

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



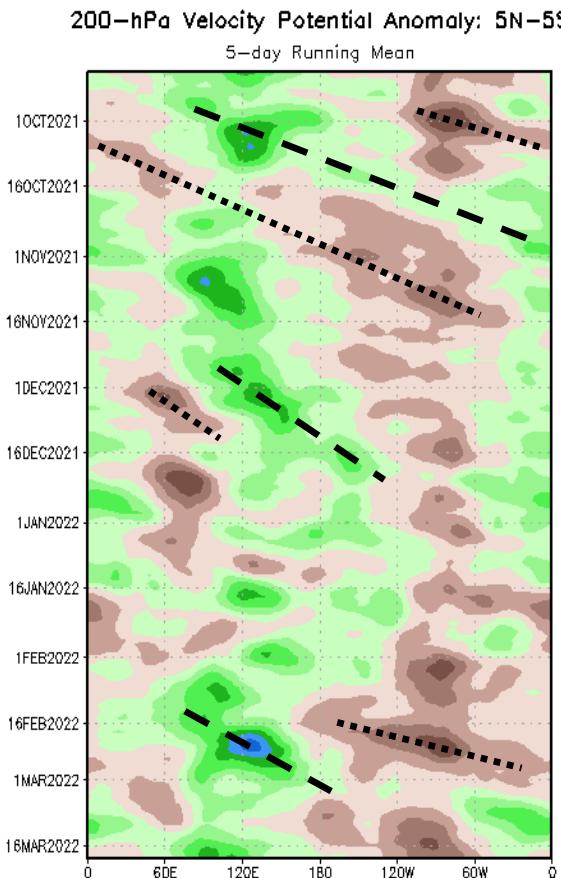
**Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
21 March 2022**

Overview

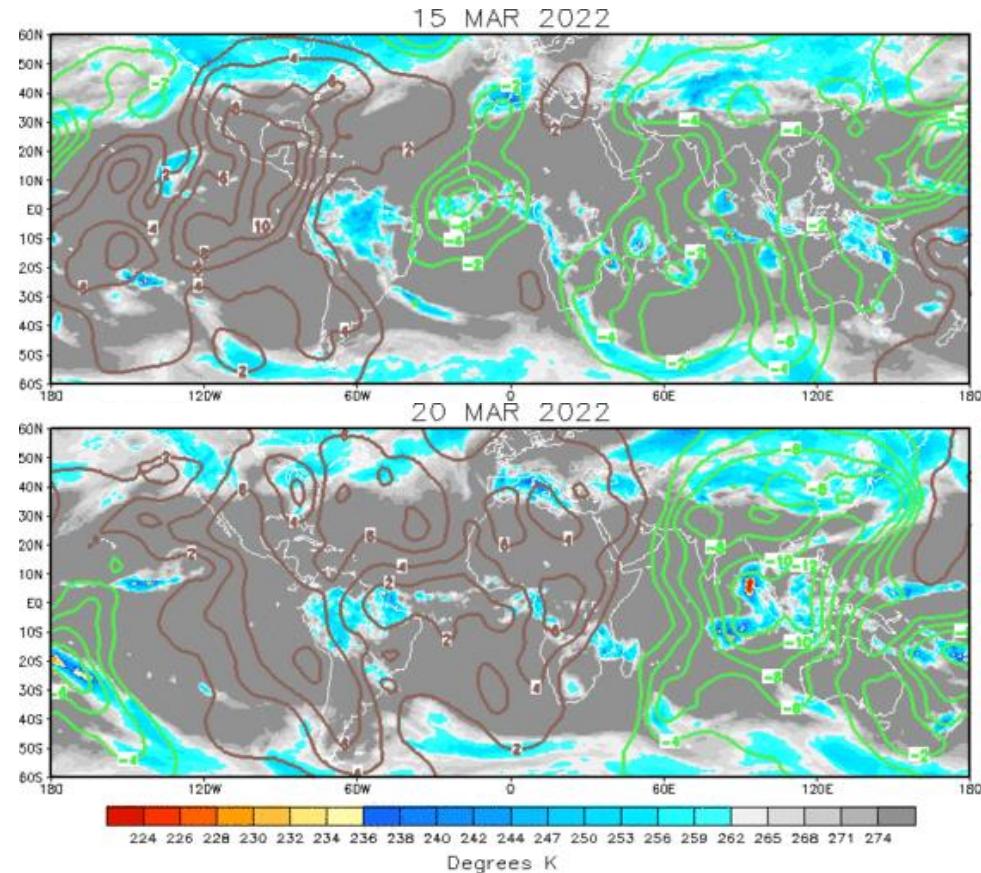
- After a more organized intraseasonal signal emerged last week, there are now signs that MJO will weaken significantly as it moves eastward into the Maritime Continent.
- Both the GEFS and ECMWF depict the RMM index declining rapidly in the coming week. There is some disagreement on how quickly the strength of the MJO will decrease, but both models bring the RMM into the unit circle within the next 7 days.
- The enhanced phase of the MJO is beginning to move out of the Indian Ocean, but nonetheless increased convergence over the eastern IO may increase the possibility of TC formation over the area for the next week or so.

