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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
2 September 2019

Overview

- The MJO remains weak with a Kelvin wave propagating east from the tropical Atlantic to Africa toward the end of August.

- Dynamical models do not show a strong indication of a MJO re-emergence in the next two weeks. Some members from the ECMWF favor a growing signal over the western Pacific and Maritime Continent in Week-2.

- Tropical cyclone development picked up in the Atlantic in late August, with the Kelvin wave causing a period of suppressed wind shear over the tropical Atlantic. Several systems are currently of interest for cyclogenesis in the next two weeks.

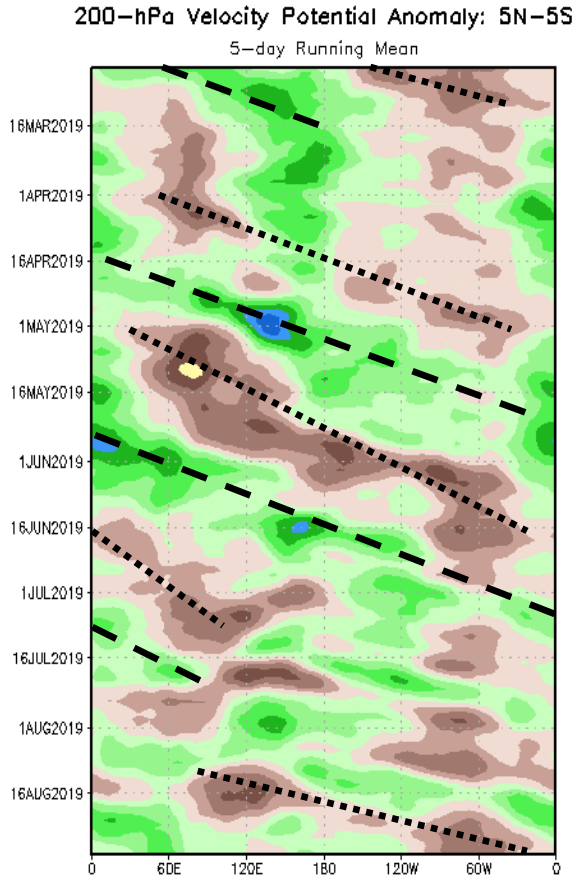
- Tropical cyclone development is unlikely across the East Pacific.

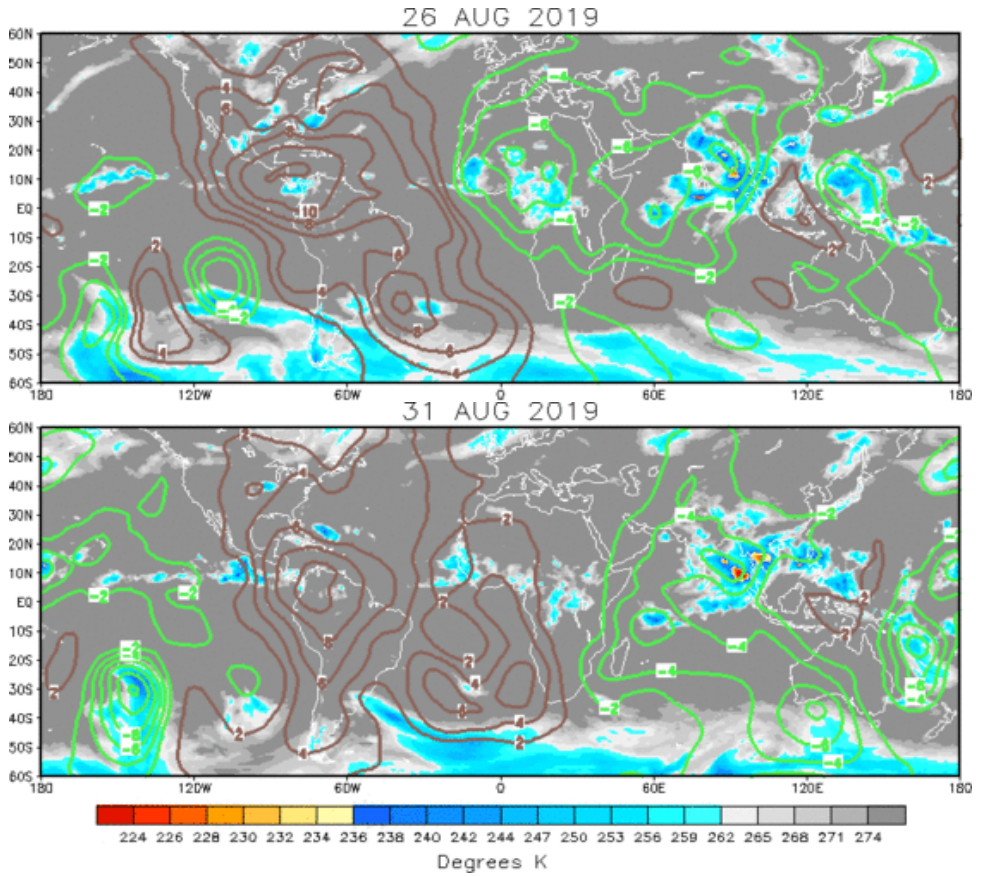
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

