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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
27 September 2021

Overview

- The RMM index indicates the MJO has stalled over the Maritime Continent while weakening in amplitude during the last week.

- Dynamical models point to the reemergence of the intraseasonal signal over the Maritime Continent that propagates eastward into the West Pacific during the next two weeks. However, there is uncertainty that the MJO will maintain organization given the strengthening low frequency base state and continued large spread in the ensemble guidance.

- Additional tropical cyclone formation in the East Pacific and Atlantic during week-1 is possible, with decreasing chances for development across the Western Hemisphere during week-2 tied to large-scale suppressed environment forecast and a less active climatology later in October.

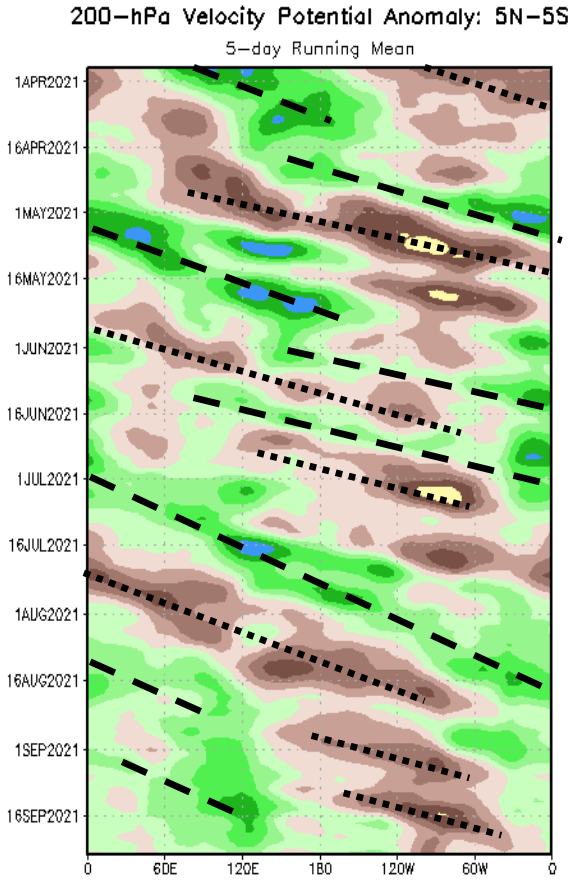
- Continued tropical cyclone activity is favored in the eastern Hemisphere.

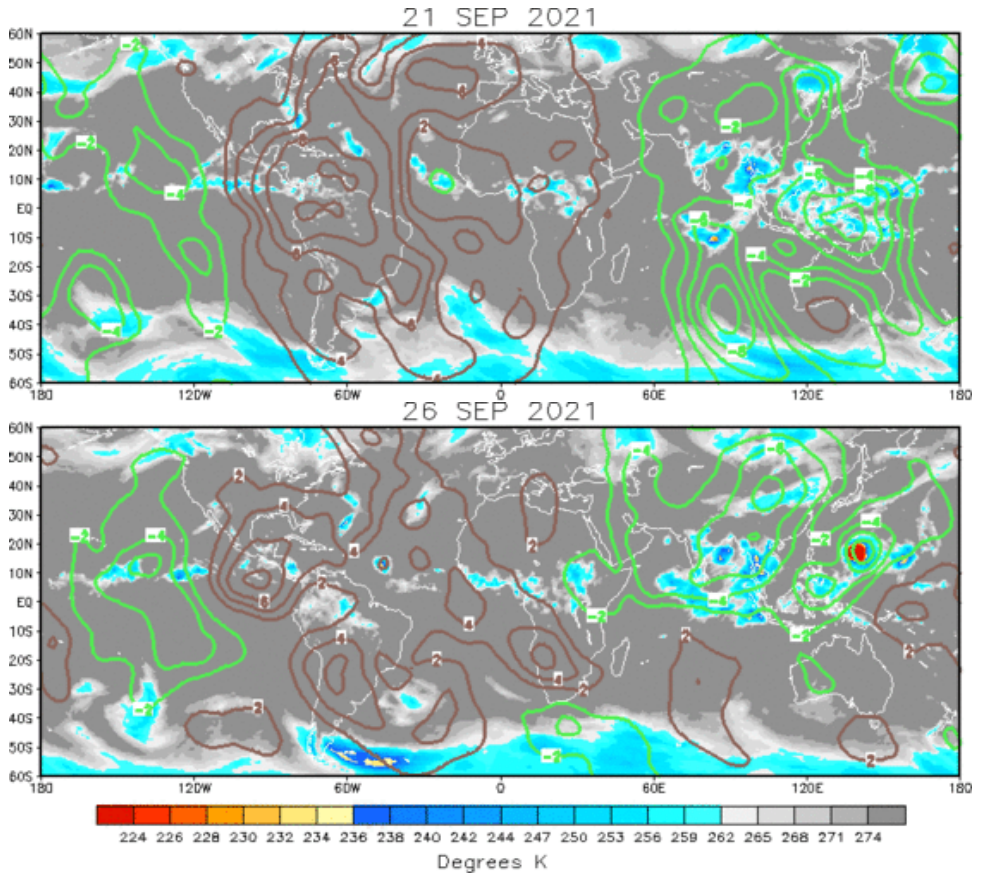
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).