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



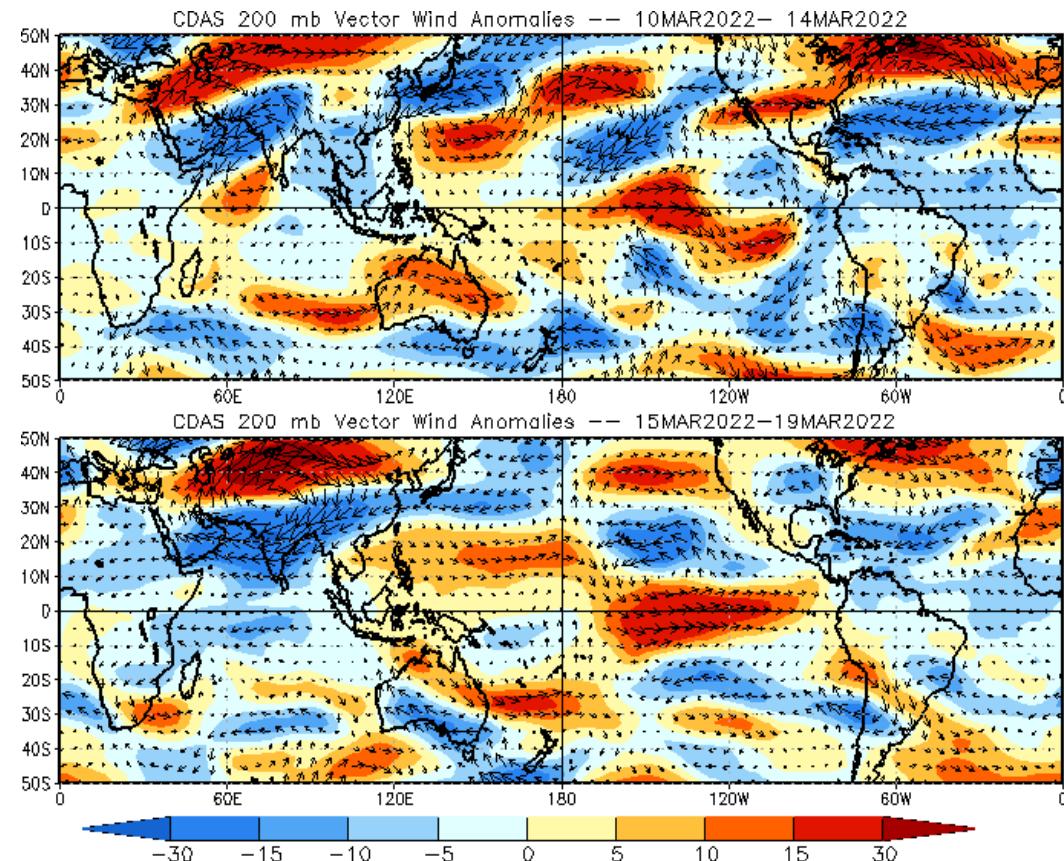
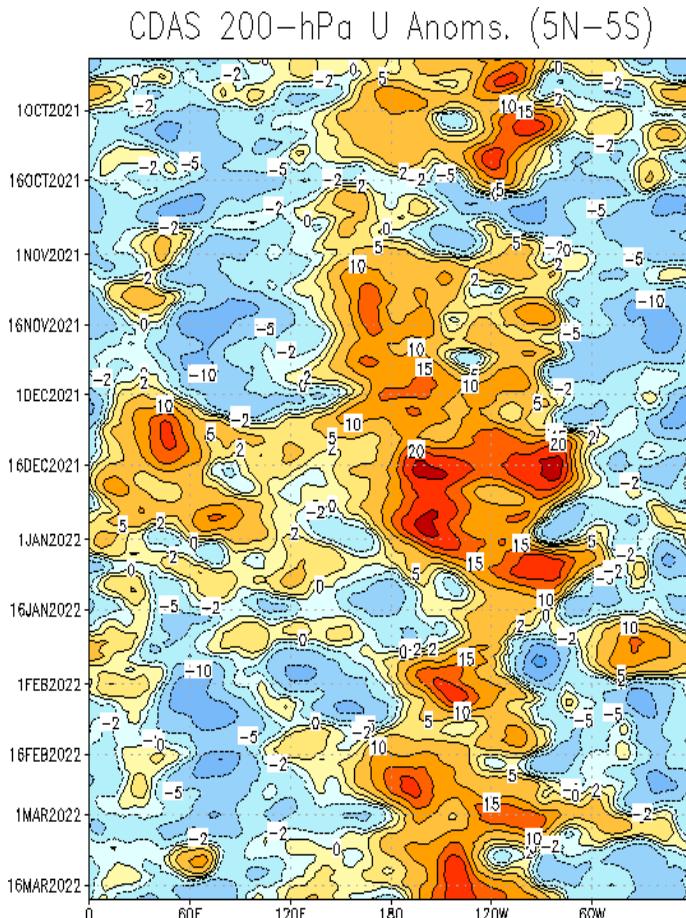
Green shades: Anomalous divergence (favorable for precipitation)
Brown shades: Anomalous convergence (unfavorable for precipitation)



- The velocity potential pattern continues to be coherent with more enhanced (suppressed) convection and anomalous divergence (convergence) aloft observed over the Indian Ocean (Africa and tropical Atlantic).
- The renewed intraseasonal activity appears to be tied to a convectively coupled Kelvin wave that propagated eastward from the Western Hemisphere earlier in March.

200-hPa Wind Anomalies

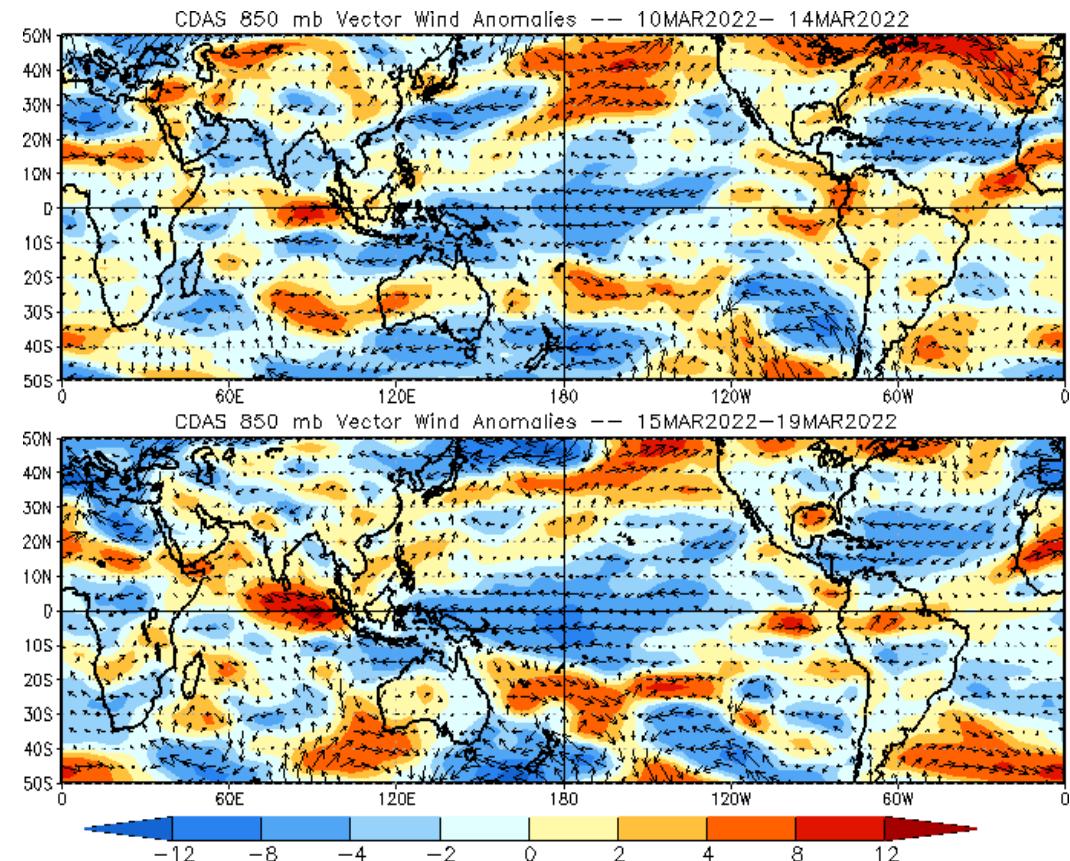
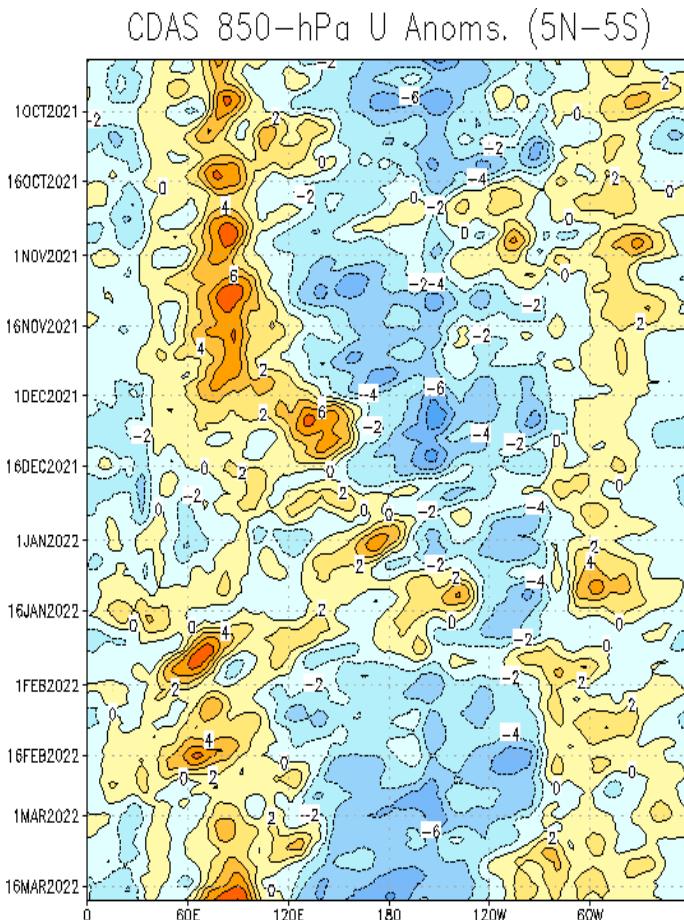
Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.



