

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



Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
19 April 2021

Overview

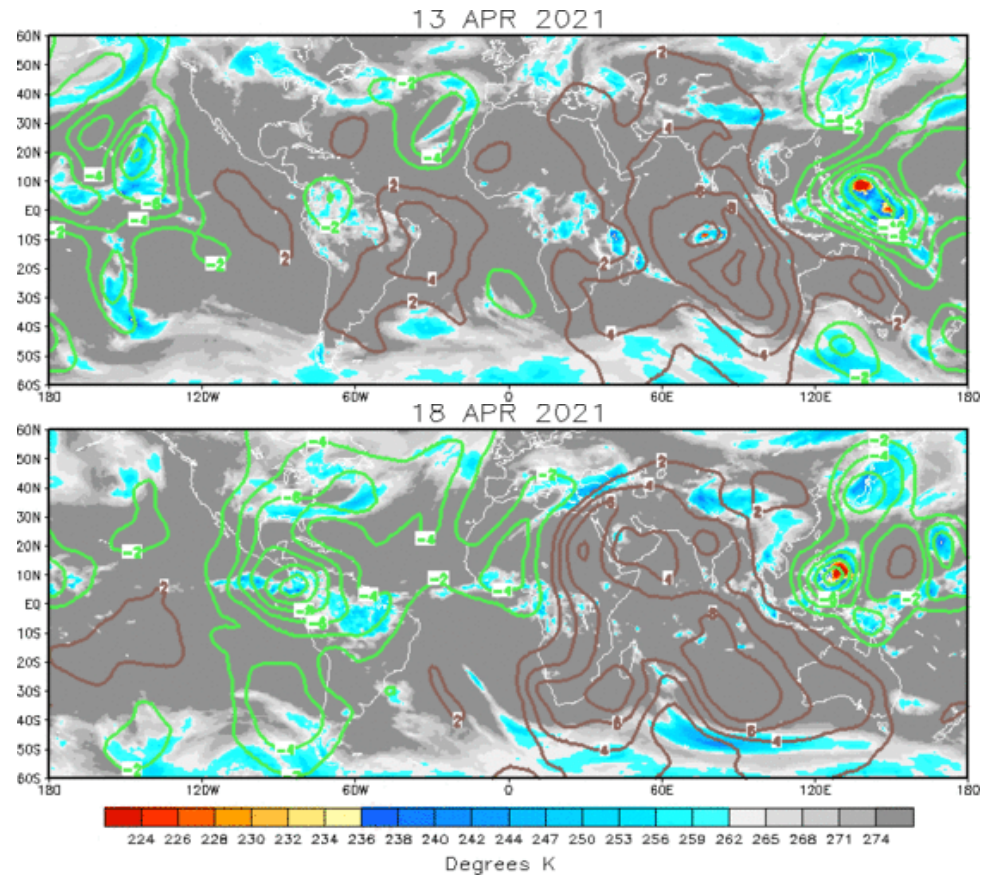
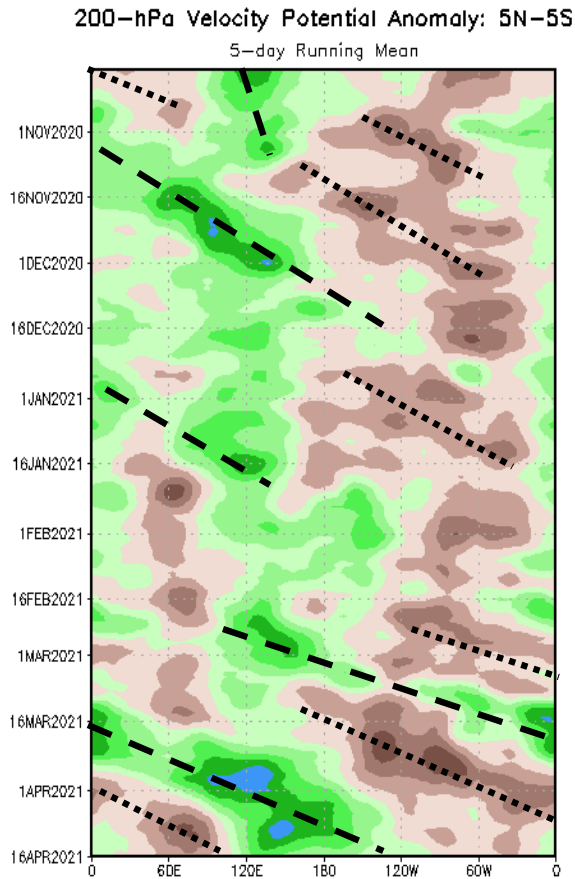
- Since early April, the enhanced (suppressed) phase of the MJO shifted east from the Maritime Continent to over the West Pacific (Indian Ocean) where it is destructively interfering with the weakening La Niña.
- Dynamical models favor the continued eastward propagation of the MJO through the Western Hemisphere and back over the Indian Ocean during the next two weeks.
- The MJO contributed to the development of Typhoon Surigae over the West Pacific during the last week. Elevated chances for TC development exist in the Pacific, while quieter conditions are anticipated over the southern Indian Ocean tied to the suppressed 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).

