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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
22 April 2024

Overview

- The MJO remained weak and incoherent during mid-April, while El Niño continues to provide less of an influence on global tropical rainfall.

- Dynamical model forecasts favor a strengthening MJO by the beginning of May with eastward propagation to the West Pacific.

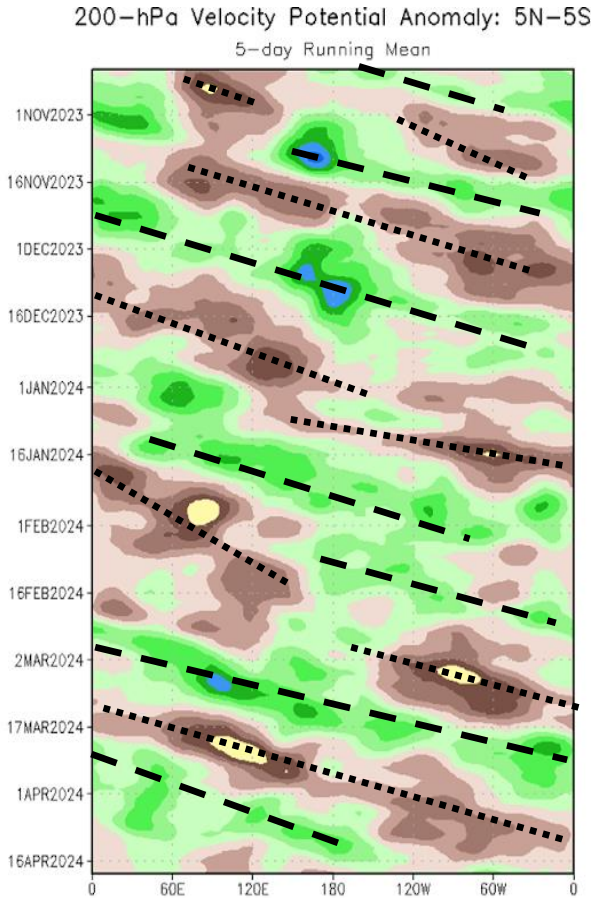
- No tropical cyclones formed during mid-April and this is climatologically the least active time of year. If a more coherent MJO propagates eastward, then a chances for tropical cyclone development may begin to increase during early May.

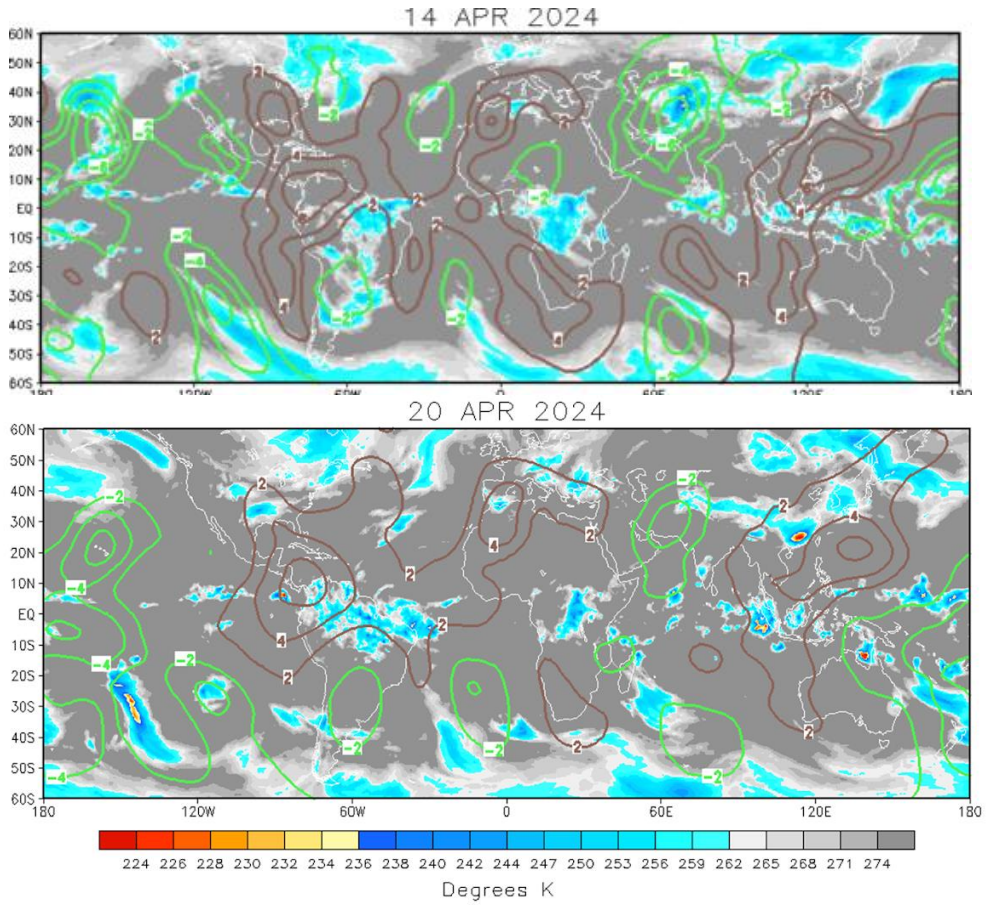
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