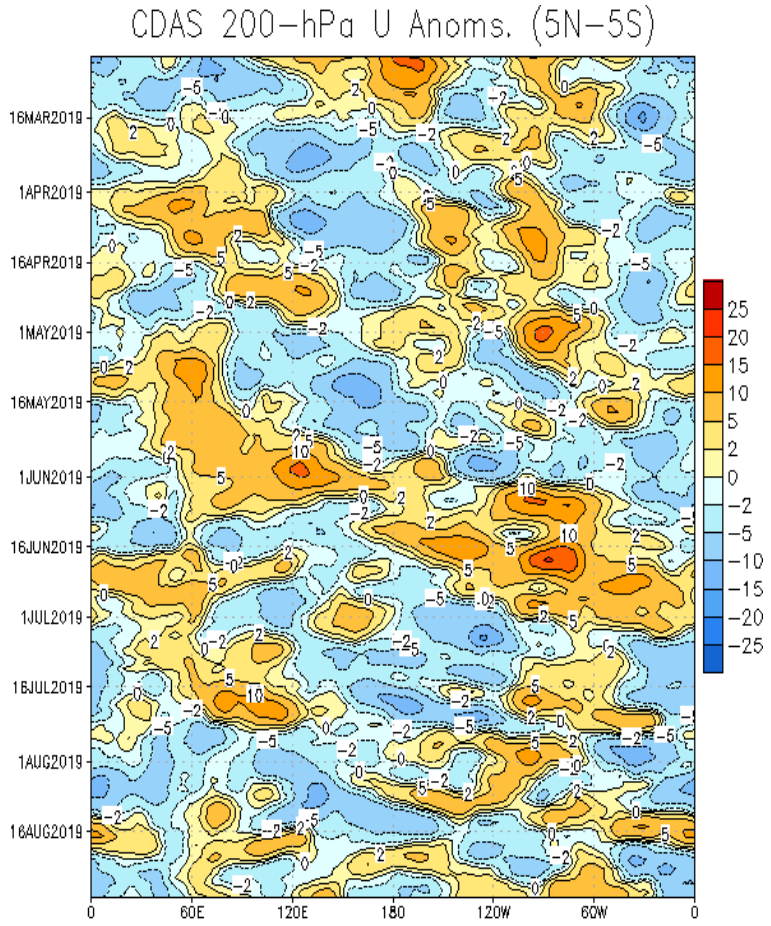


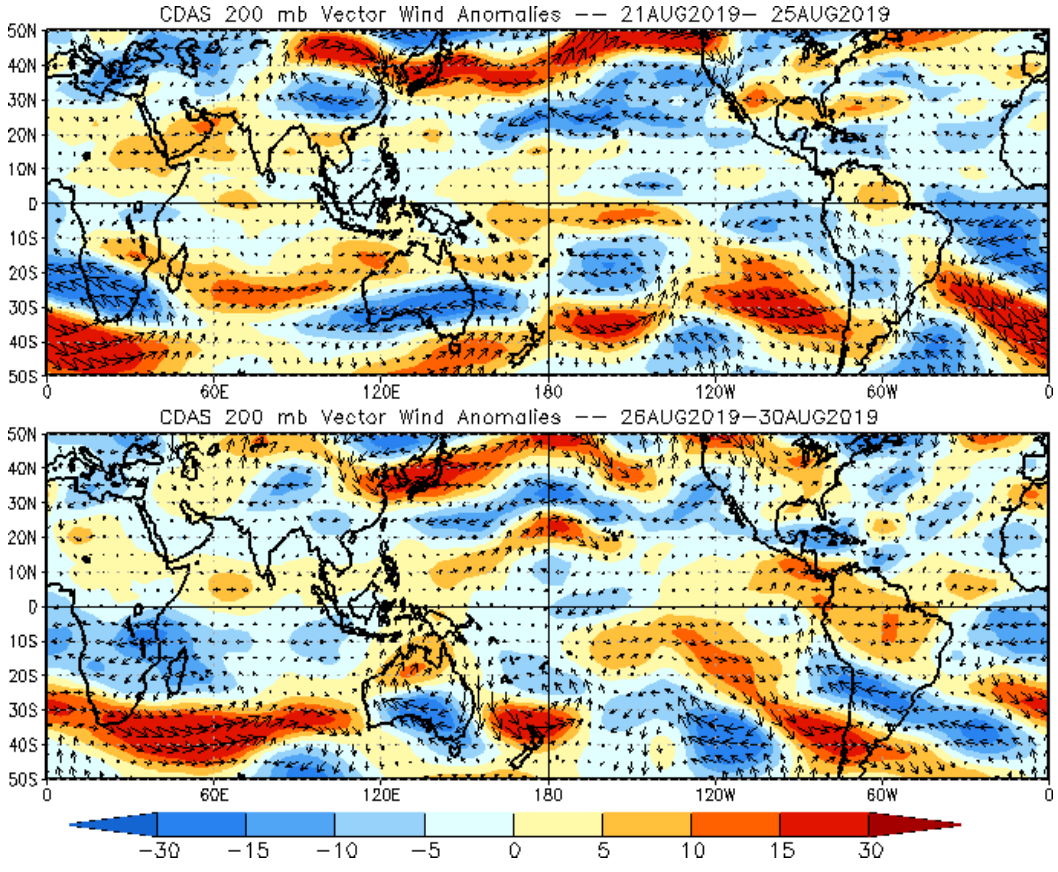


- A Kelvin wave crossed the Western Hemisphere during mid-August and recently propagated east of the Prime Meridian to Africa.
- Rossby and Kelvin wave activity have left the upper-level VP anomaly field noisy over the past two weeks, with a somewhat coherent wave-1 pattern in the background.
- Upper-level convergence remains over North America and has spread further east across the Atlantic toward western Africa over the past week.

200-hPa Wind Anomalies

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



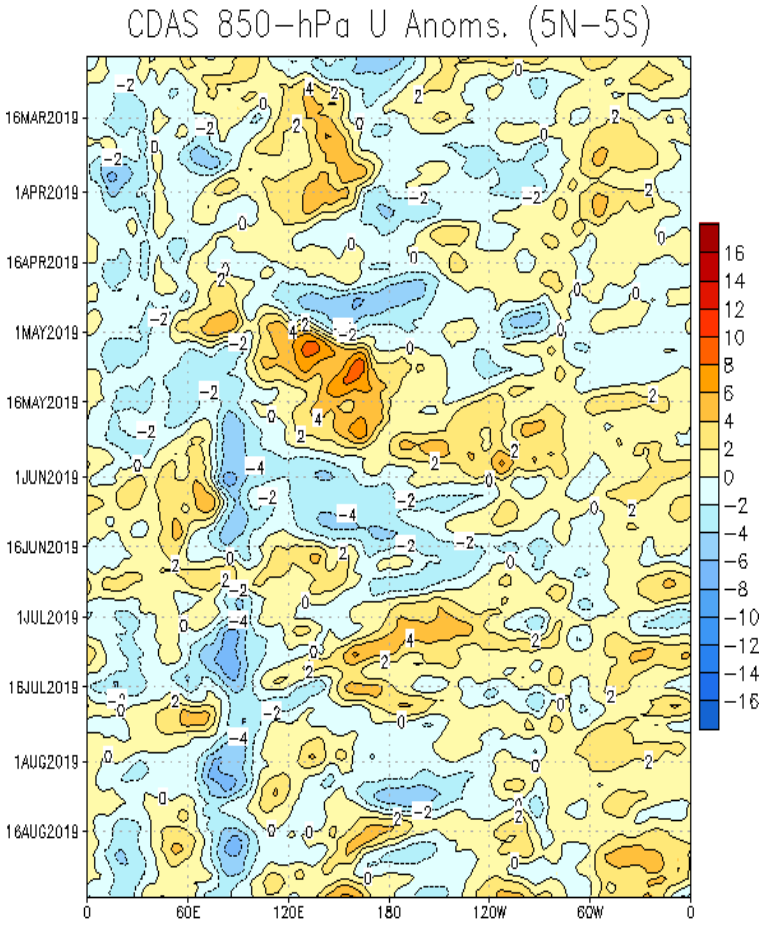


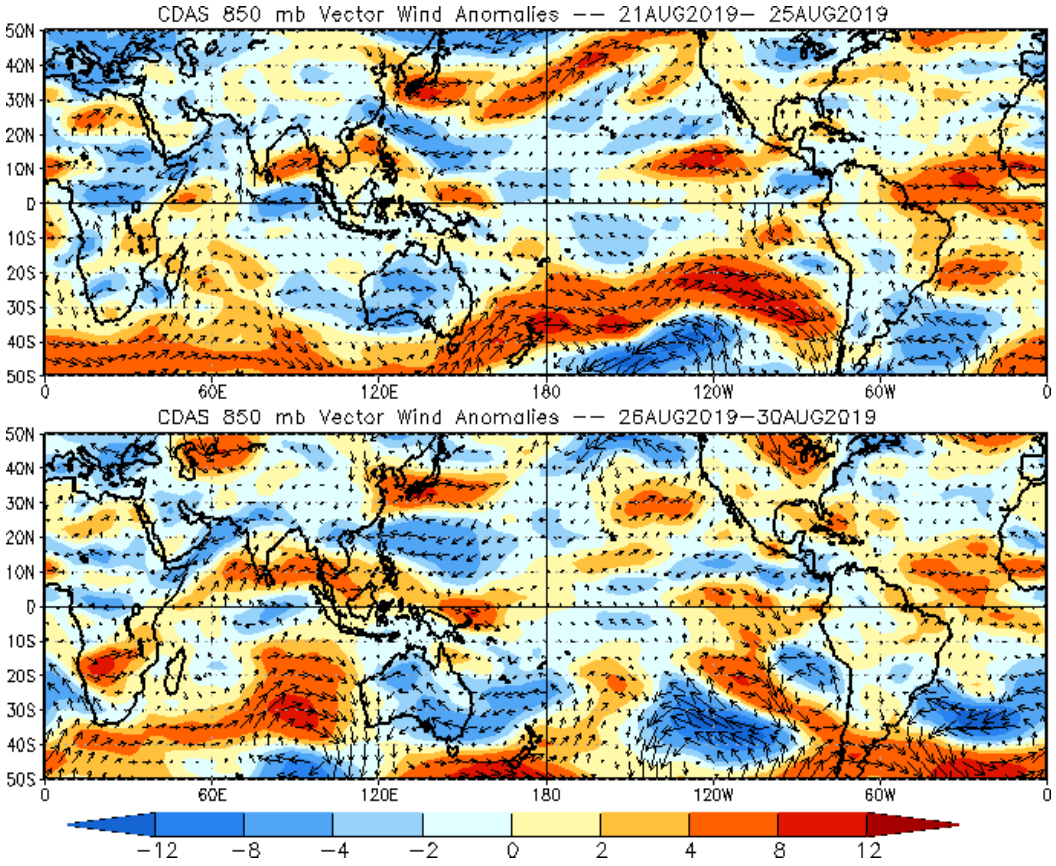
- Anomalous upper-level westerlies moving along the Equator from the Pacific and over North America have broken up the anomalous easterlies over the tropical Atlantic.