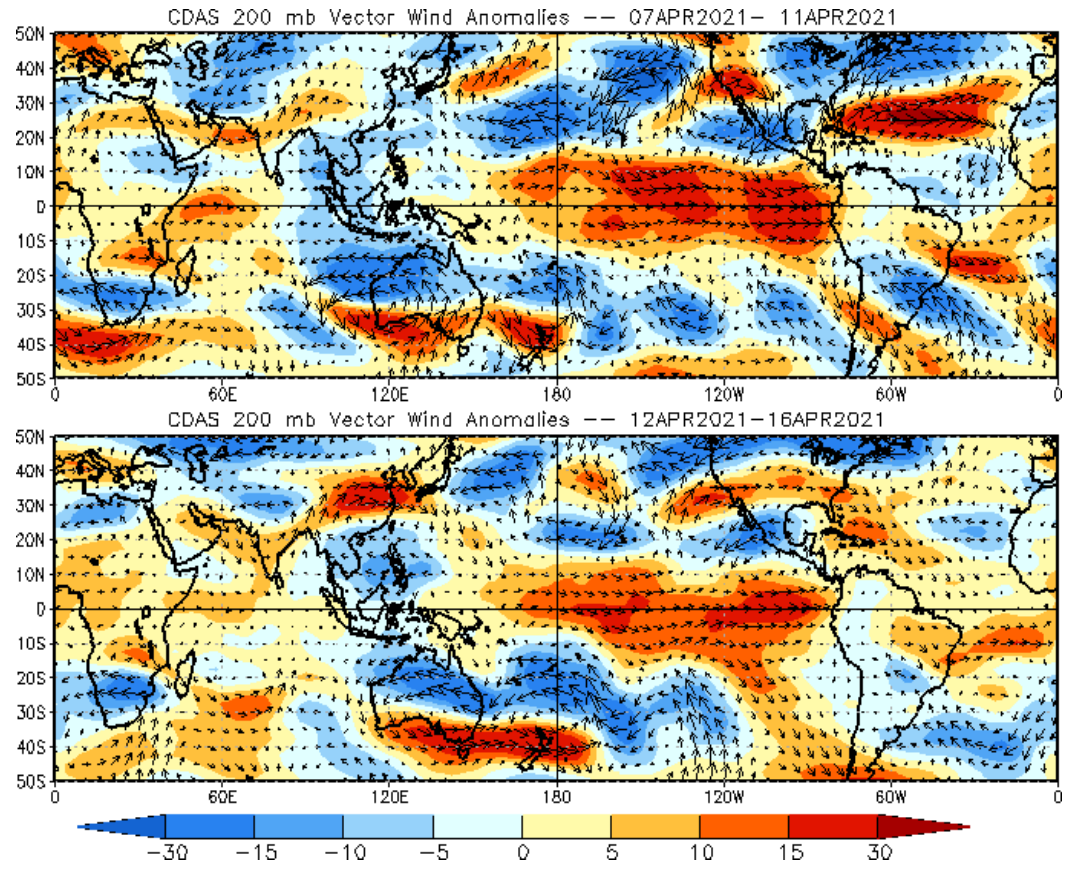
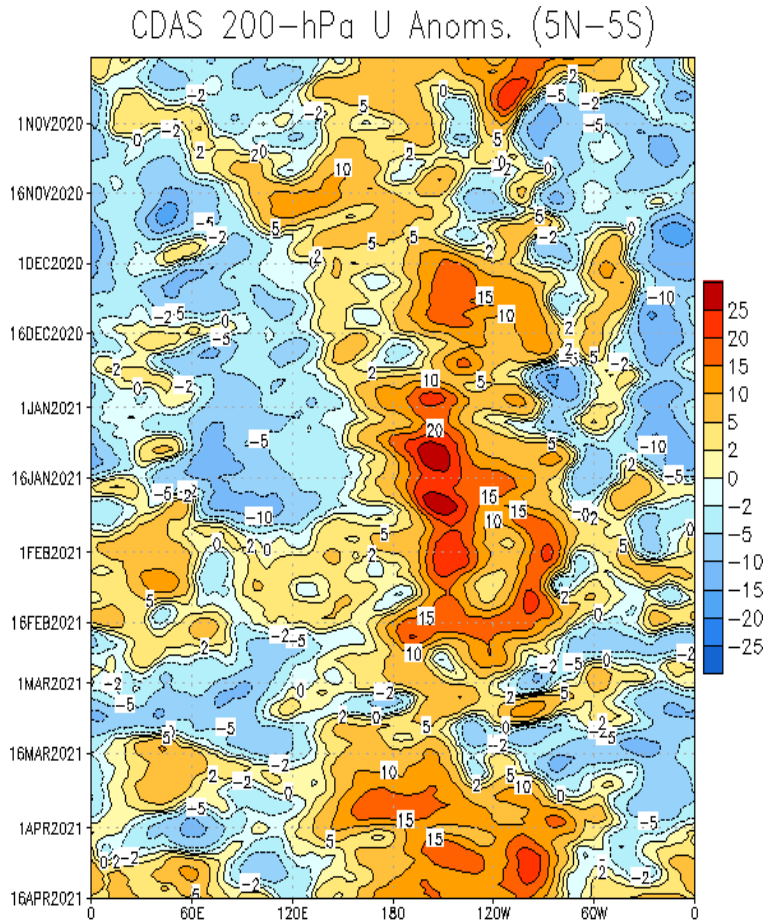
Brown shades: Anomalous convergence (unfavorable for precipitation).



- Since mid-March, the MJO has been active with a well-defined Wave-1 pattern in the velocity potential field.
- The spatial velocity potential pattern is anchored by the MJO's Wave-1 pattern, with a smaller-scale area of enhanced convection in the West Pacific due to recent tropical cyclone activity.

