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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
9 November 2020

Overview

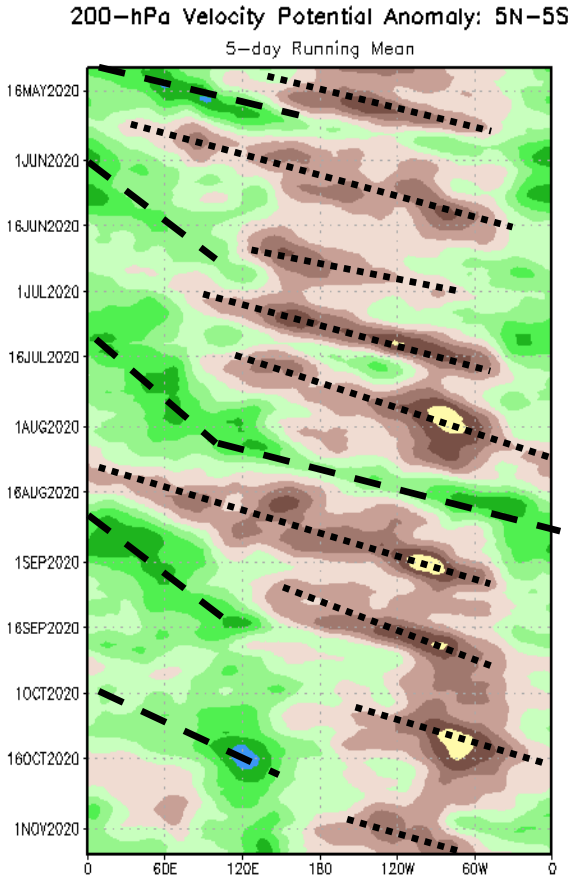
- The MJO has weakened, but the enhanced phase is now crossing the Western Hemisphere.
- Enhanced (suppressed) convection persisting over the far West Pacific (central and eastern Pacific) are consistent with the ongoing La Niña base state.
- Dynamical models generally favor continued eastward propagation of the intraseasonal signal to the Indian Ocean over the next two weeks, although the amplitude of the event is uncertain.
- The MJO, in conjunction with La Niña conditions, may help maintain enhanced tropical cyclone activity over the western Atlantic basin, and may favor tropical cyclogenesis over the southern Indian Ocean.

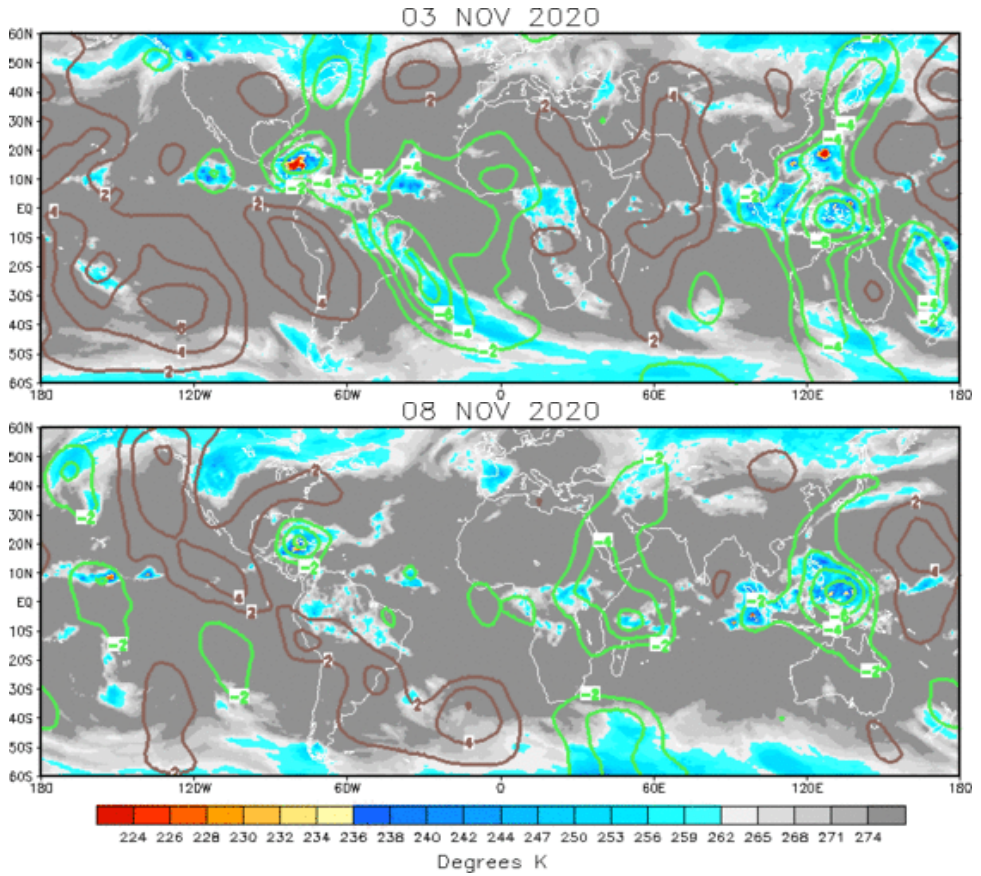
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



