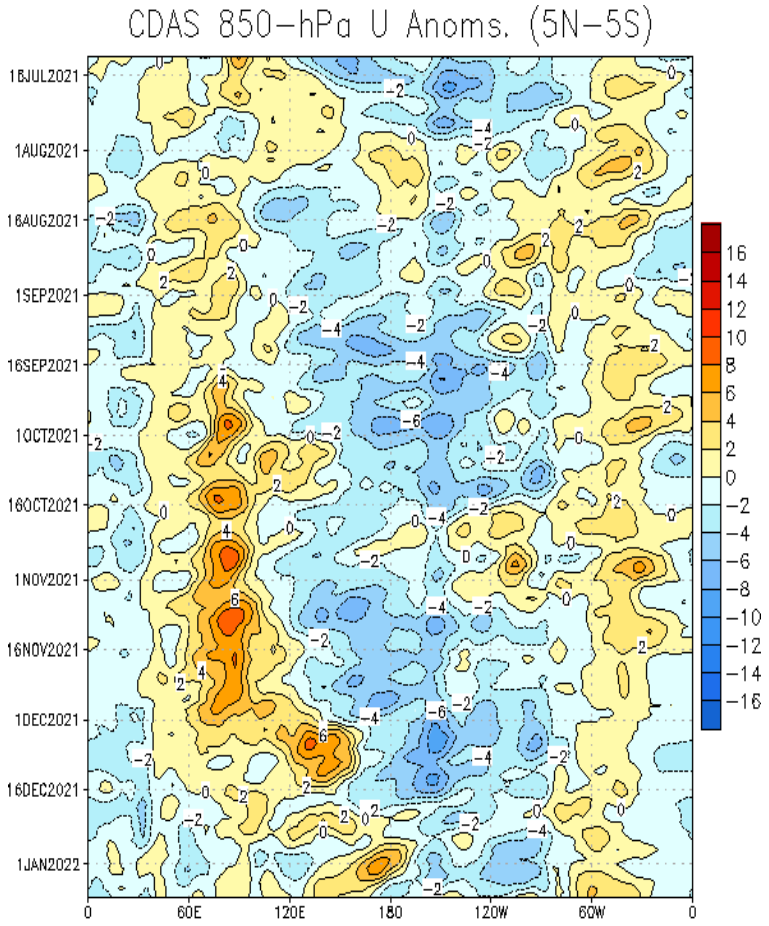


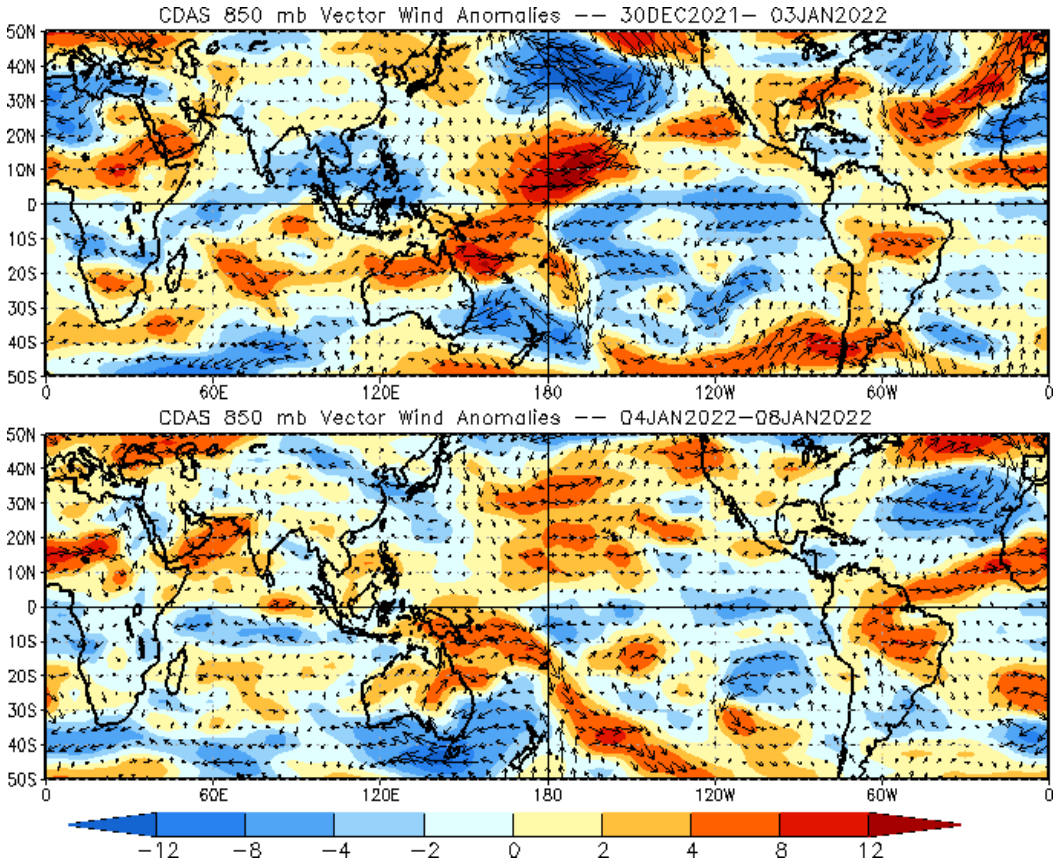


- The strongest upper-level westerly anomalies shifted eastward to the East Pacific during early January, though weak westerlies persist across the entire equatorial Pacific.
- Eastward propagating westerly anomalies have also been apparent, moving from Africa and the western Indian Ocean in December to the Maritime Continent.