200-hPa Wind Anomalies

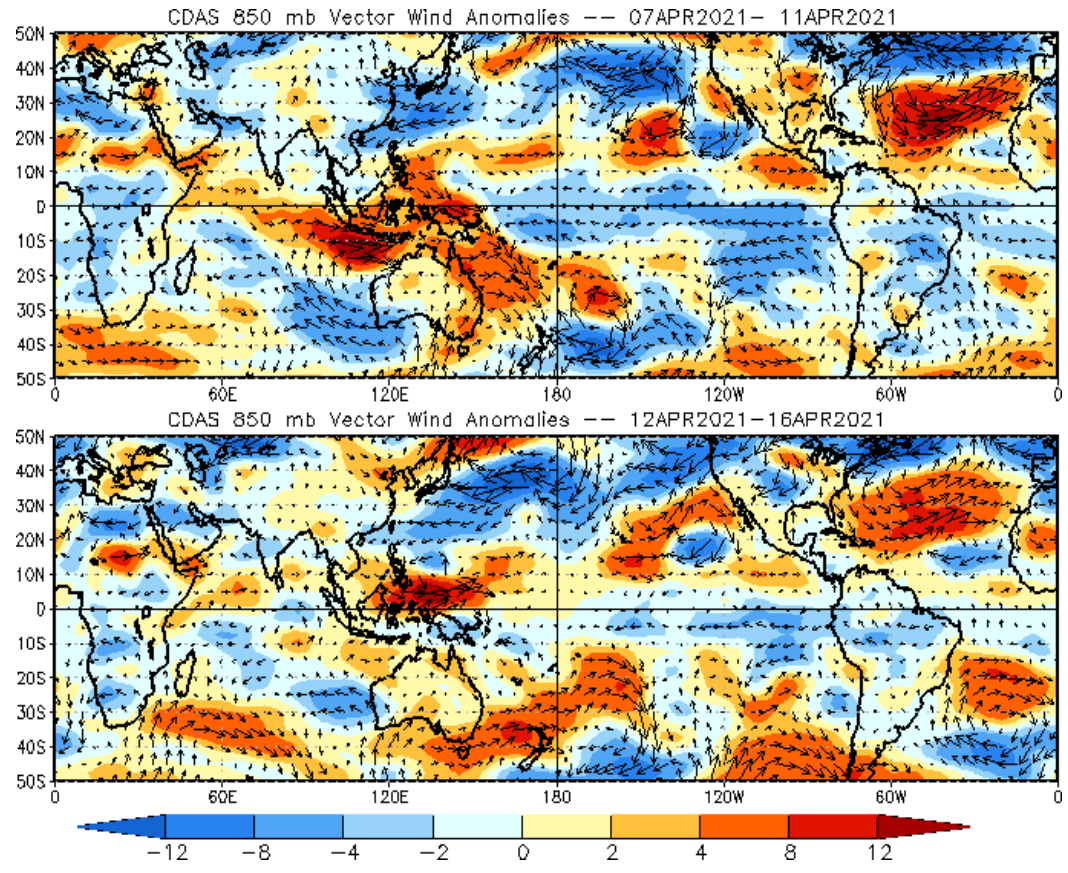
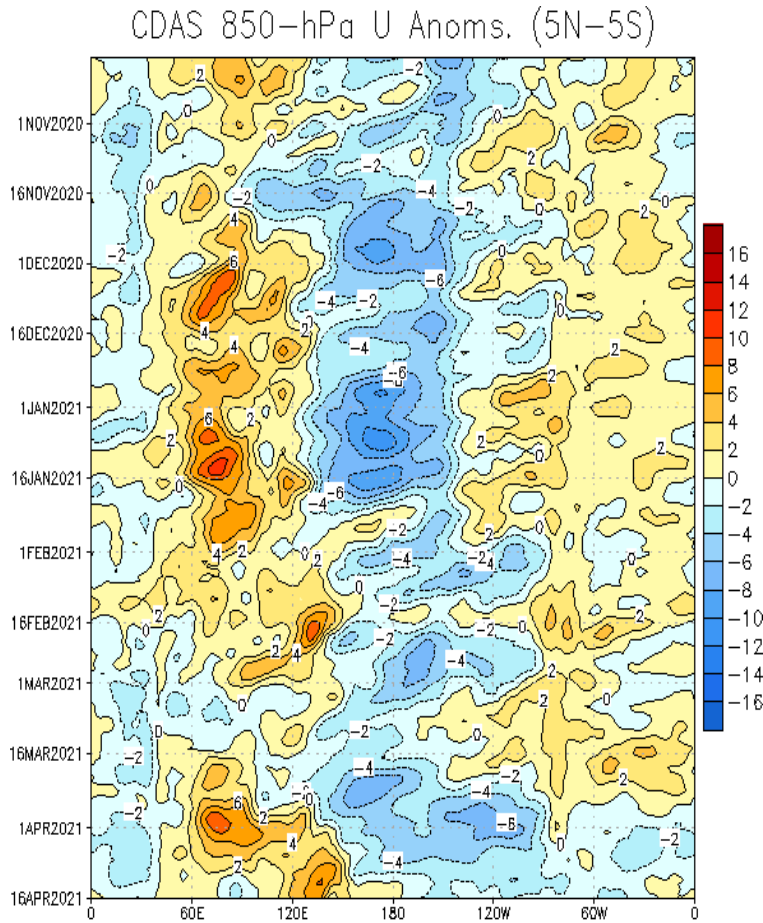
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- Anomalous upper-level westerlies are present throughout the central and eastern equatorial Pacific, which is consistent with the weak La Niña as well as the current state of the MJO, which is located over the central Pacific.