- Consistent with the ongoing La Niña, a broad region of anomalous upper-level westerlies persists over the equatorial Pacific, reinforced by deep troughing to the east of the Date Line.
- There are continued indications of a wave train aloft across the northern Hemisphere in the most recent analysis.
- Anomalous easterlies developed over India and are contributing to enhanced divergence aloft over the Indian Ocean.

850-hPa Wind Anomalies

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

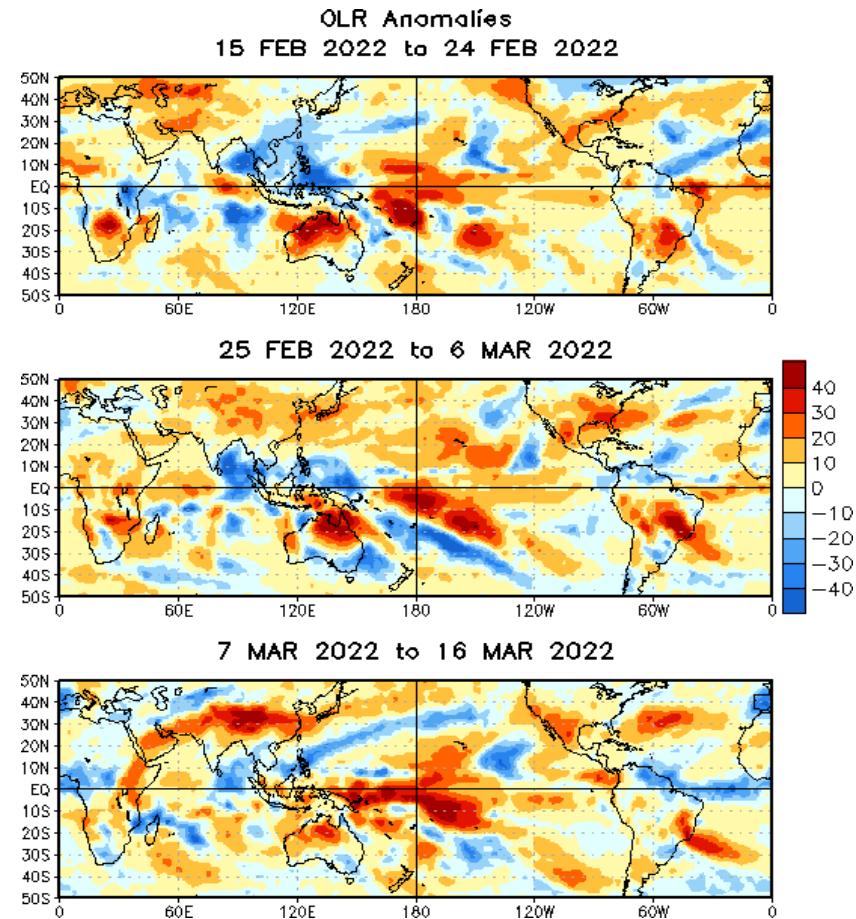
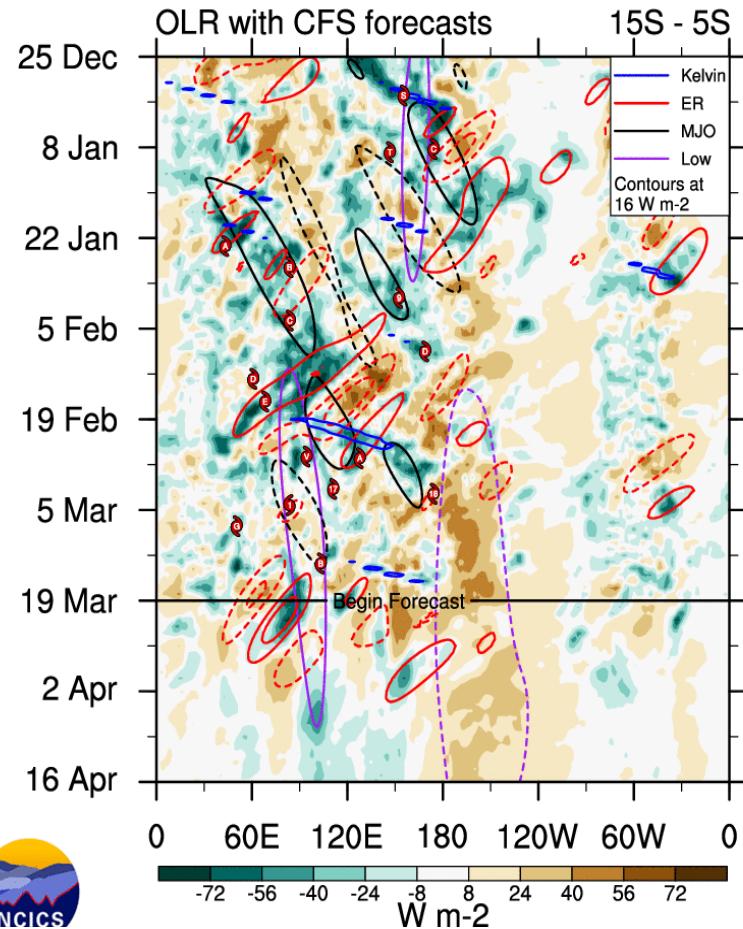


