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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
14 July 2025

Overview

- A low frequency enhanced convective signal continues to meander across the Maritime Continent and Western Pacific.

- Dynamical models depict a robust MJO emerging across the Western Pacific in mid- to late-July, with eastward propagation into the Western Hemisphere possible by the end of the month.

- Increased tropical cyclone (TC) activity remains likely across the Western North Pacific during the next 2 weeks tied to the aforementioned enhanced low frequency convective signal.

- The developing MJO favors increasing chances of TC development spreading into the Eastern North Pacific toward the end of July into early August ending the current lull in TC activity across the basin.

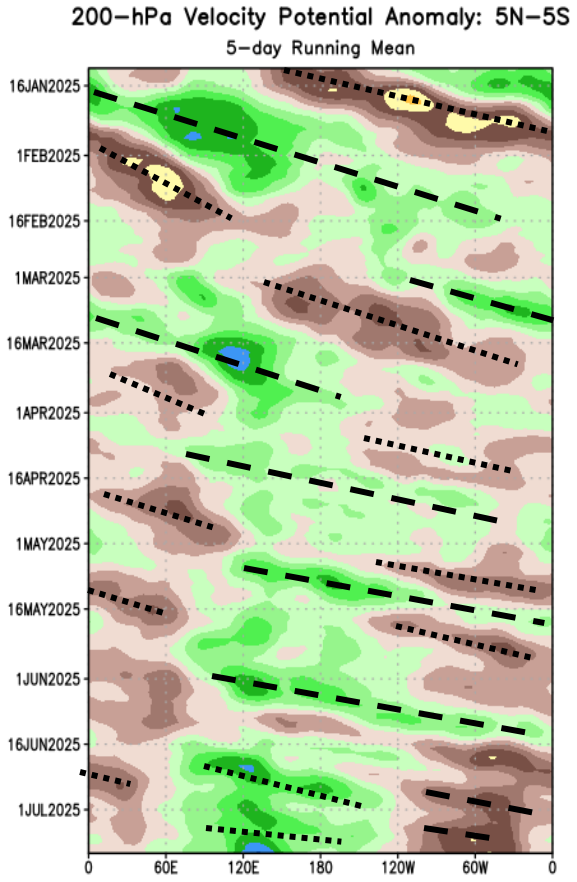
- While the Atlantic is likely to continue to remain quiet in terms of TC activity for the next few weeks, signs point to this MJO event reaching a more favorable position in early- to mid-August, possibly leading to increased chances of TC formation coinciding with the uptick in climatology across the Main Development Region.

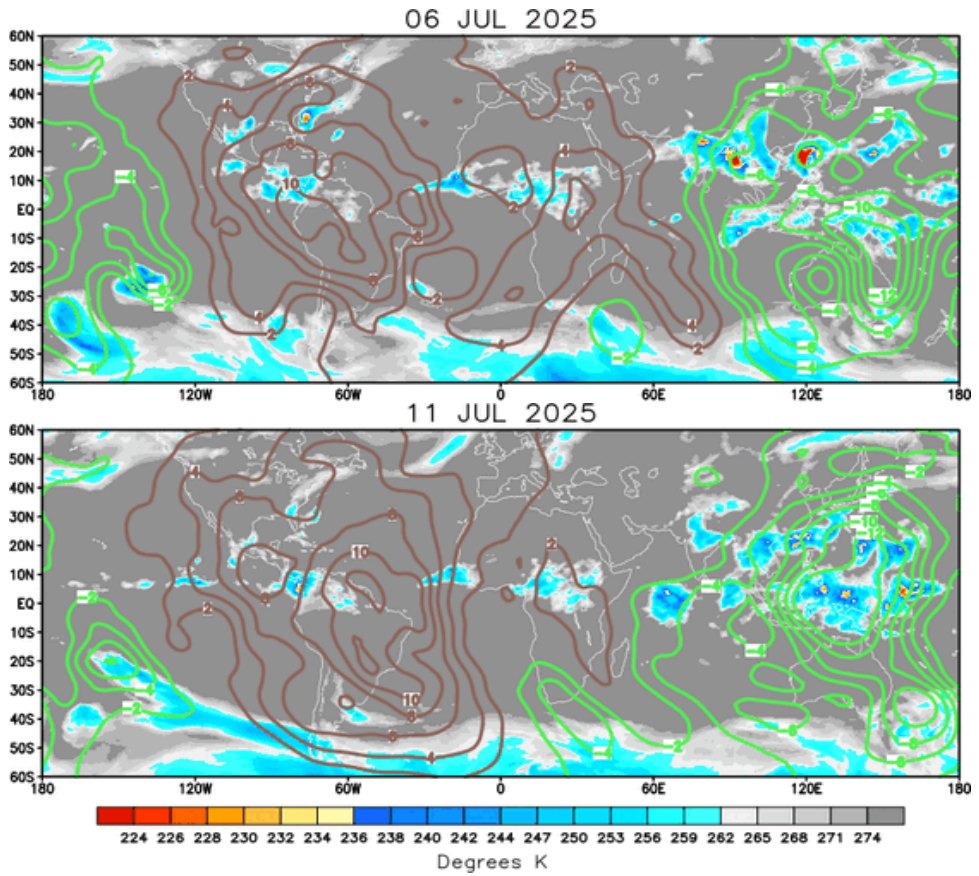
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