850-hPa Wind Anomalies

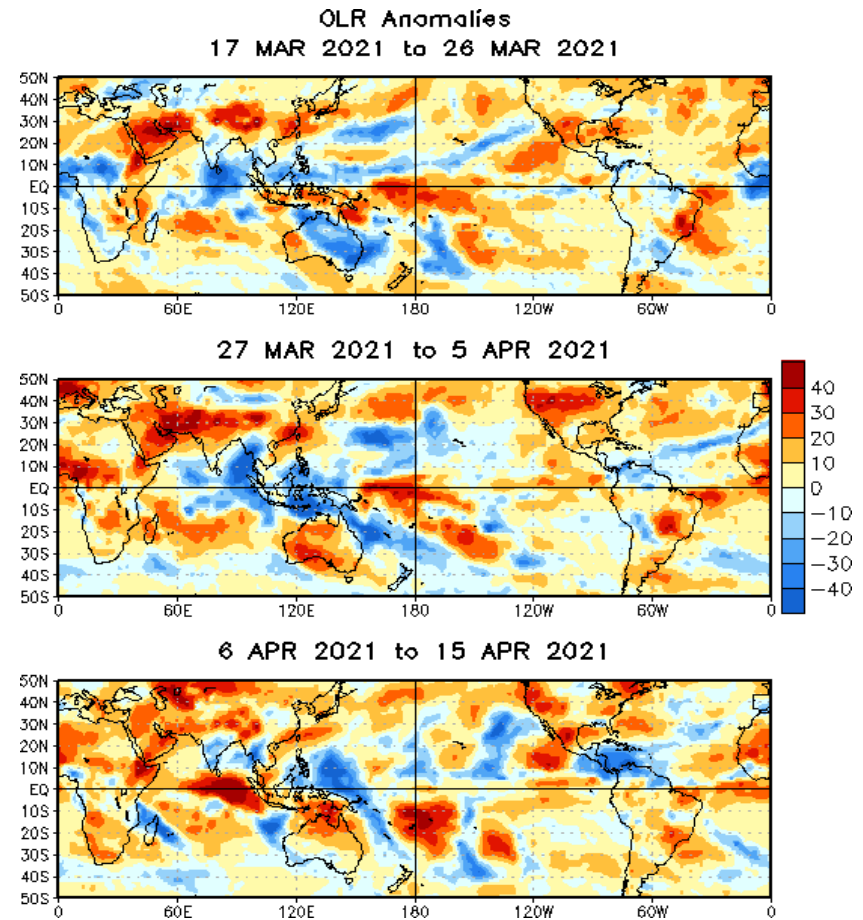
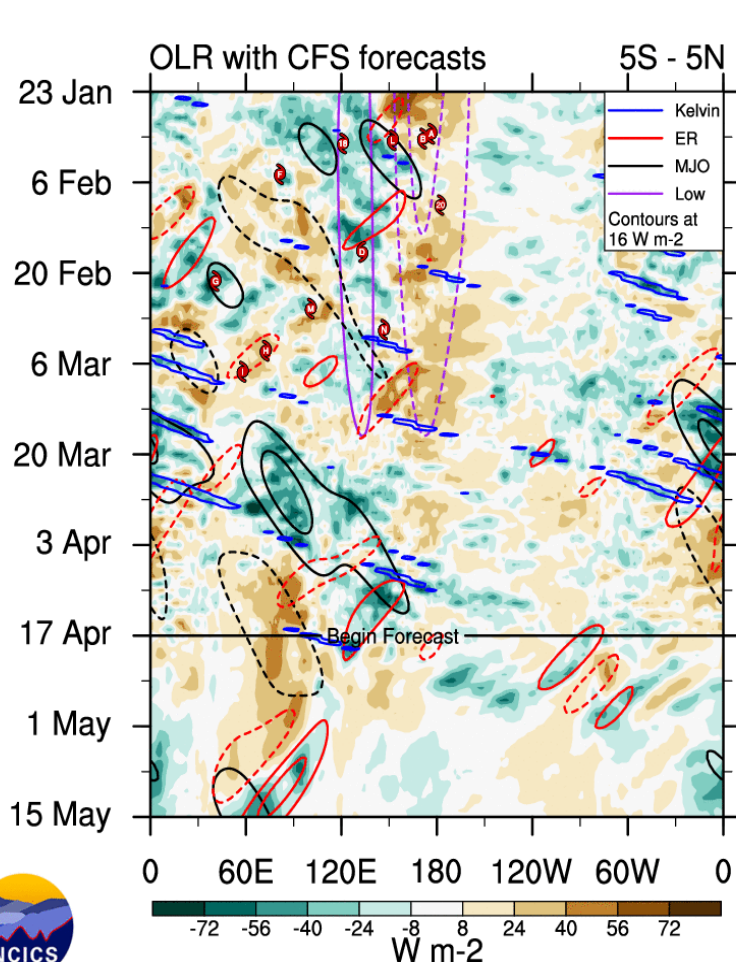
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- The trade winds are noticeably weaker this week compared to last throughout the equatorial Pacific. This is due to a combination of a weakening La Niña and the passage of the MJO.