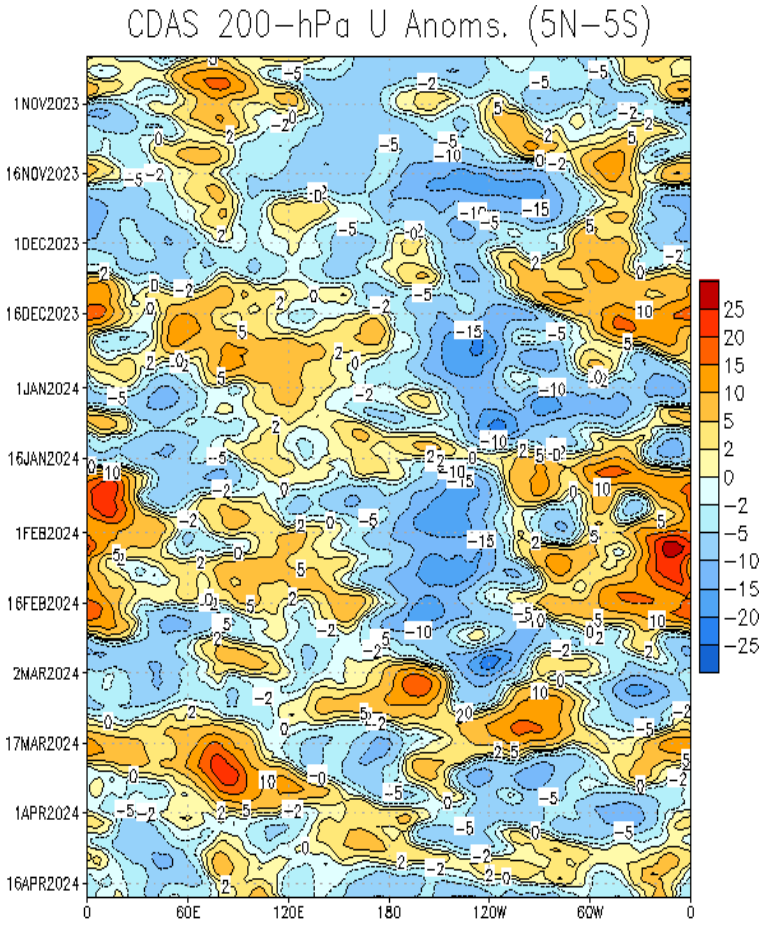


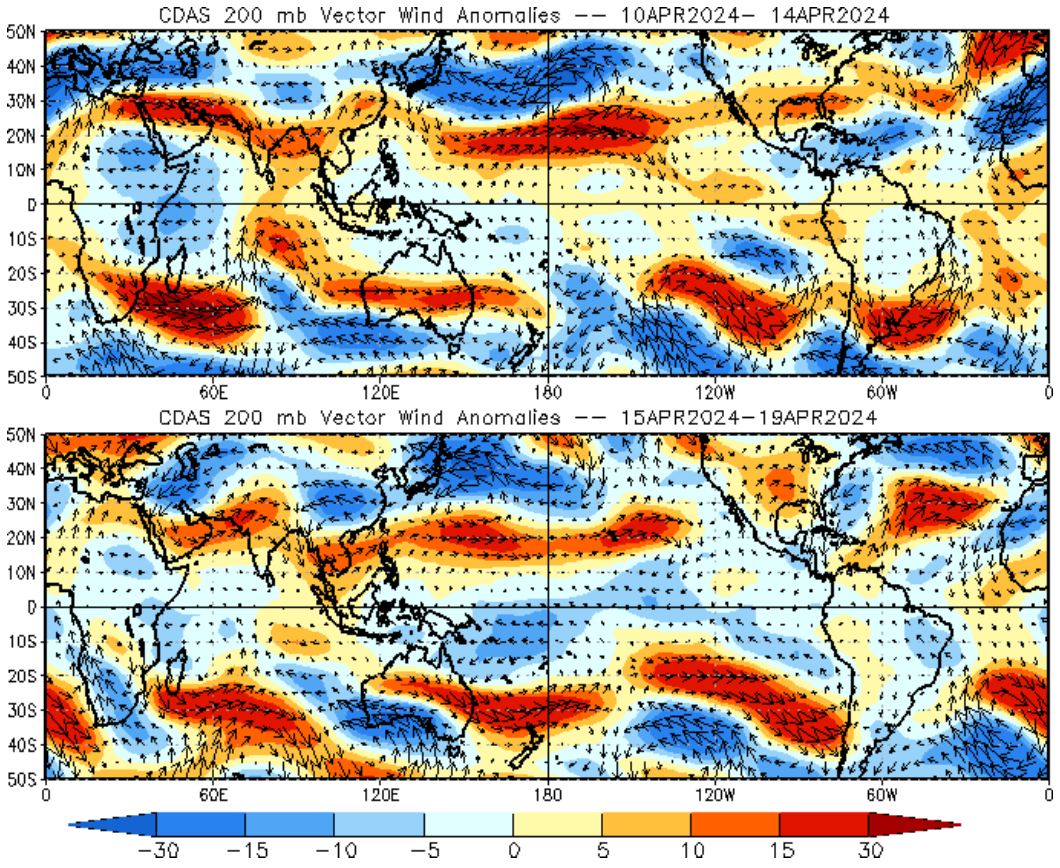
- Eastward propagation of a wave-1 pattern is evident in the time-longitude plot through early April, consistent with a fast-moving MJO.

- However, spatial maps reveal a breakdown of the coherent wave-1 structure by mid-April.