850-hPa Wind Anomalies

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



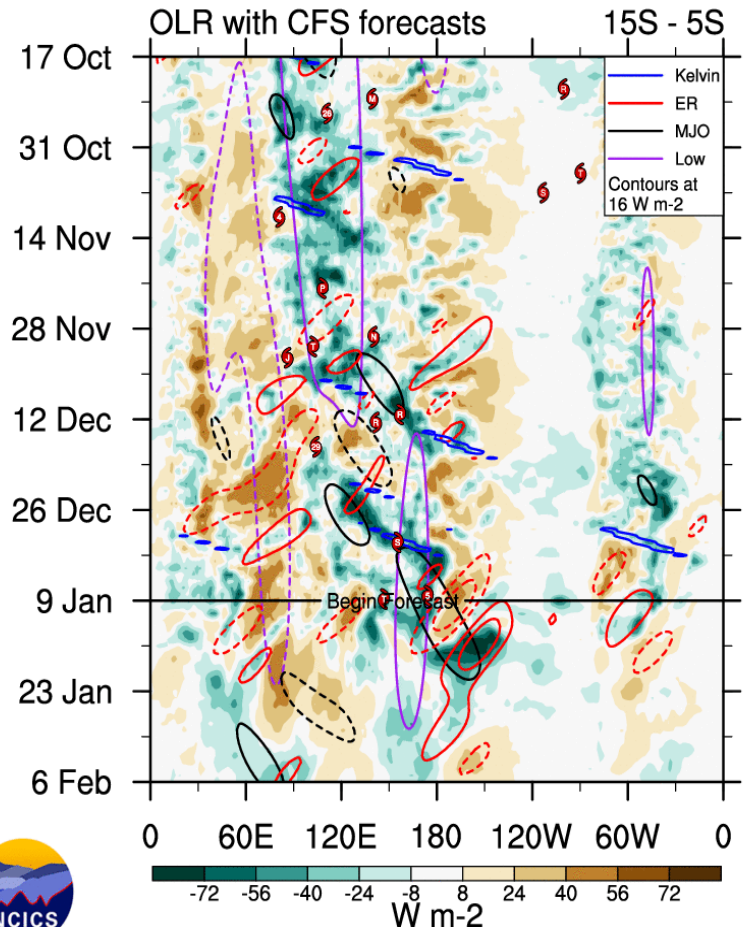


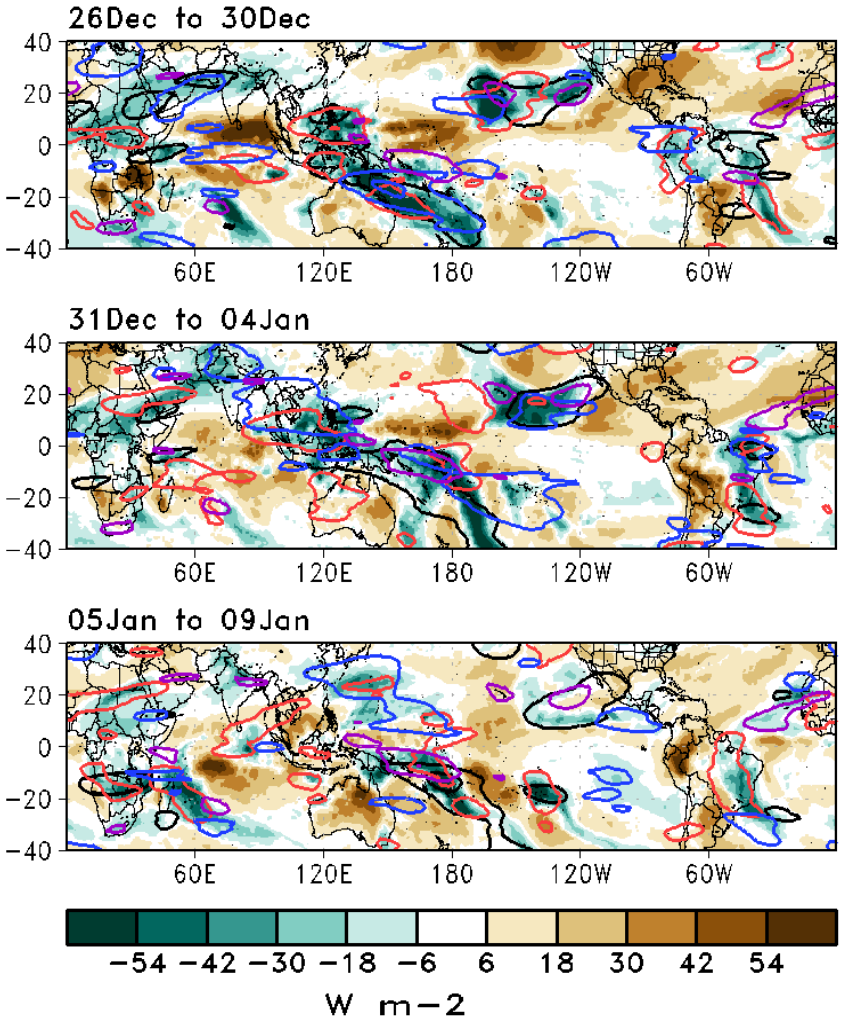
- Strong cyclonic circulation over the North Pacific helped generate a robust westerly wind burst near the Date Line in early January.

- The low frequency enhanced trade wind regime has become increasingly disrupted recently.