- Anomalous flow along the tropical Pacific has weakened over the past week, with an anticyclone centered around 20 N along the Date Line and another over the west coast of the U.S.

850-hPa Wind Anomalies

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



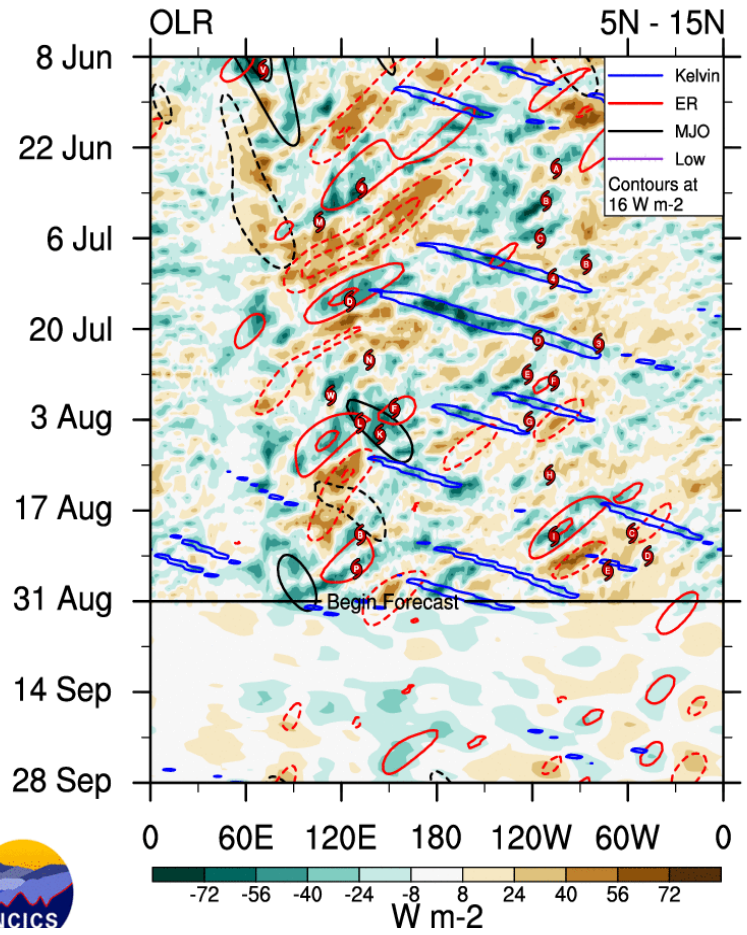


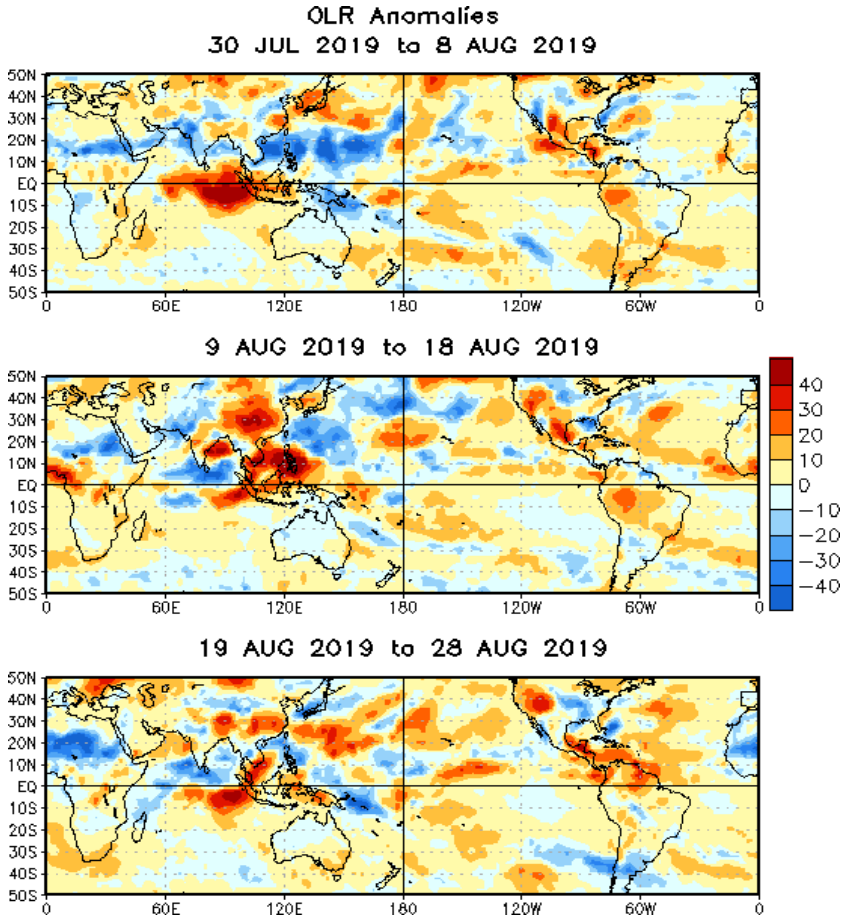
- Low-level westerlies have weakened across the tropical Atlantic and the eastern Pacific during the past five days.

- Anomalous westerly flow has strengthened over the northern Indian Ocean and Maritime Continent, with anticyclonic flow centered south of Japan.