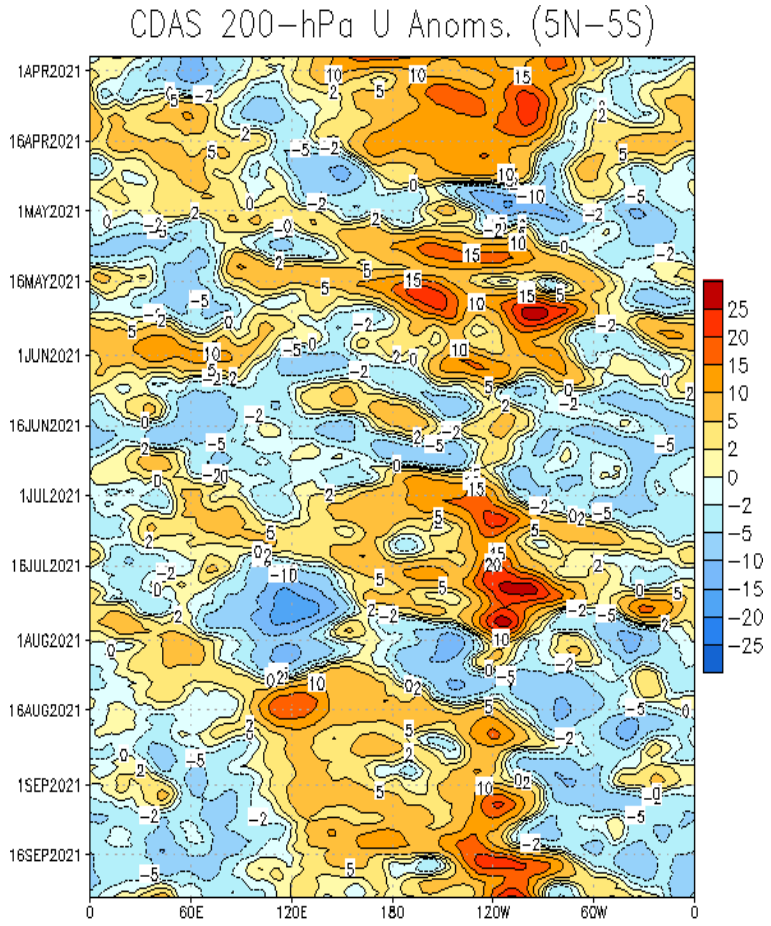


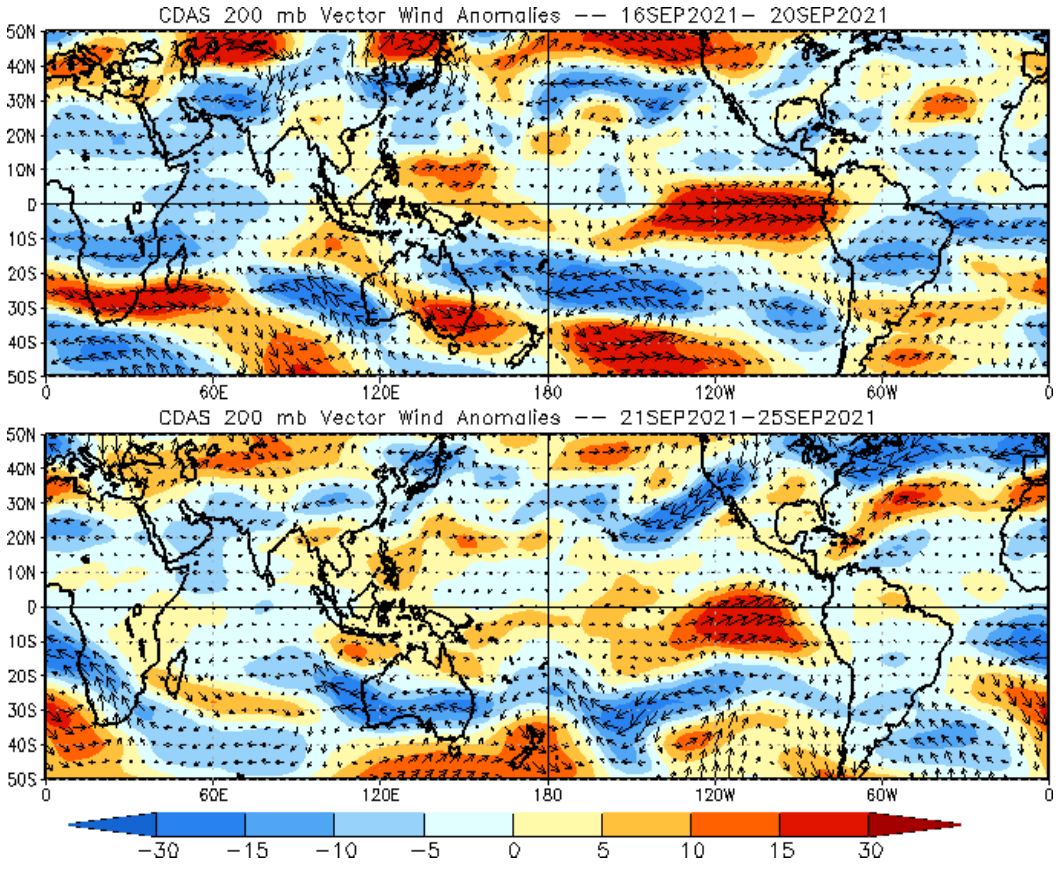
- Upper-level velocity potential anomalies show a poorly organized pattern, with enhanced convection remaining anchored over the Indian Ocean and Maritime Continent suggestive of a low frequency footprint.

- Some enhancement in convection is seen to the east of the Date Line likely tied to a convectively coupled Kelvin wave near 135E.