Outgoing Longwave Radiation (OLR) Anomalies

Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

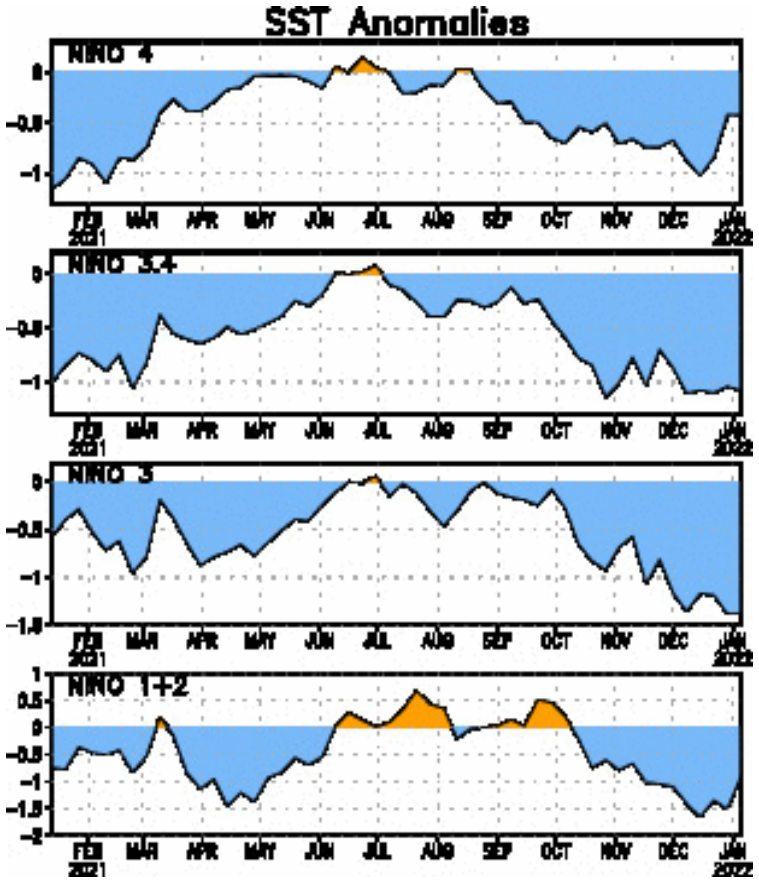


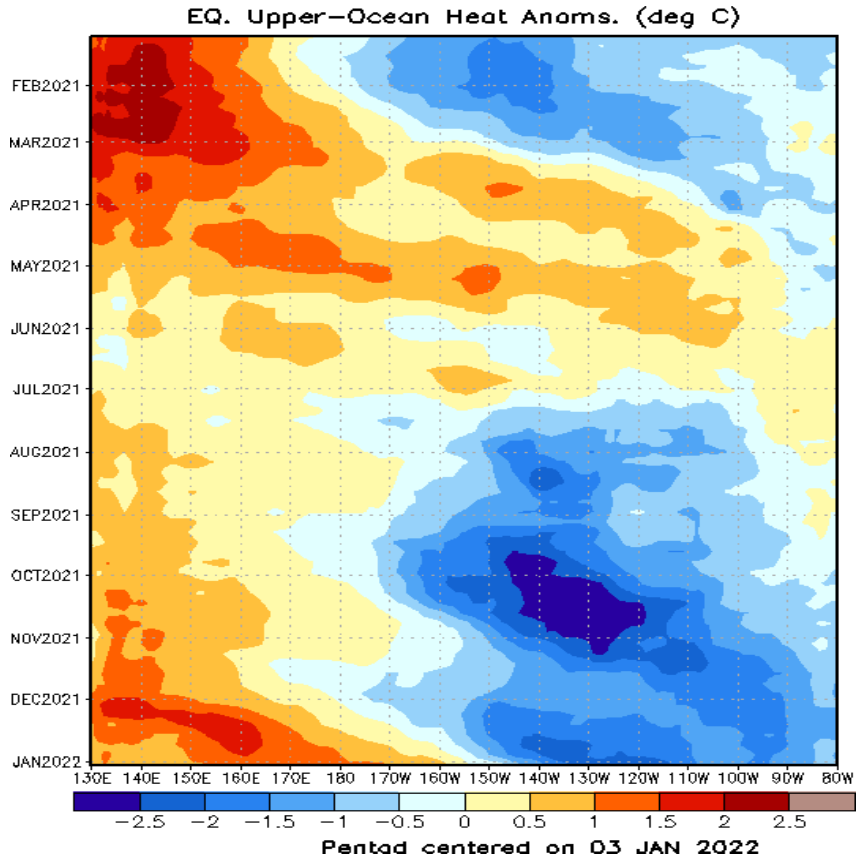


- Enhanced convection remains persistent west of the Date Line and along the SPCZ, with evidence of constructive interference with a convectively coupled Kelvin wave.

- The CFS depicts strong central Pacific Rossby wave activity through mid-January, which may interfere with any eastward propagating signal.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

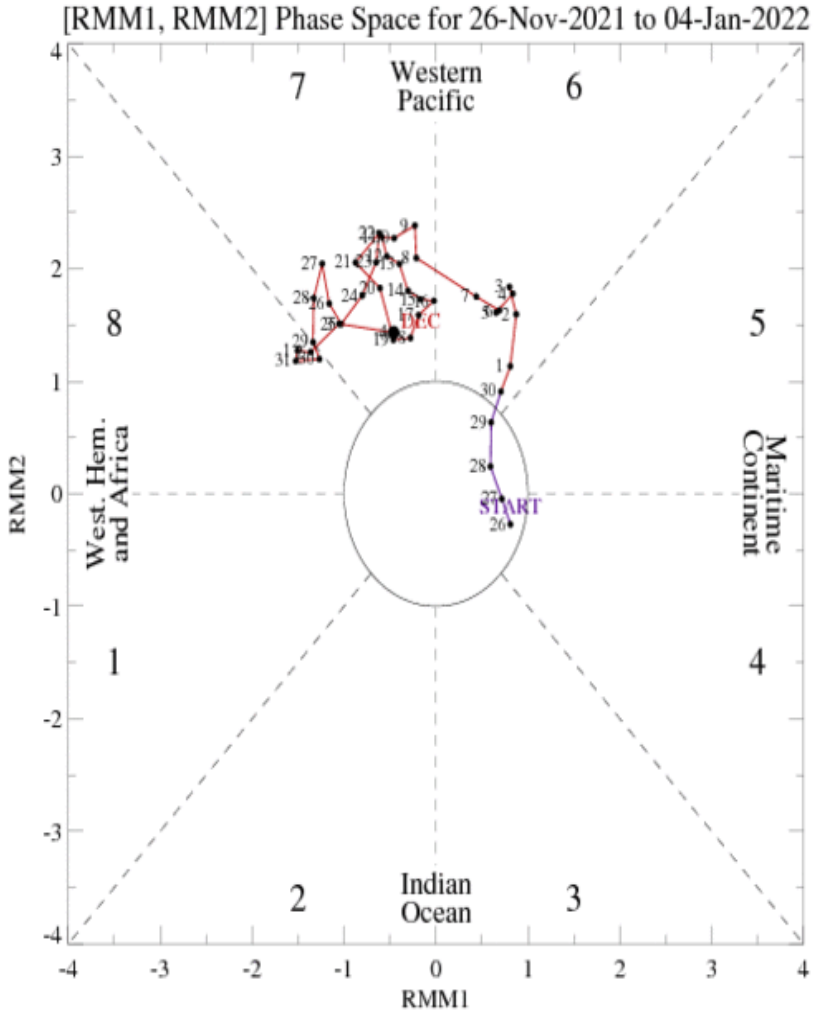




- A strong downwelling oceanic Kelvin wave event was initiated in December 2021 following a low-level westerly wind burst over the West Pacific.
- Above-average upper-ocean heat content anomalies have progressed as far east as 155W.
- Below-average sea surface temperature anomalies persist across all of the Niño regions, reflecting continued La Niña conditions.