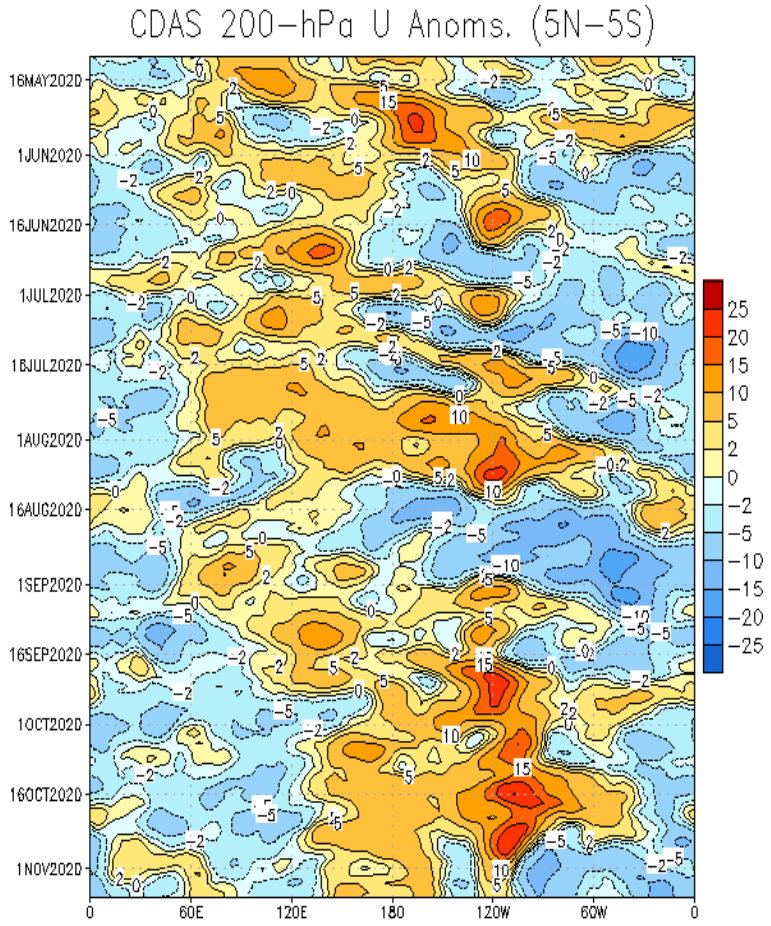


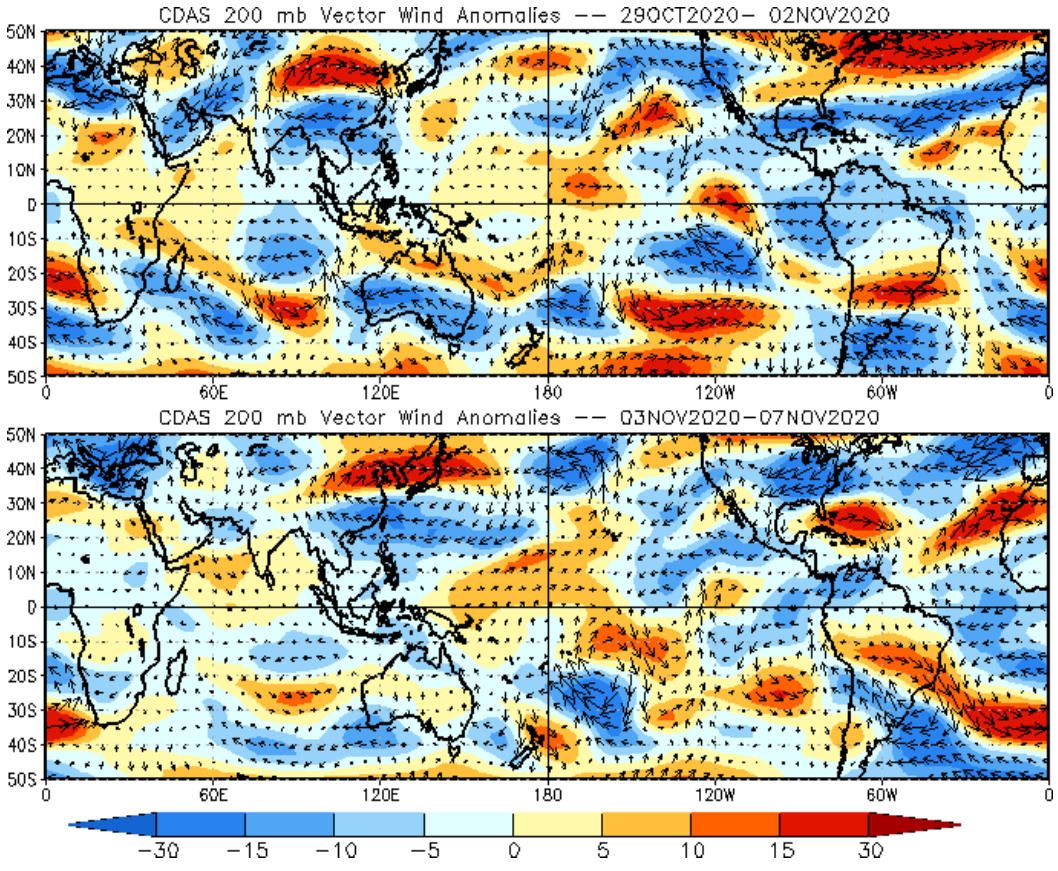
- The upper-level MJO signature began to break down in early November, with enhanced convection persisting over the far West Pacific basin, while a fast propagating signal crossed the Western Hemisphere.

- More recently, the signal was incoherent, although there were some signs of organization over the Indian Ocean basin.

