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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
24 June 2024

Overview

- According to the RMM-based MJO index, the MJO was weak since the beginning of June. The 200-hPa velocity potential anomaly field became less coherent the past few weeks although there is a remnant MJO signal crossing the Western Hemisphere.

- During early July, dynamical models favor a strengthening of the MJO over the Indian Ocean and Maritime Continent.

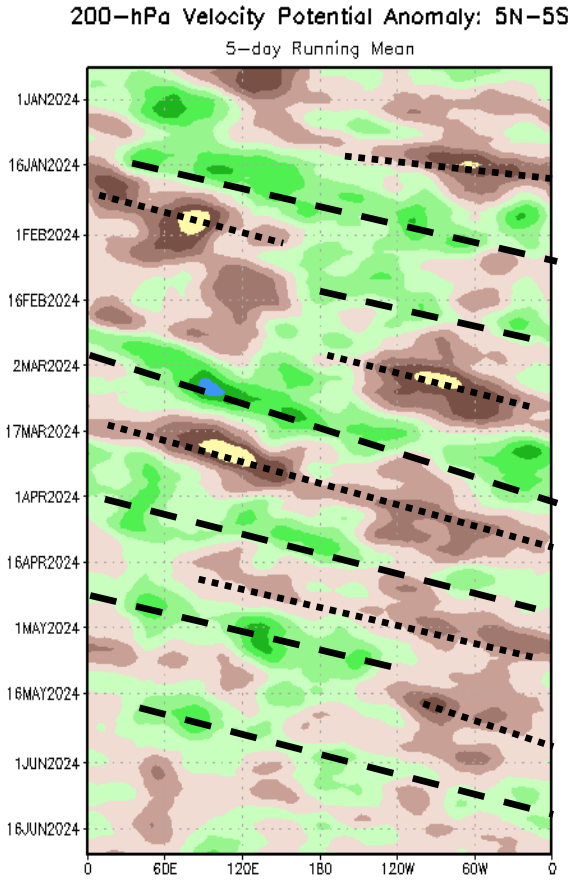
- If the MJO strengthens and propagates eastward, then the large-scale environment would become more favorable for tropical cyclone (TC) development over the West Pacific basin during early July. An elevated chance of TC development is posted for the western Caribbean Sea and southern Gulf of Mexico during week-2. The MJO would tend to suppress chances for the East Pacific (weeks 2 and 3) and Atlantic basin (week-3).

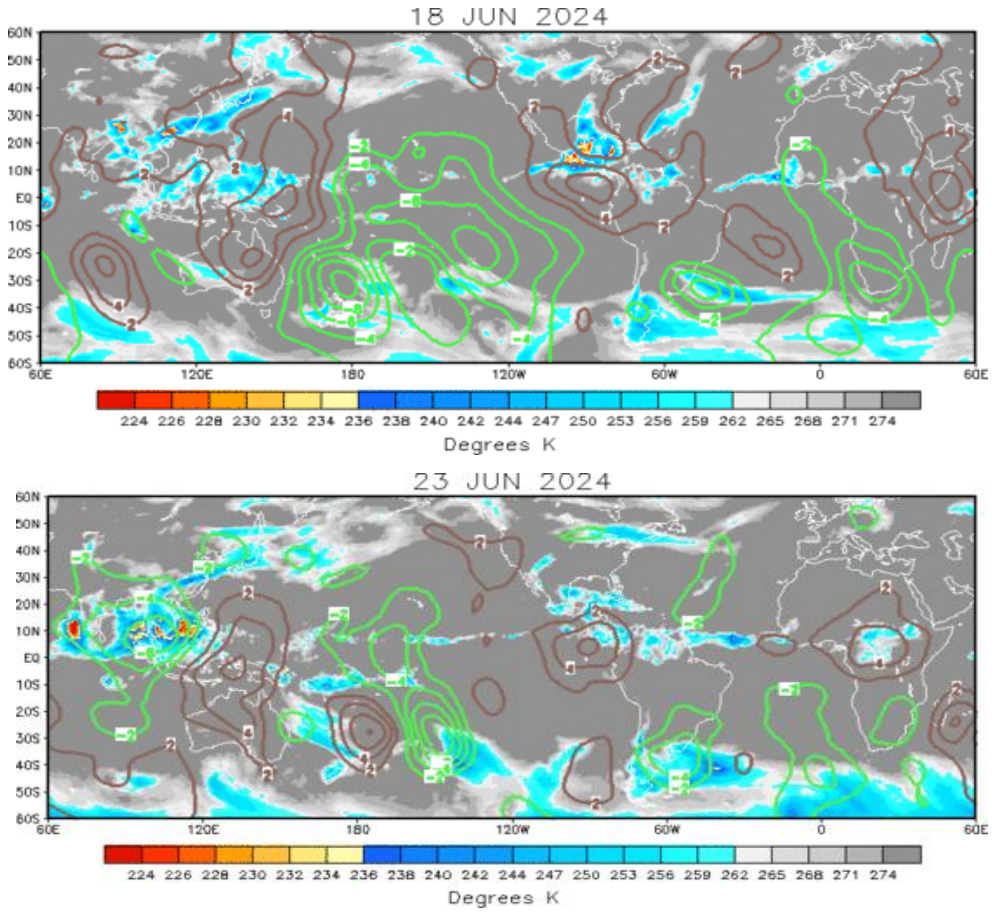
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