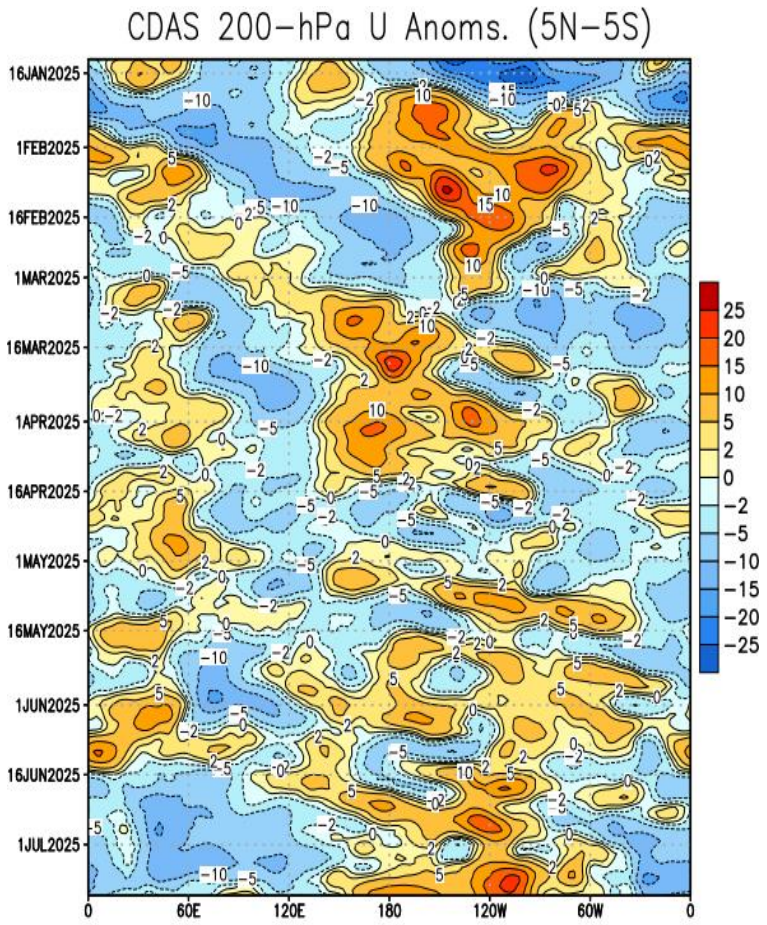


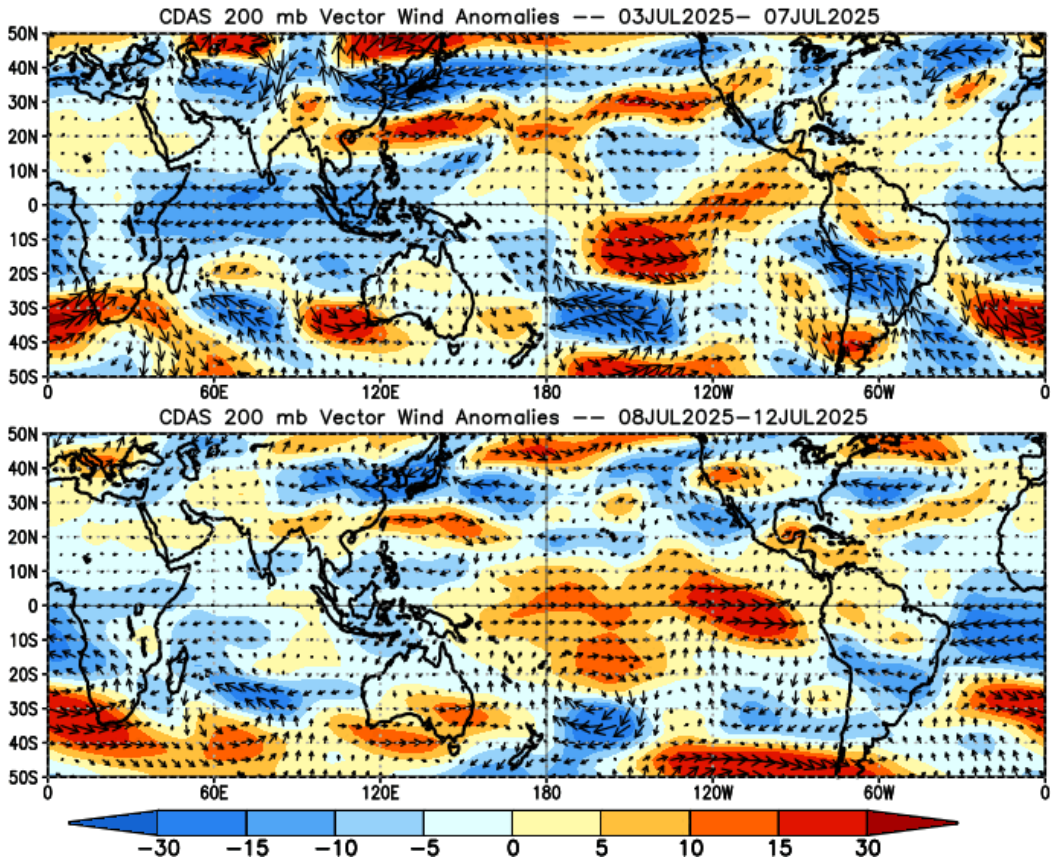


- The global upper-level velocity potential pattern remains in a very stable wave-1 asymmetry pattern.
- Anomalous upper-level divergence (enhanced convection) is observed across much of the Maritime Continent and Western and Central Pacific. Conversely, anomalous convergence aloft (suppressed convection) is noted across the Americas, extending through the Atlantic, and into portions of Europe and Africa.