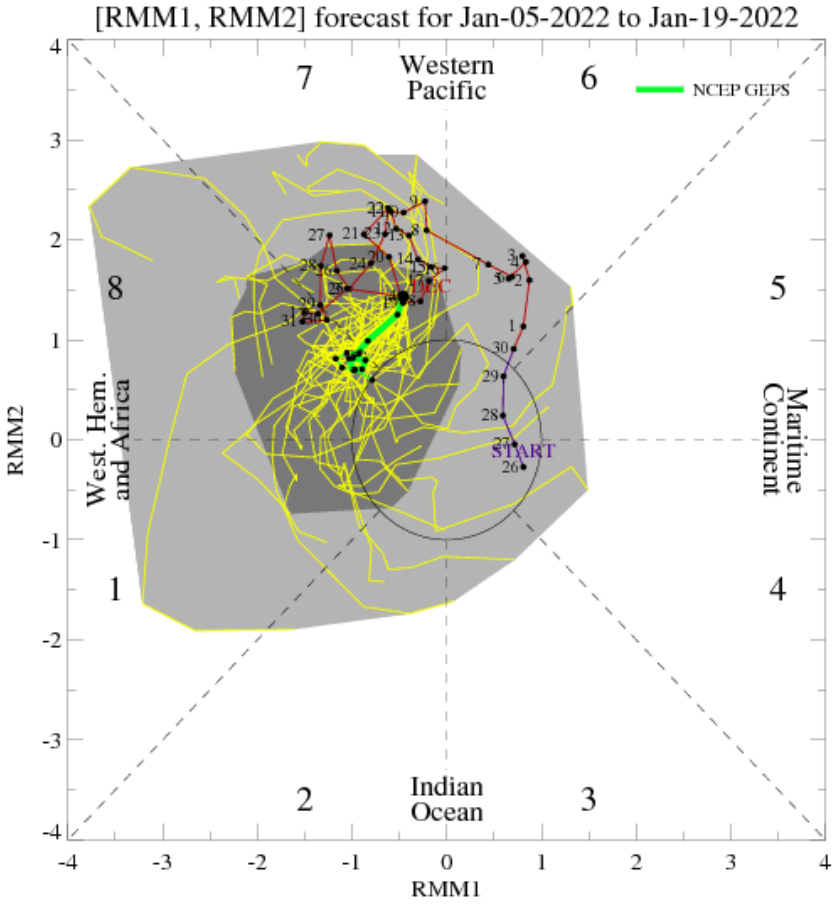
MJO Index: Recent Evolution

- The RMM based MJO index is delayed by several days.
- The intraseasonal signal has been meandering for the last few weeks over the West Pacific, with the signal at times approaching the central Pacific and then retreating back towards the West Pacific.