200-hPa Wind Anomalies

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

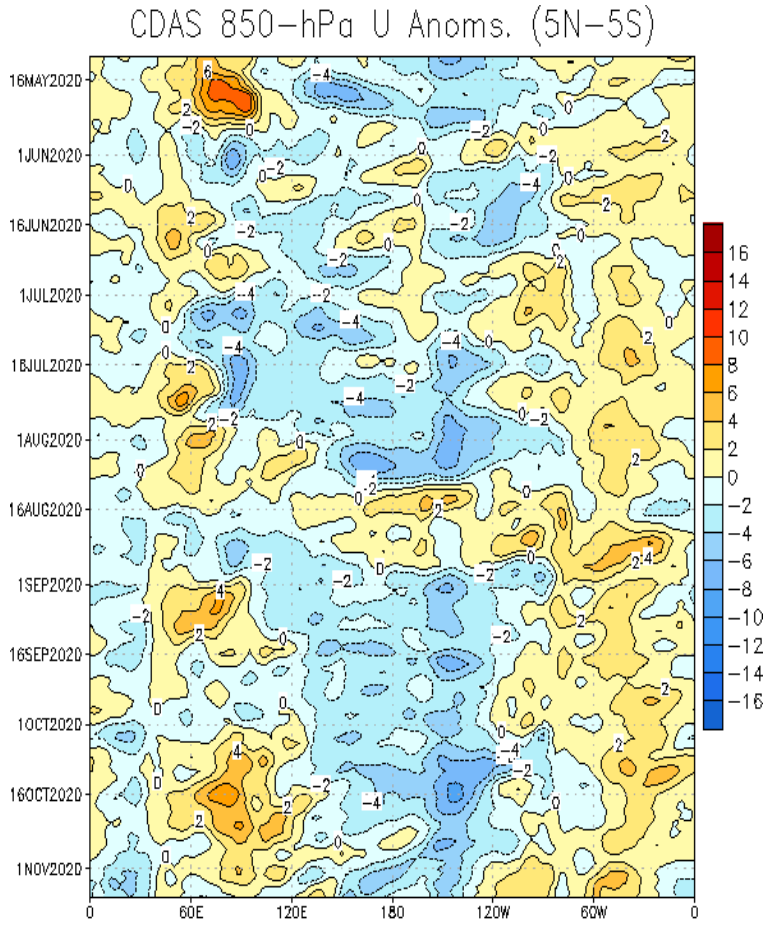


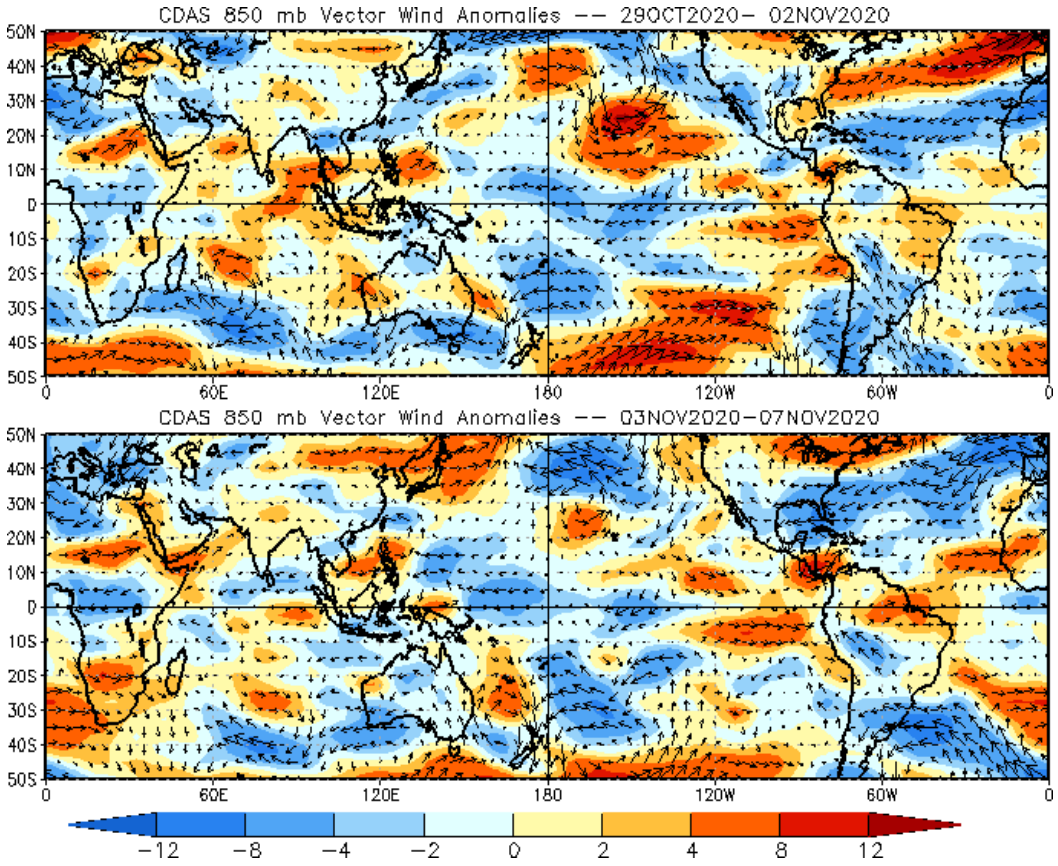


- The upper-level pattern continues to broadly reflect La Niña conditions.
- Extratropical wavebreaking onto the tropics continues to influence the pattern, with cross-equatorial flow clearly evident near 120W.

850-hPa Wind Anomalies

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

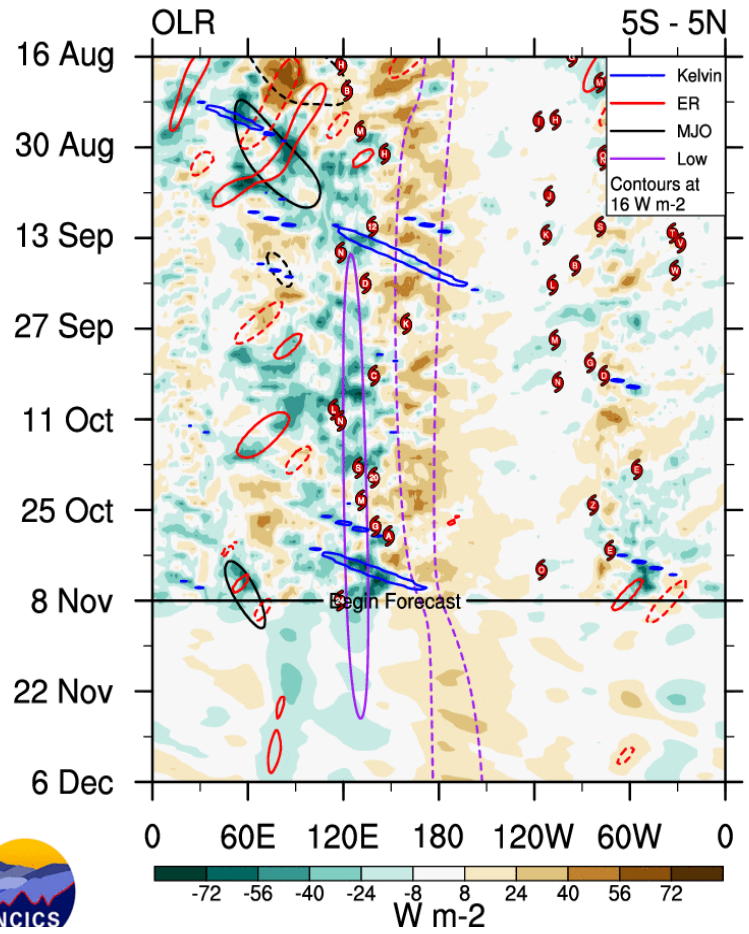


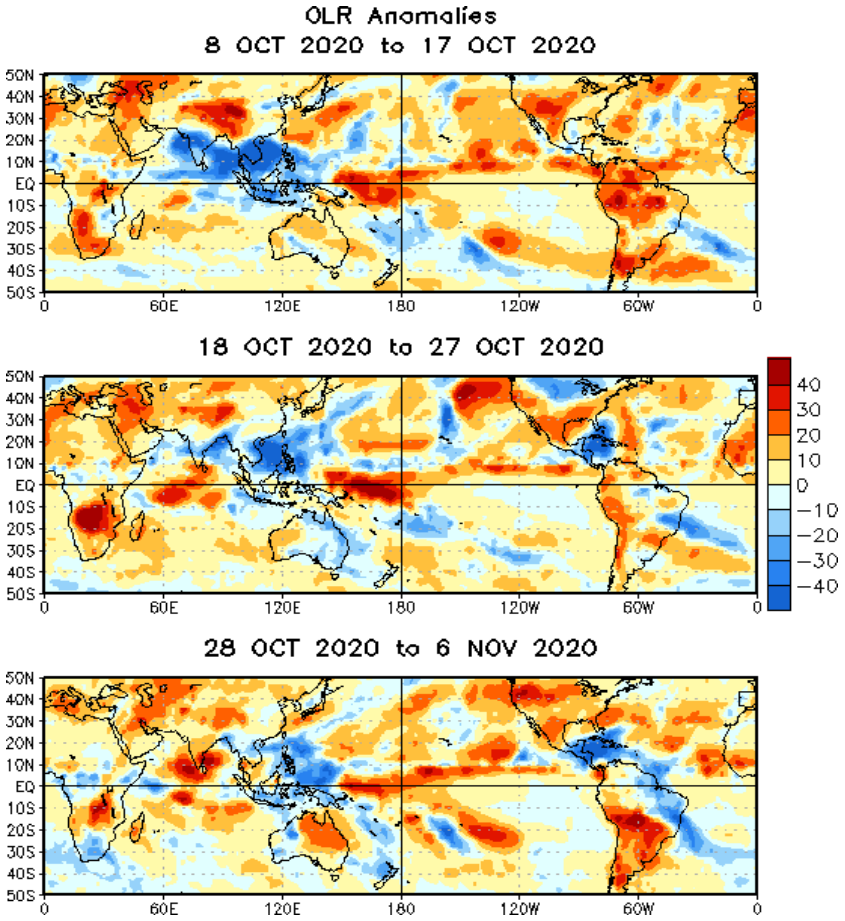


- The extratropical wavebreaking onto the tropics also continues to influence the low-level East Pacific zonal wind pattern, disrupting the enhanced trades normally associated with the La Niña response.
- Enhanced trade winds remain evident across much of the central Pacific.