200-hPa Wind Anomalies

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

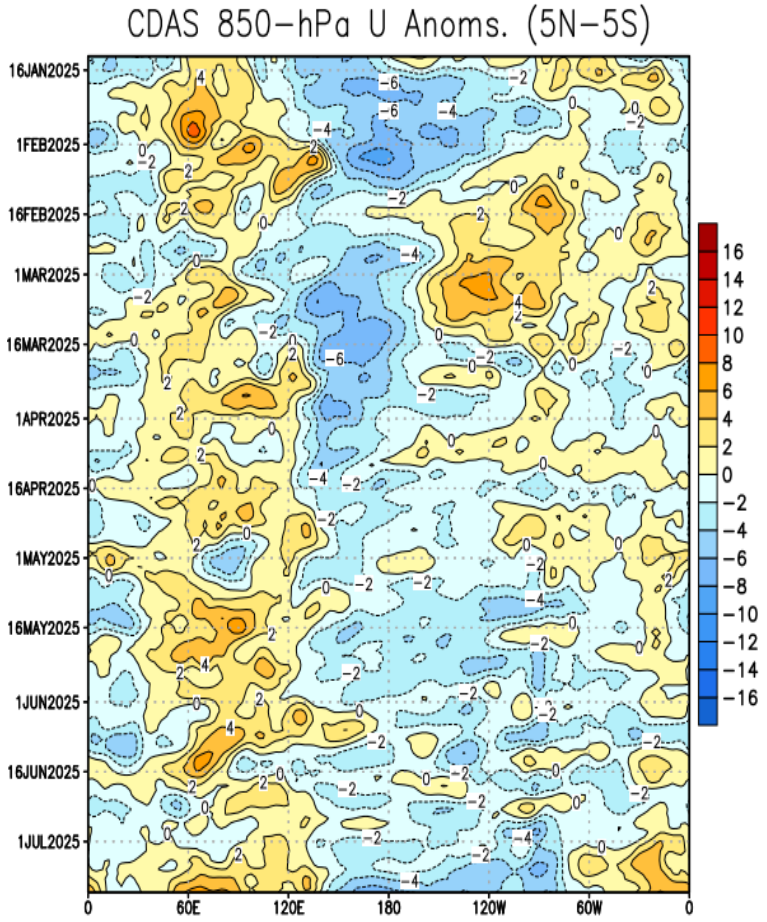


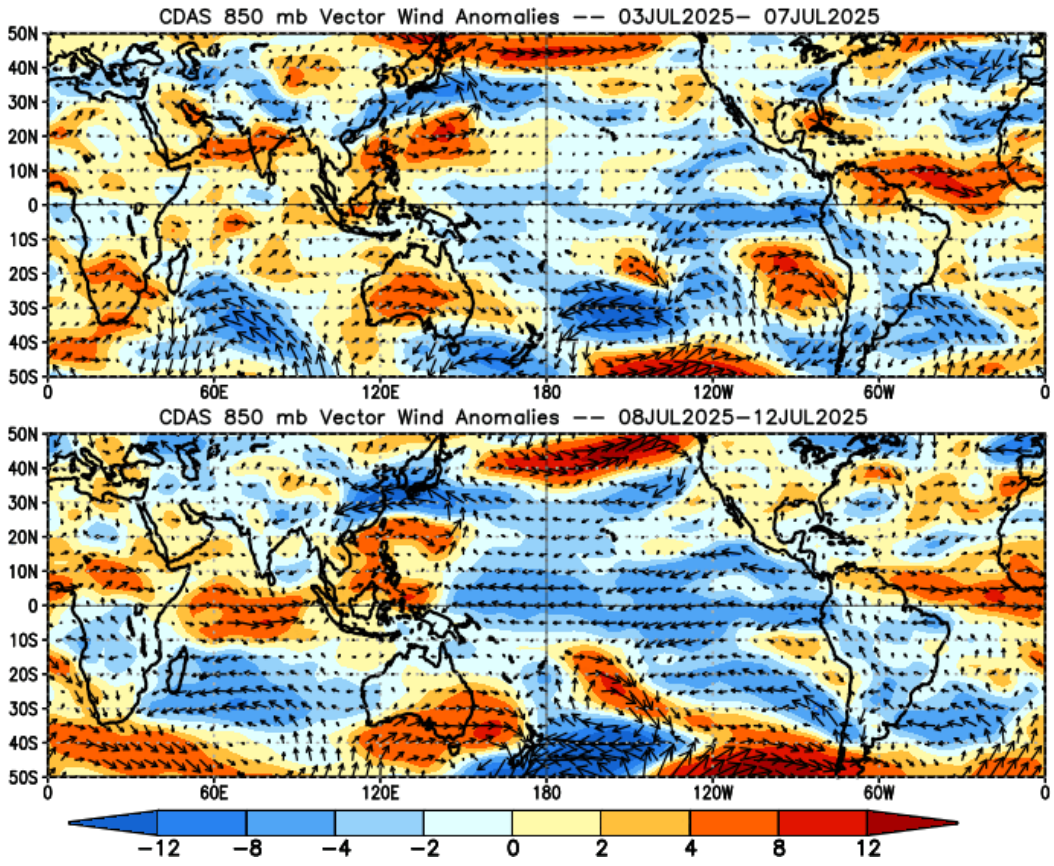


- Anomalous upper-level easterlies across the equatorial Indian Ocean have weakened during the past week.
- Upper-level westerlies have increased over much of the central and eastern tropical Pacific, creating an unfavorable environment for TC formation.

850-hPa Wind Anomalies

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

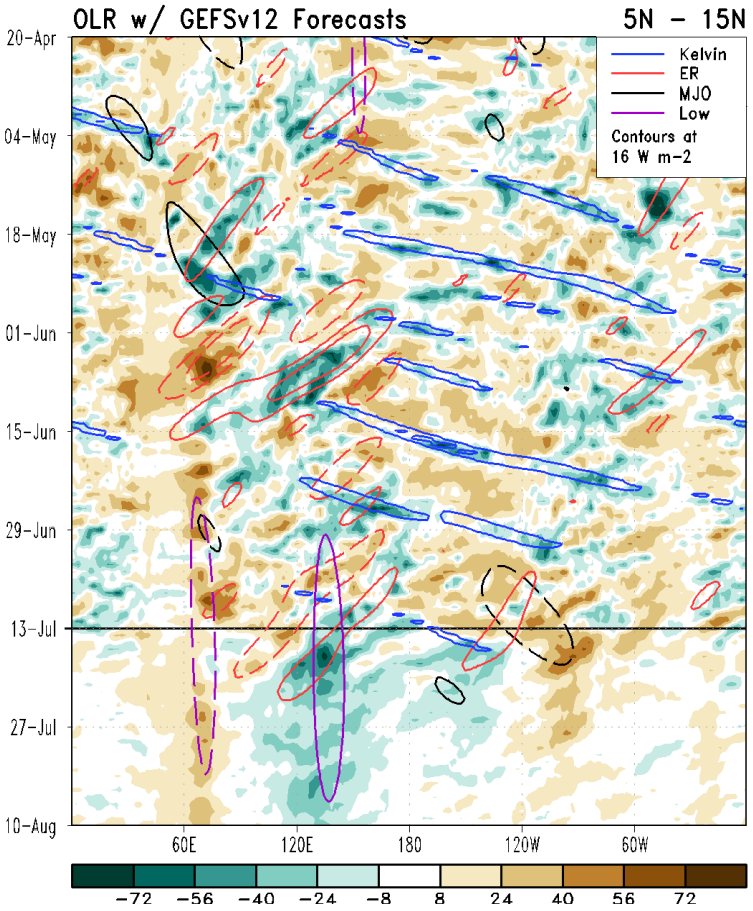


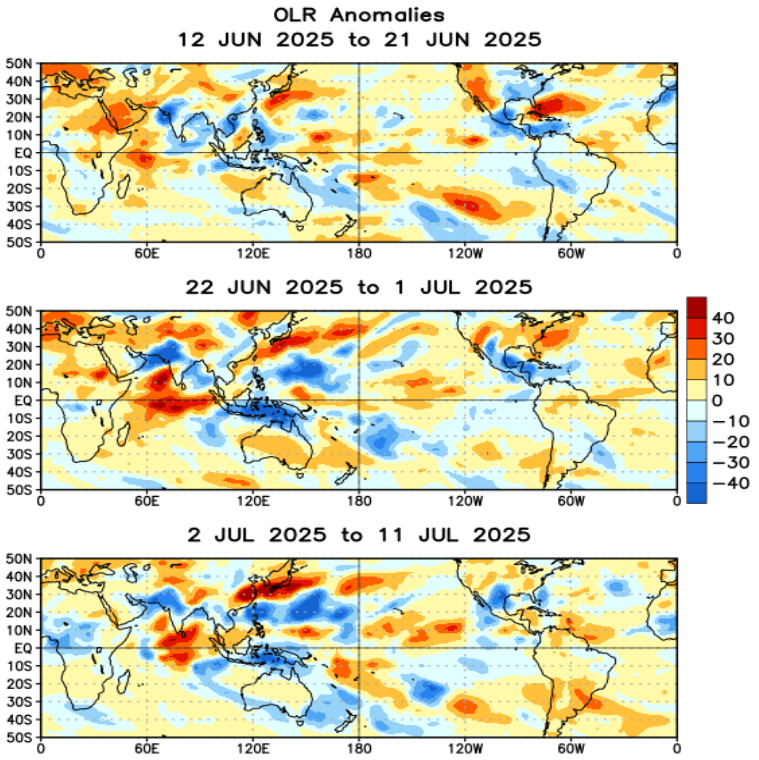


- Anomalous low-level westerlies across the Indian Ocean and Maritime Continent re-strengthened during the past week following a brief period of weakening.
- The low frequency enhanced convective signal across the Maritime Continent has led to increased trades downstream across much of the equatorial Pacific.
- Lower-level westerlies continue across the tropical Atlantic.