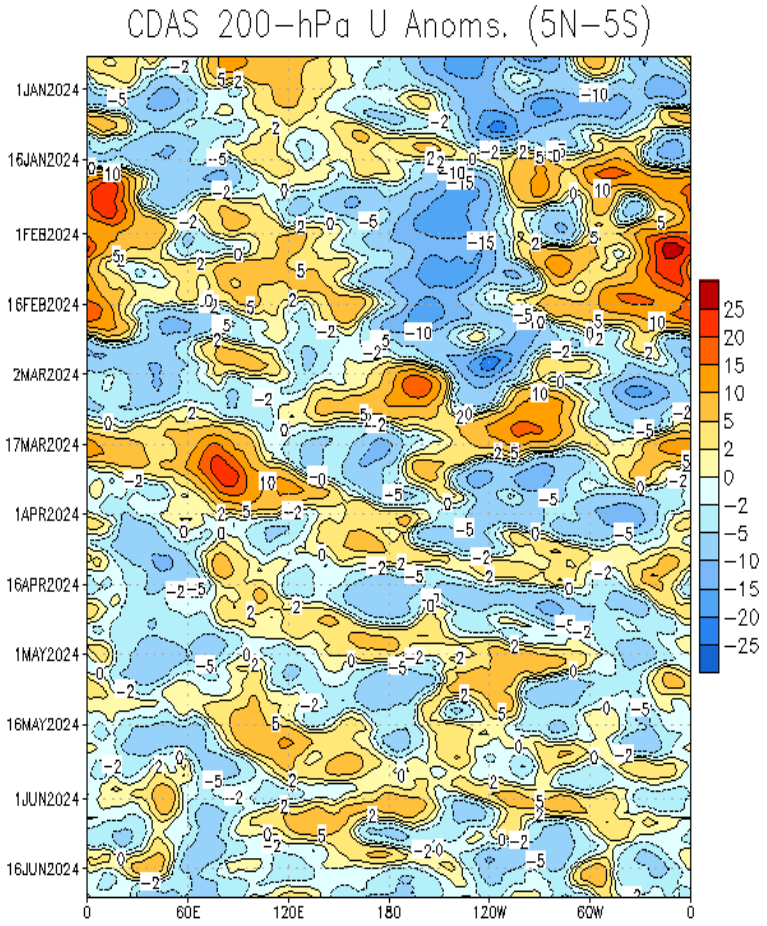


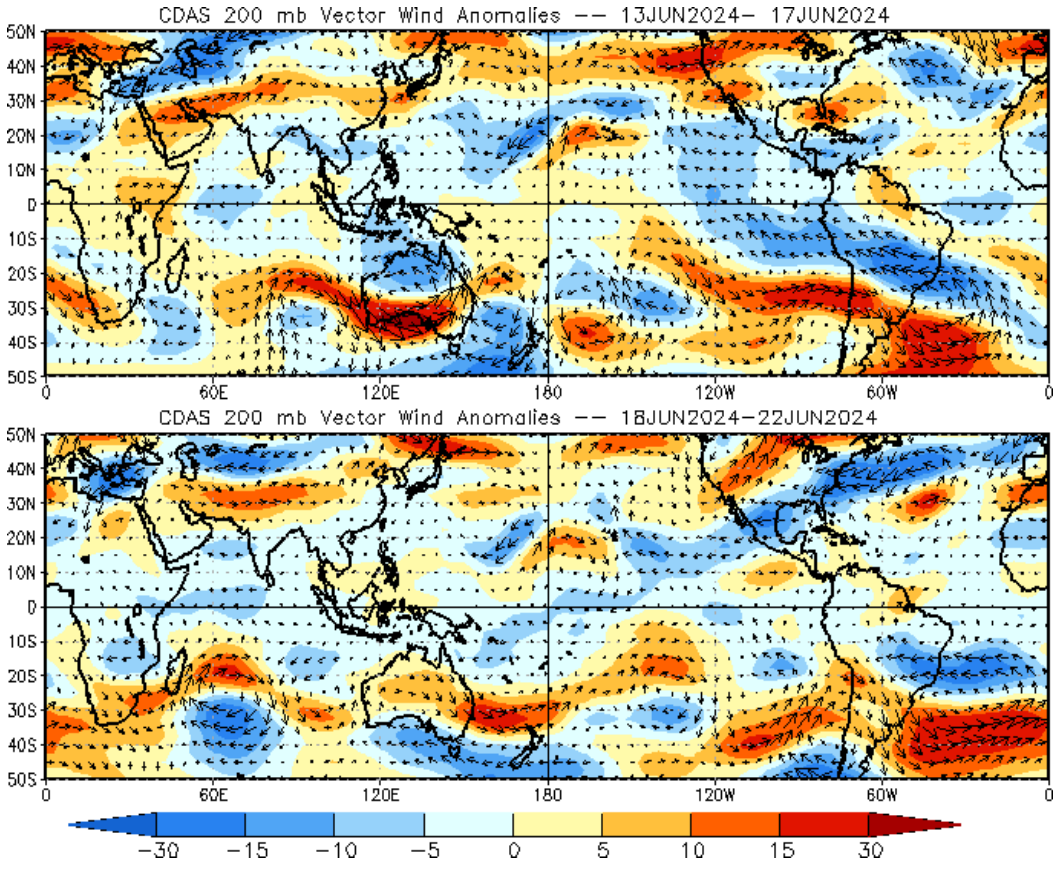


- During June, the upper-level velocity potential pattern became less coherent as the MJO weakened.
- A low-frequency base state with anomalous upper-level divergence appears to be developing over the Maritime Continent centered near 120E.