200-hPa Wind Anomalies

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

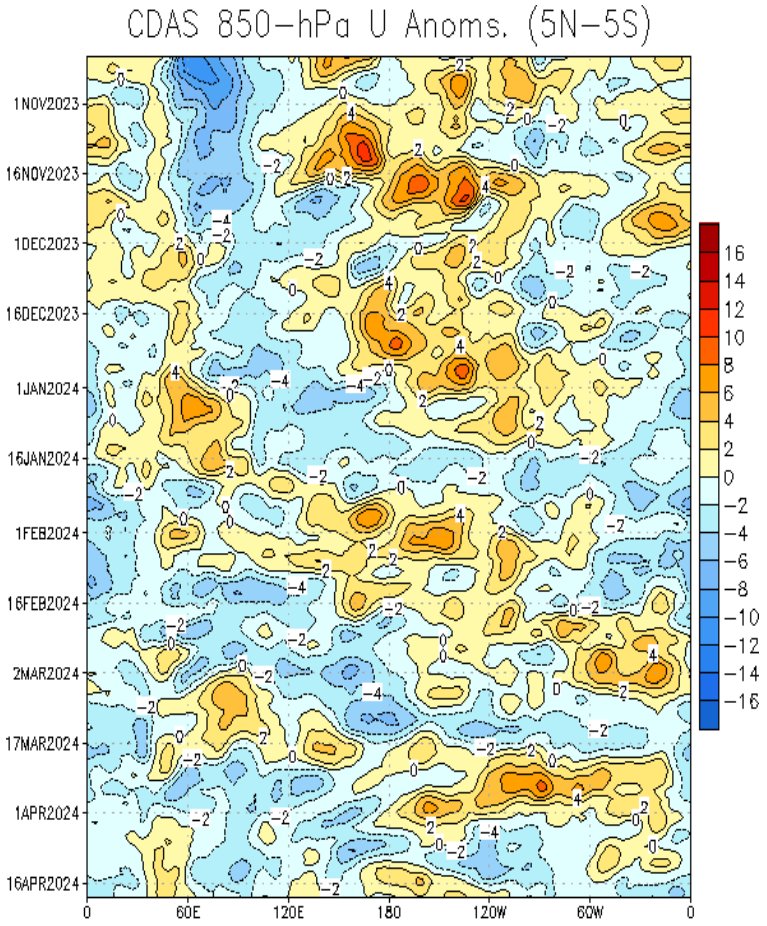


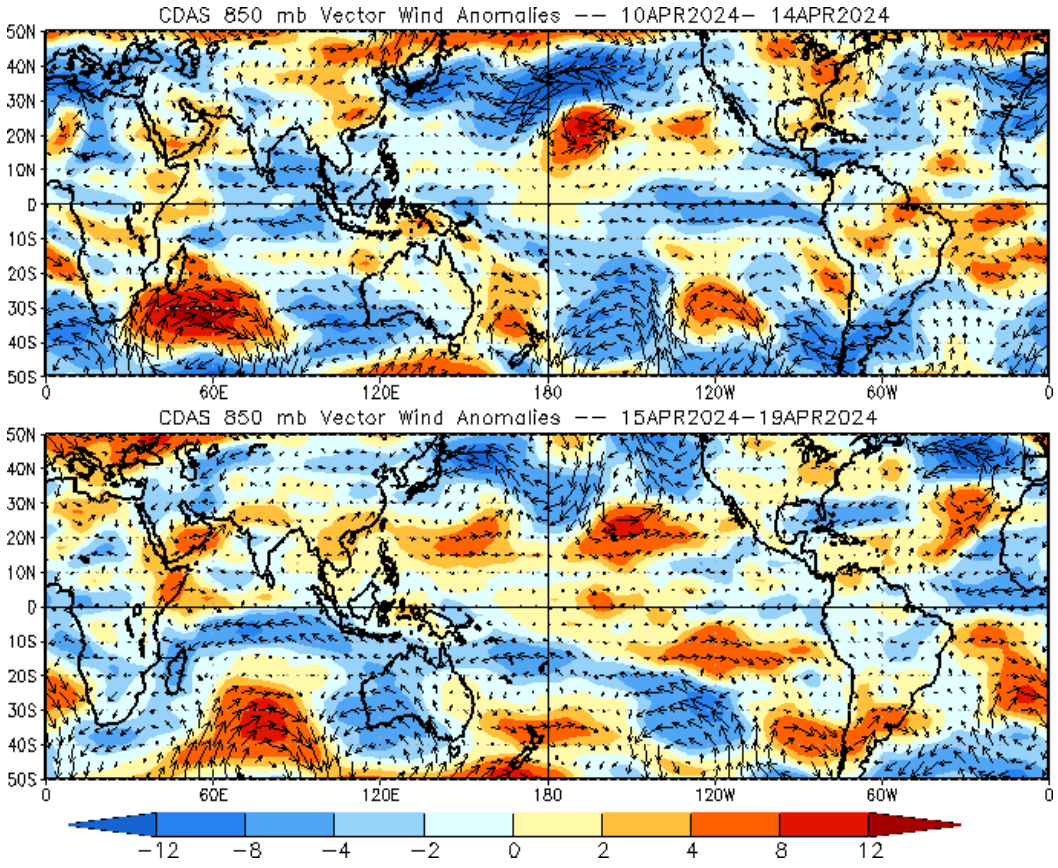


- Upper-level easterly wind anomalies returned to the east-central Pacific during mid-April.
- The subtropical jet remains enhanced across the North Pacific and southern North America as lingering effects from El Niño continue.
- A cyclonic upper-level low was recently observed over the Middle East where unusually heavy rainfall and flooding occurred.