- Enhanced trade winds persist across equatorial central Pacific, with anomalous westerlies continuing near the western coast of South America.
- Anomalous westerlies strengthened considerably over the equatorial Indian Ocean, which is expected to contribute to tropical cyclone formation.

Outgoing Longwave Radiation (OLR) Anomalies

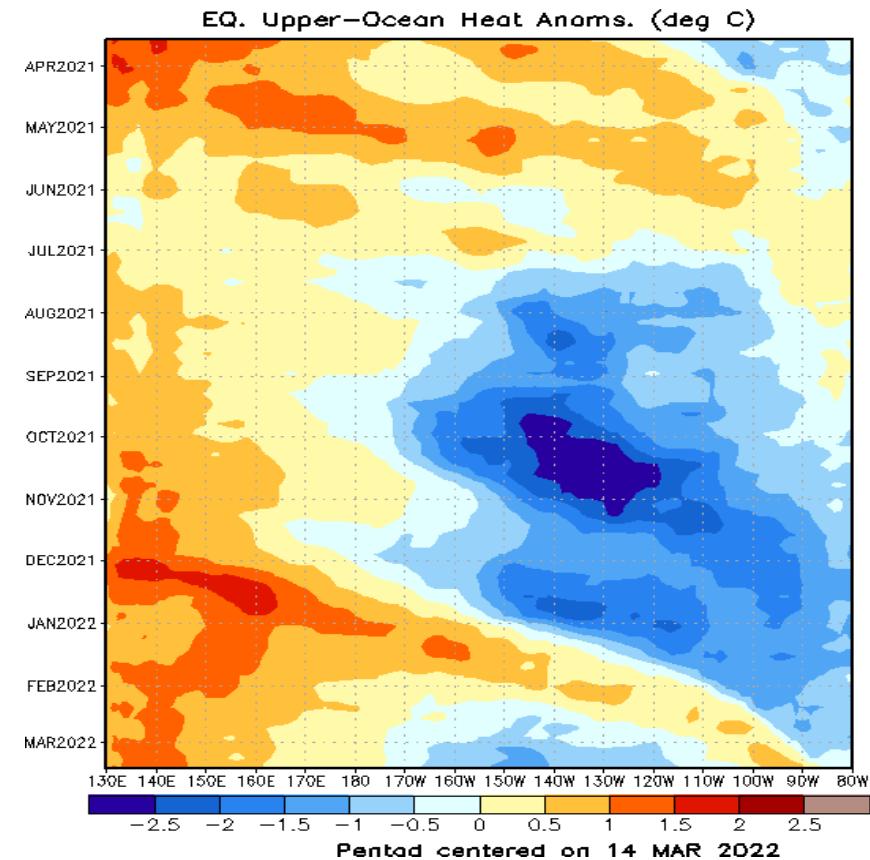
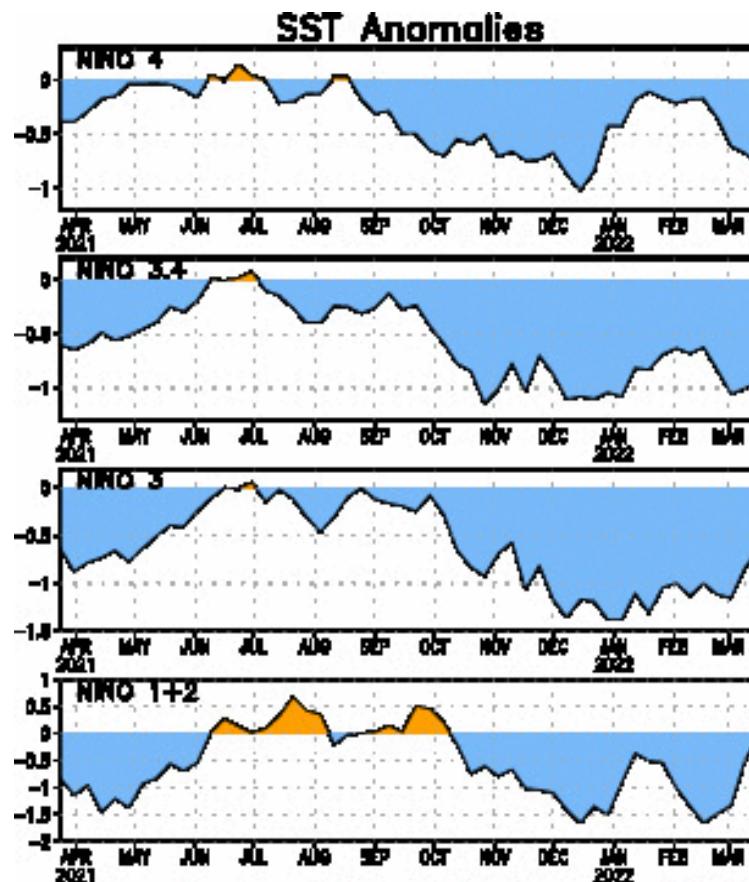
Green shades: Anomalous convection (wetness)

Brown shades: Anomalous subsidence (dryness)



- MJO signal has decreased significantly, with continued La Niña footprint continuing and the emergence of equatorial Rossby waves.
- Forecasts favor more enhanced convection over the Indian Ocean.