200-hPa Wind Anomalies

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



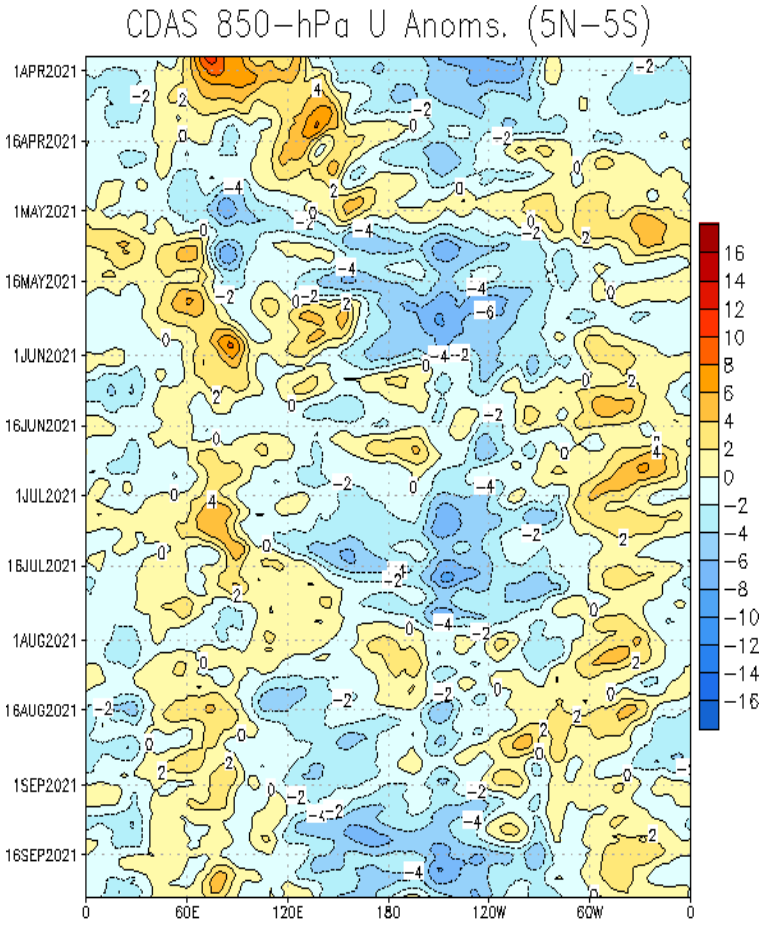


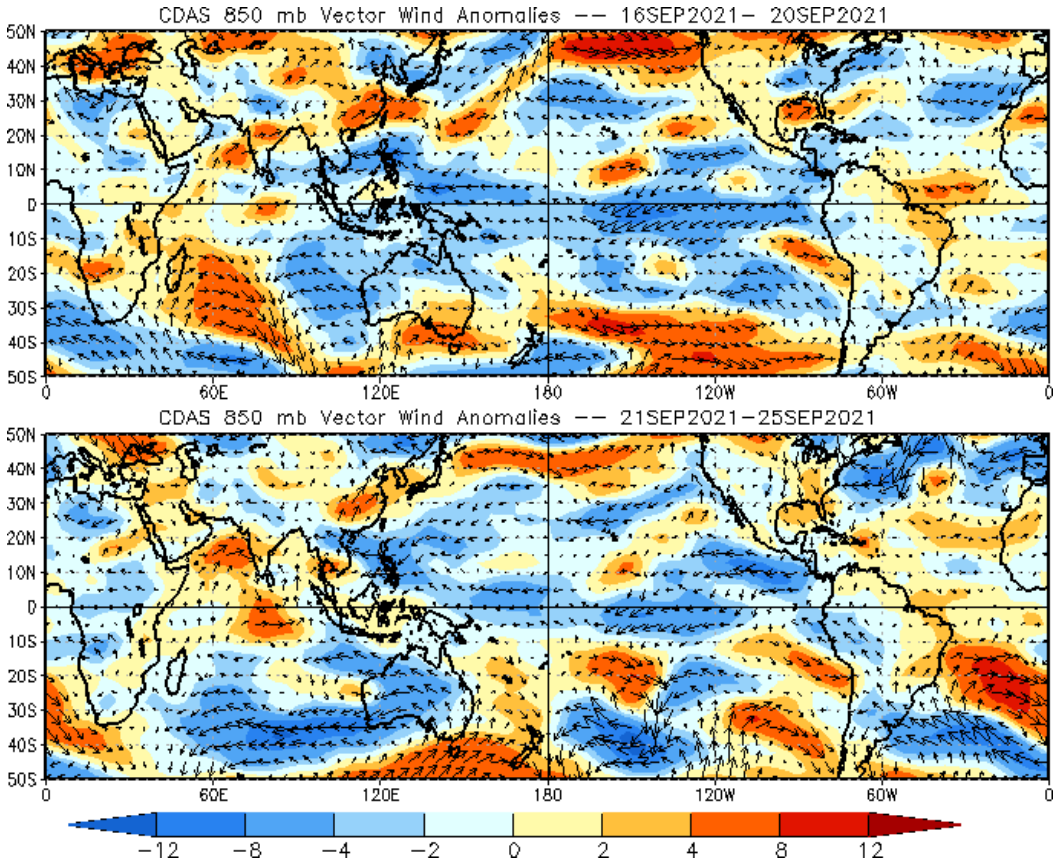
- Anomalous westerlies persist across much of the equatorial Pacific consistent with the atmospheric response to the developing La Niña state.

- Anomalous easterlies have weakened across the Indian Ocean, with westerlies developing off East Africa.

850-hPa Wind Anomalies

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



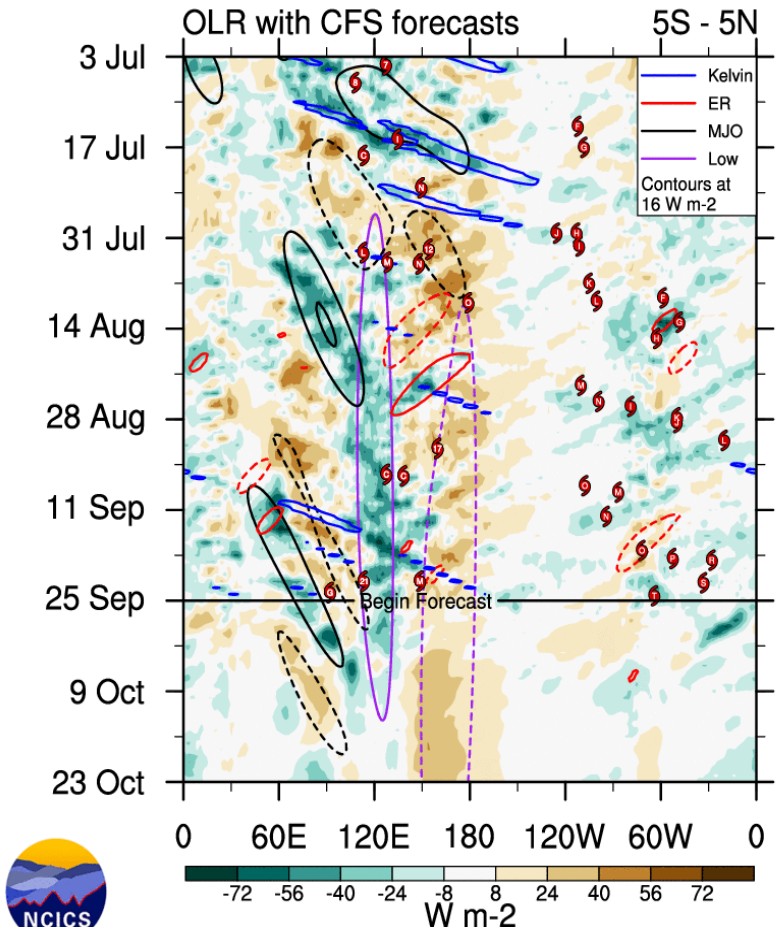


- Enhanced trades continue throughout the much of the Pacific, making it difficult for propagation of the intraseasonal signal.

- Anomalous westerlies remain evident near 60E which may be tied to a negative Indian Ocean Dipole circulation since earlier this summer.