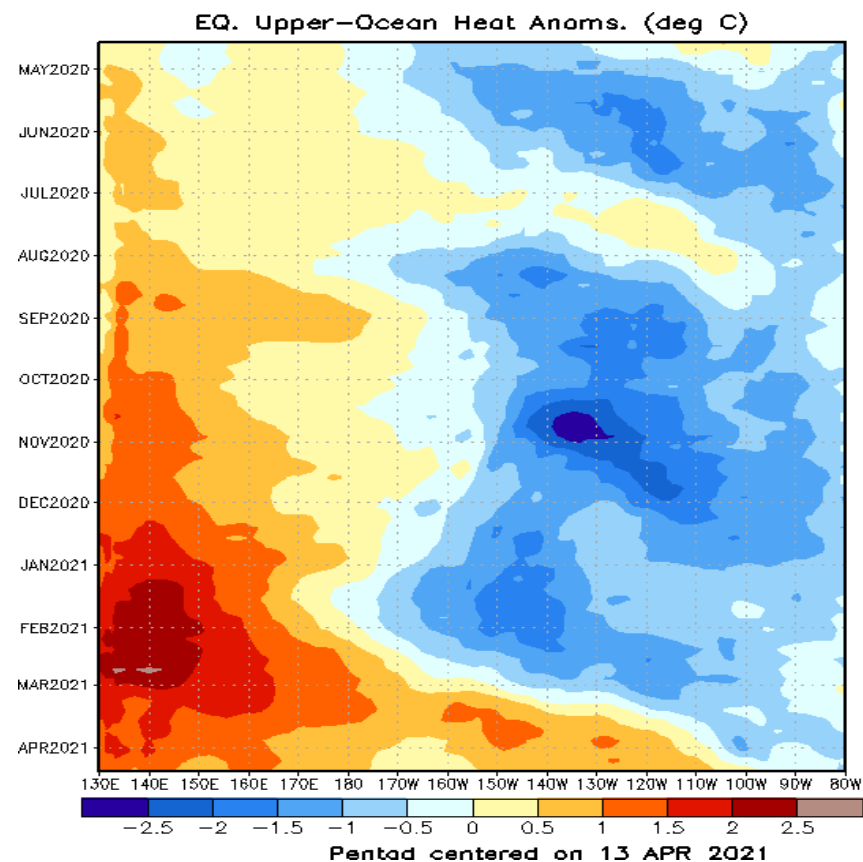
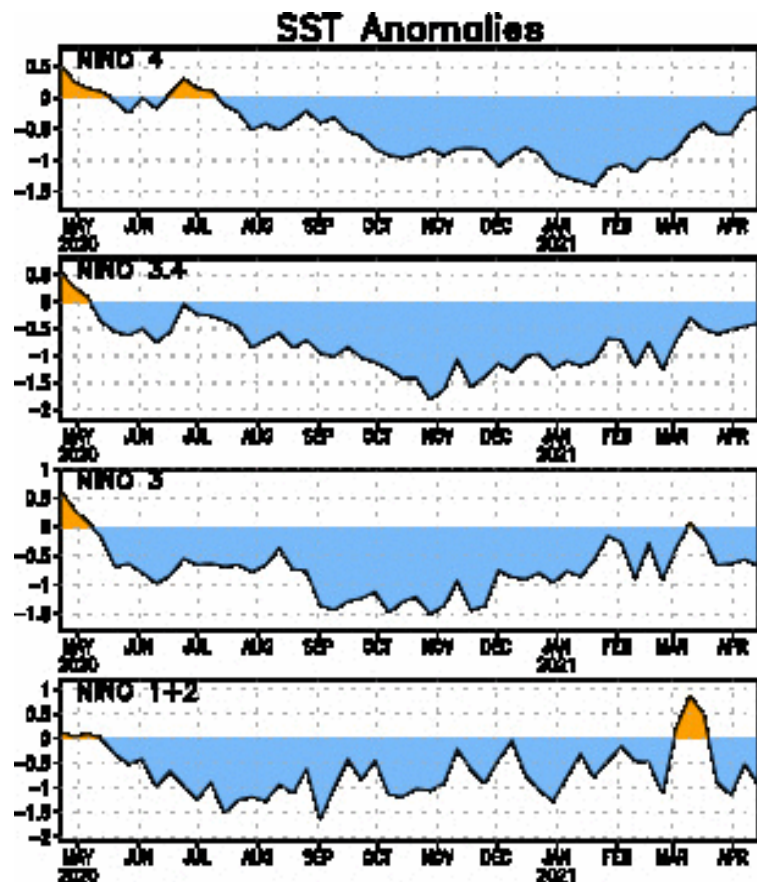
Outgoing Longwave Radiation (OLR) Anomalies

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



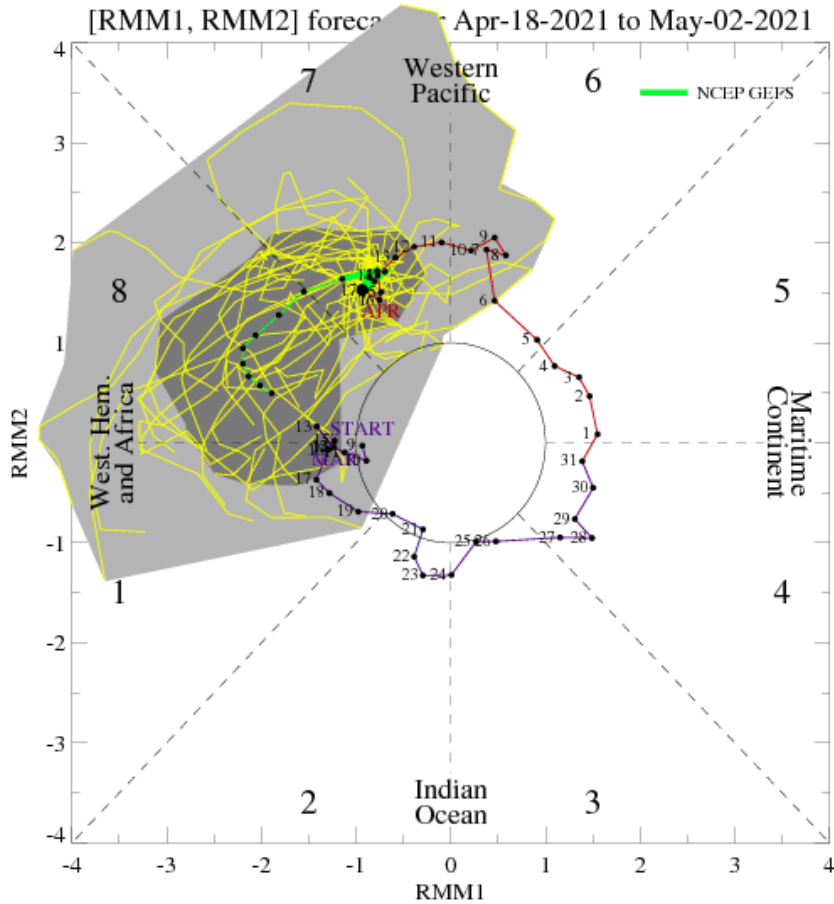
- The majority of the anomalous convection related to the current MJO event has been located north of the Equator, well outside of the 5S-5N band shown in the above hovmöller diagram.
- There is enhanced convection over the western Pacific due to Typhoon Surigae.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