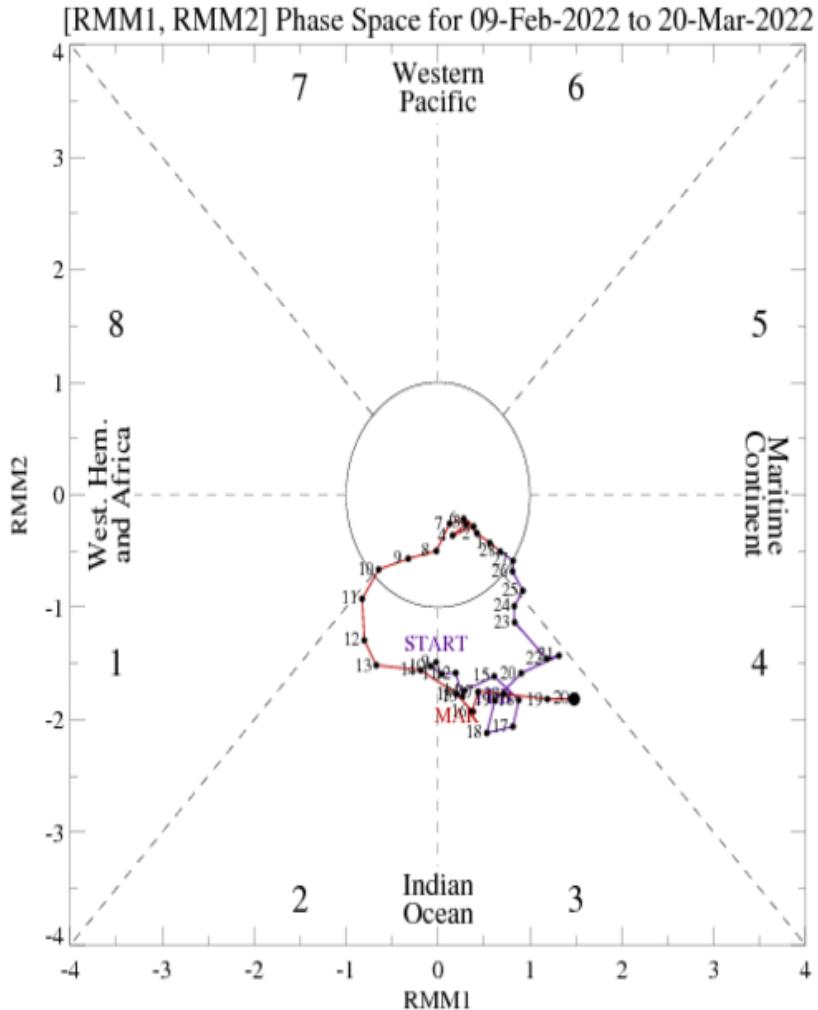
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Following the passage of a robust downwelling oceanic Kelvin wave that was generated in response to a significant westerly wind burst in December, negative upper-oceanic heat content anomalies have redeveloped between 170W and 120W.
- Despite a warming trend in the Nino1+2 and Nino 3 regions since early March, negative SSTs remain in place across all Nino regions.

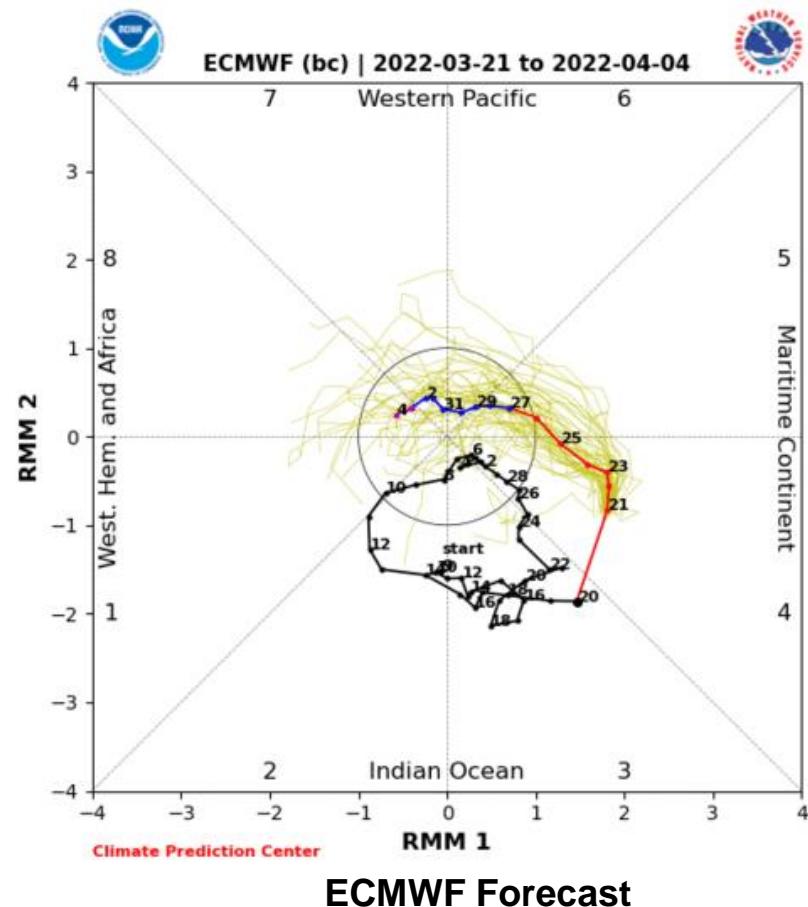
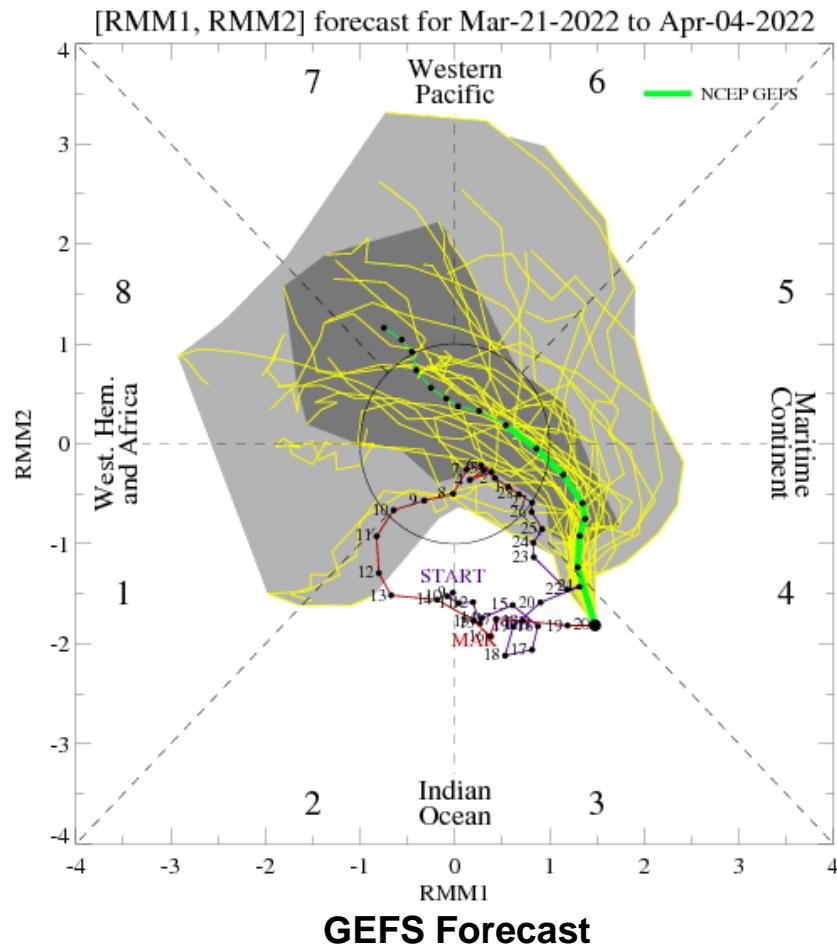
MJO Index: Recent Evolution

- During the past week, the RMM index shows the intraseasonal signal propagating eastward over Indian Ocean, and approaching the Maritime Continent.