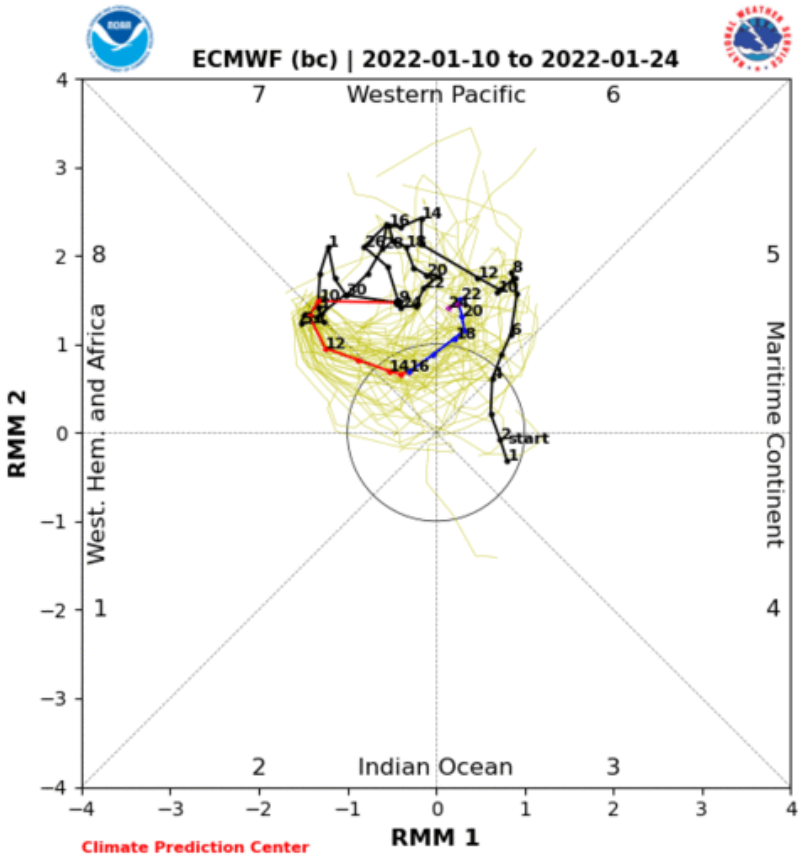


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

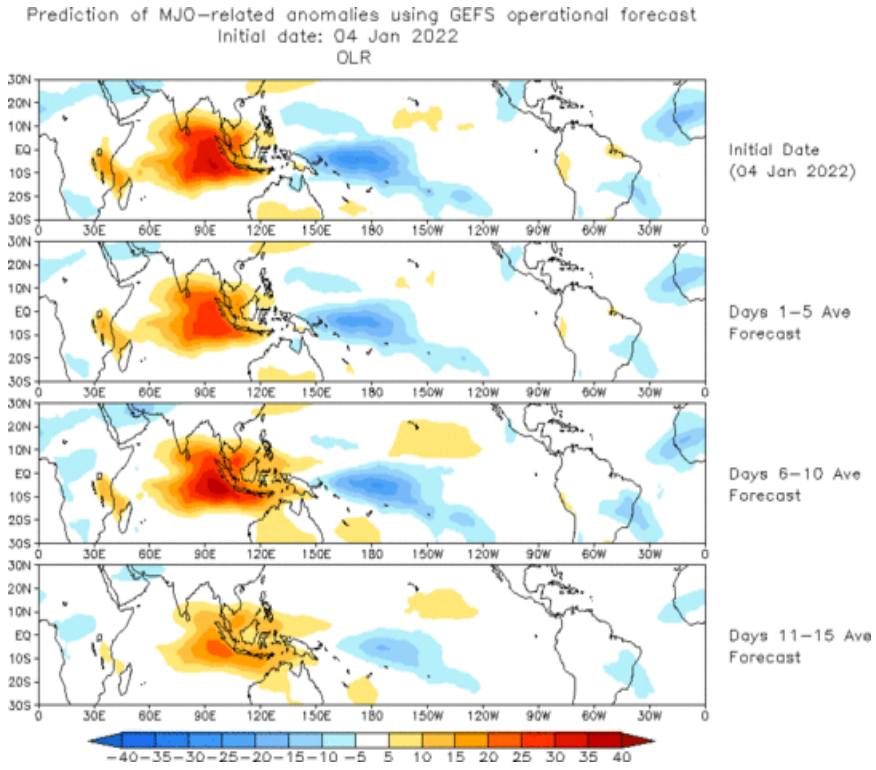


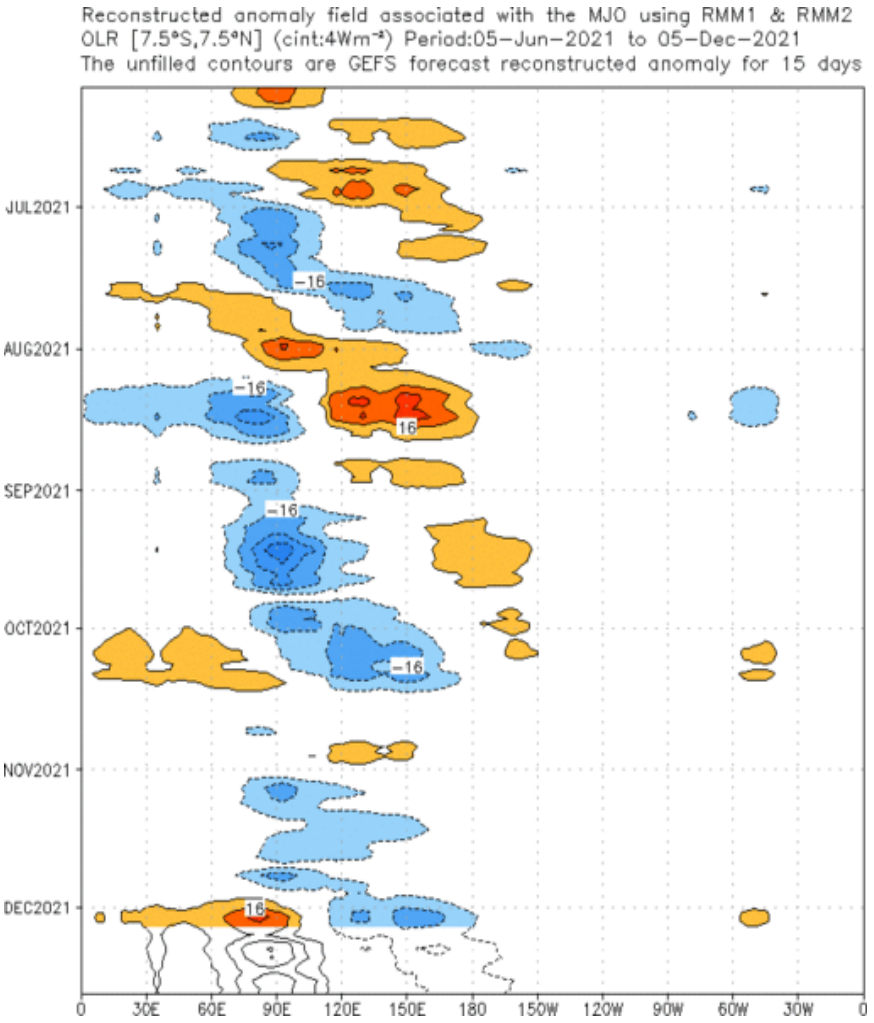
ECMWF Forecast

- Note: The GEFS guidance is out of date.
- The ECMWF forecast depicts a generally westward propagating signal, with enhanced convection over the central Pacific weakening, followed by potential re-amplification over the West Pacific.

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.)