Outgoing Longwave Radiation (OLR) Anomalies

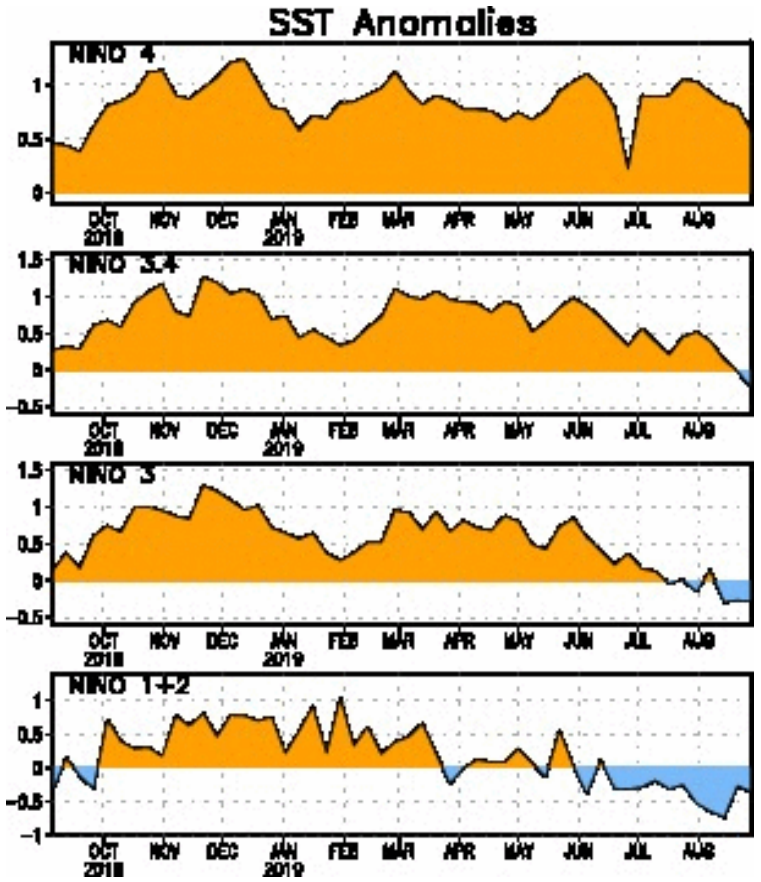
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

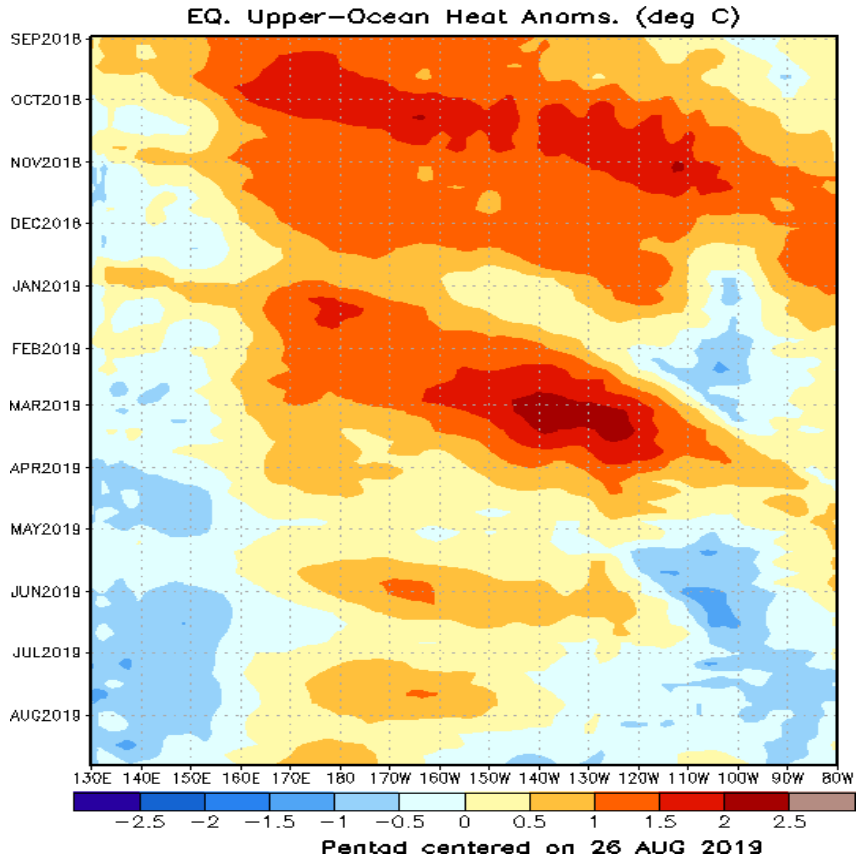




- Kelvin and Rossby waves have been active for the latter half of August throughout the tropics.
- Suppressed convection over the Maritime Continent started to wane last week, possibly due to a weak MJO signal and Kelvin wave activity.
- Anomalous convection has overspread northern Africa, likely due to a Kelvin wave traversing the continent at the end of August.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

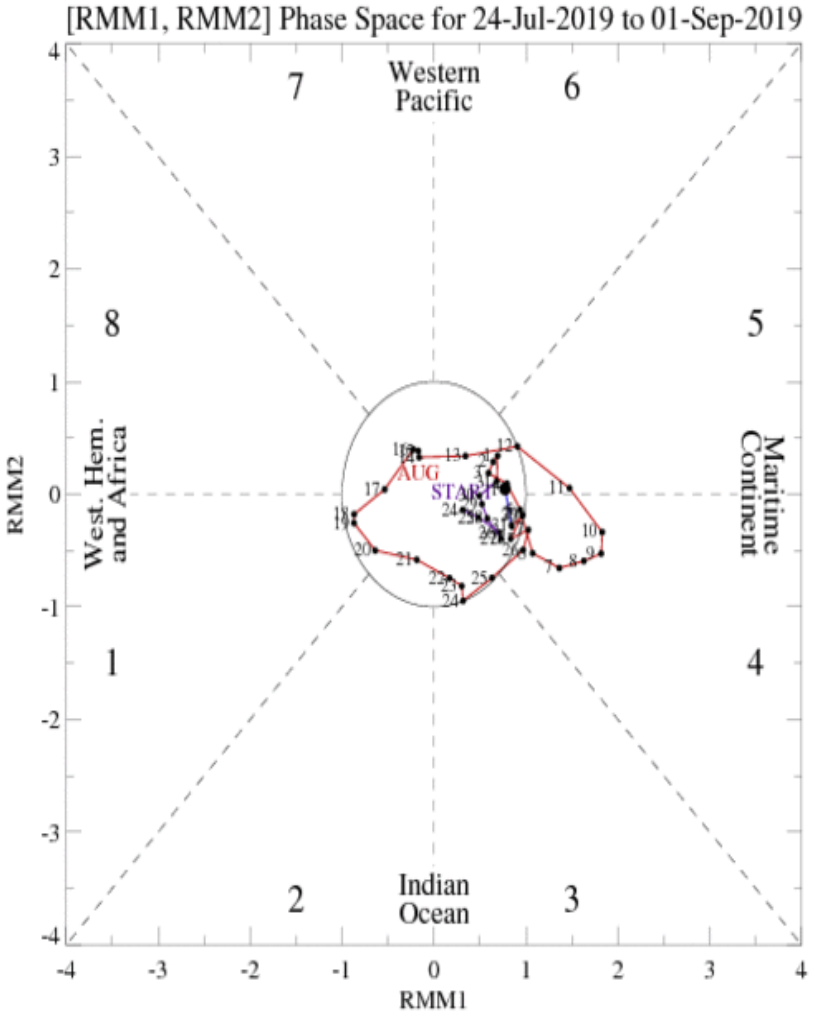




- Equatorial SST anomalies are near to slightly negative across much of the Pacific, particularly the eastern Pacific.
- A downwelling Kelvin wave event was evident over the central and eastern Pacific during mid-May through mid-June, but its amplitude was weaker than what was observed in previous events. Overall, upper-ocean heat content has continued to steadily decline over the past several months.
- Another weak downwelling wave developed in response to recent period of anomalous westerlies over the central Pacific.