200-hPa Wind Anomalies

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

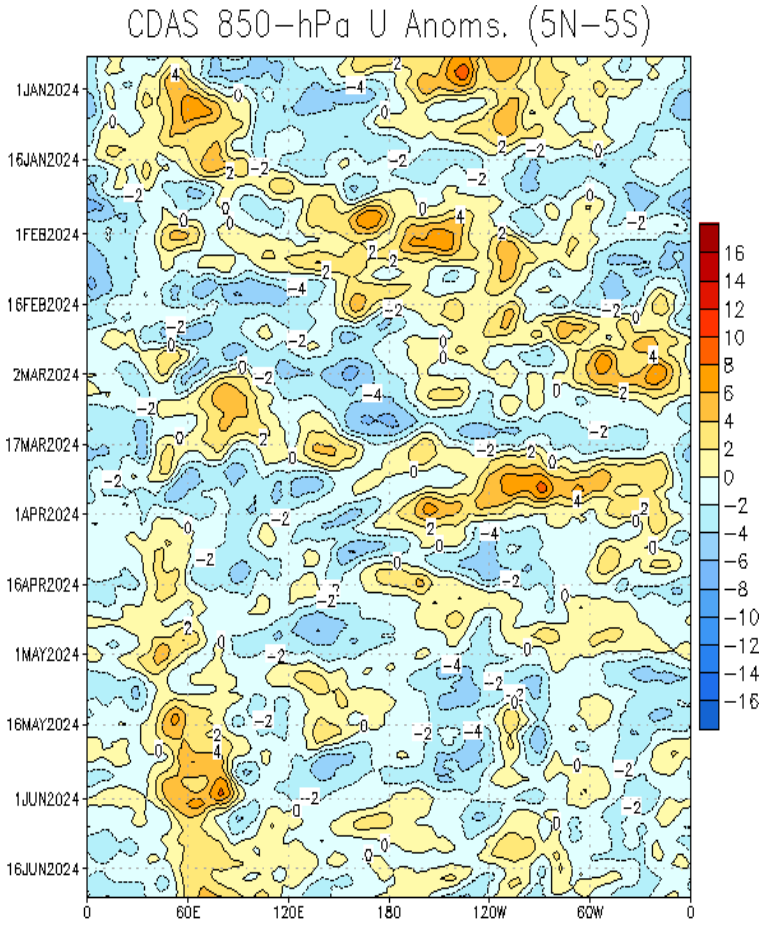


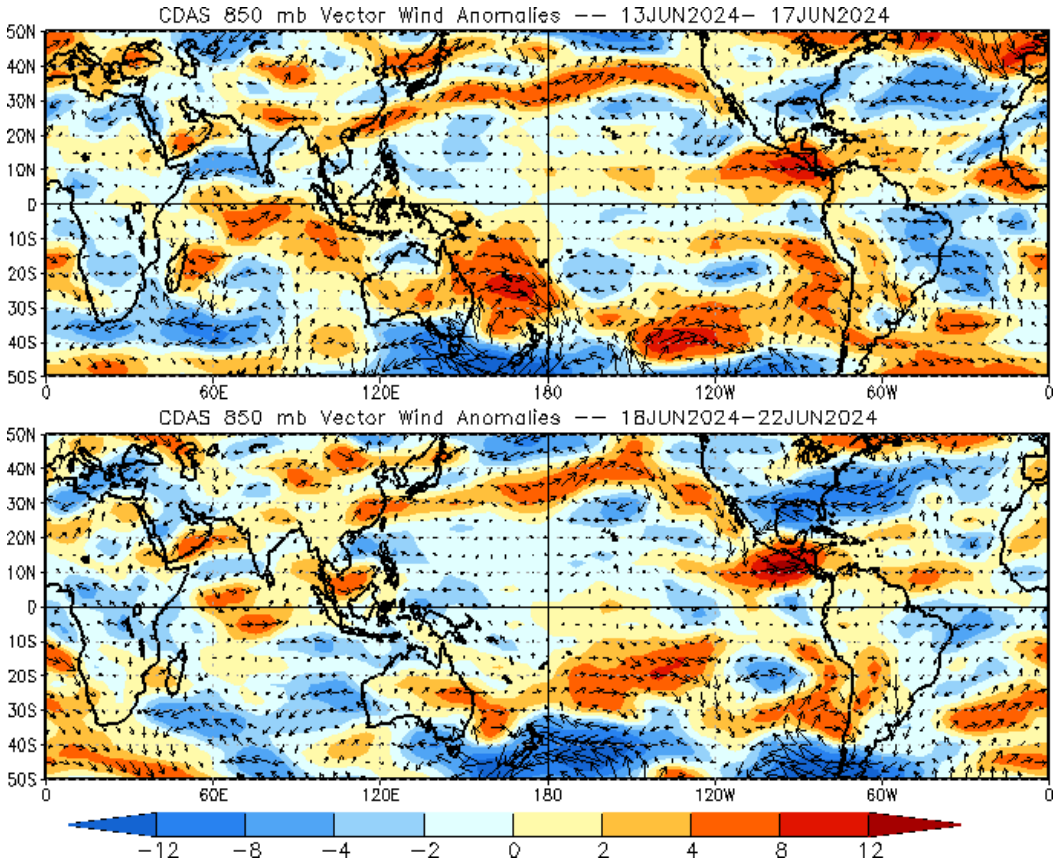


- Upper-level wind anomalies are generally weak and easterly at the lower latitudes.
- A large anticyclone was located over the South Atlantic and near South America during mid-June.