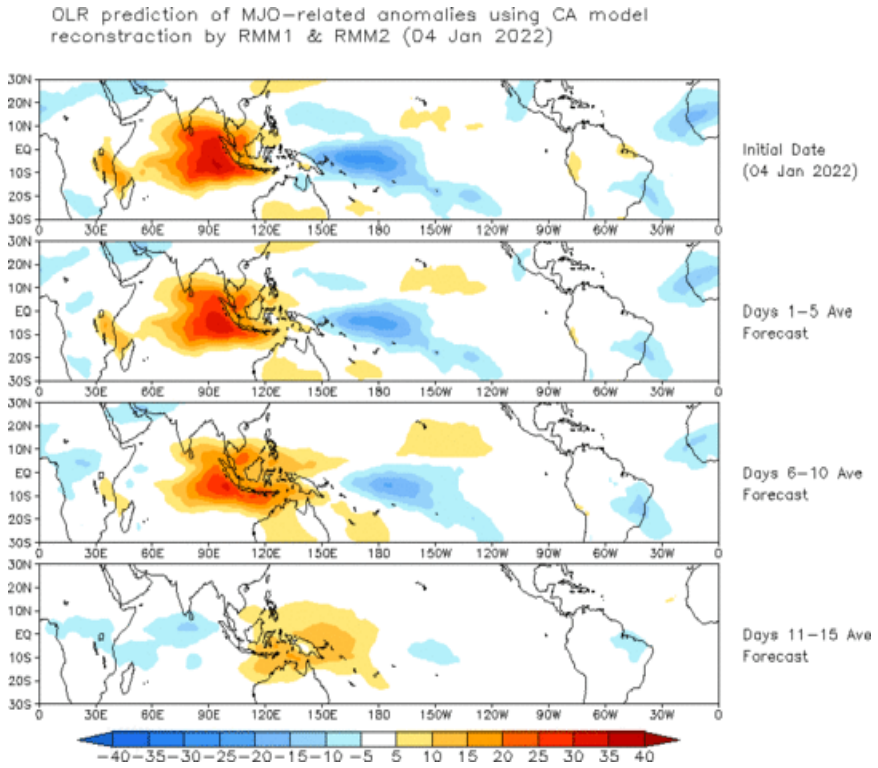


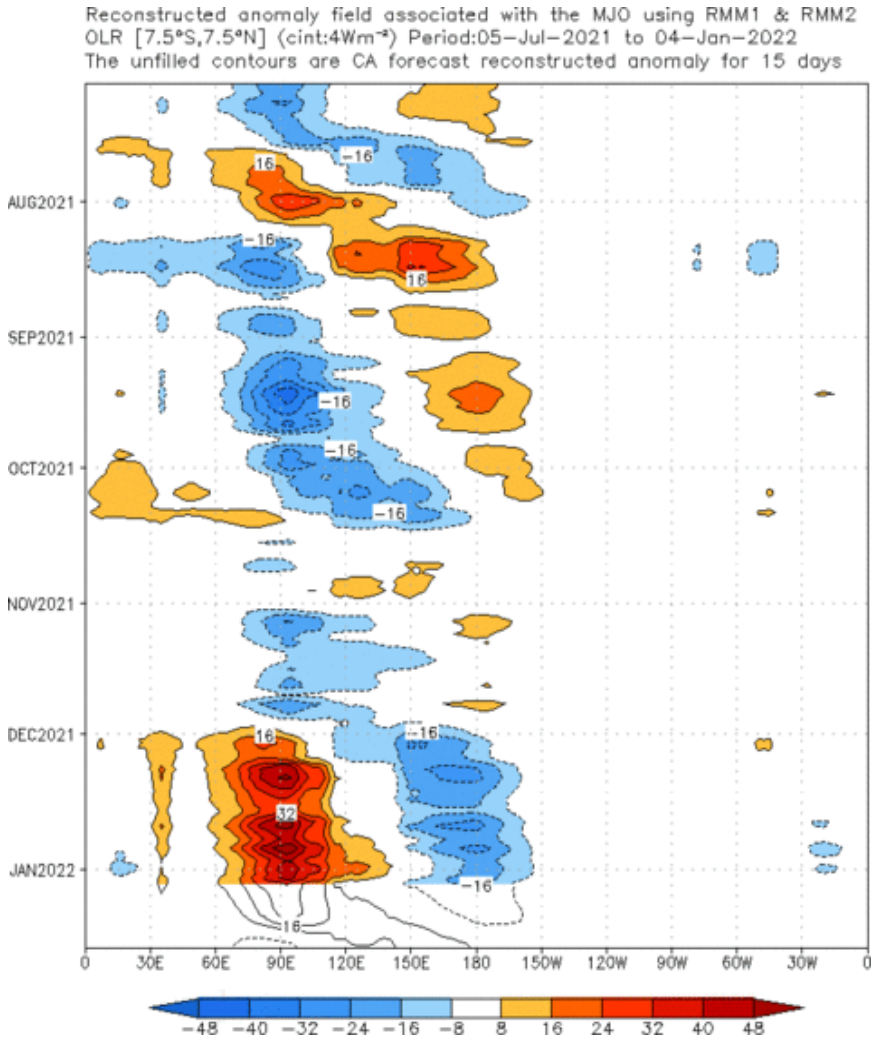


- The GEFS RMM-based OLR anomaly forecast is out of date by several days.
- At the time of forecast release, a slow eastward propagation of enhanced convection from the West Pacific to the central Pacific was depicted.

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.)