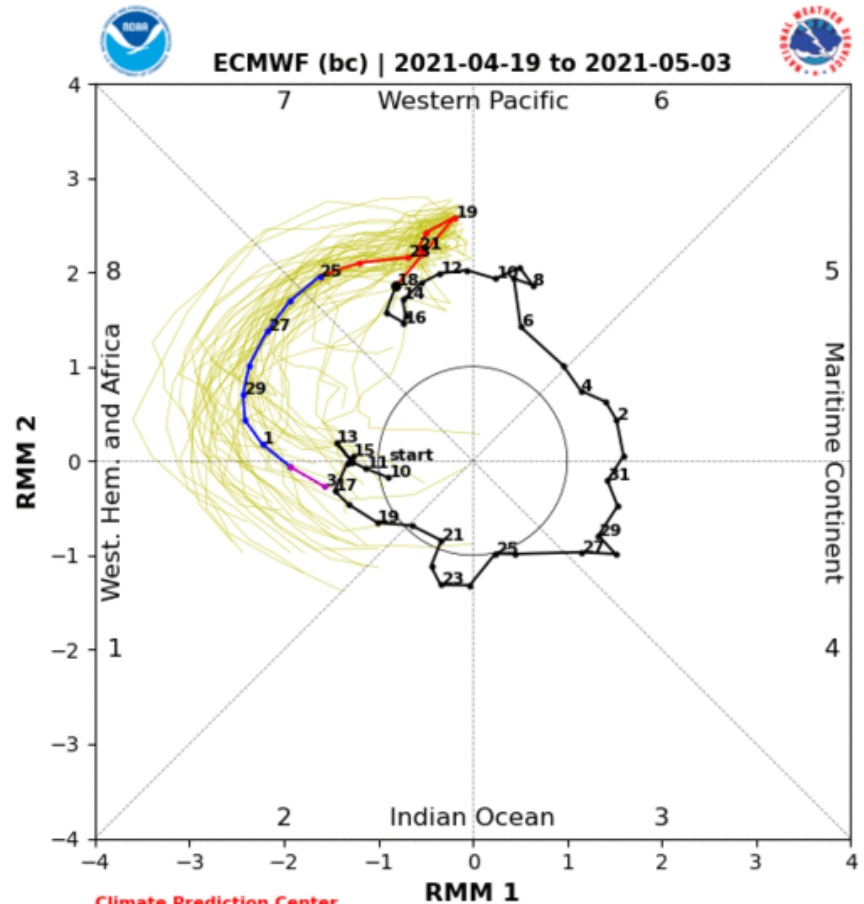


- La Niña conditions have been present since August 2020. Negative SST anomalies in the Niño 4 region have steadily weakened since January.
- Strong Rossby wave activity over the West Pacific in February generated a westerly wind burst that initiated a downwelling oceanic Kelvin wave. This Kelvin wave pushed warmer water within the upper-ocean across the Central and East Pacific.

MJO Index: Forecast Evolution



GEFS Forecast



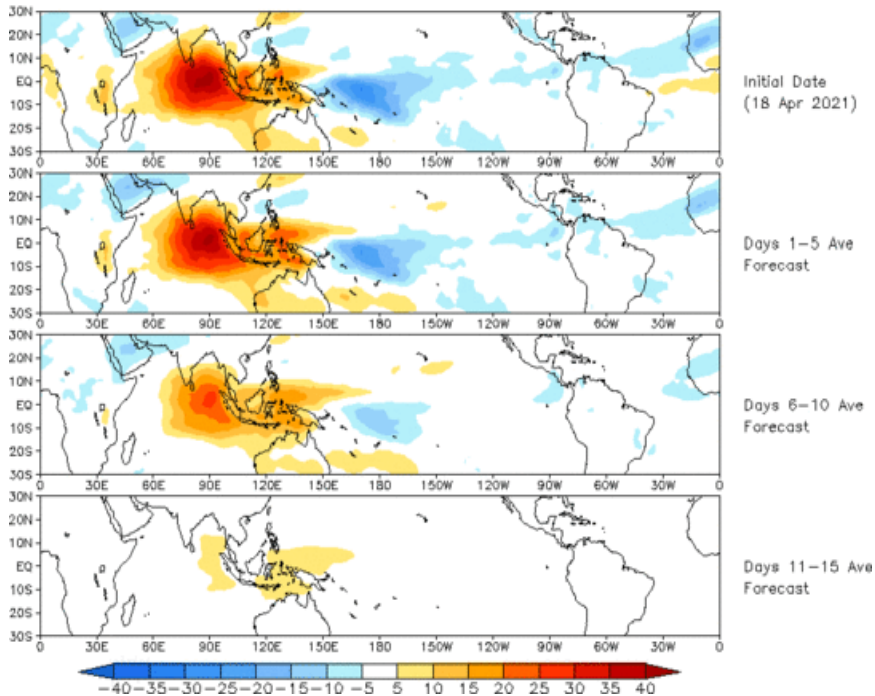
ECMWF Forecast

- The GEFS and ECMWF forecast the MJO to continue propagating through RMM Phase 8 over the Western Hemisphere and will likely continue through Phase 1 in early May.