850-hPa Wind Anomalies

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

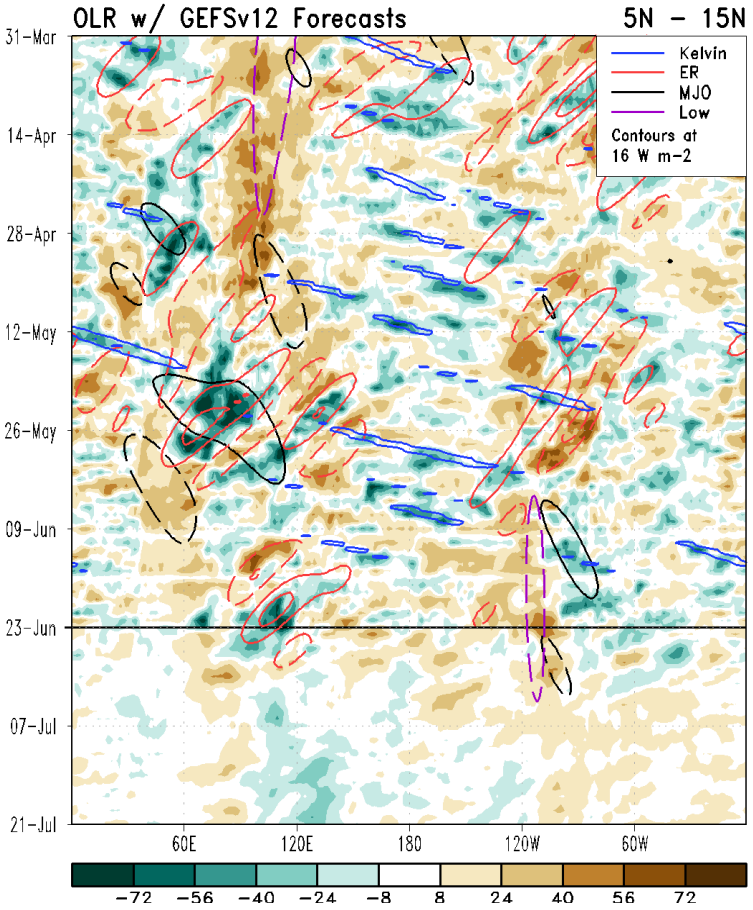


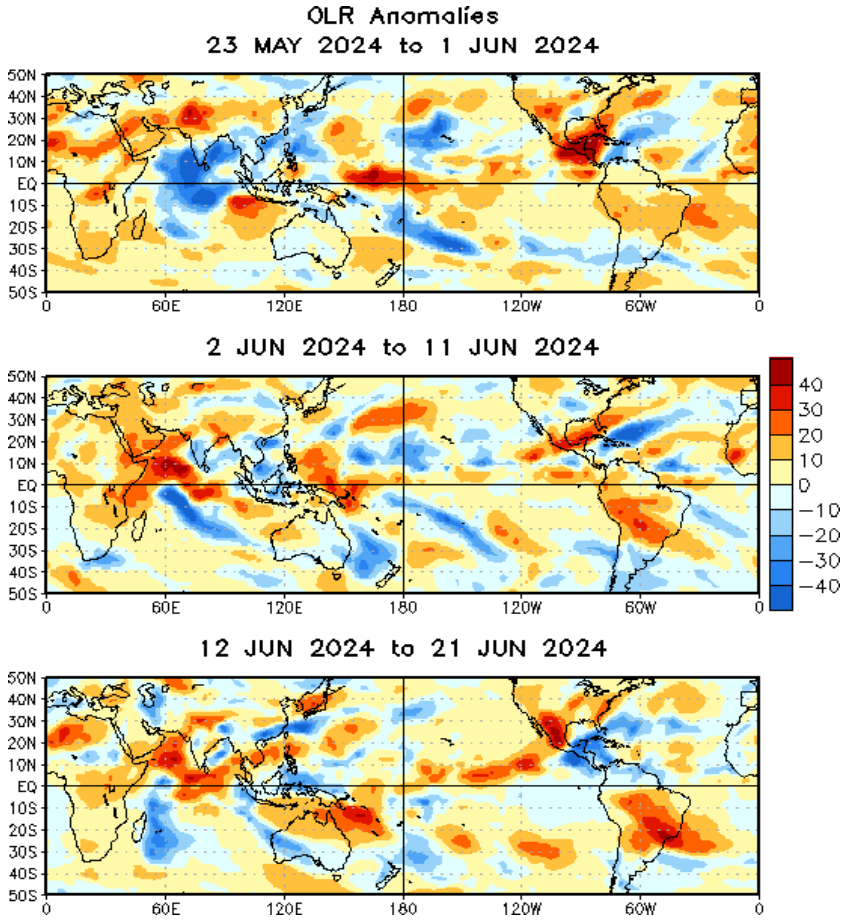


- Persistent area of anomalous equatorial low-level westerlies noted around 60°E, recently spreading into more of the Indian Ocean and Maritime Continent.
- Low-level cyclonic flow apparent across the Gulf of Mexico contributed to the development of Tropical Storm Alberto.
- Anomalous low-level southeasterly flow recently initiated convective rainfall over the southwestern U.S.

Outgoing Longwave Radiation (OLR) Anomalies

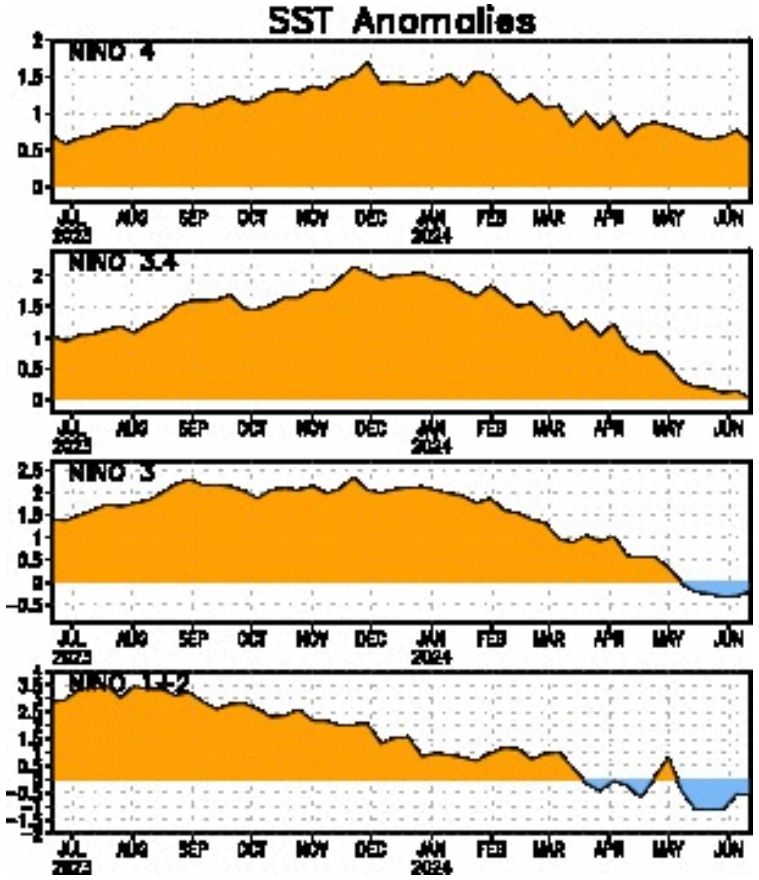
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