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

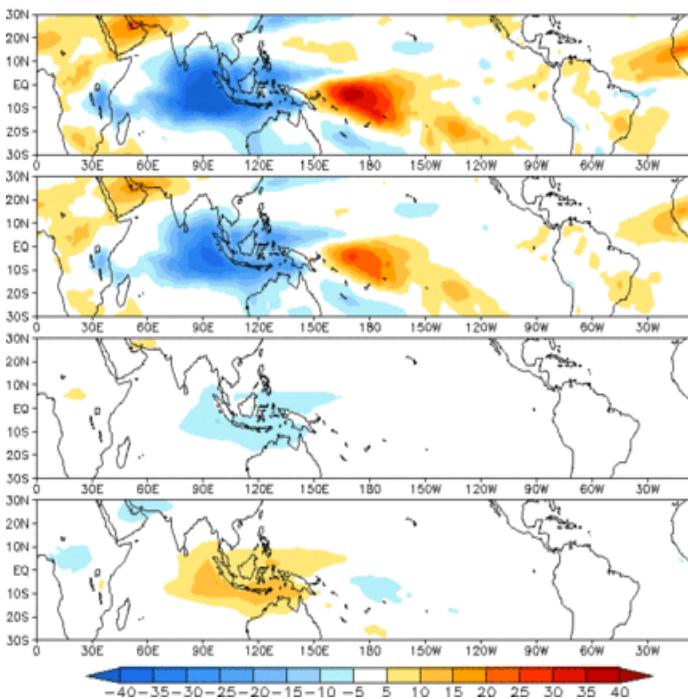


- Dynamical models favor a diminished intraseasonal signal over the Indian Ocean and into the Maritime Continent during the next two weeks.
- There is broad agreement between ensemble members that the RMM index will descend quickly into the unit circle in the coming week, though some ensemble members suggest possible re-strengthening over the Western Pacific later in April.

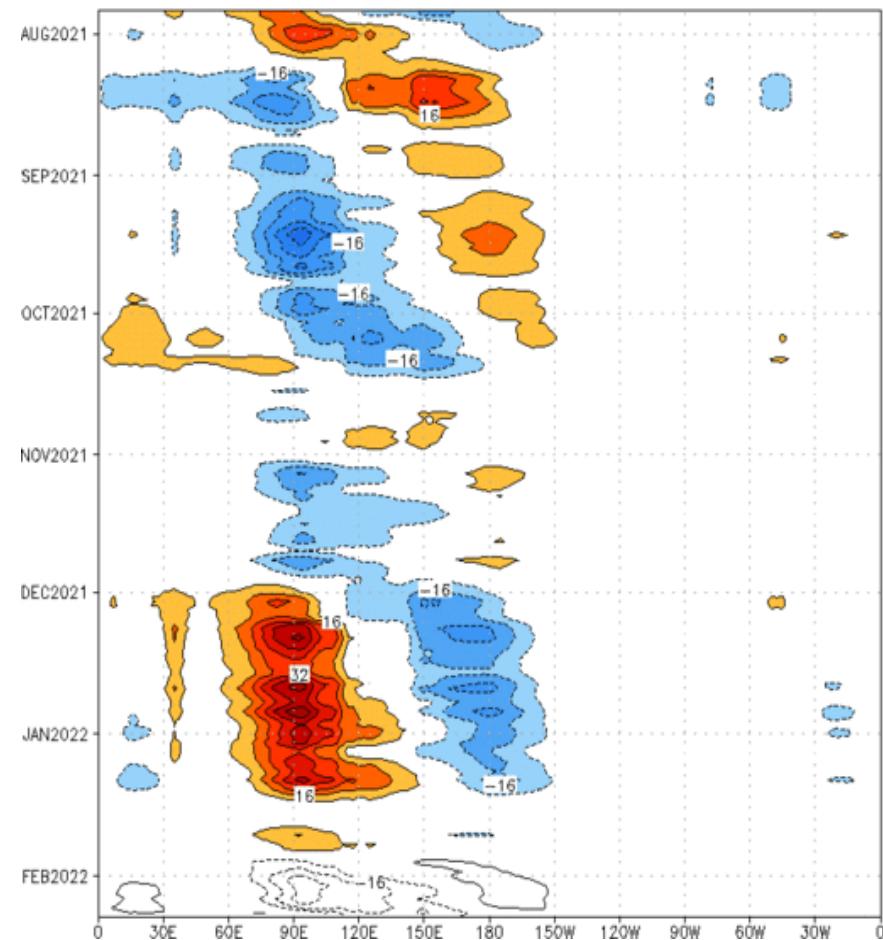
MJO: GEFS Forecast Evolution

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.)

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 20 Mar 2022
OLR



Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:27-Jul-2021 to 26-Jan-2022
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days

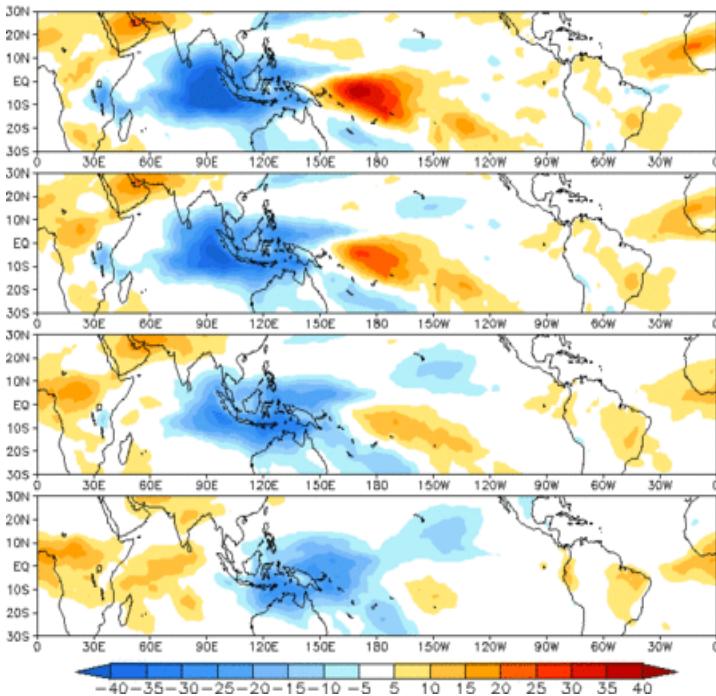


- The GEFS RMM-based OLR field initially depicts an robust MJO that weakens as it into the Maritime Continent.