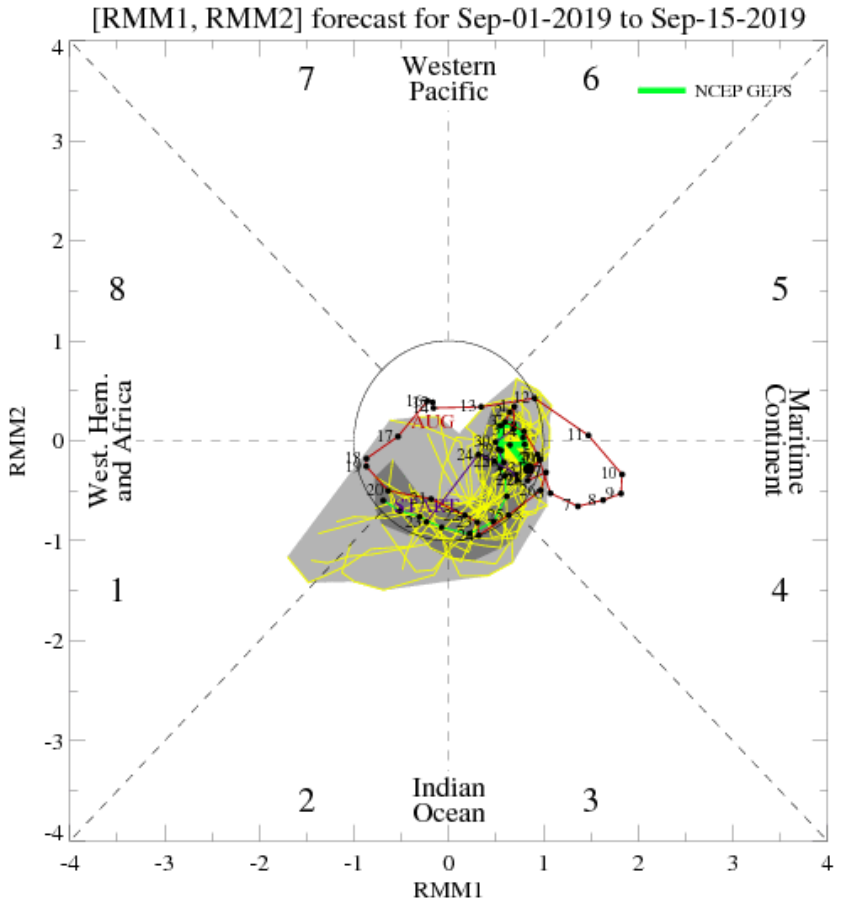
MJO Index: Recent Evolution

- The projection of the intraseasonal signal in RMM space remains weak and incoherent.
- A brief period of resurgence of the signal was seen in early to mid August, but since then, the signal has remained within the unit circle.
- Whatever weak signal there is has been meandering over the Maritime Continent.