Outgoing Longwave Radiation (OLR) Anomalies

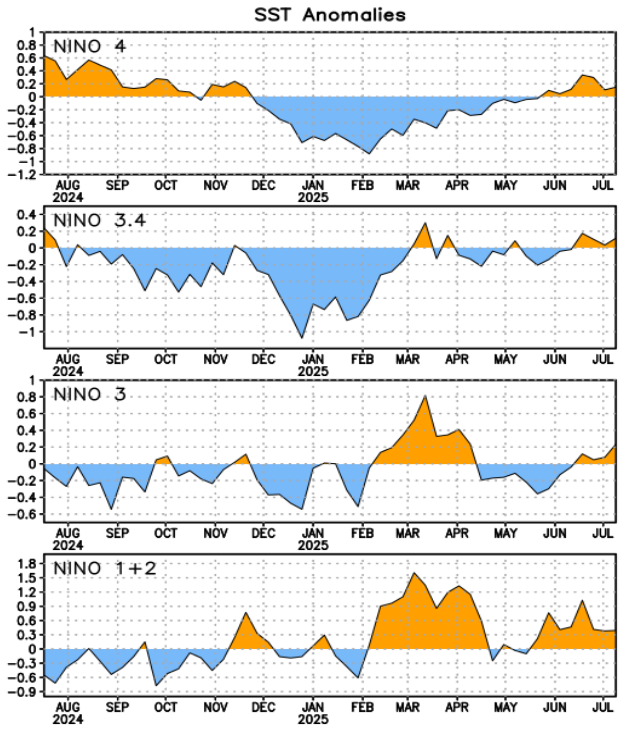
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

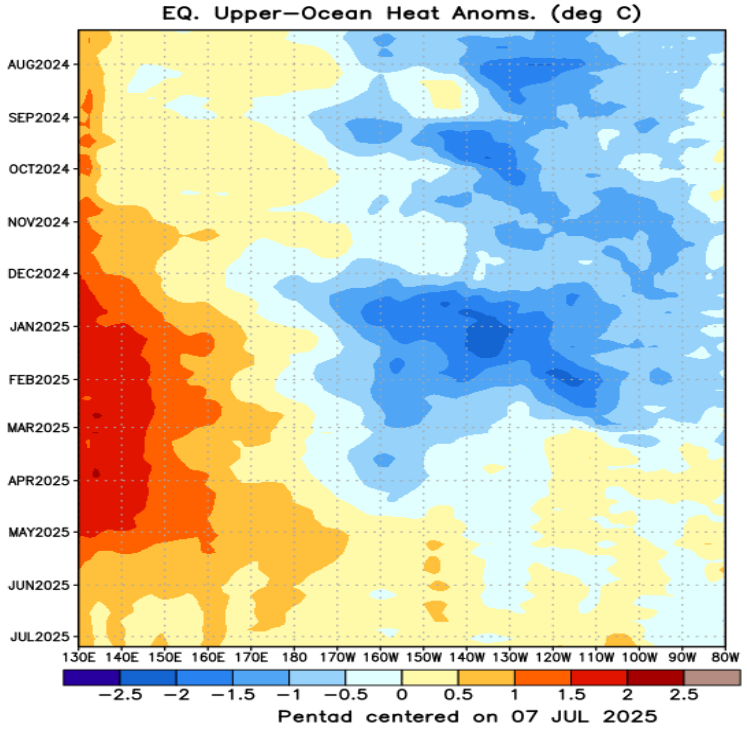




- A low frequency enhanced (suppressed) convective signal is coming through the OLR objective filtering across the Maritime Continent and Western Pacific (Indian Ocean).
- Equatorial Rossby wave activity constructively interfering with the enhanced low frequency convective signal resulted in strengthening negative OLR anomalies across the Maritime Continent and Western Pacific, resulting in enhanced TC activity over the region.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

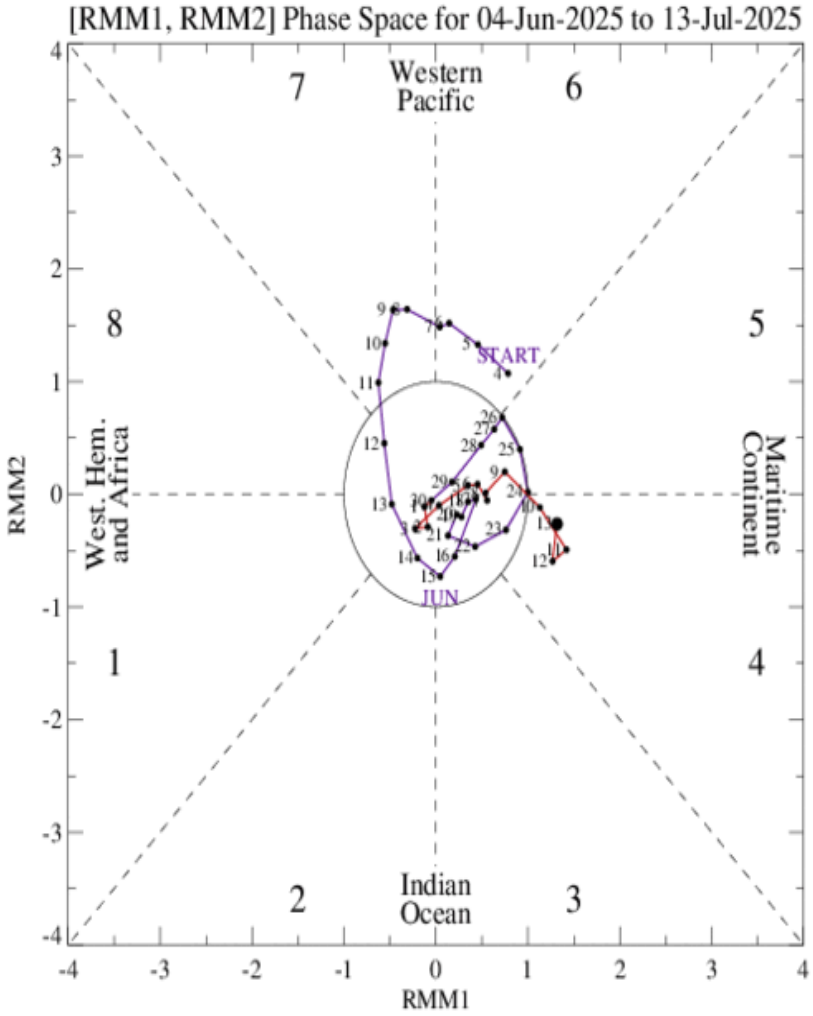




- SST anomalies are weakly positive in all of the NINO regions, with little to no change since the previous week.
- Positive subsurface upper-ocean heat content anomalies have decreased across the Western Pacific during the past few weeks.
- Closer to normal upper-ocean heat content is observed throughout much of the Eastern Pacific.