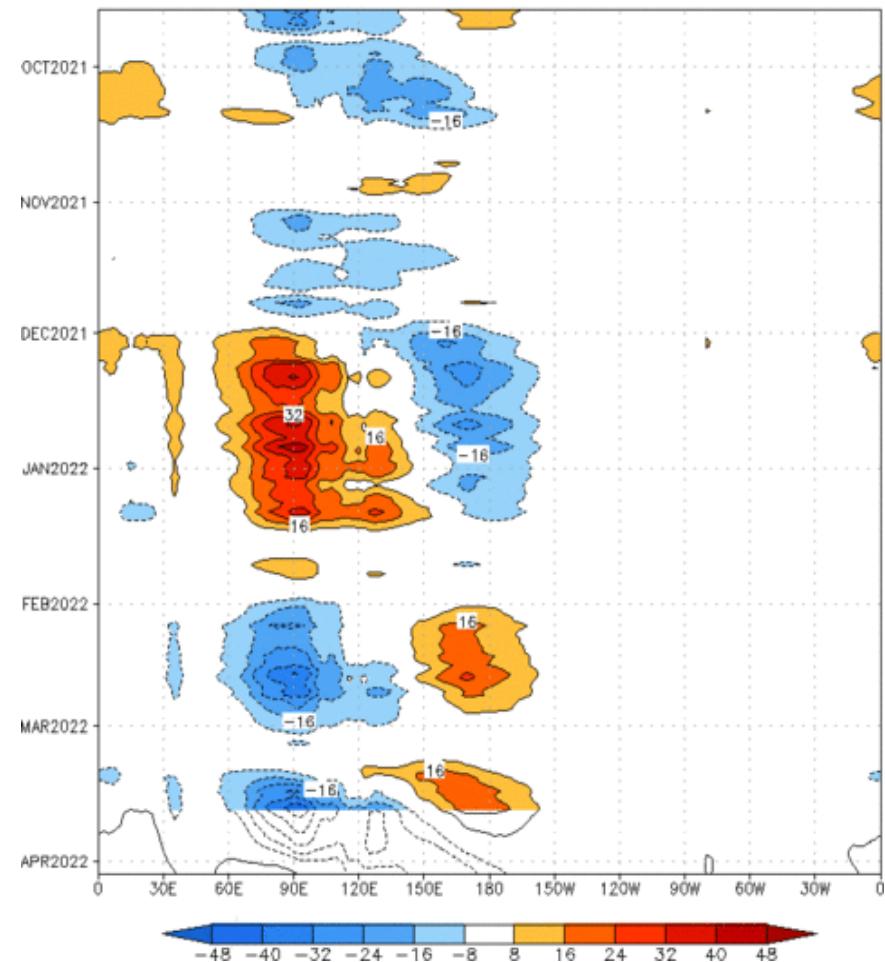
MJO: Constructed Analog Forecast Evolution

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 reconstruction by RMM1 & RMM2 (20 Mar 2022)



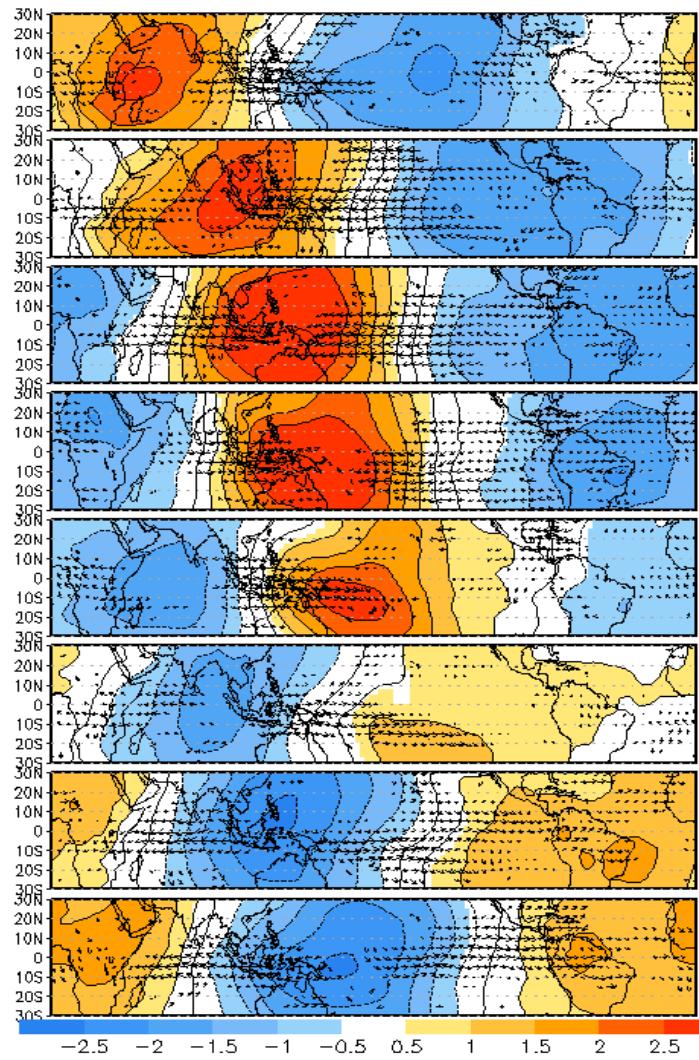
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [$7.5^{\circ}\text{S}, 7.5^{\circ}\text{N}$] (cint: 4Wm^{-2}) Period: 18-Sep-2021 to 20-Mar-2022
The unfilled contours are CA forecast reconstructed anomaly for 15 days