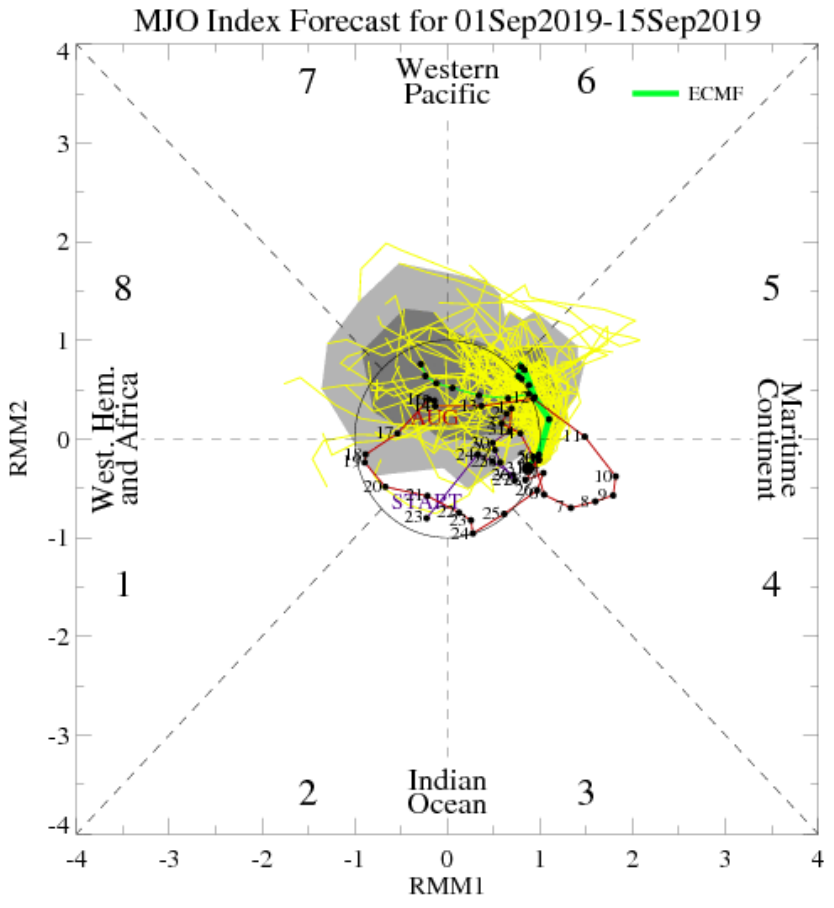


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



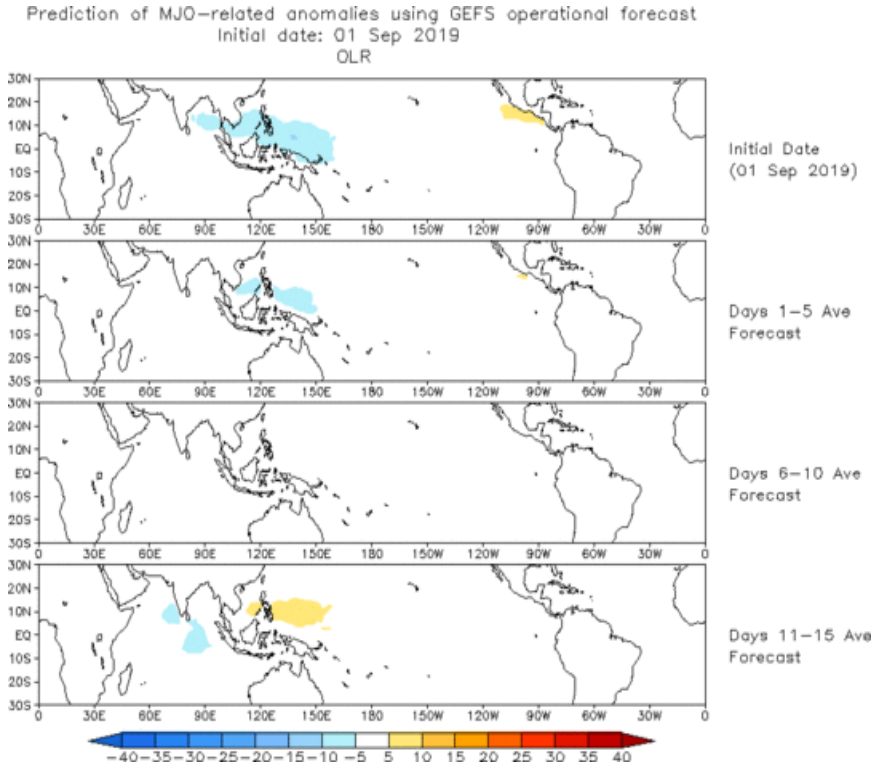
ECMWF Forecast

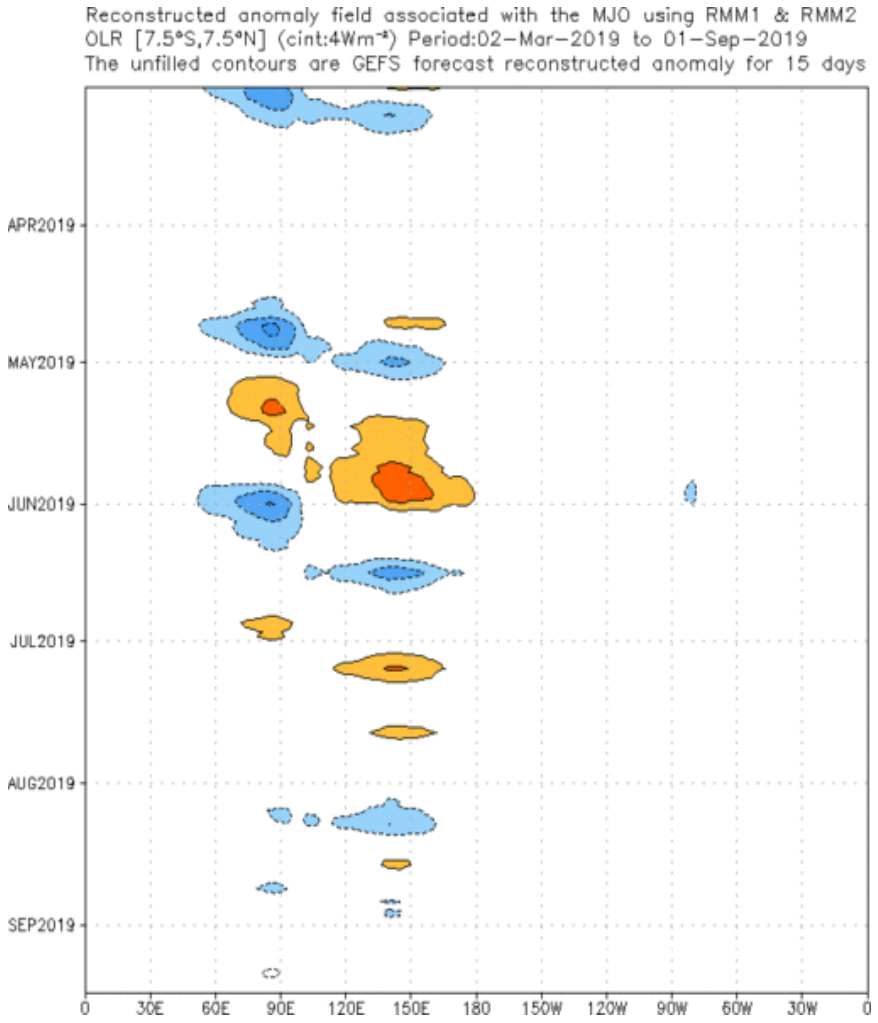
- The GEFS indicates a continued weak MJO signal during the next two weeks, remaining over the Maritime Continent and Indian Ocean.

- Many of the ECMWF ensemble members feature a slight increase in the amplitude of the RMM index with eastward propagation over the Maritime Continent and Western Pacific. However, the high amount of spread between ensemble members limits the confidence in that forecast.

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.)

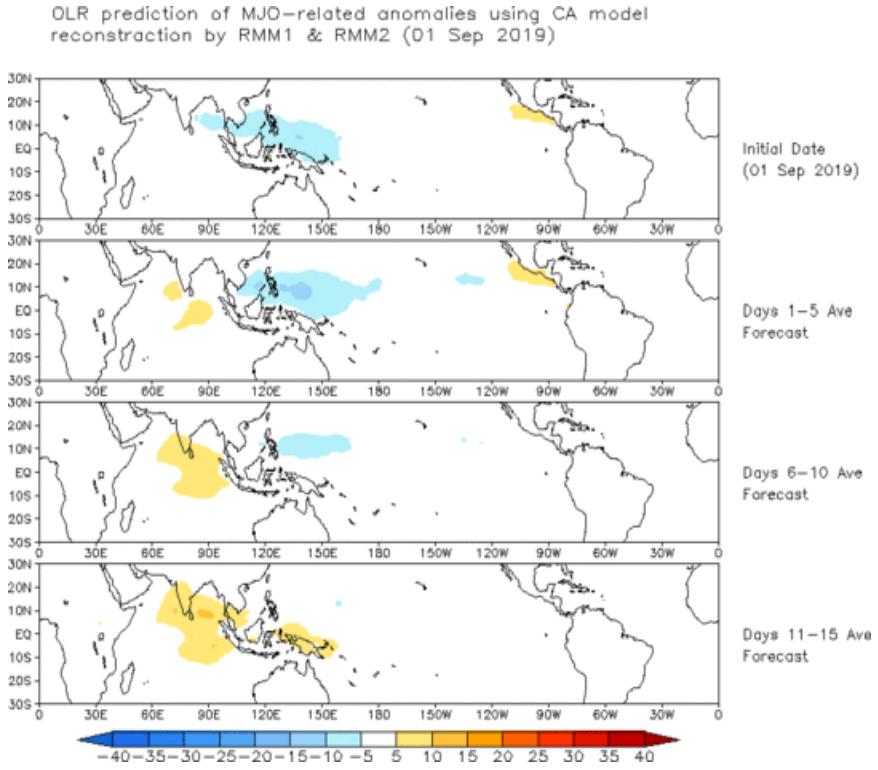


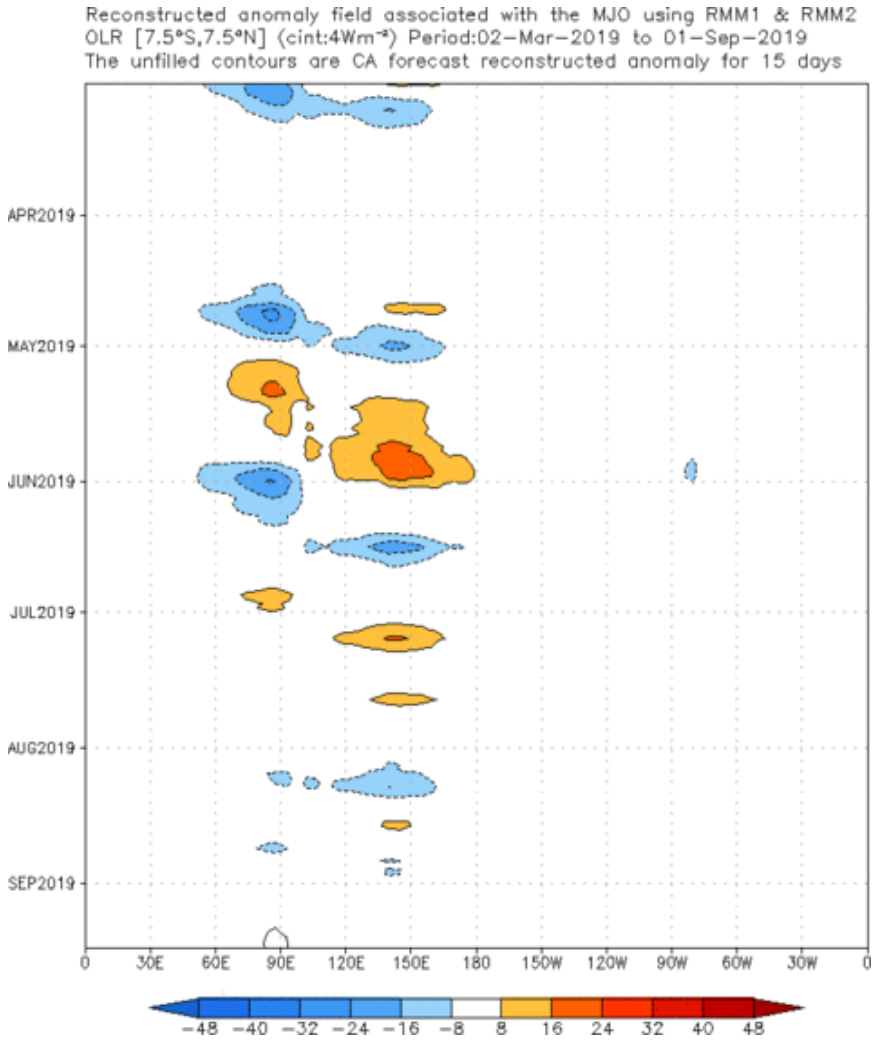


- The spatial depiction of OLR anomalies based on the GEFS RMM index shows little to no anomalies.