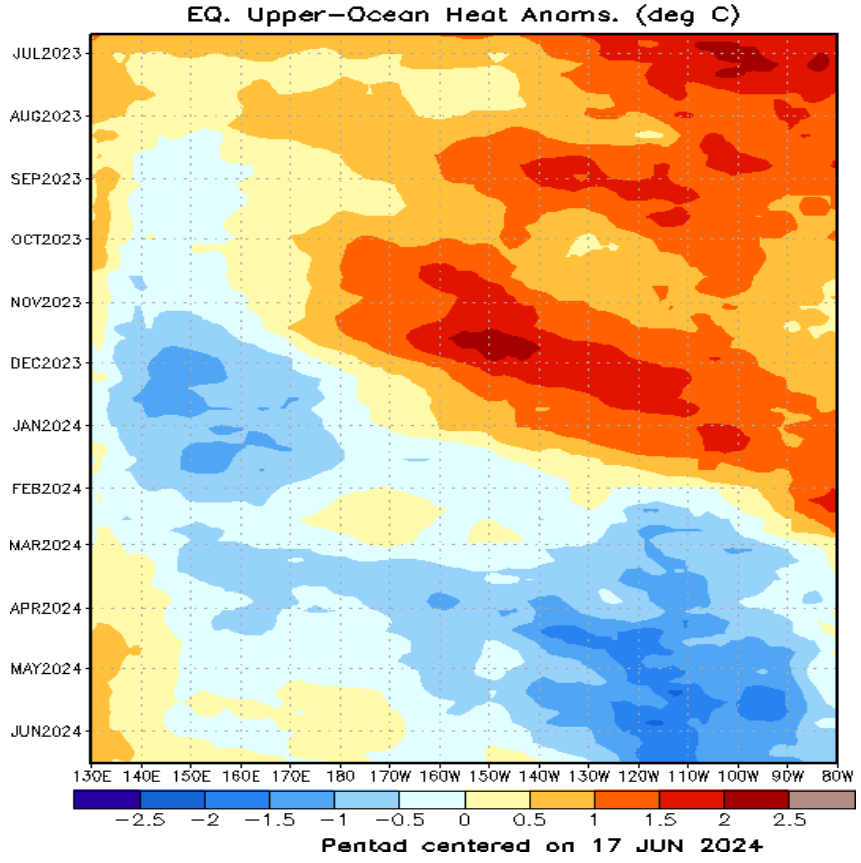




- Suppressed convection was observed across much of the northern Indian Ocean and contiguous U.S. during early to mid-June.
- Enhanced convection replaced suppressed convection the past few weeks over Central America, the western Caribbean Sea, and southern Gulf of Mexico.
- The GEFS OLR forecast anomalies are largely incoherent through mid-July, with no significant modes of tropical variability coming through the objective filtering.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

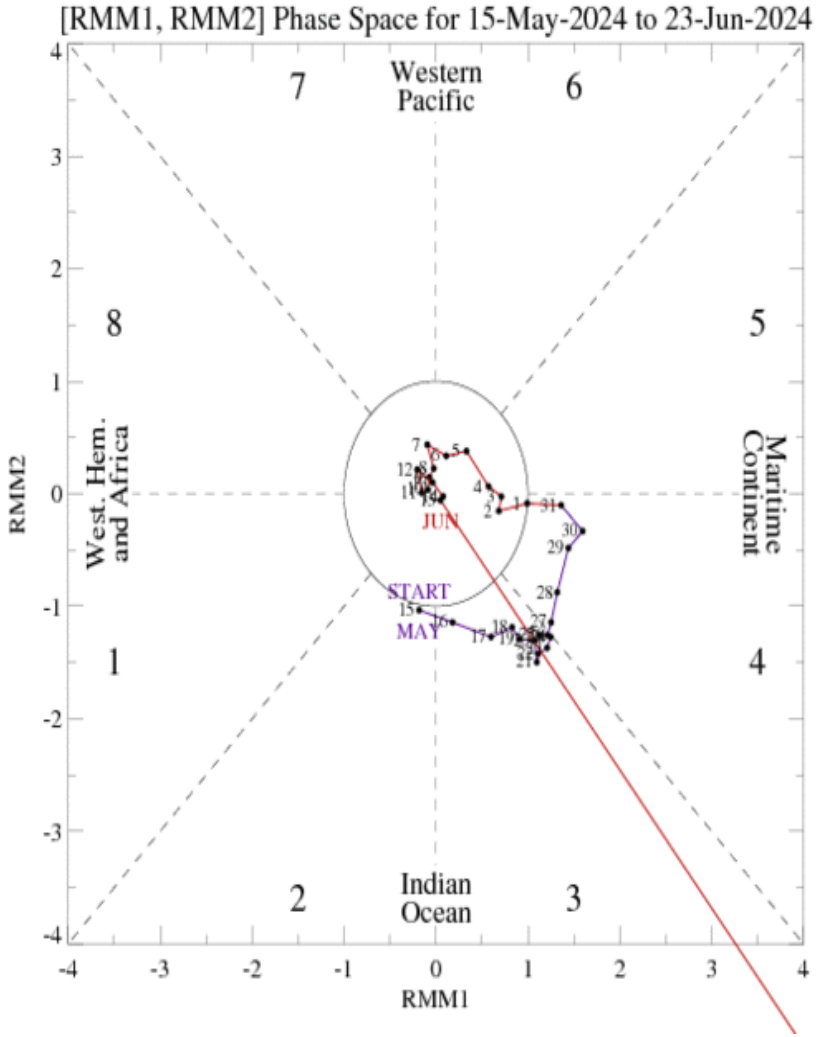




- SSTs continue to trend downward, with negative SST anomalies observed in the easternmost Niño regions, indicative of a transitioning ENSO pattern.
- Negative subsurface temperature anomalies continue to build across the equatorial eastern Pacific.