Outgoing Longwave Radiation (OLR) Anomalies

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



Blue shades: Anomalous convection (wetness)
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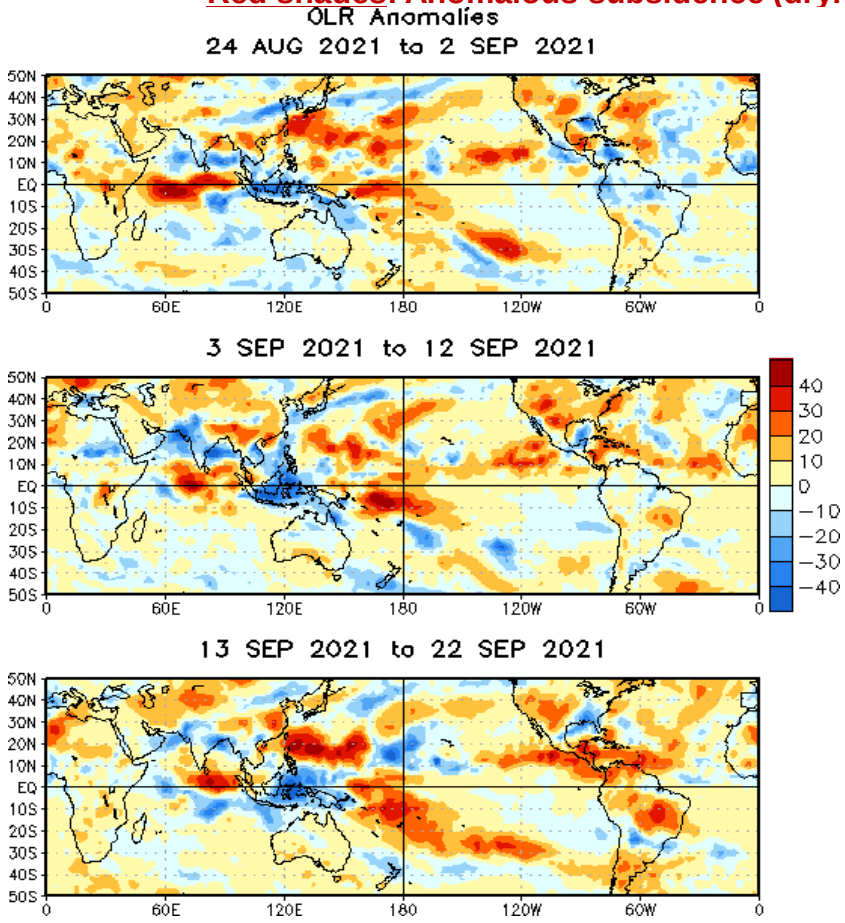
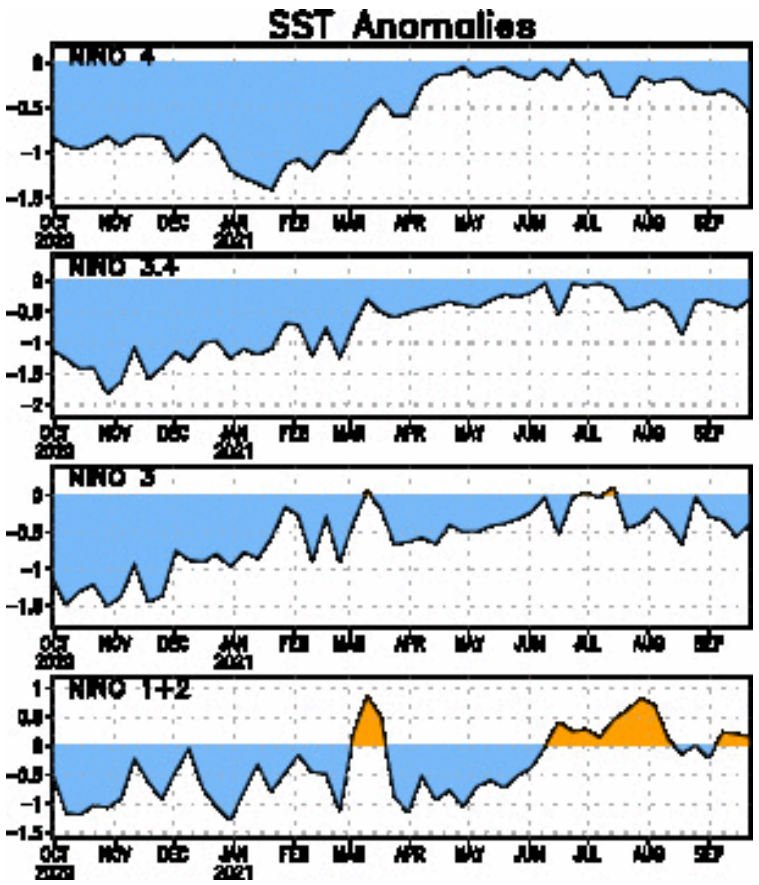
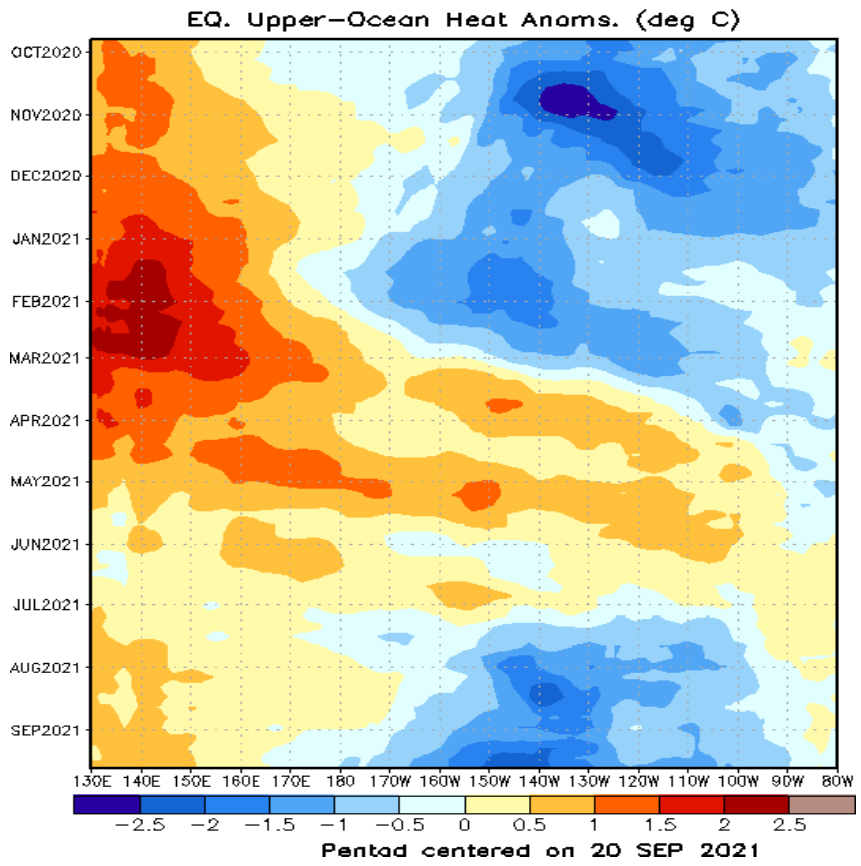


- Enhanced convection continues over the Maritime Continent, with suppressed conditions forecast to continue along the equator to the west of the Date Line.

- Drier conditions are observed throughout the East Pacific associated with a lull in TC activity across the Basin since mid-September.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific





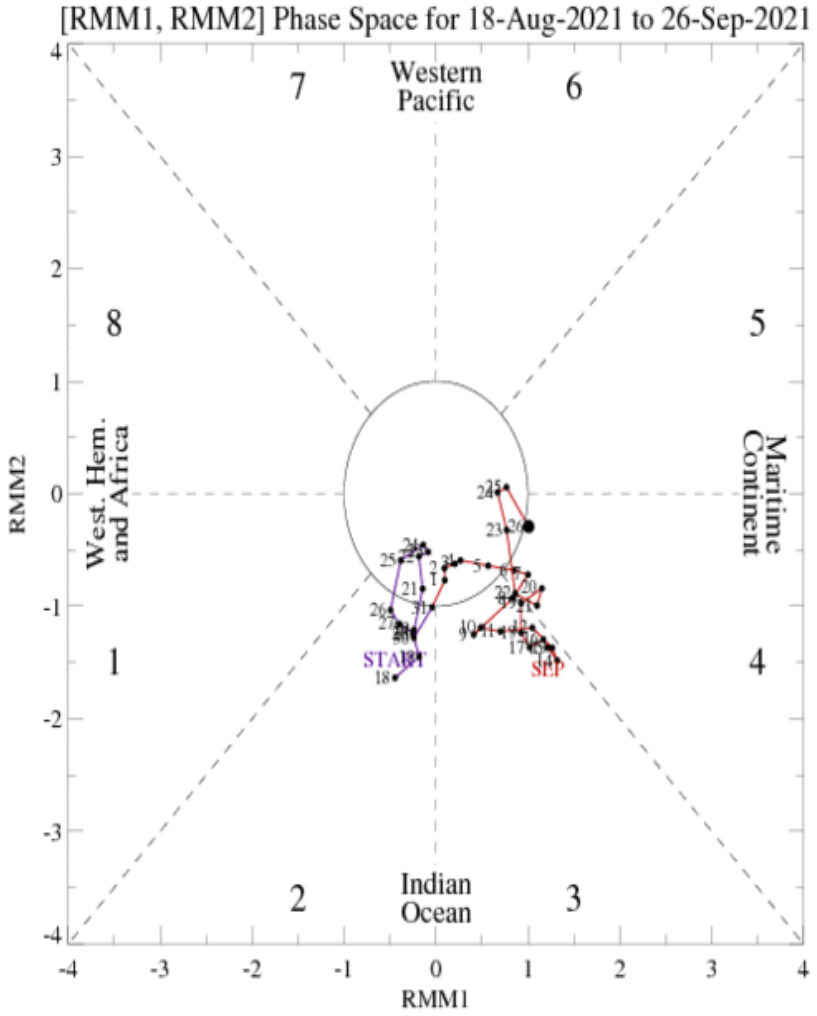
- Negative upper-ocean heat anomalies continue to strengthen across much of the central and eastern equatorial Pacific, with much of this sub-surface cooling expanding westward towards the Date Line during September.