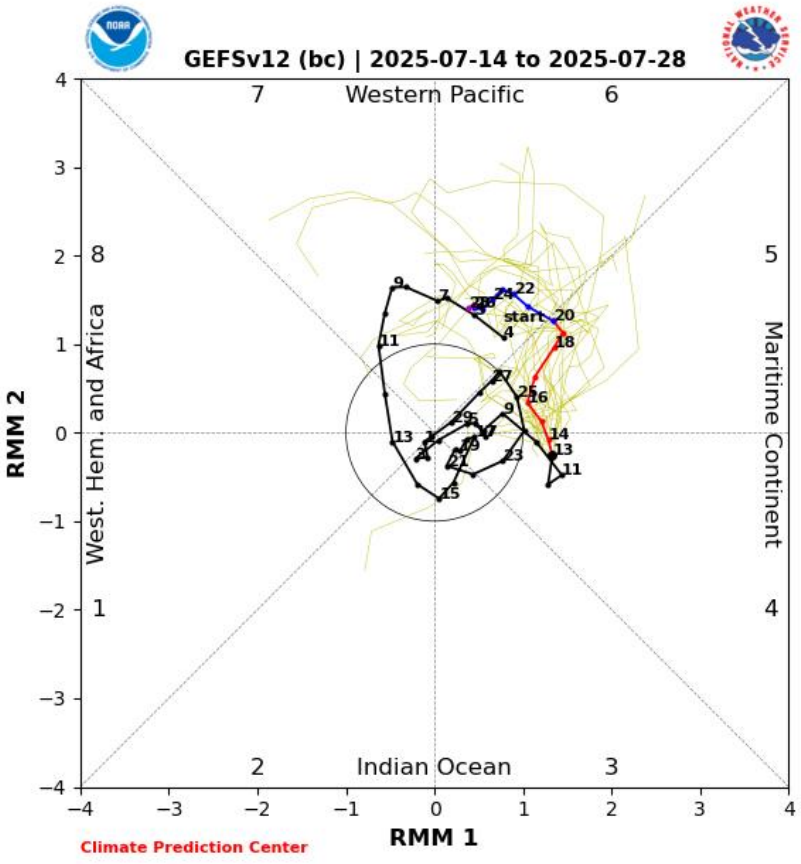
MJO Index: Recent Evolution

- The RMM-based MJO index has emerged from the unit circle in the past week, and continues to meander within phase-4 (Maritime Continent).