Outgoing Longwave Radiation (OLR) Anomalies

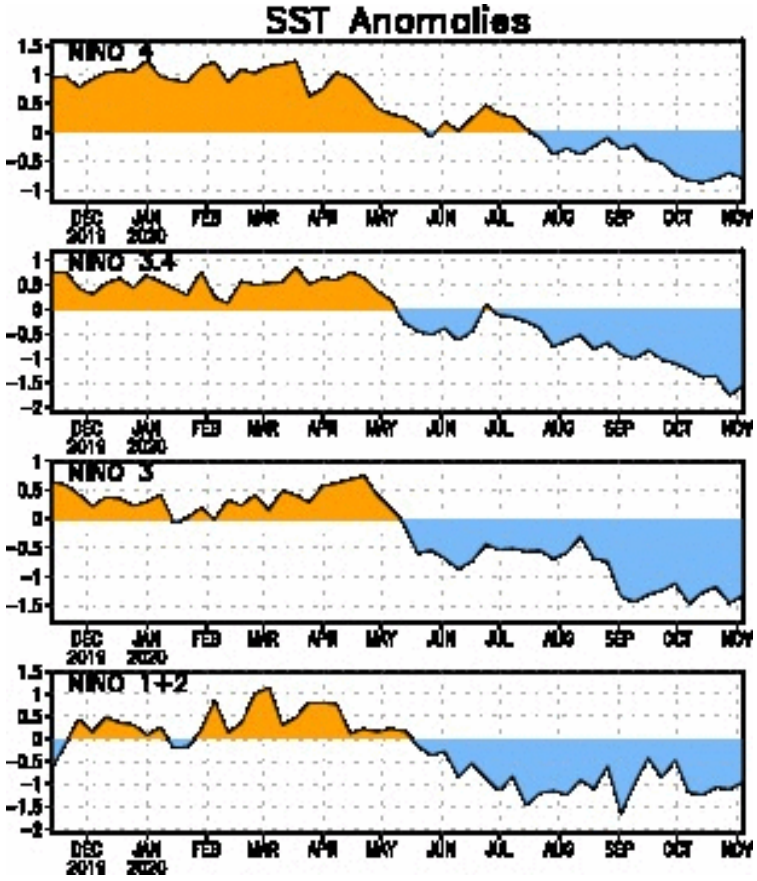
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

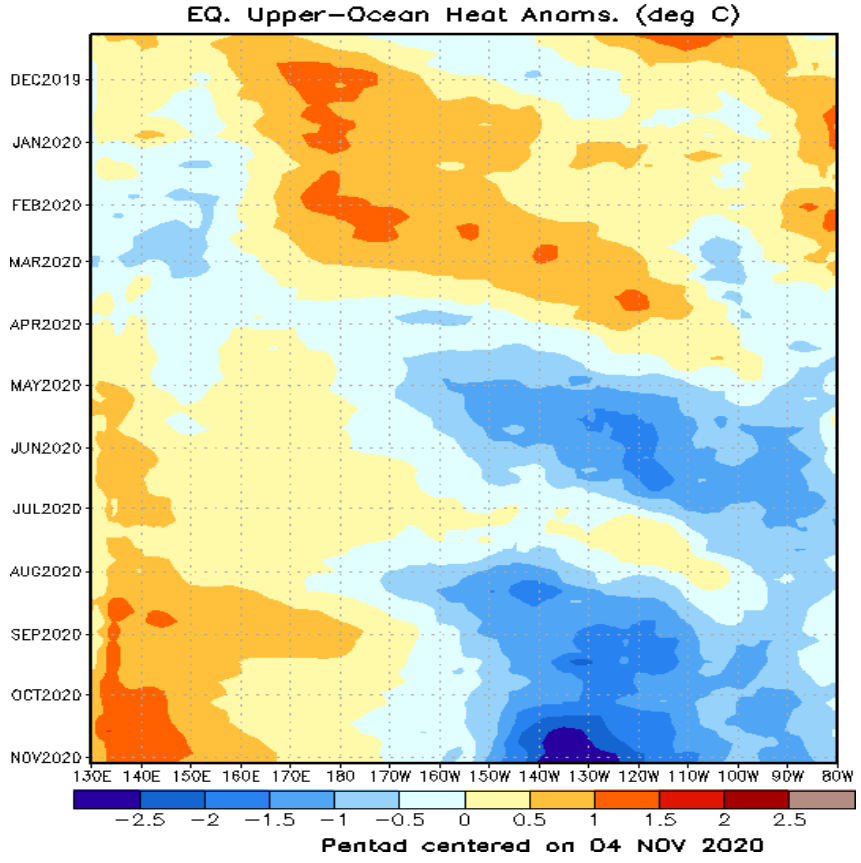




- Recent intraseasonal (MJO or Kelvin wave) activity did not substantially alter the low frequency base state.
- OLR anomalies have taken on a Wave-2 asymmetry as the intraseasonal signal crosses the Western Hemisphere while the base state favors continued enhanced convection across the far West Pacific and Maritime Continent.
- The Kelvin wave/intraseasonal signal has promoted tropical cyclone development over the western Caribbean, while an active tropical pattern continues across the West Pacific.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

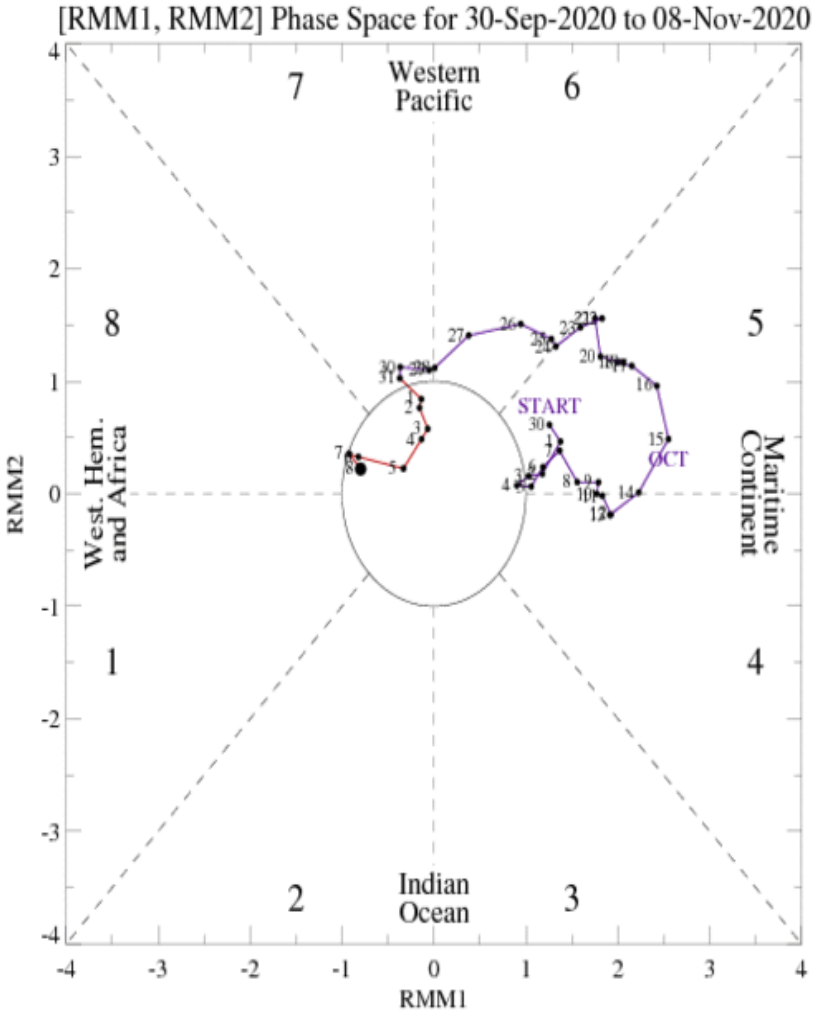




- Following destructive interference with the base state by a downwelling Kelvin wave, the subsequent upwelling phase has pushed the Pacific into La Niña conditions.
- A subsequent downwelling Kelvin wave initiated in late August and failed to cross the central Pacific.
- Negative anomalies in all of the Niño regions have continued to strengthen, with the greatest declines observed in the Niño 4 and 3.4 regions since September.