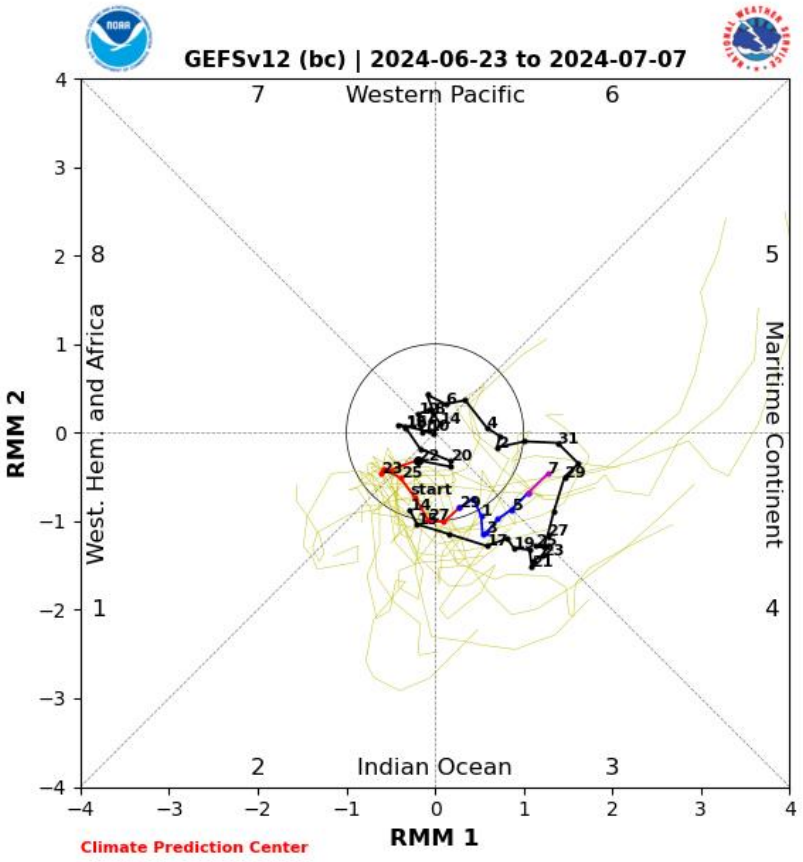
MJO Index: Recent Evolution

- Following an active MJO across the Indian Ocean and Maritime Continent at the end of May, the RMM-based MJO index has remained inside the unit circle since the beginning of June.