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.)

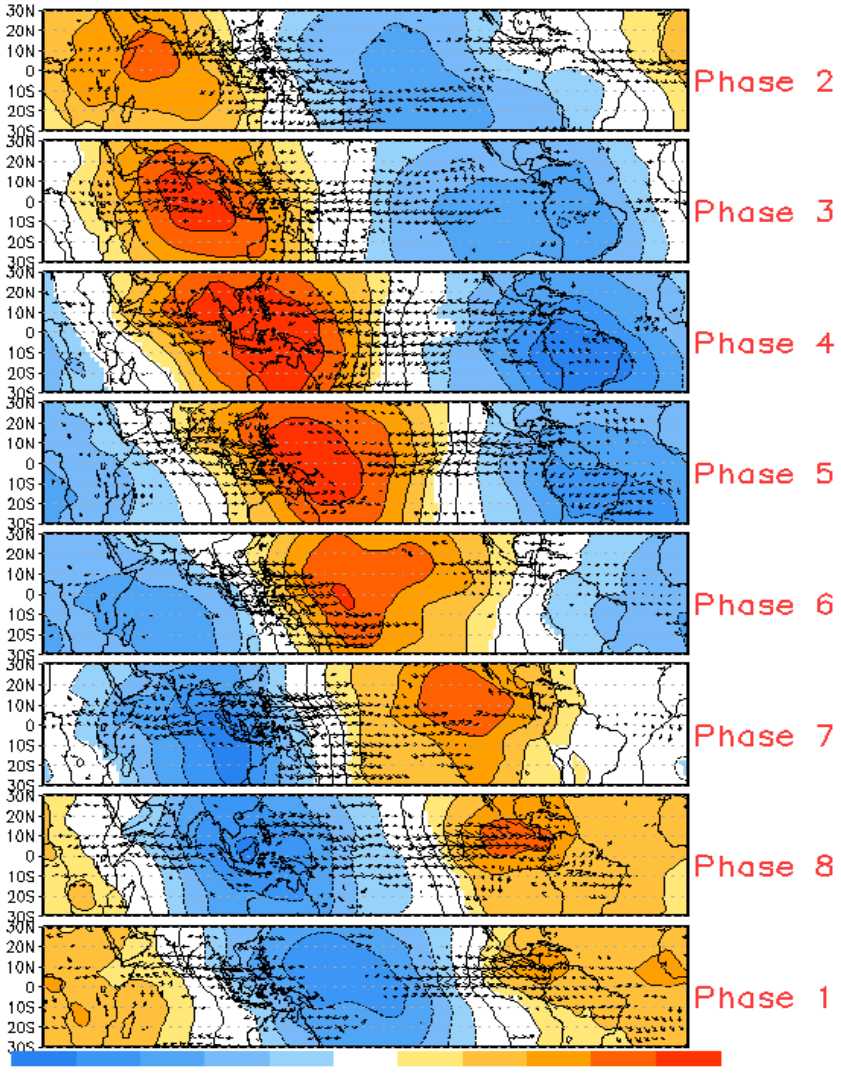




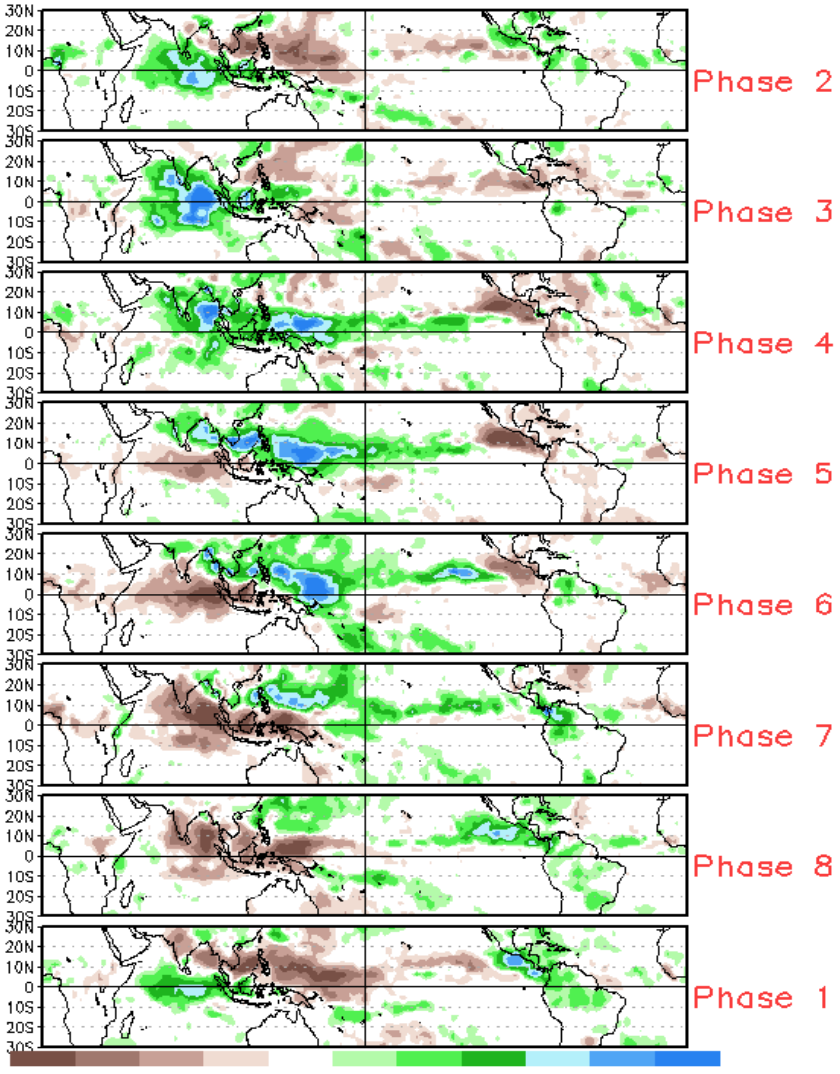
- The constructed analog MJO forecast indicates enhanced convection shifting east from the Maritime Continent to the West Pacific during week-1, and suppressed convection developing over the Indian Ocean in week-2.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