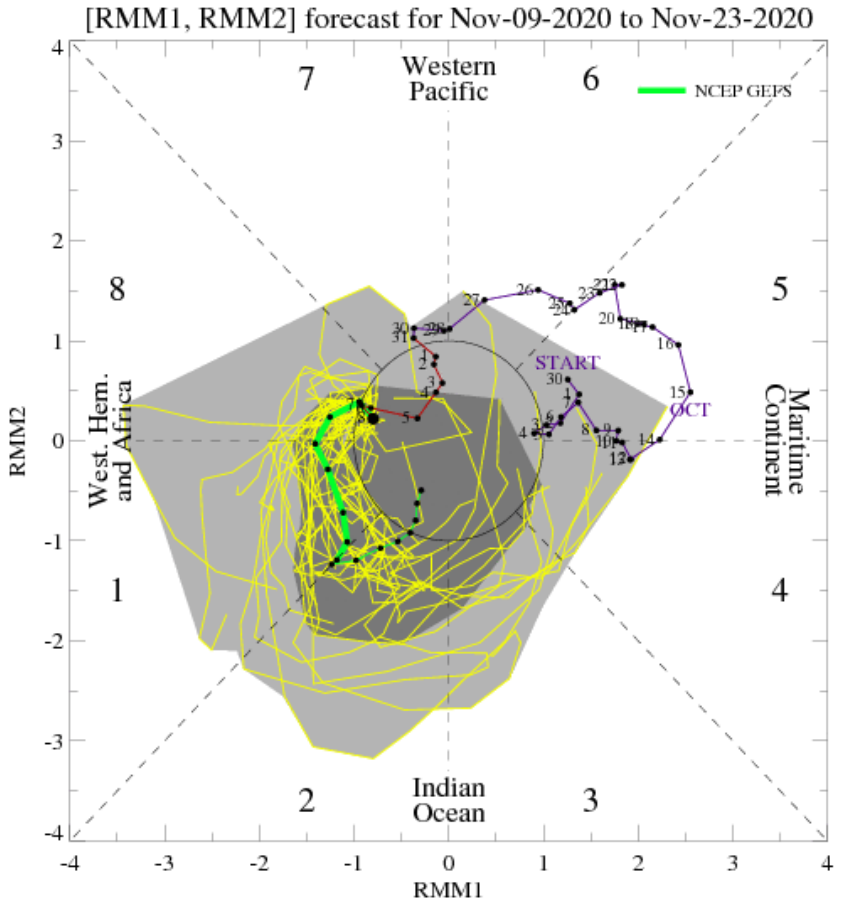
MJO Index: Recent Evolution

- Despite the weak presentation at the upper-levels, the RMM Index showed fairly robust propagation of the MJO across the Pacific.
- Rossby wave activity over the East Pacific helped weaken the MJO signal over the past few days.