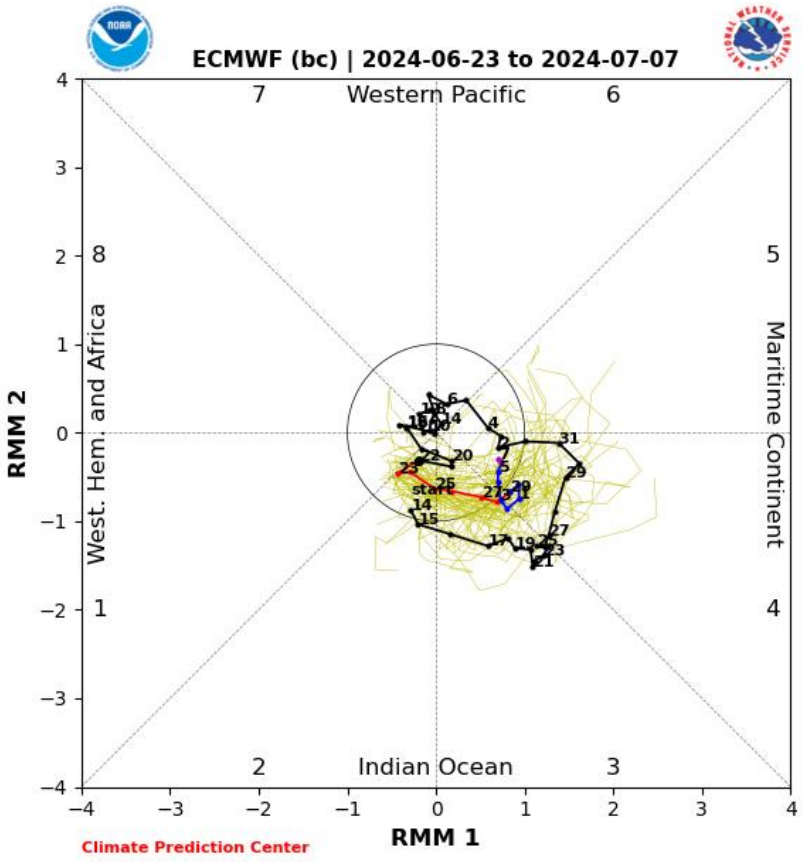


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

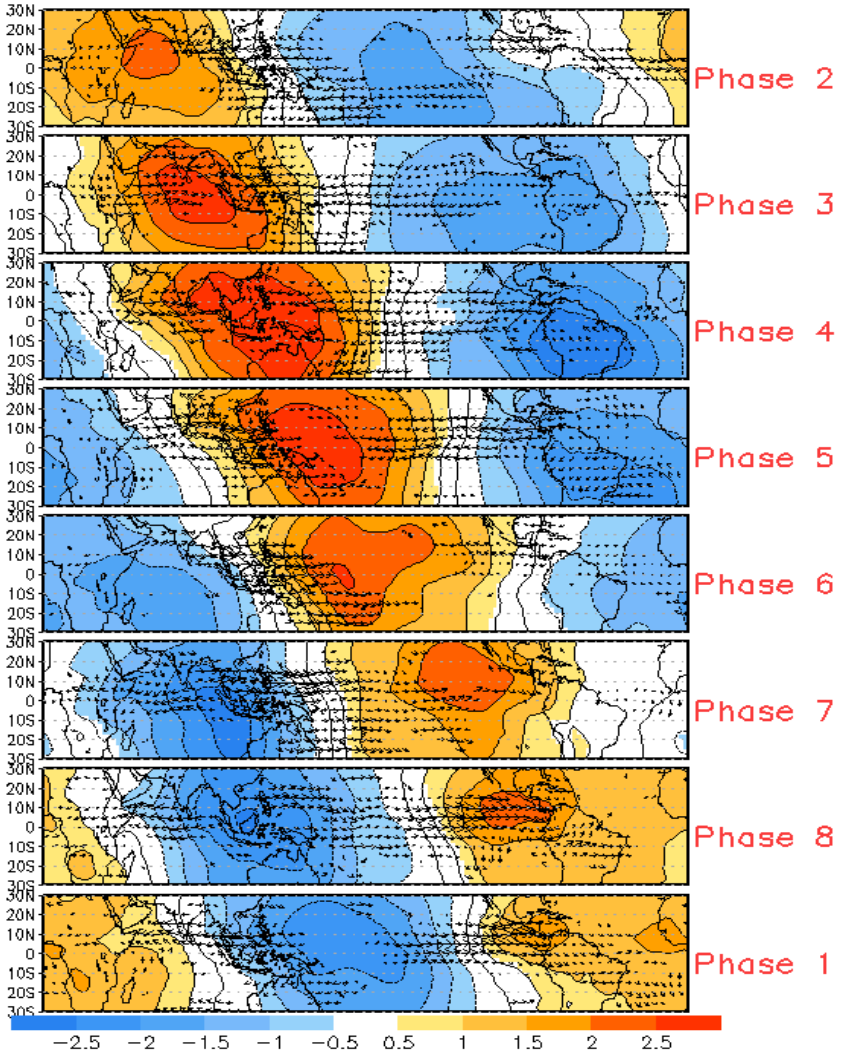


ECMWF Forecast

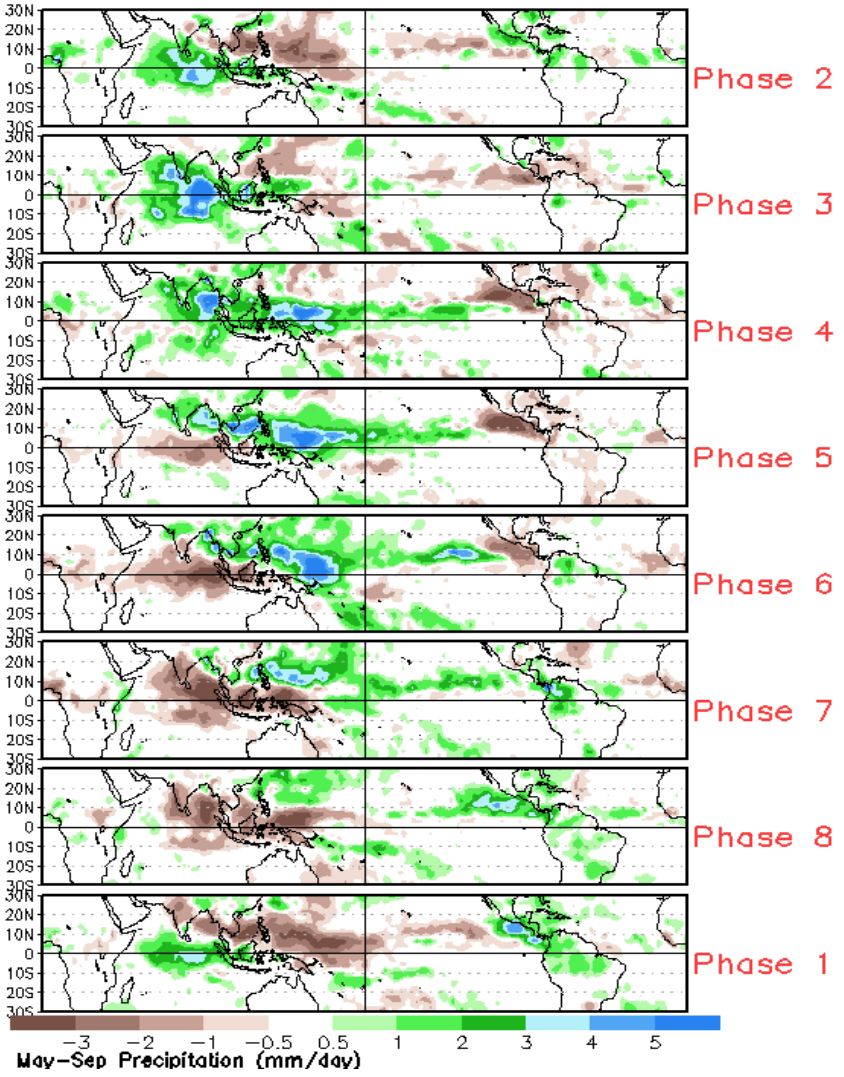
- The ECMWF and GEFS ensembles are in good agreement that the MJO strengthens over the Indian Ocean and western Maritime Continent during the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