MJO: Constructed Analog Forecast Evolution

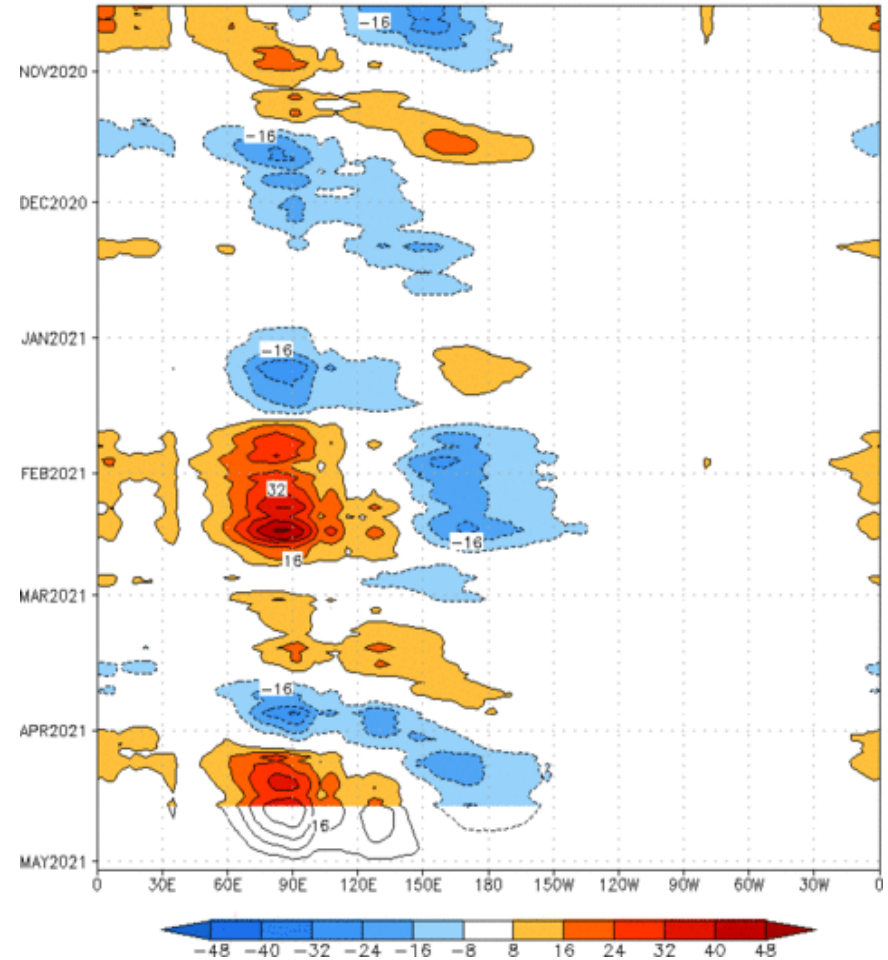
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (18 Apr 2021)



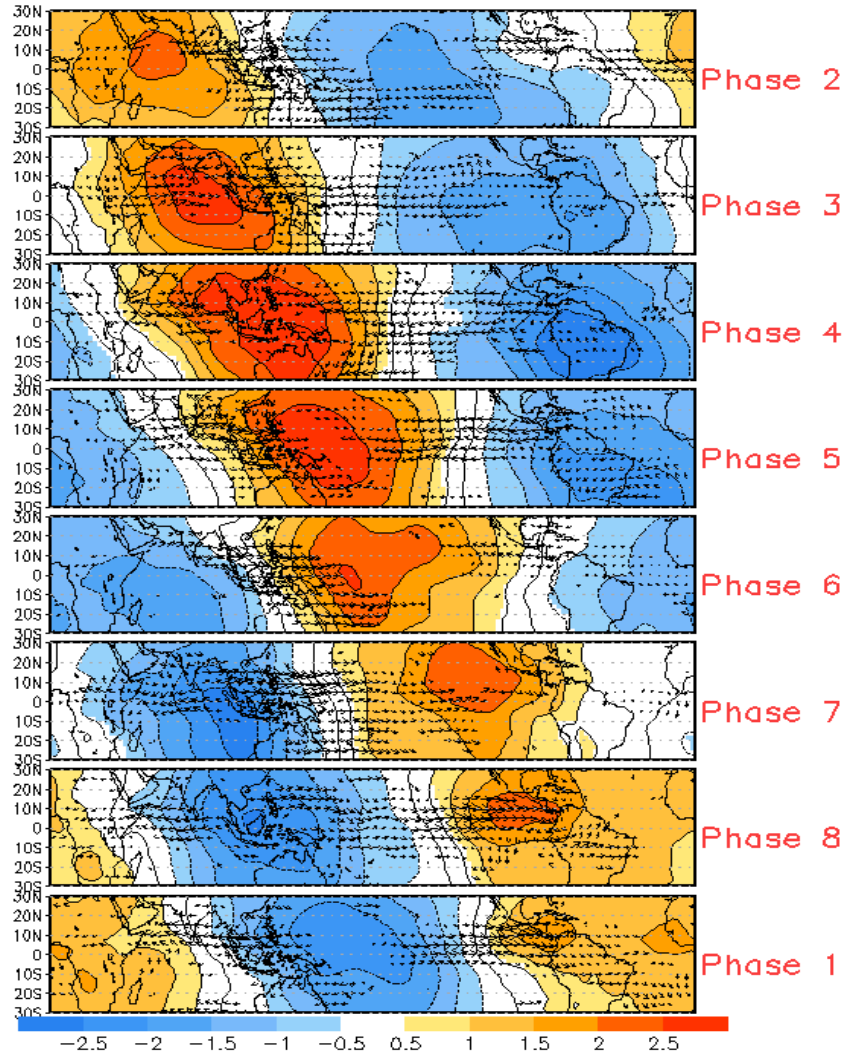
- The constructed analog forecast produces a stationary MJO that weakens throughout the next two weeks.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S,7.5°N] (cint:4Wm⁻²) Period:17–Oct–2020 to 18–Apr–2021
The unfilled contours are CA forecast reconstructed anomaly for 15 days