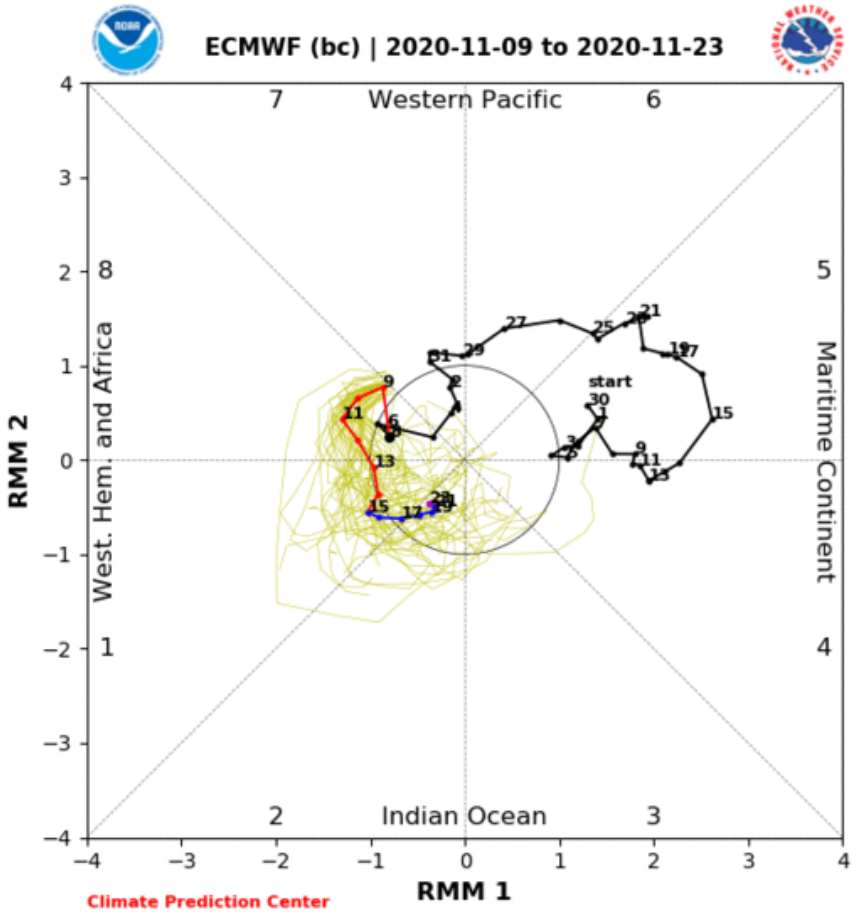


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

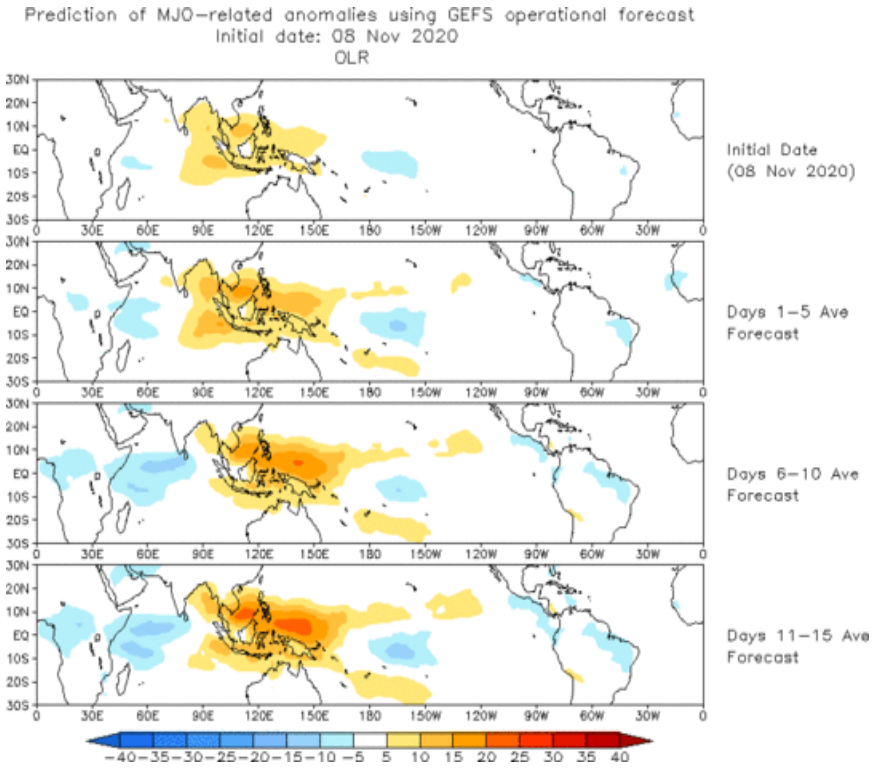


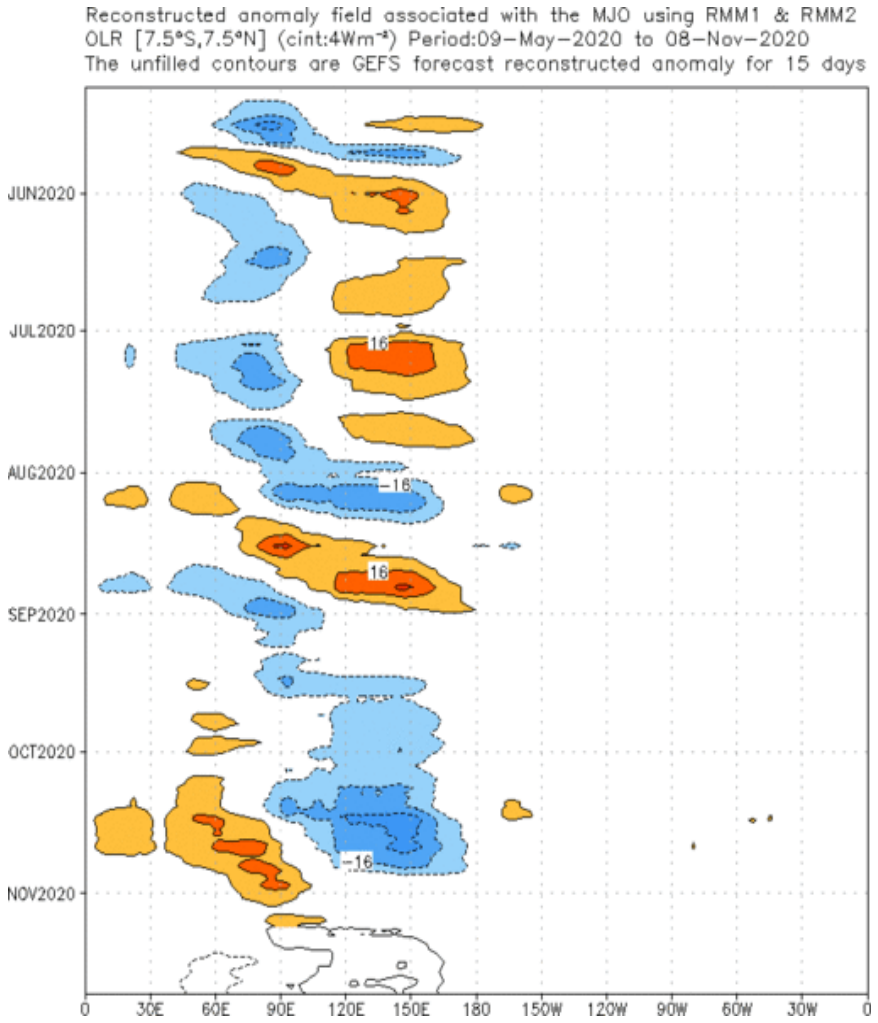
ECMWF Forecast

- Both the GEFS and ECMWF forecast the MJO to propagate eastward across the Western Hemisphere and then weaken over the Indian Ocean.
- Multiple ensemble members from both model systems show renewed MJO activity across the Indian Ocean during Week-2.

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.)

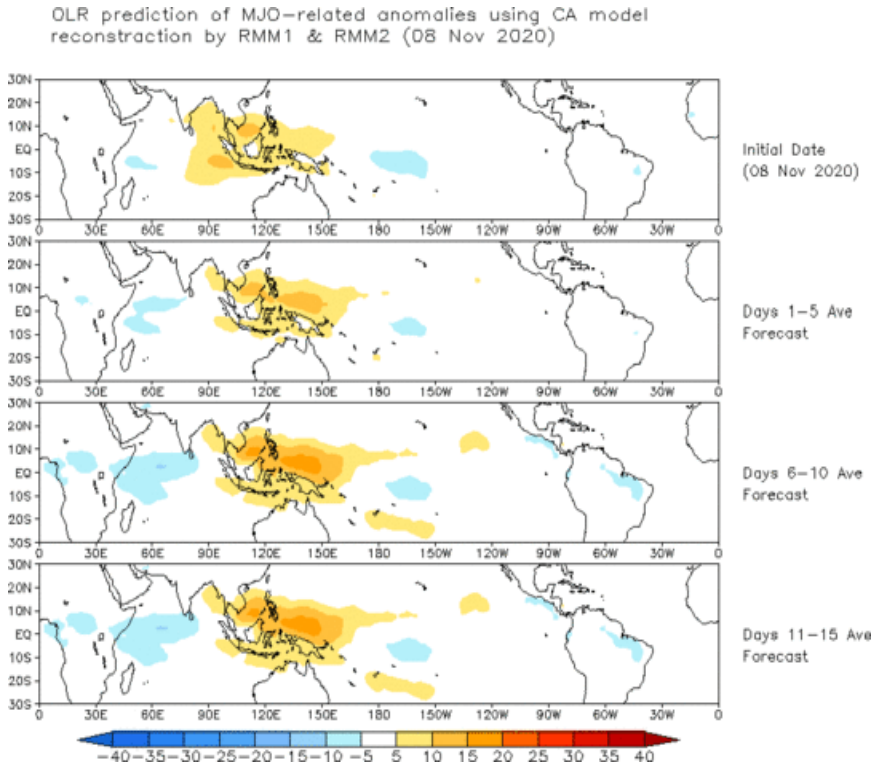


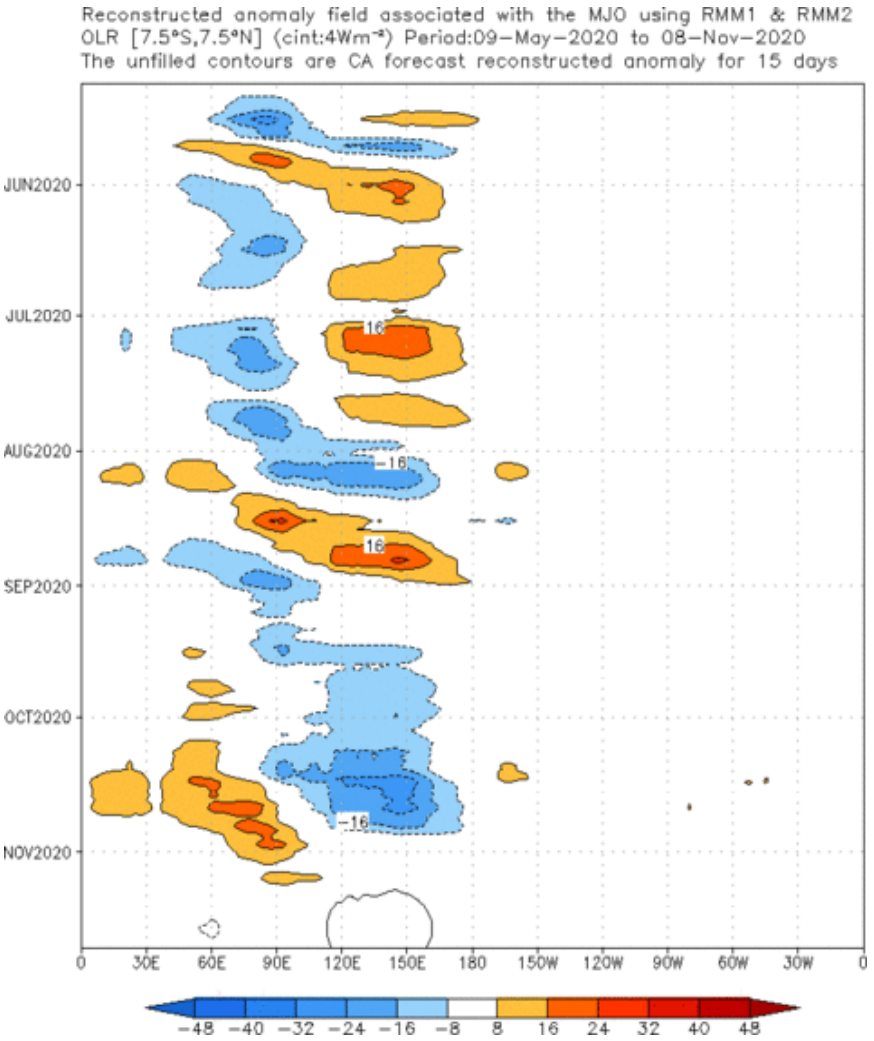


- The GEFS forecasts a slow moving MJO signal intensifying over the Indian Ocean. This signal is out of phase with the La Niña base state.