- Below-normal sea surface temperatures are observed over all Niño regions except the east Pacific, consistent with a forecast trend toward La Niña.

MJO Index: Recent Evolution

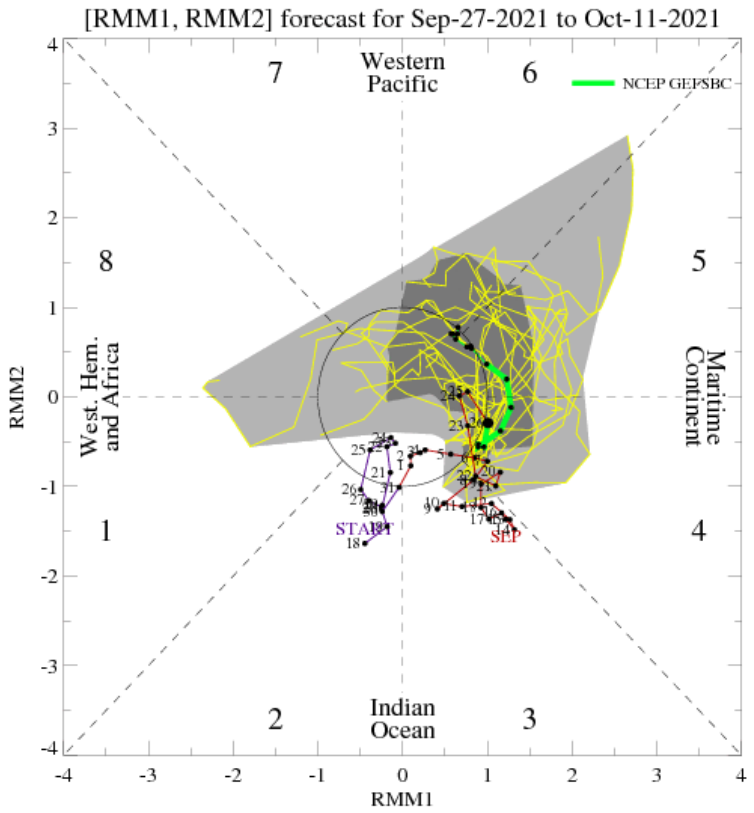
- The RMM index indicates the intraseasonal signal has been quasi-stationary over the Maritime Continent while weakening within the unit circle during the past week.

- An increase in amplitude is observed as of late.