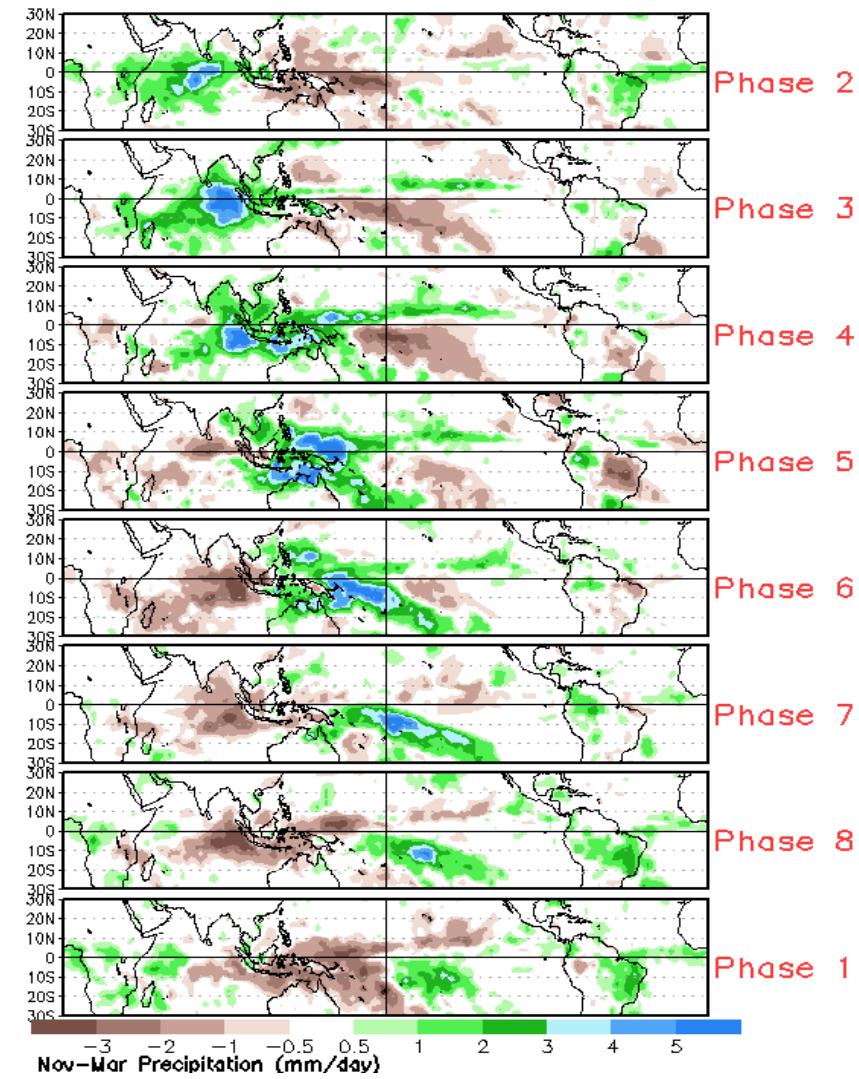
- In contrast, the constructed analog features strong convective anomalies with enhanced convection continuing eastward over the Maritime Continent during the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



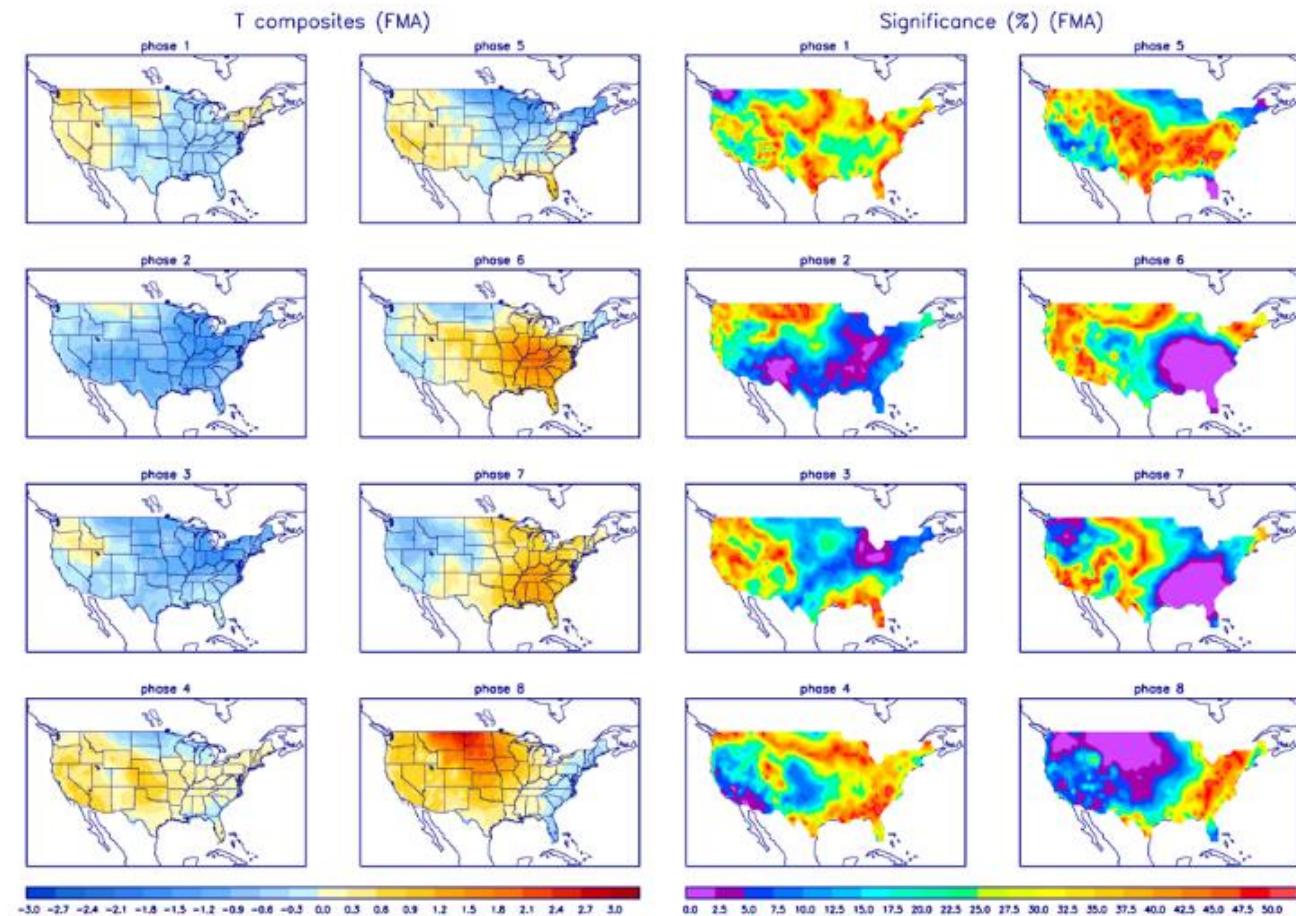
Precipitation Anomalies



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.



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.