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.)

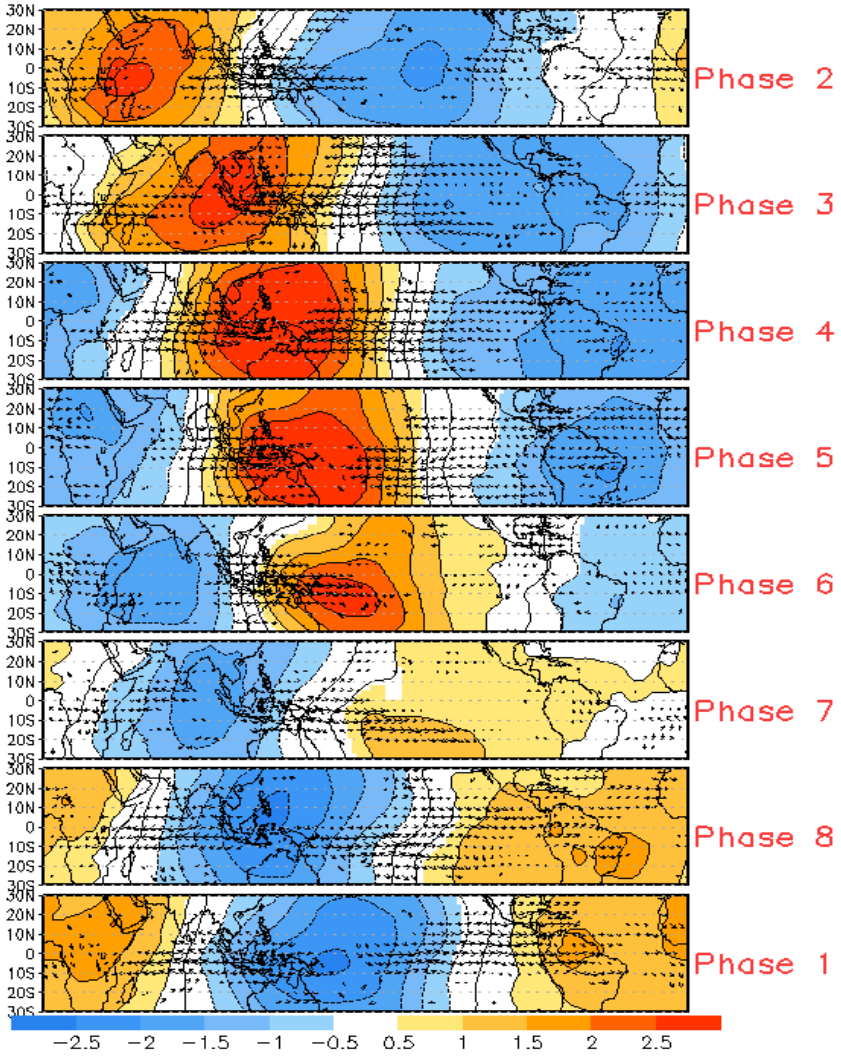




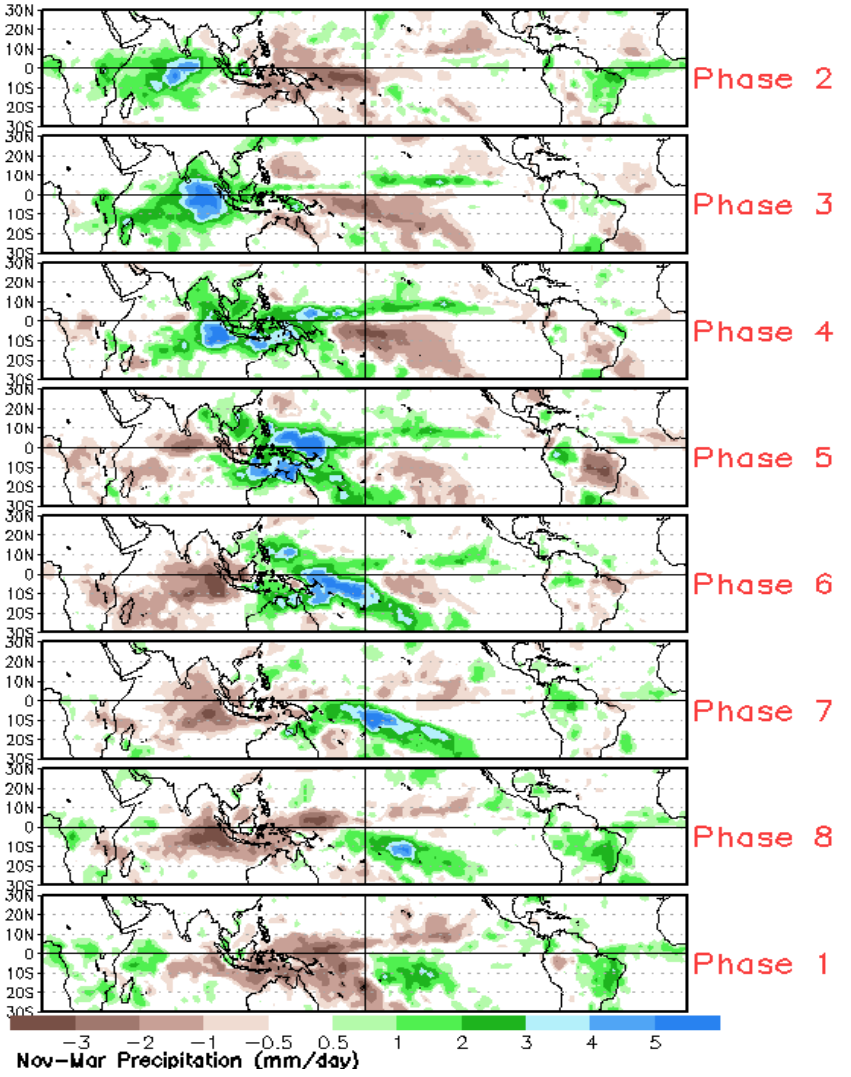
- The constructed analog model depicts a similar slowly building Indian Ocean signal, with weaker amplitude than the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