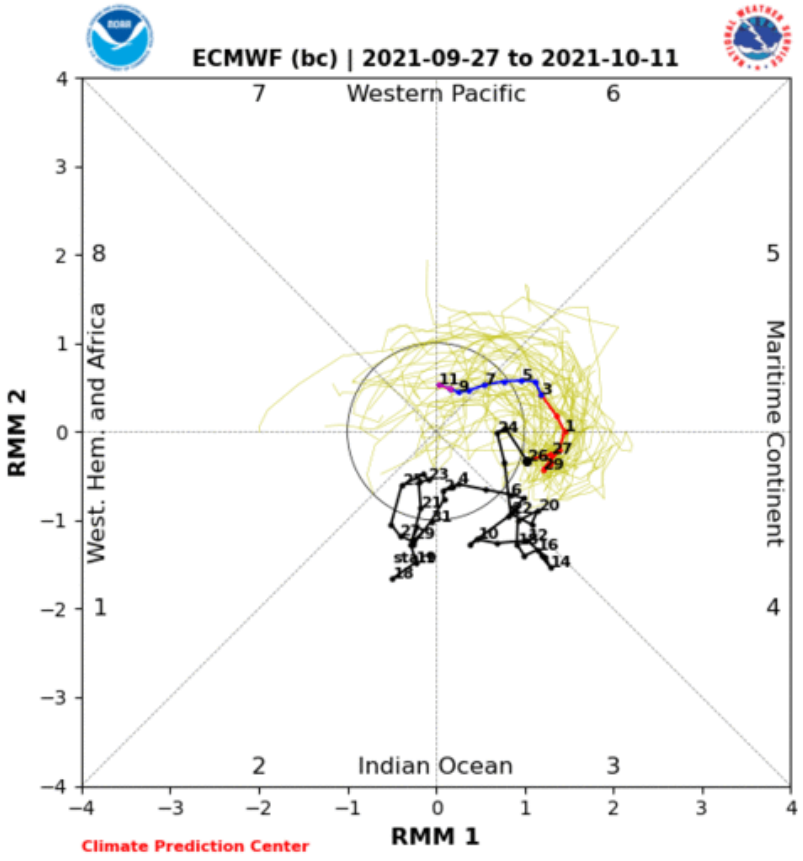


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

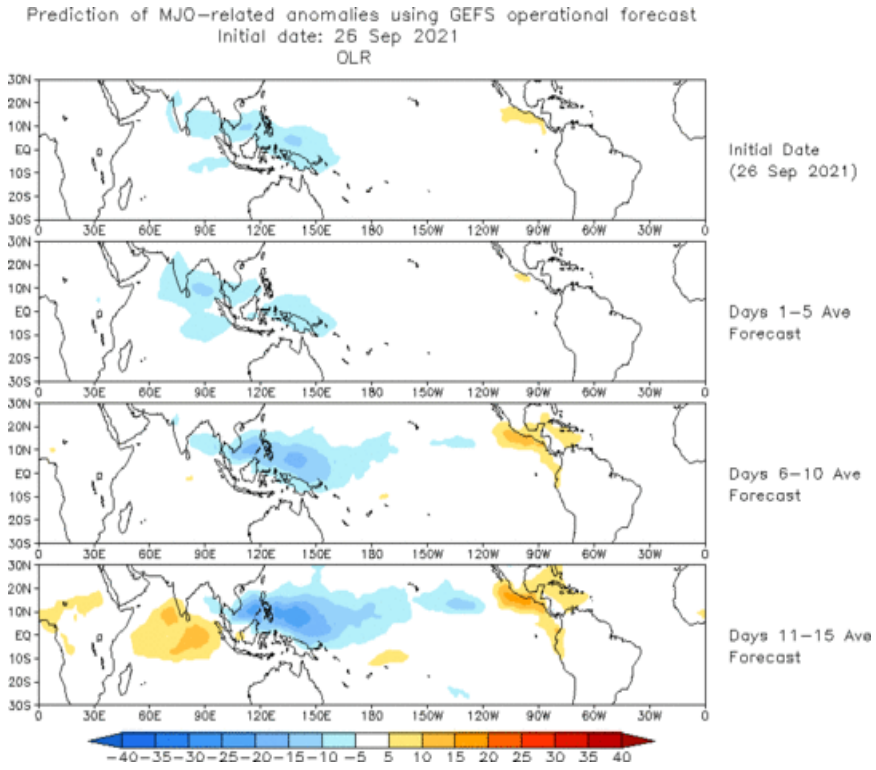


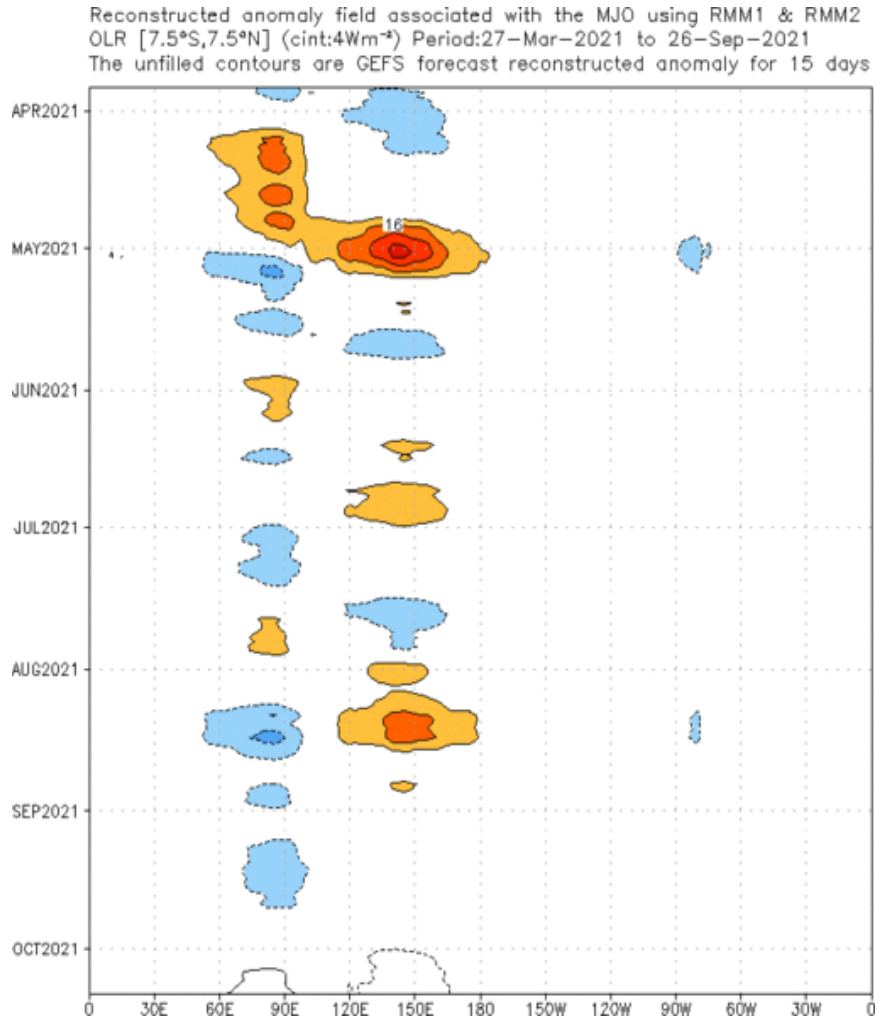
ECMWF Forecast

- Both the GEFS and ECMWF suggest a more coherent intraseasonal signal emerging during week-1, with renewed eastward propagation over the Maritime Continent and into the Western Pacific during week-2.
- In consideration of the strengthening low frequency base state, and large ensemble spread depicted by the GEFS and other models, there is uncertainty in the strength and evolution of the MJO heading into October.

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.)

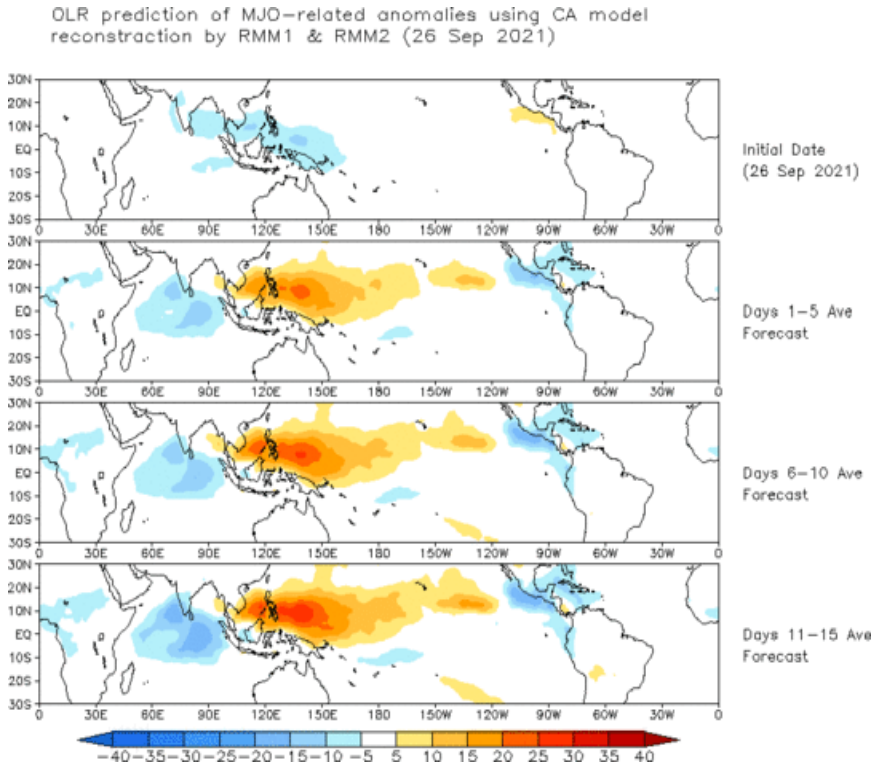


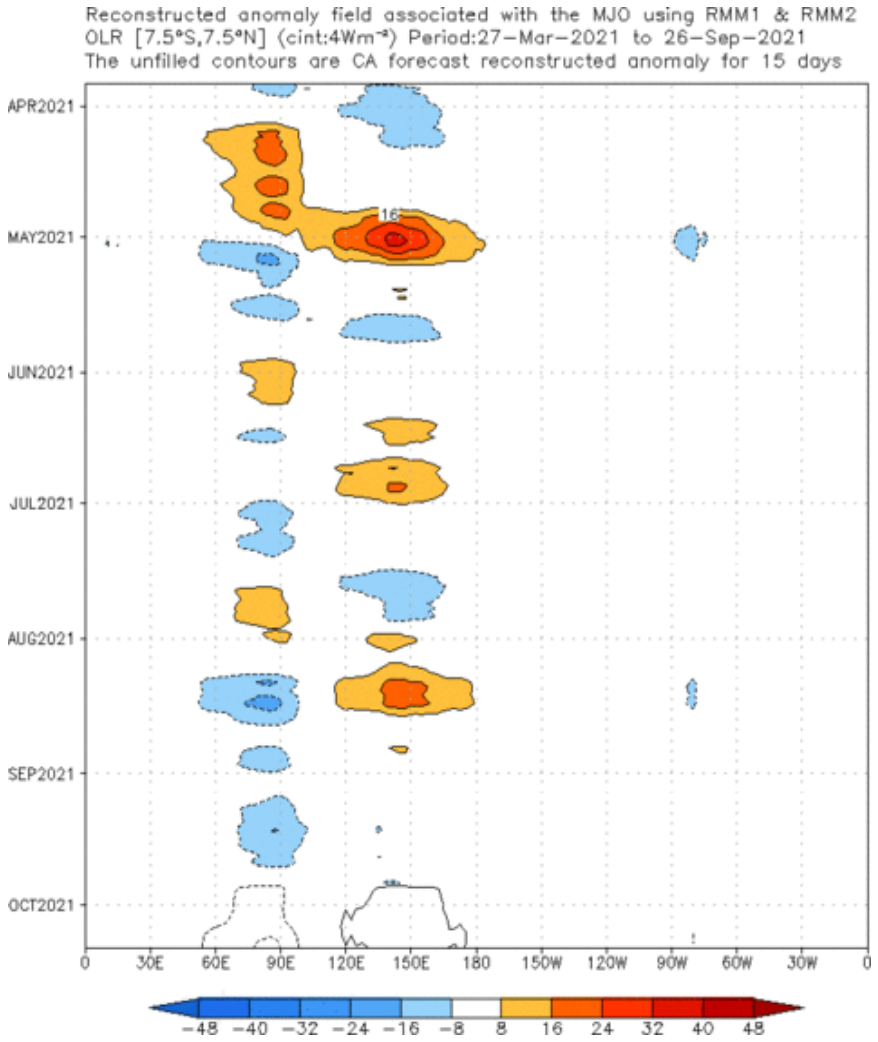


- The GEFS RMM-based OLR anomaly forecast features a stationary signal with enhanced convection strengthening over the Maritime Continent and West Pacific (East Pacific) during the next two weeks.