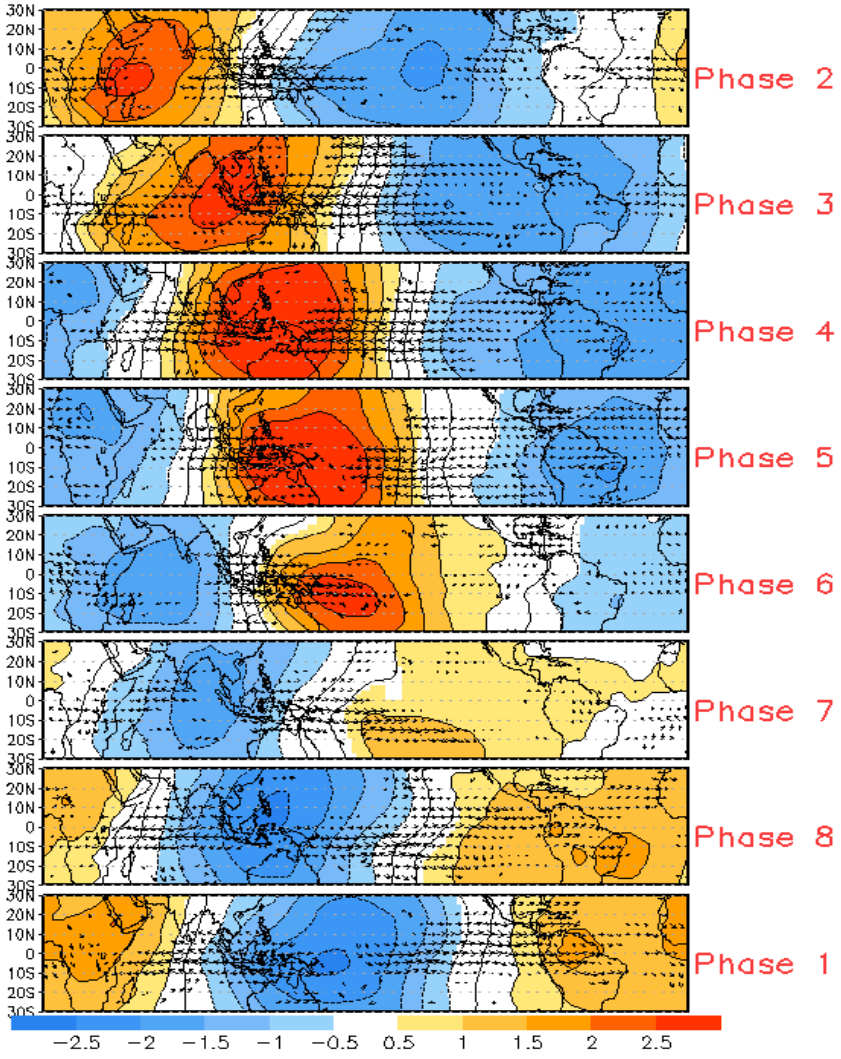




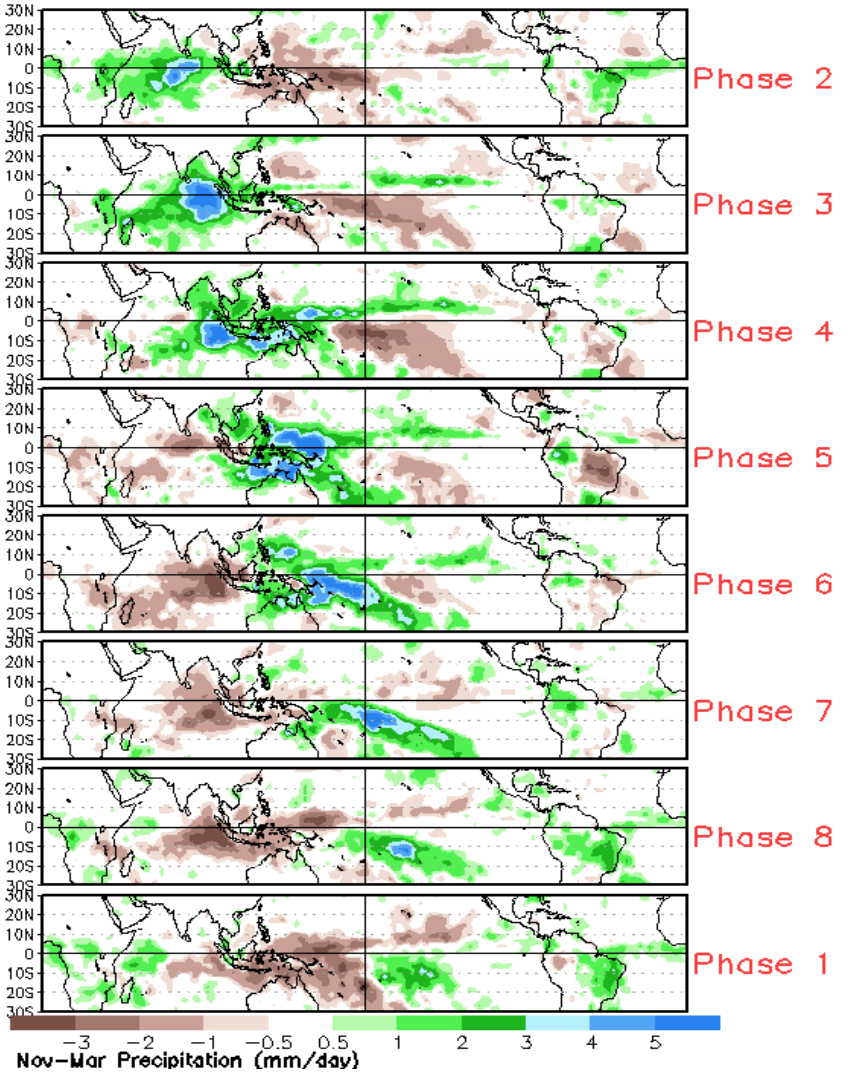
- The constructed analog tool depicts a more progressive but rapidly weakening MJO-like signal.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