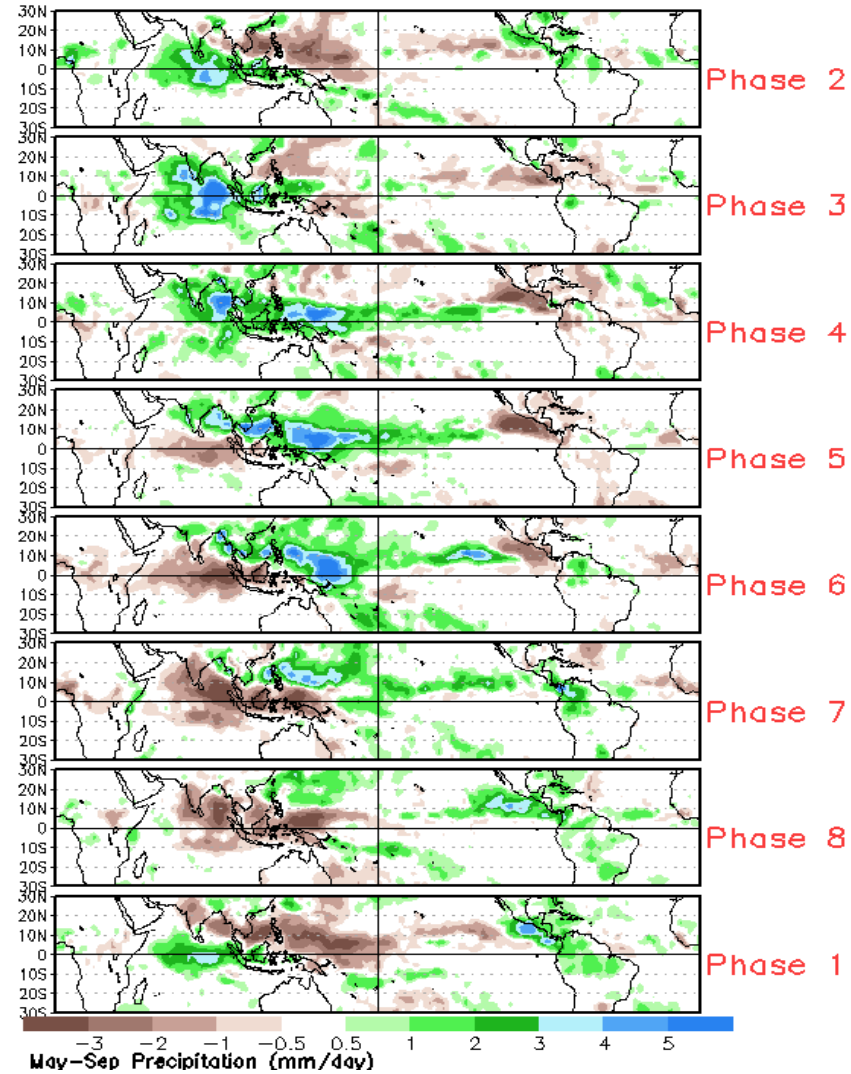


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



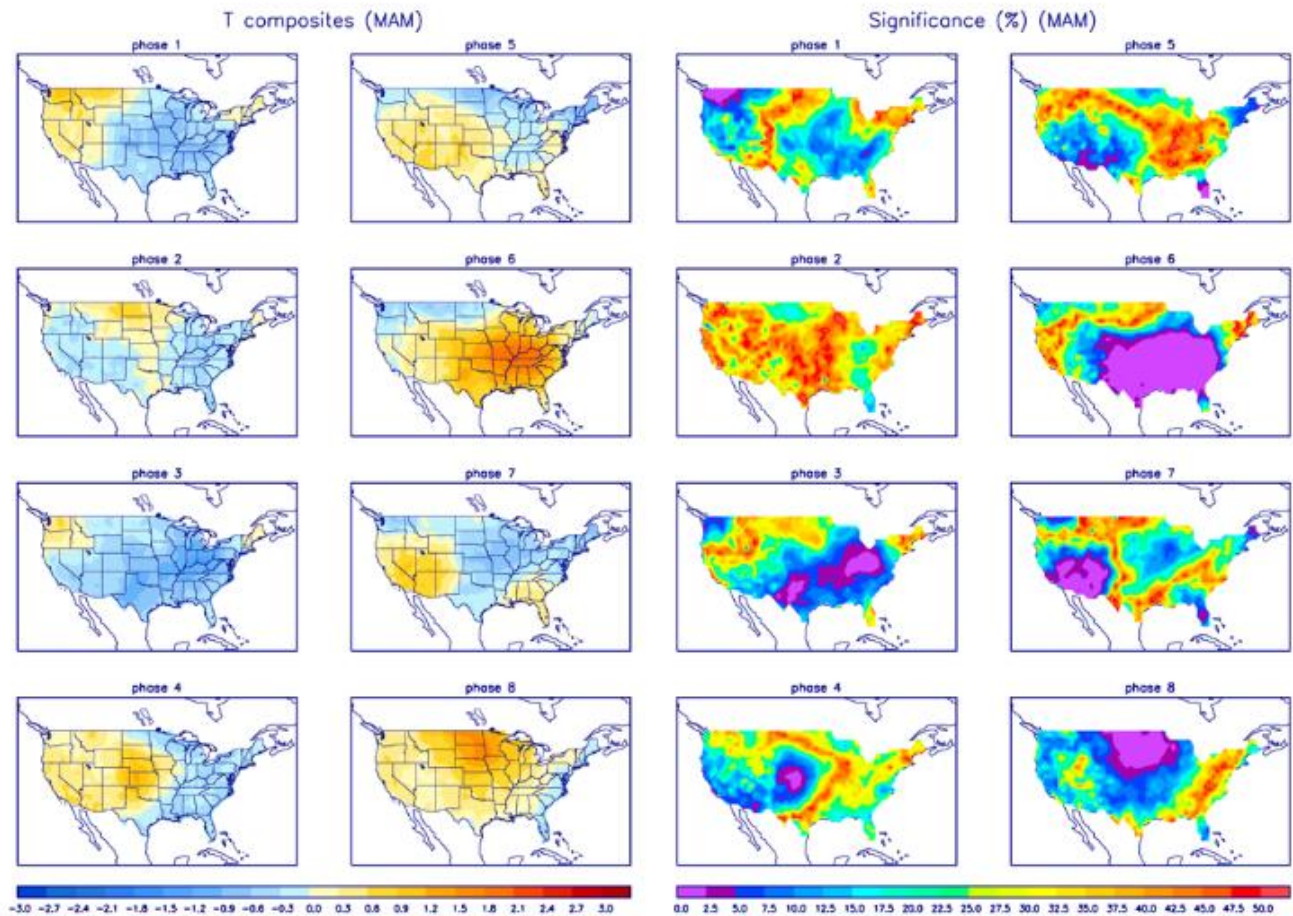
Precipitation Anomalies



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.