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.)

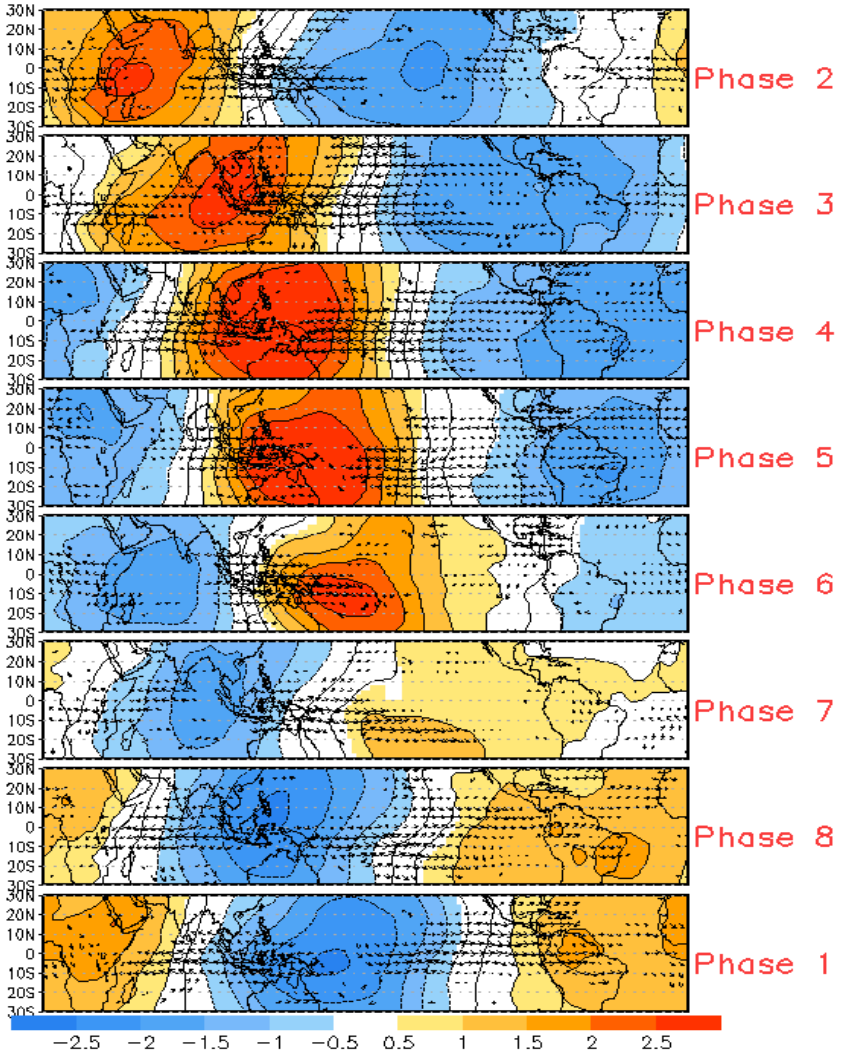




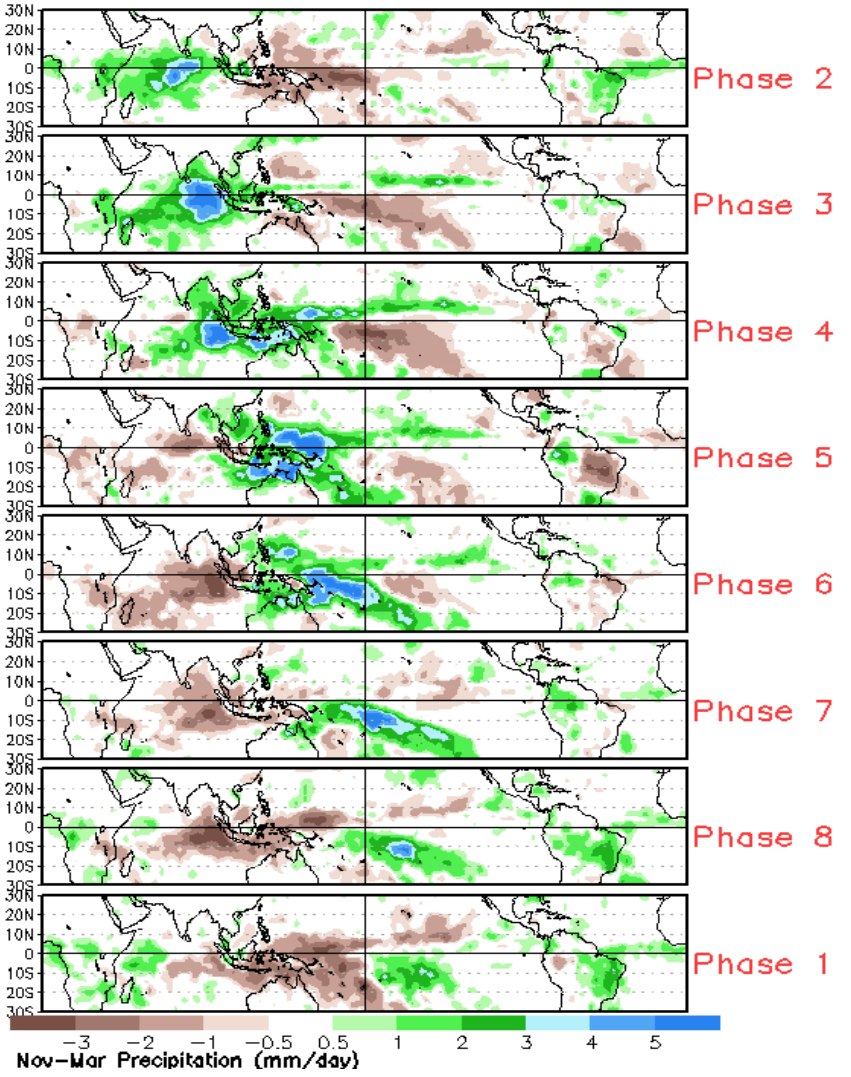
- The constructed analog forecast also depicts a more stationary convective pattern but features anomalies that are of opposite sign compared the GEFS across the global tropics.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