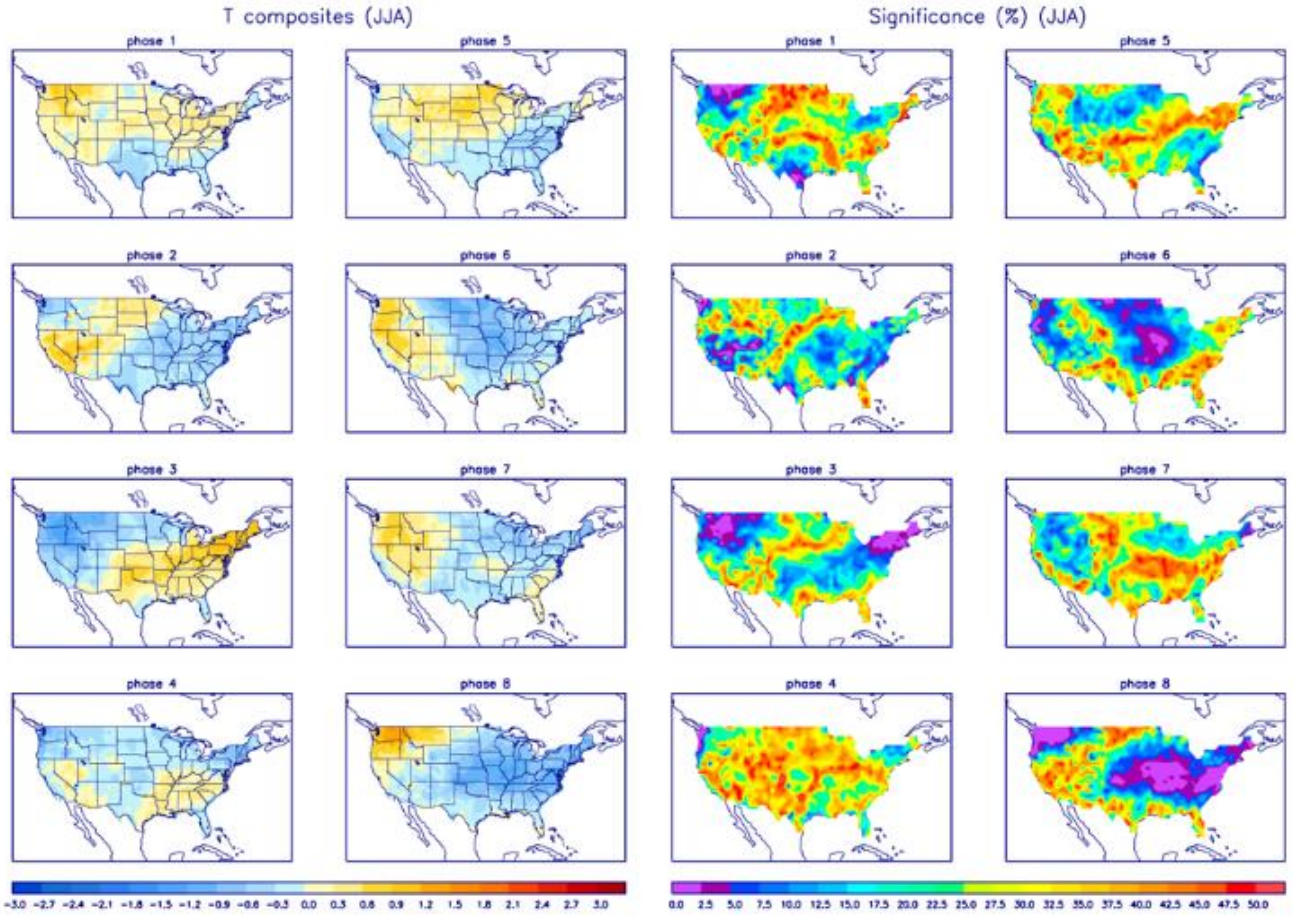
Precipitation Anomalies



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.

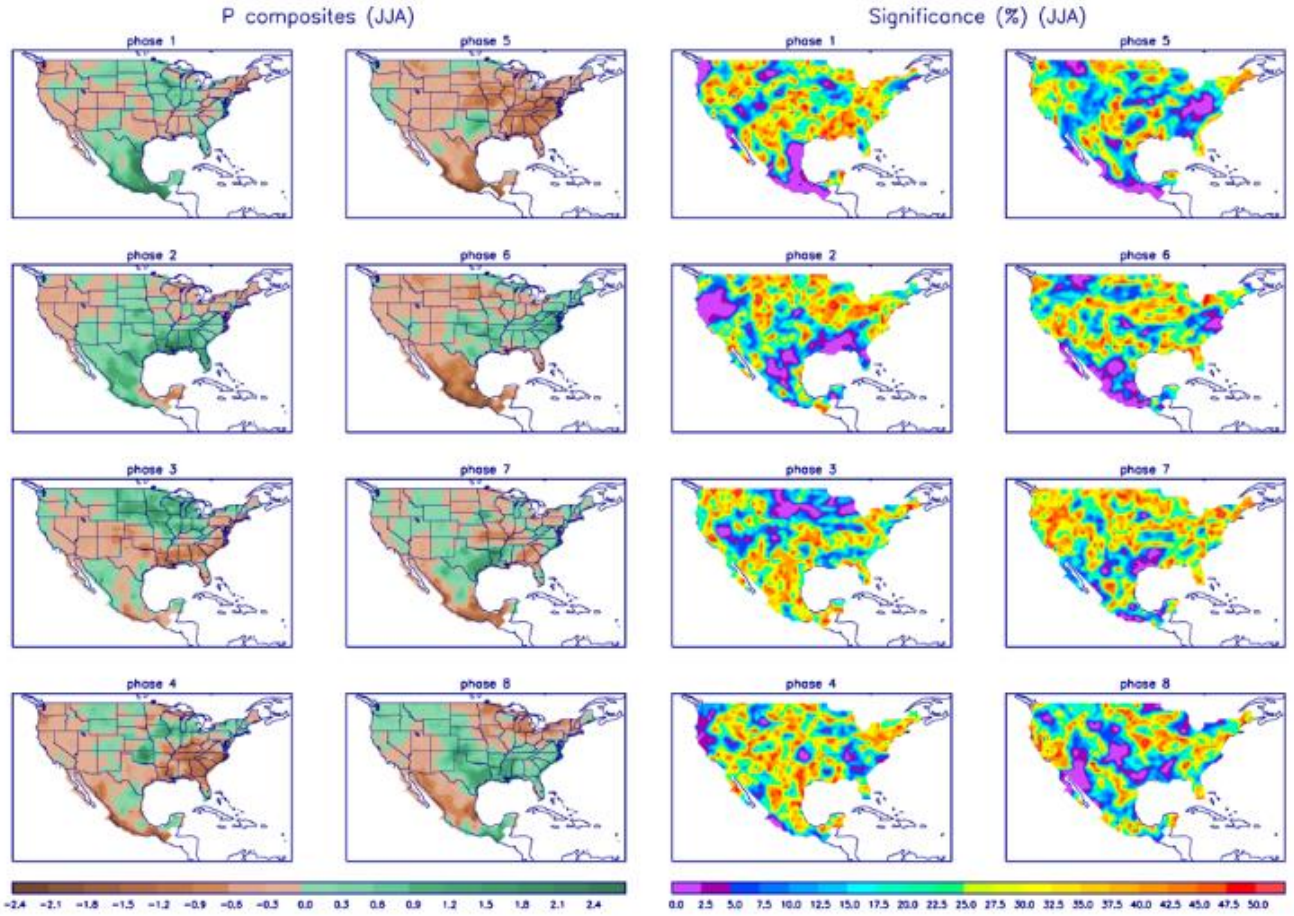


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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