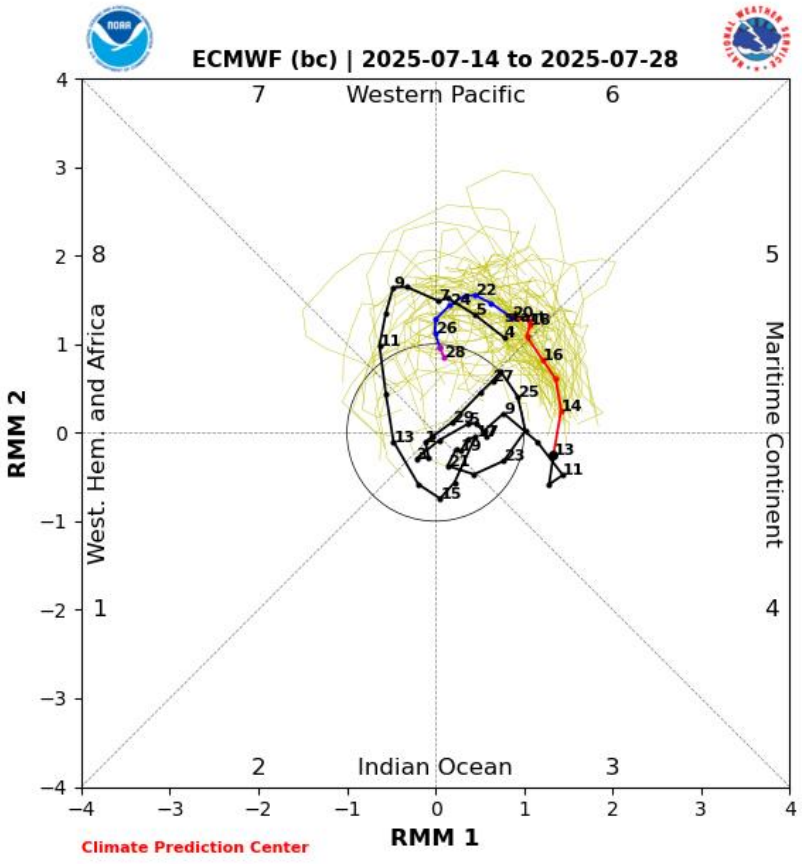


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

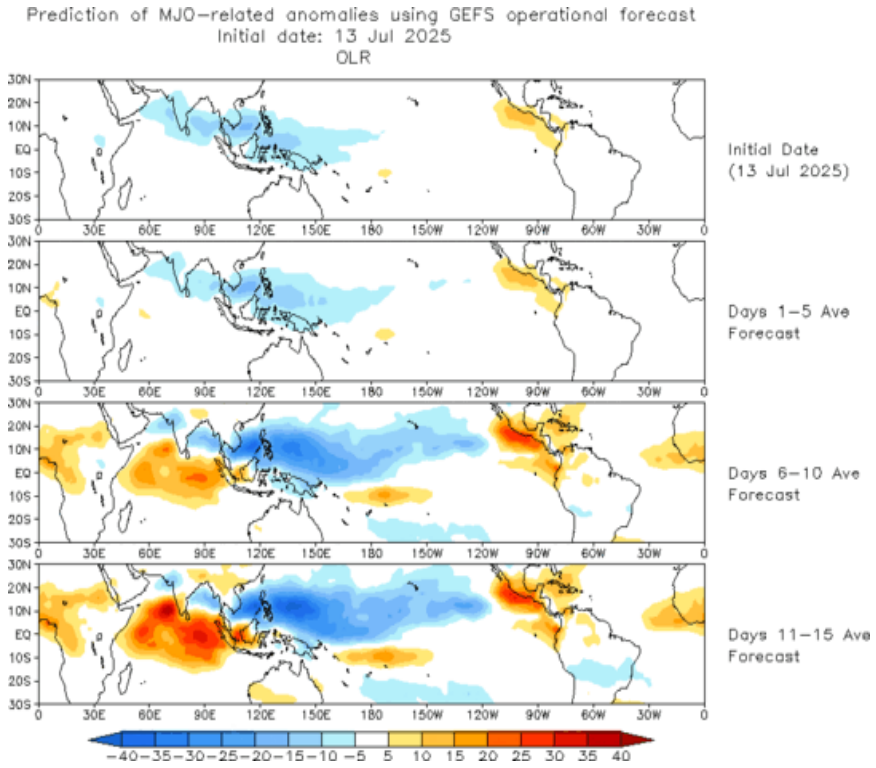


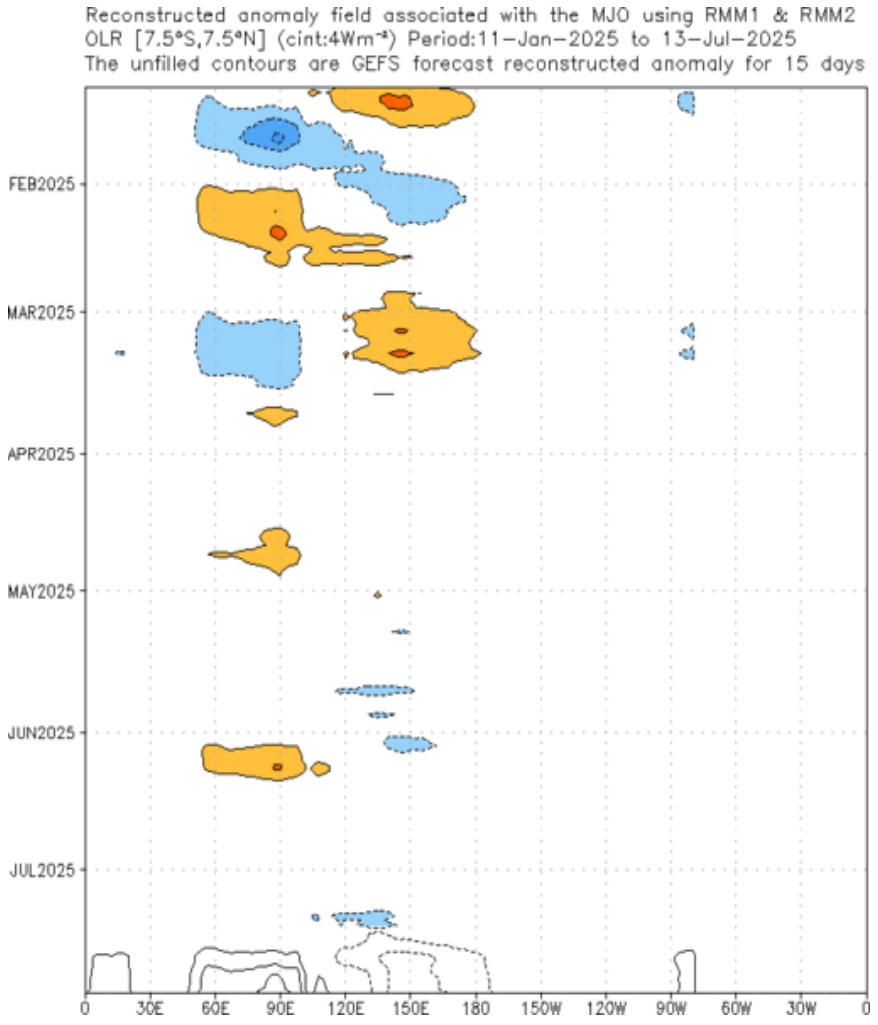
ECMWF Forecast

- The GEFS and ECMWF ensembles favor a strengthening MJO event during the next 2 weeks across the Maritime Continent and Western Pacific.
- The ECMWF is a bit faster with the eastward propagation of the MJO compared to the GEFS, with some individual ensemble members reaching the Western Hemisphere by the end of July.

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.)

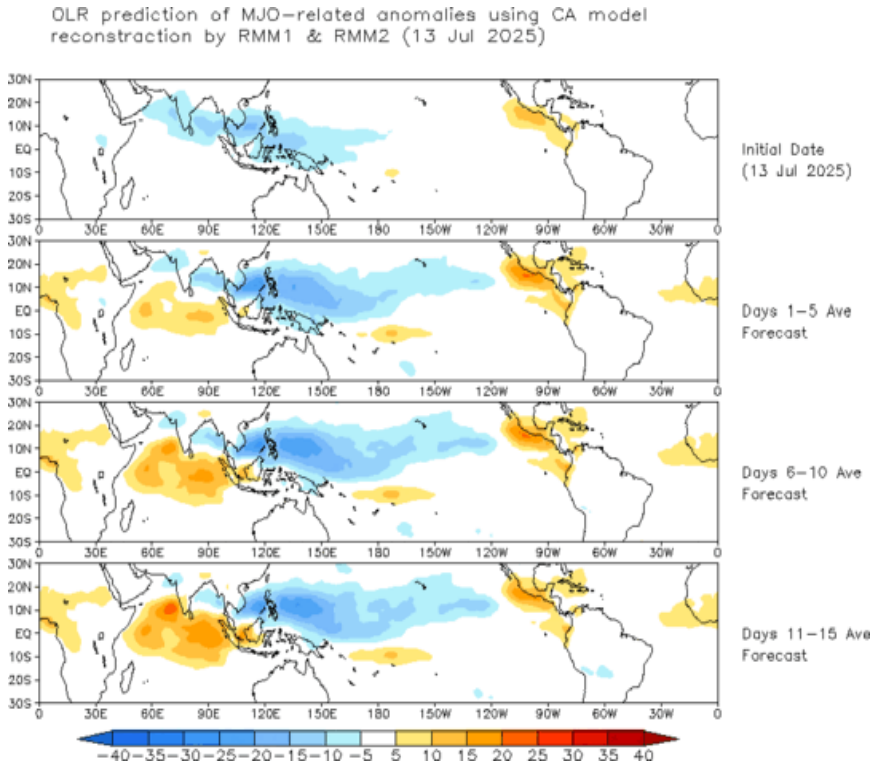


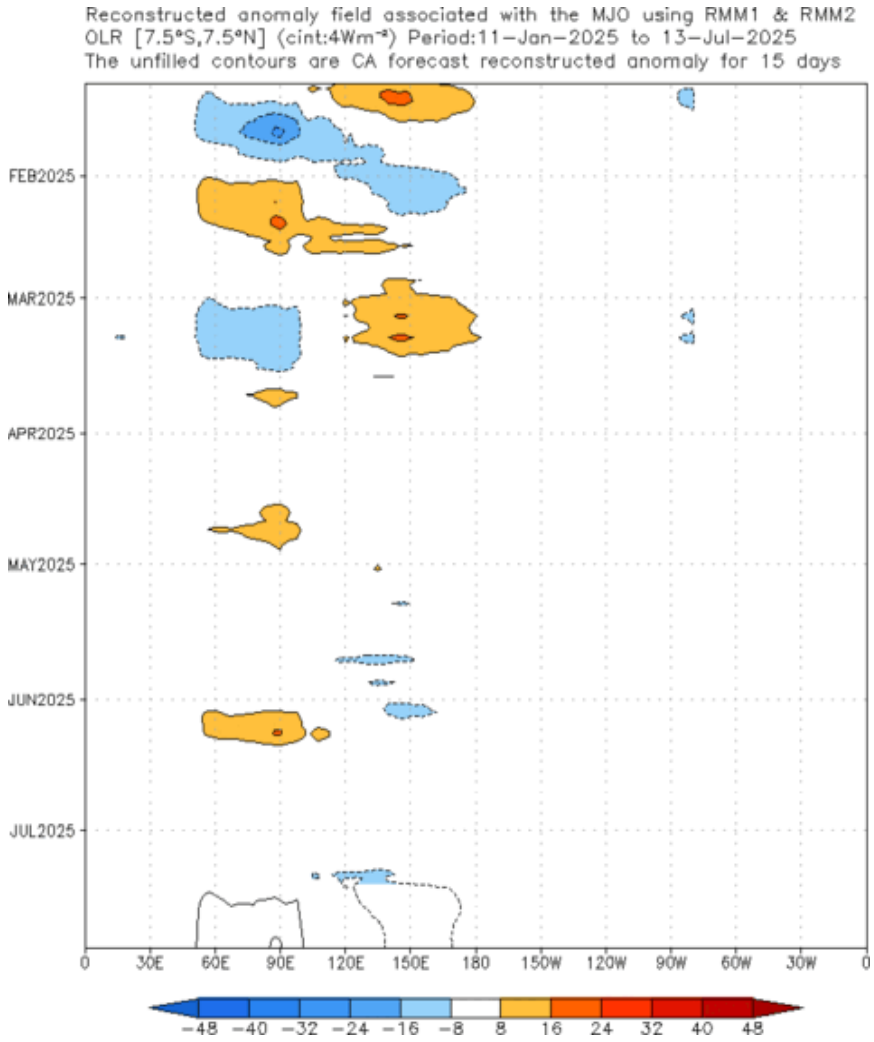


- The GEFS OLR tool depicts negative OLR anomalies (enhanced convection) spreading across the Western and Central Pacific through the end of week-2.
- Positive OLR anomalies (suppressed convection) are forecast across the tropical Americas and the Indian Ocean during week-2.