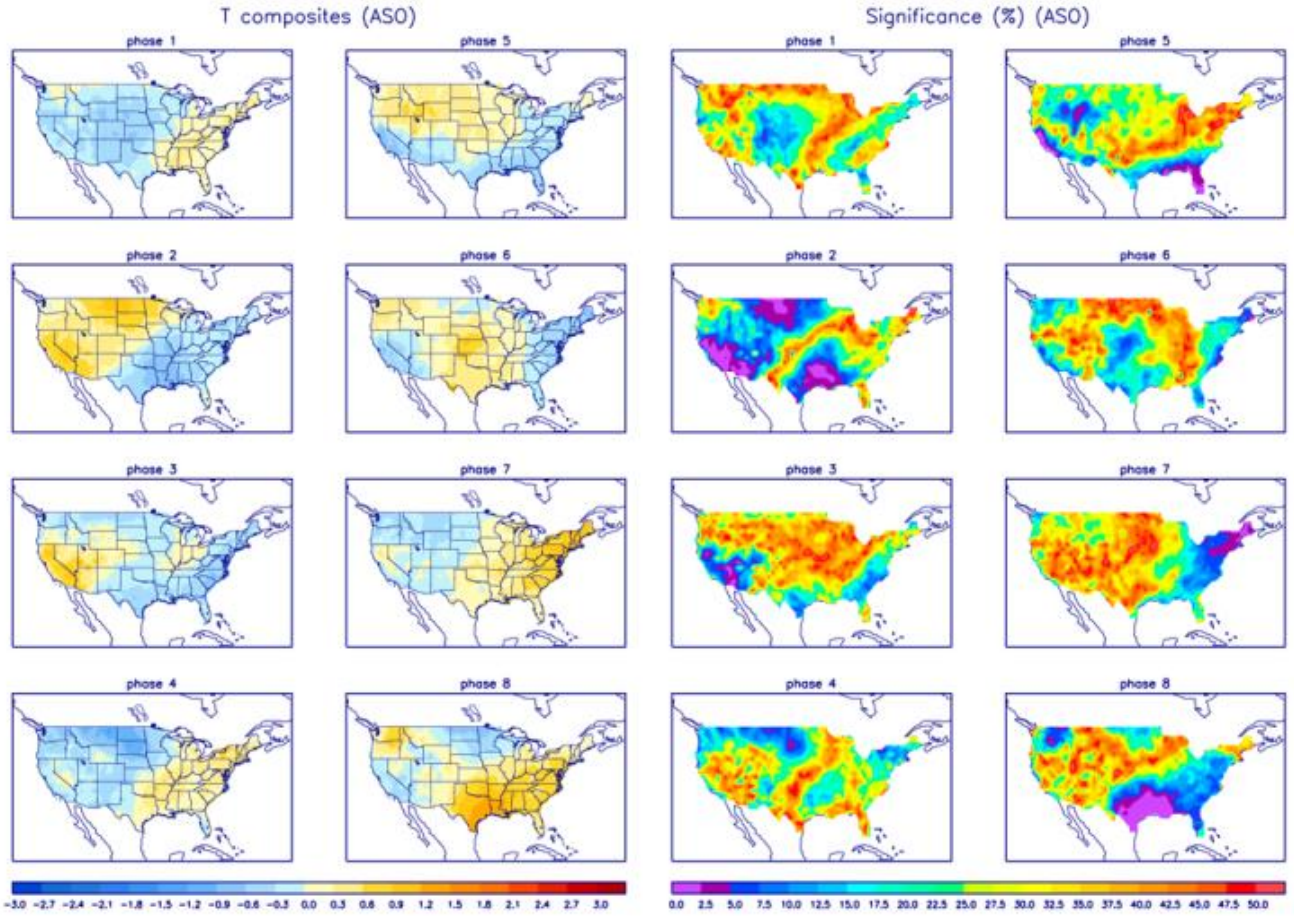
Precipitation Anomalies



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.

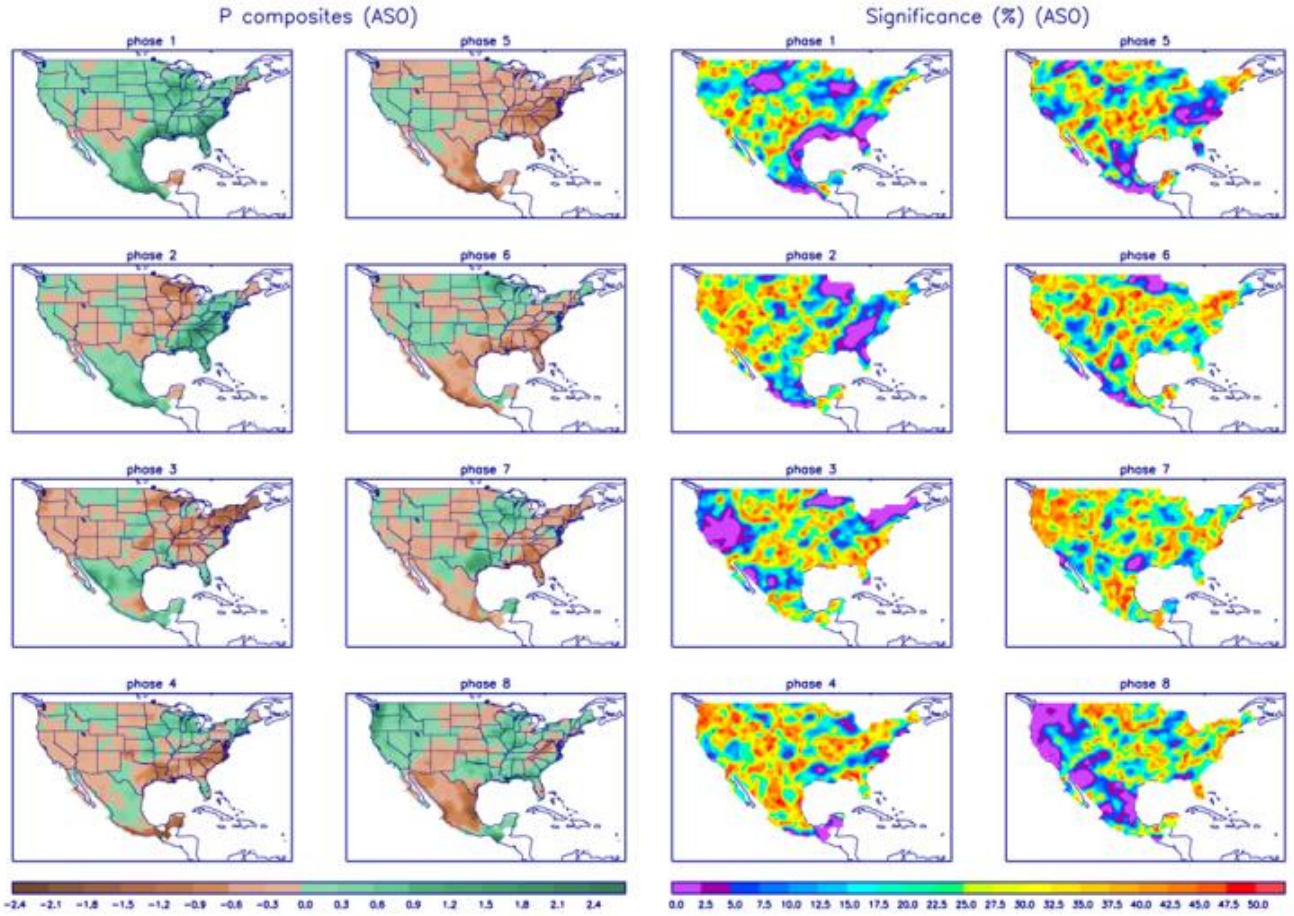


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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