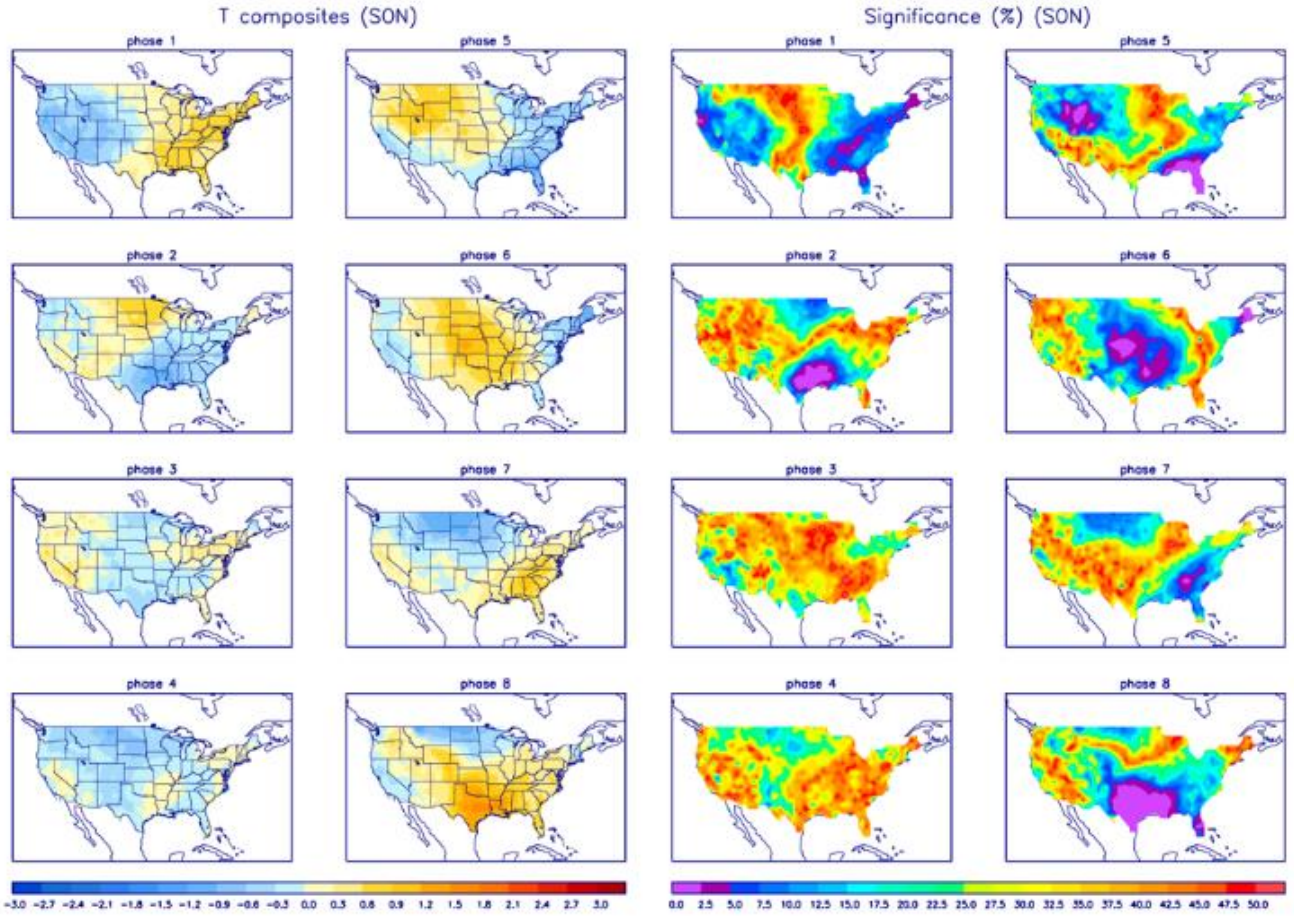
Precipitation Anomalies



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.

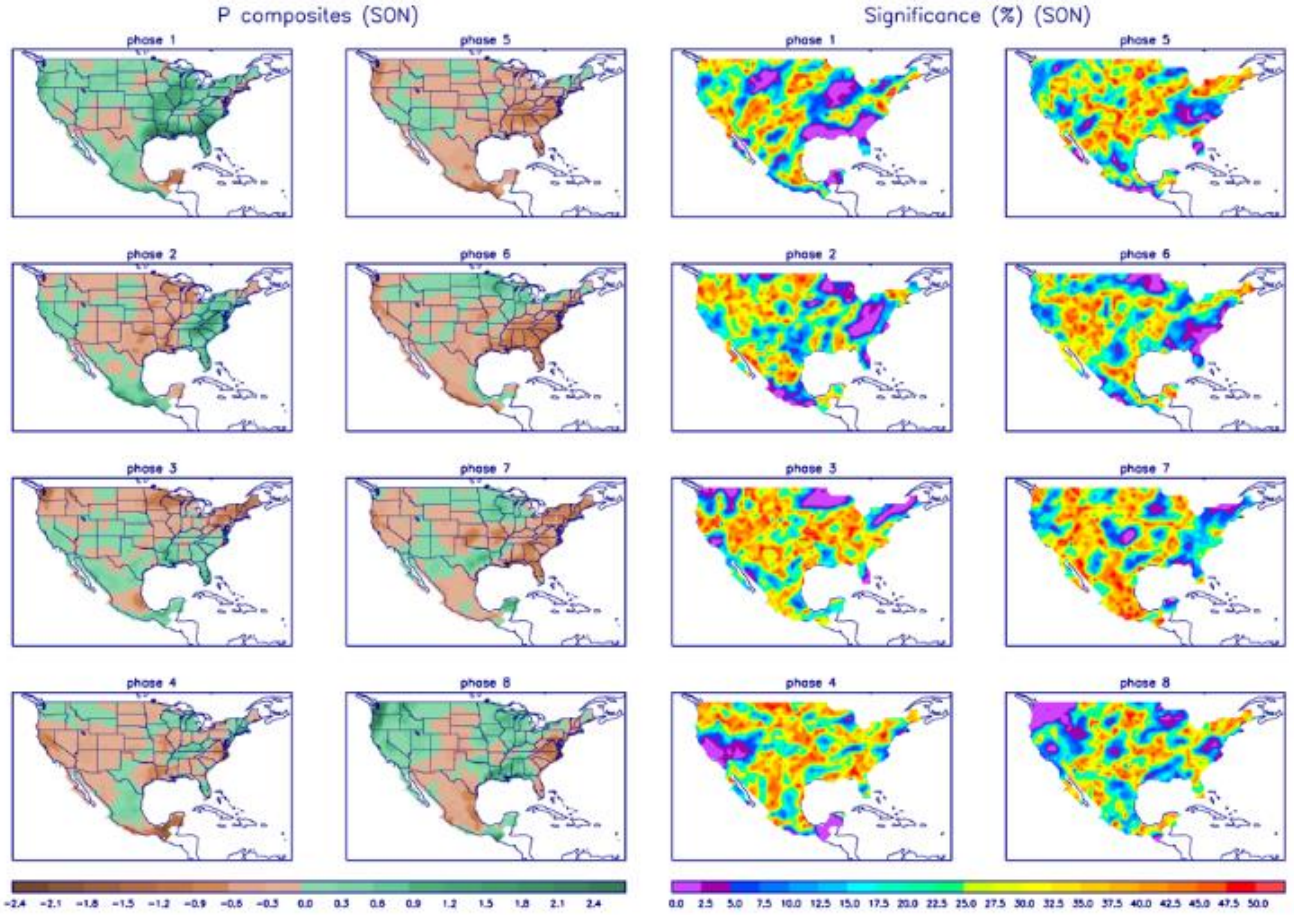


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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