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.)

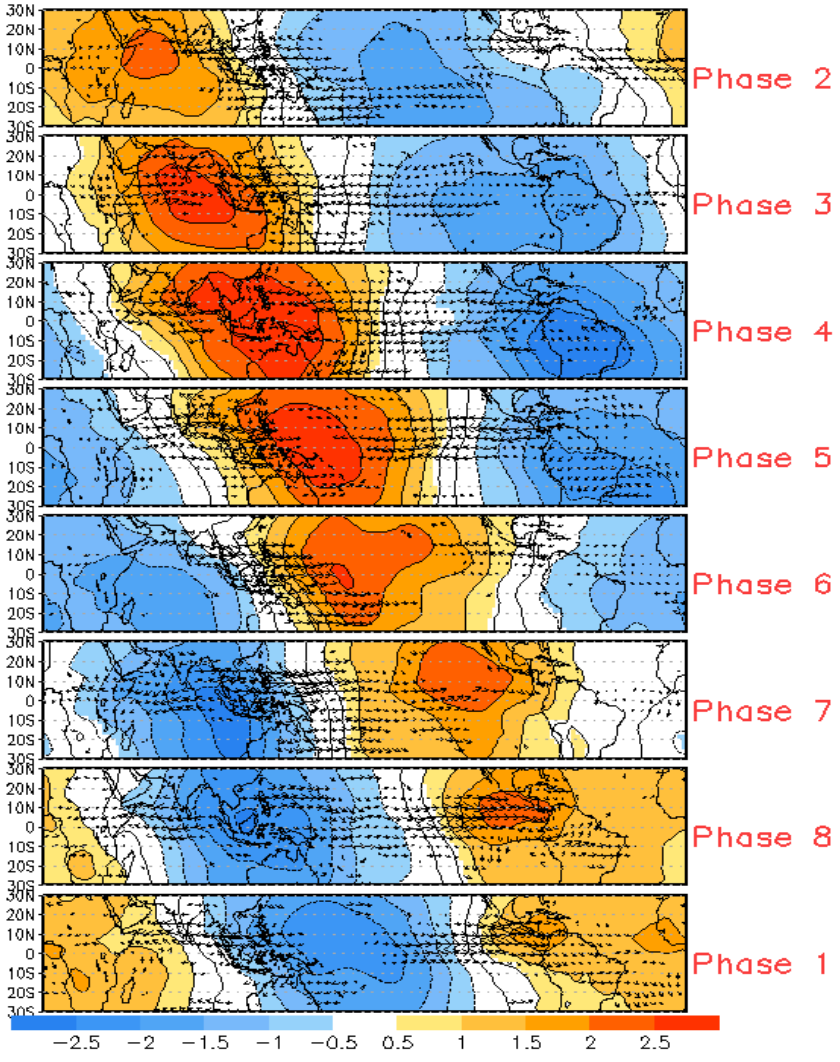




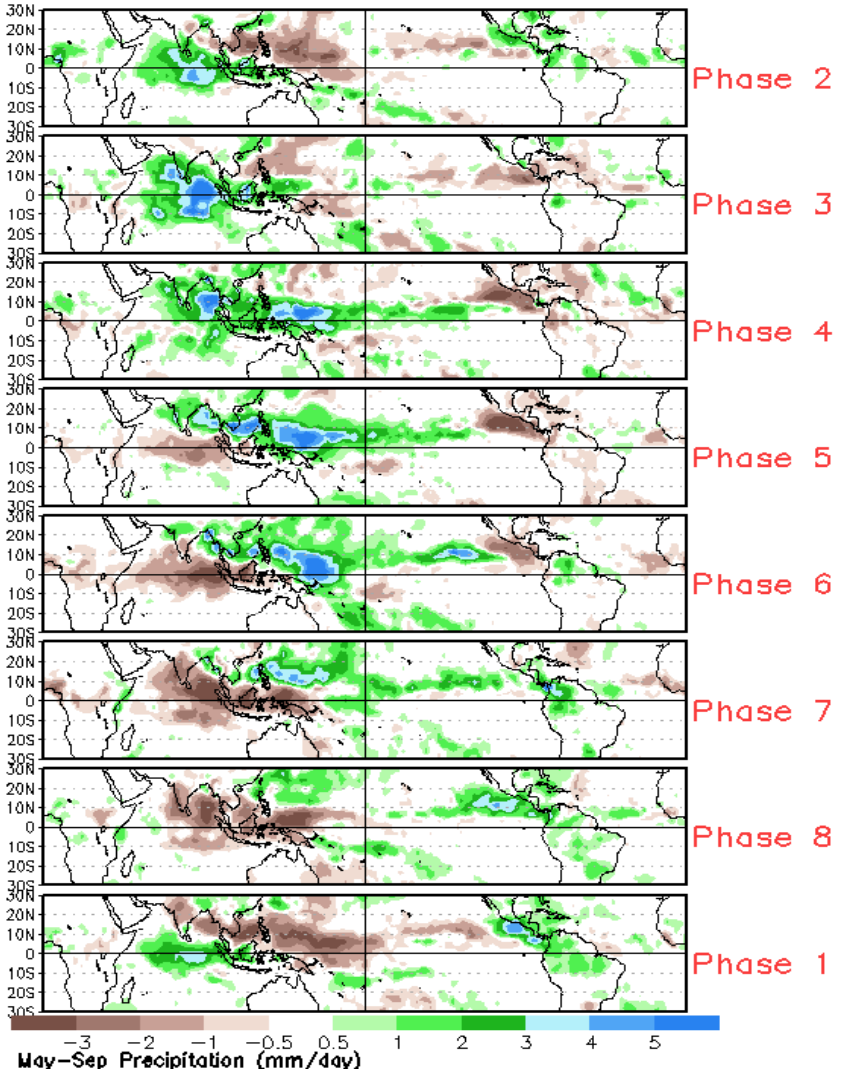
- The Constructed Analog tool is in very good agreement with the GEFS OLR tool, depicting the same general forecast evolution highlighted on the previous slide.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