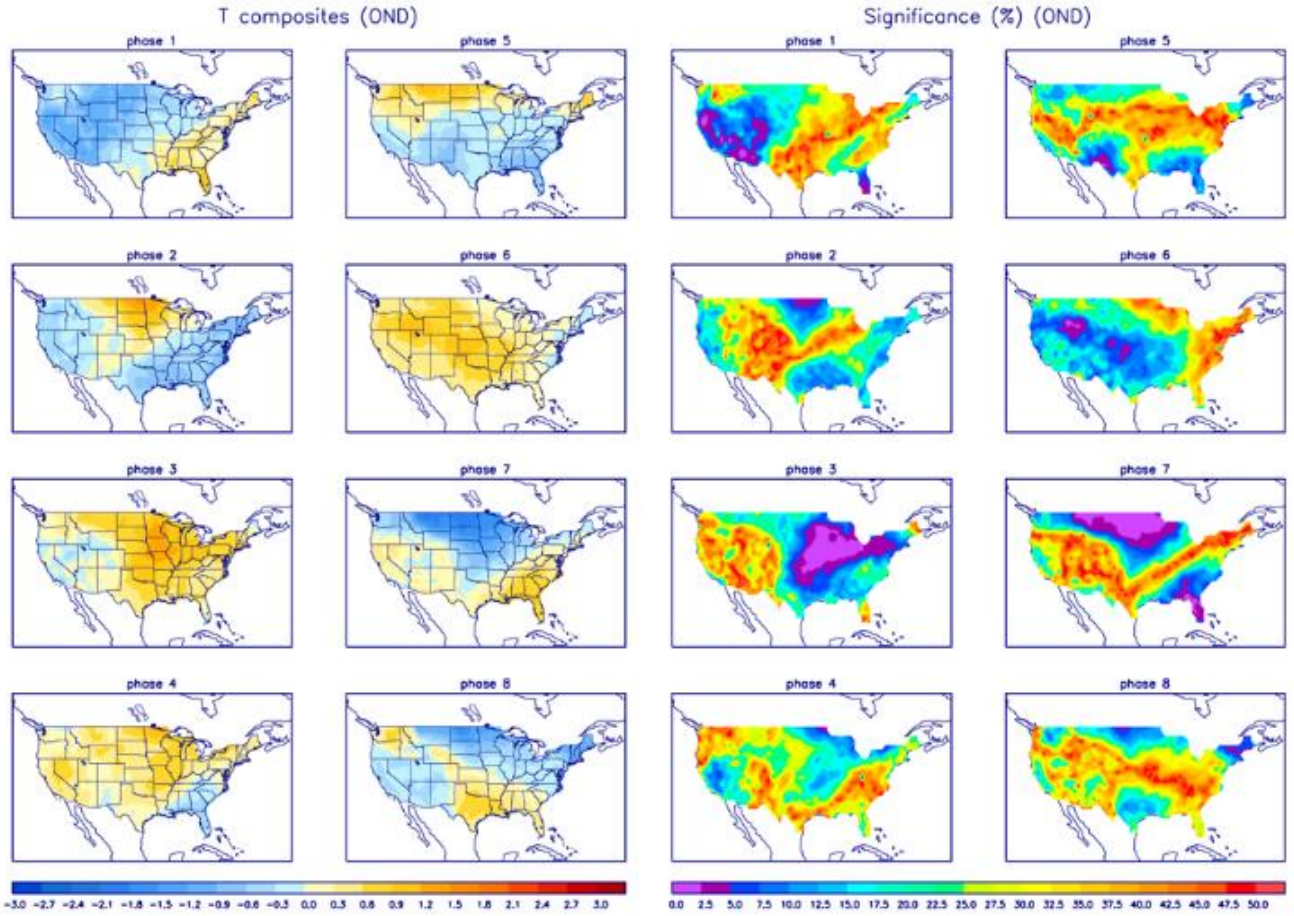
Precipitation Anomalies



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.

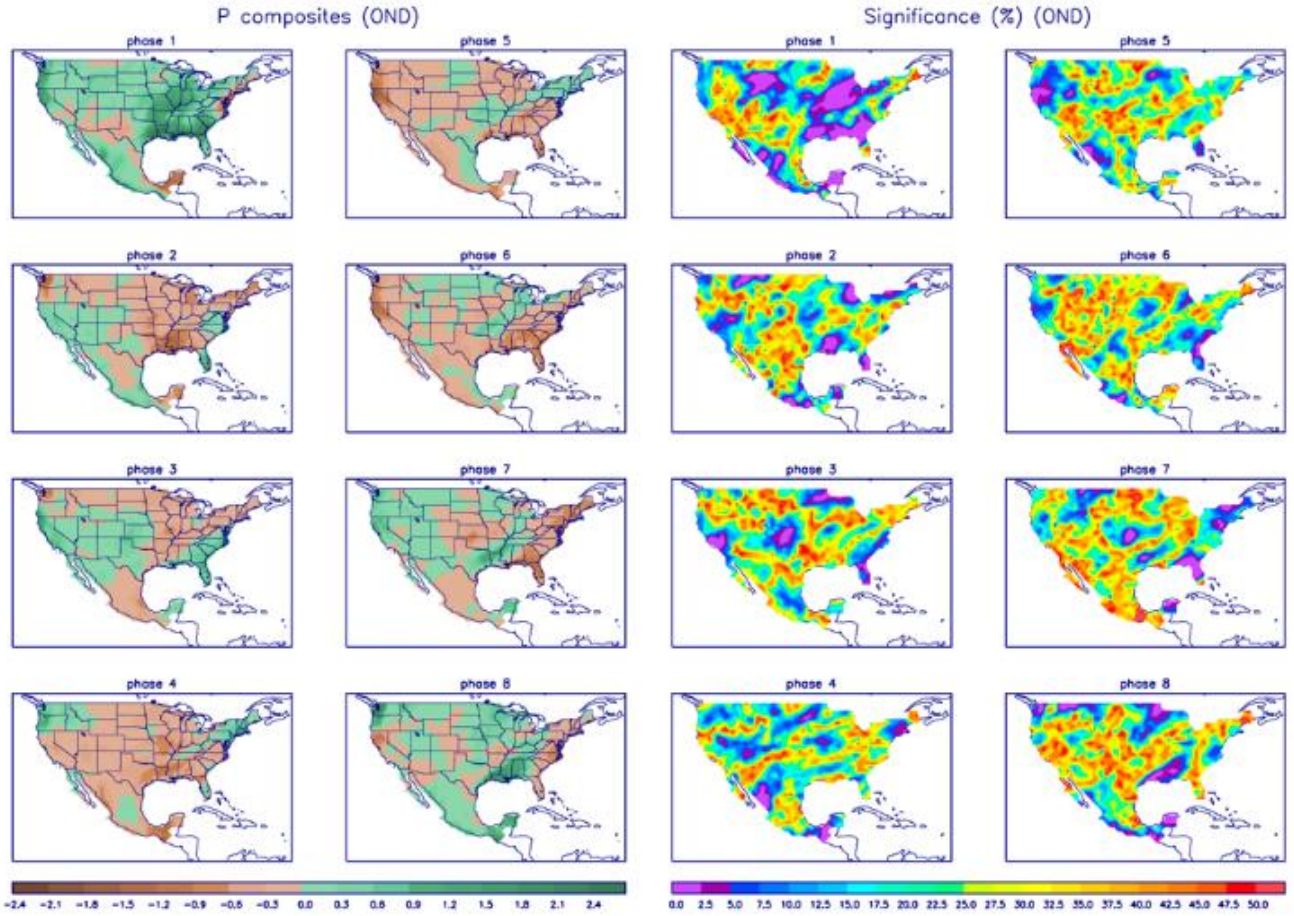


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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.

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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