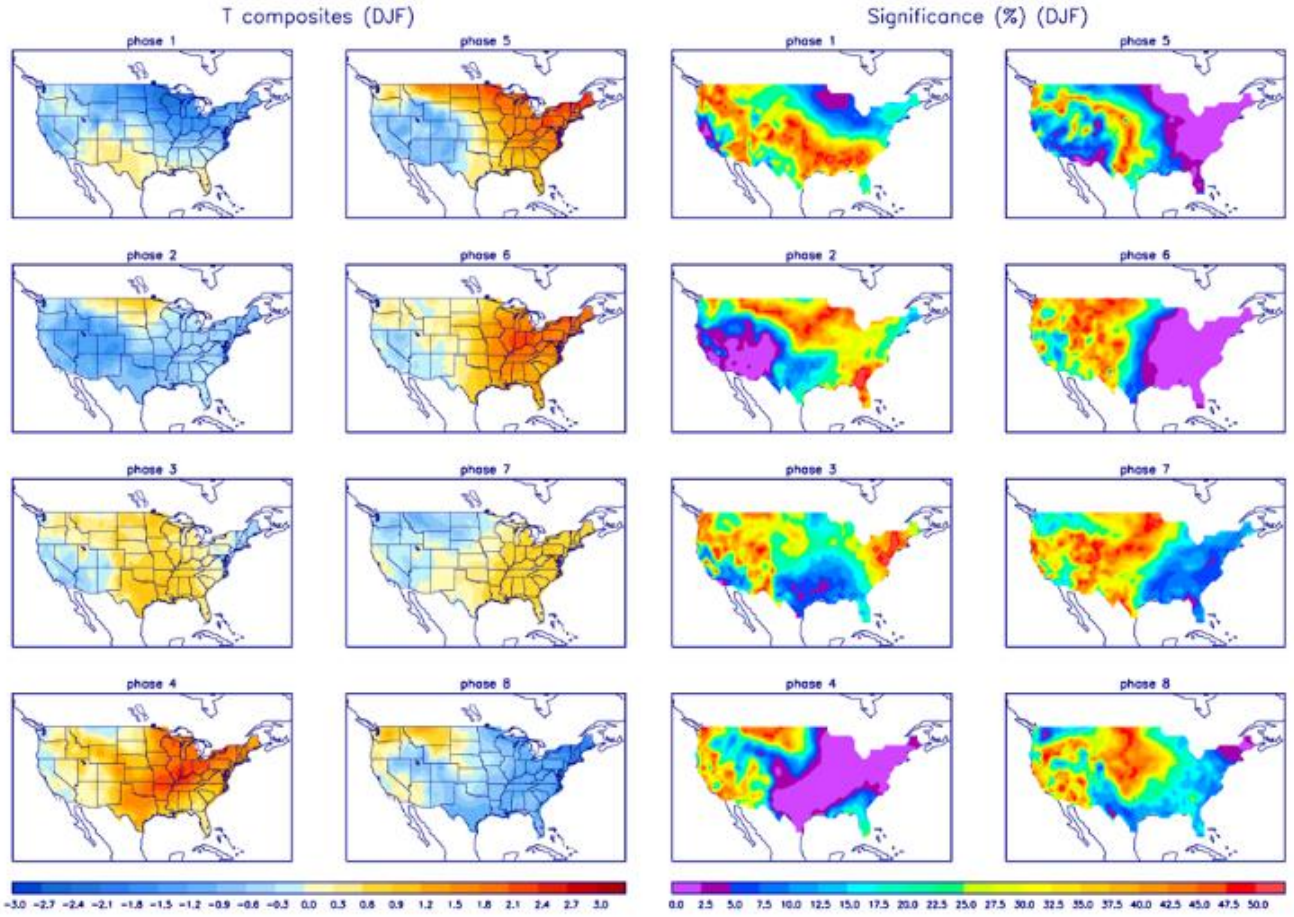
Precipitation Anomalies



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.

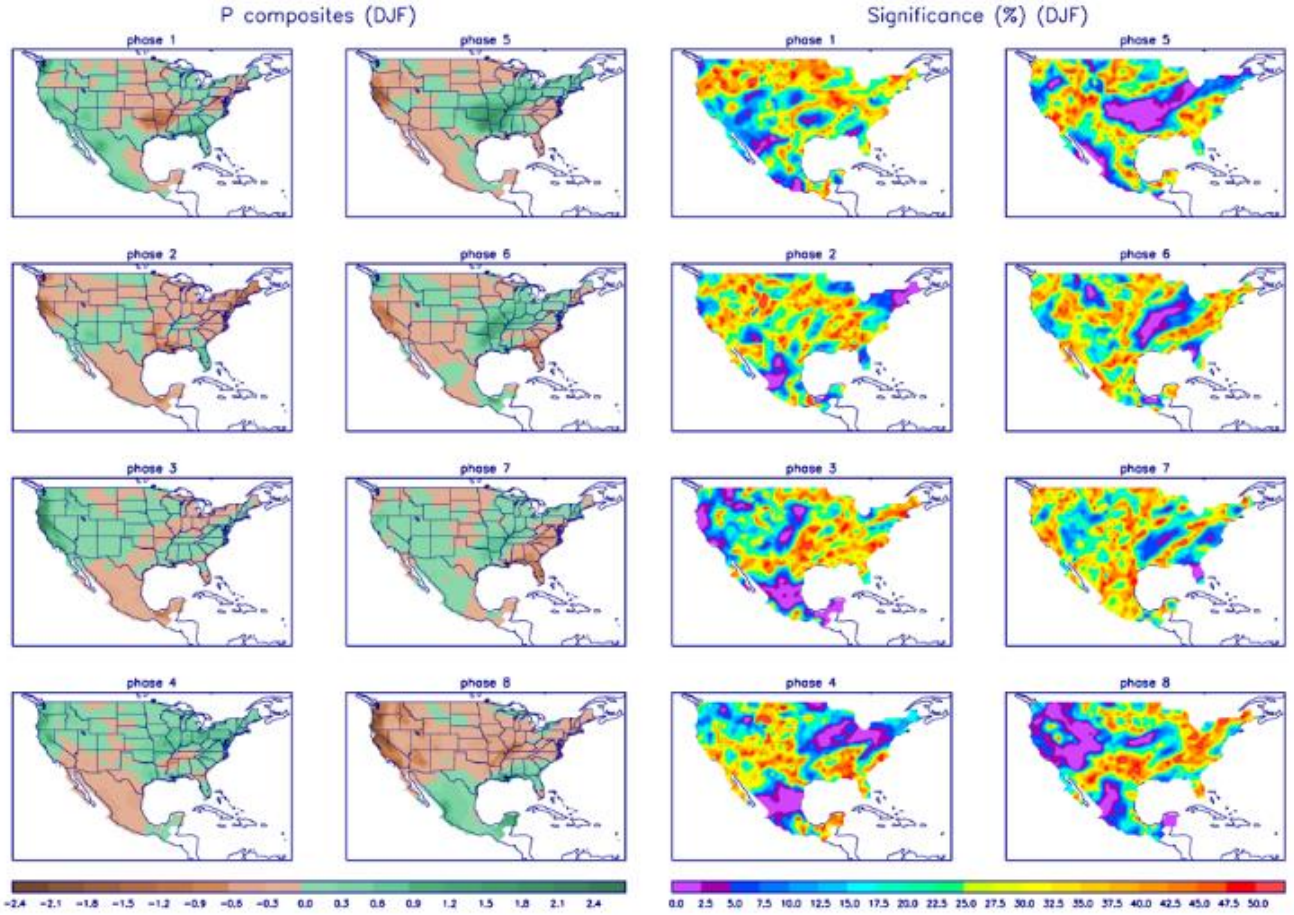


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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