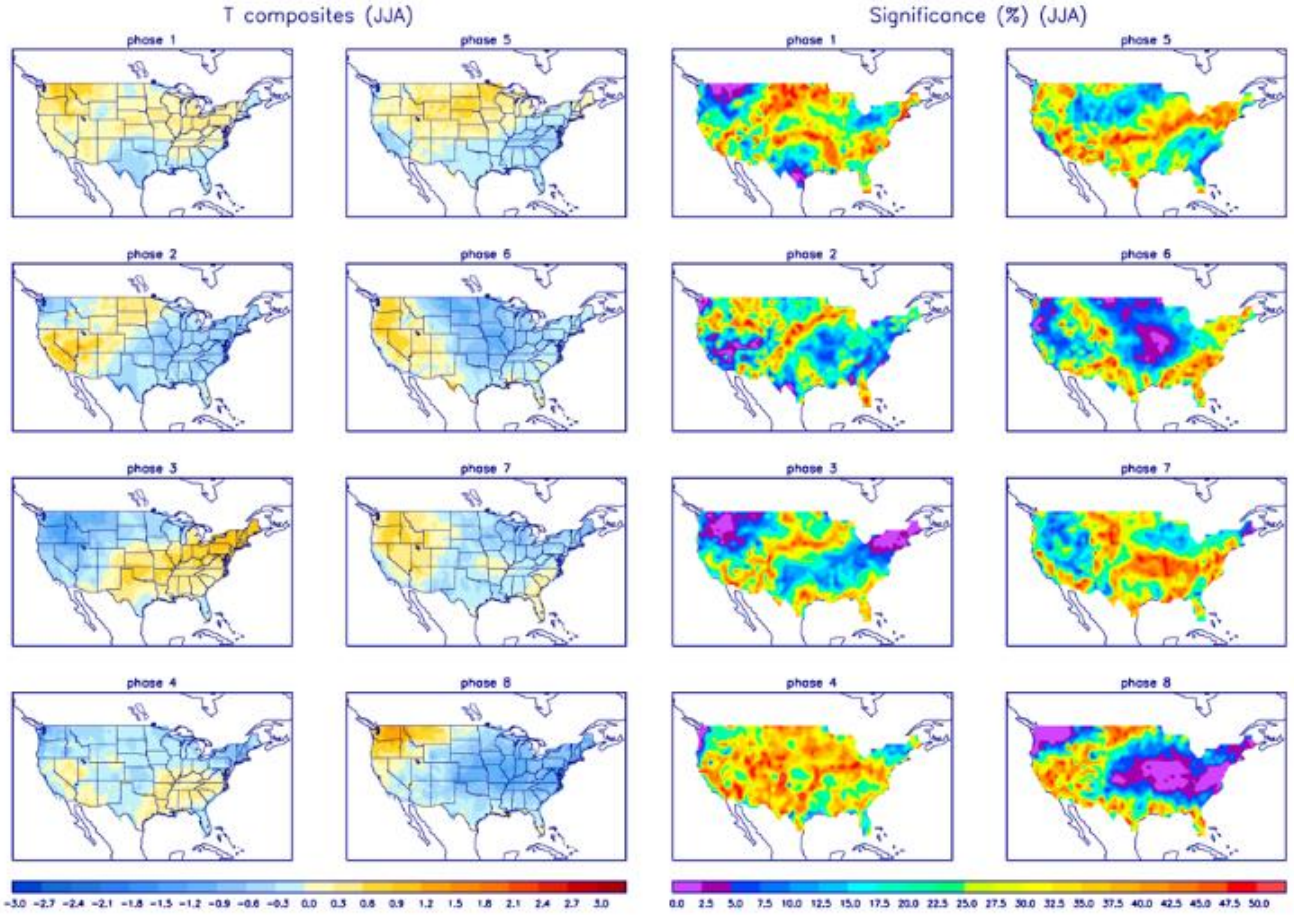
Precipitation Anomalies



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.

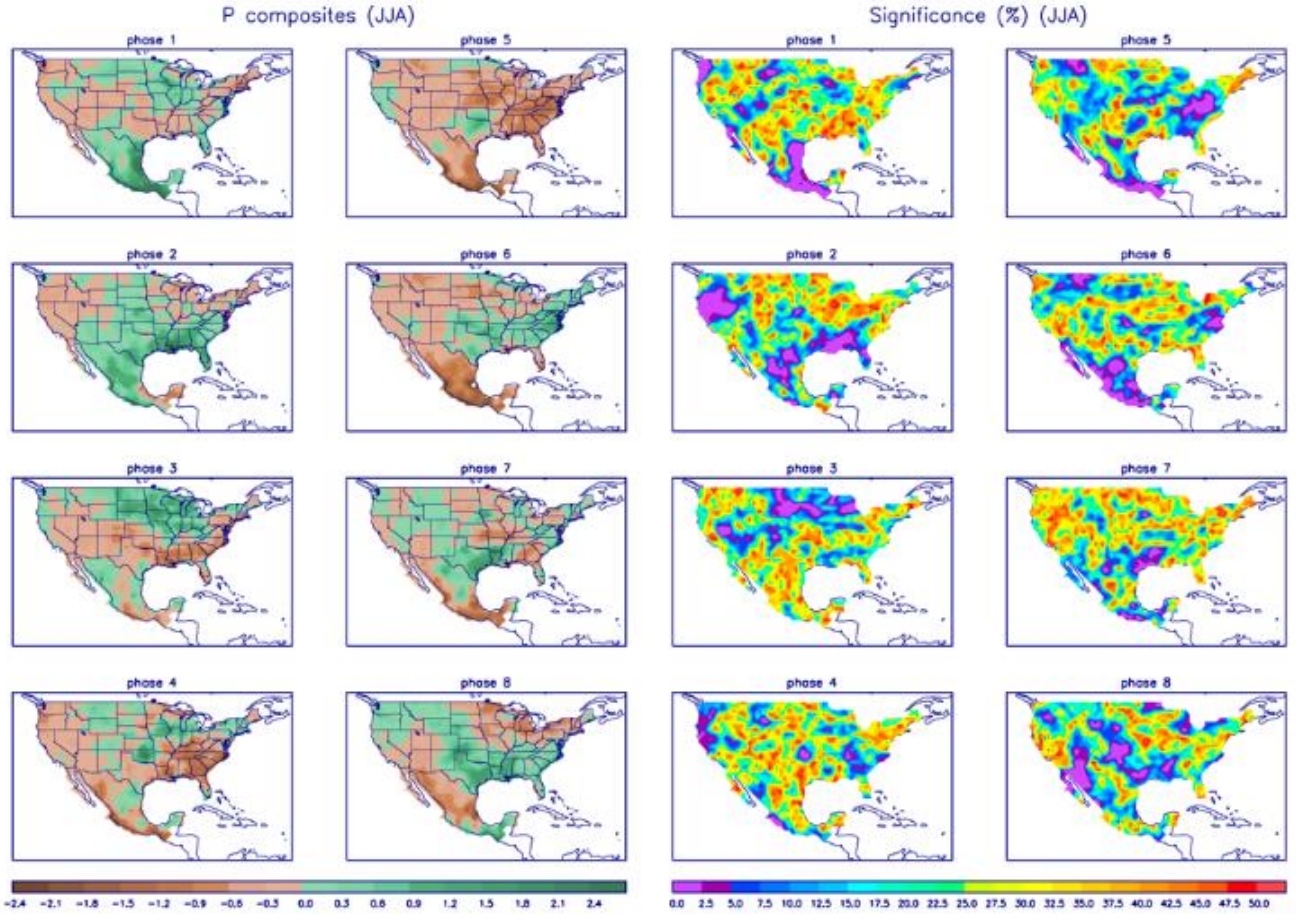


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - Precipitation

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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