850-hPa Wind Anomalies

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

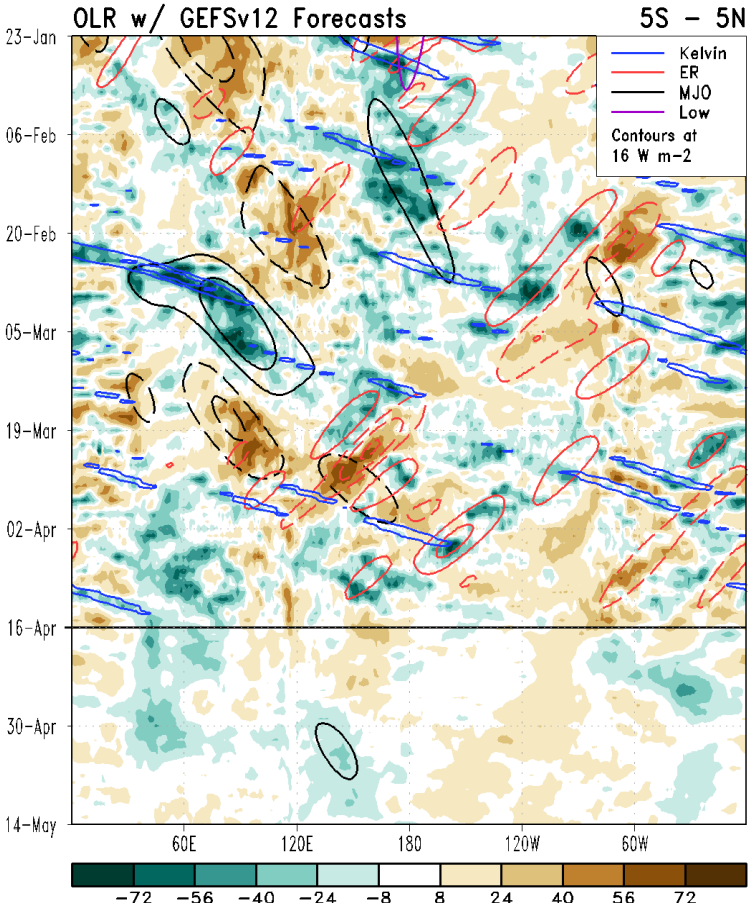


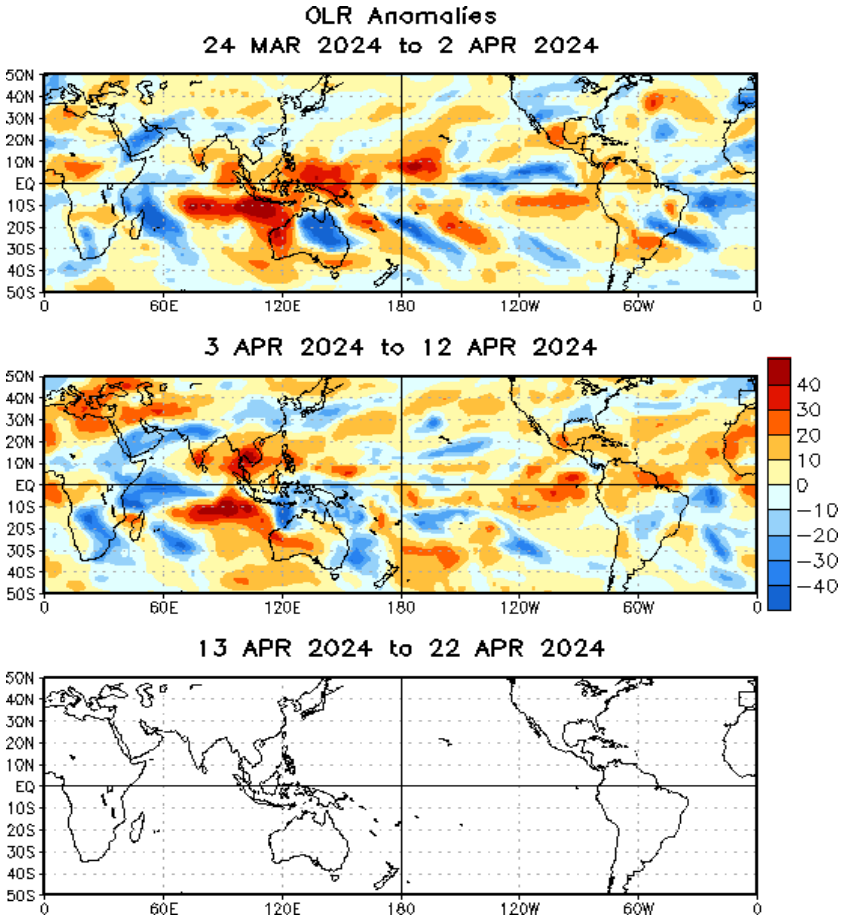


- Persistent strong anomalous low-level easterlies have been widespread over the North Pacific.
- Low-level anomalies are generally small throughout the global tropics and without a coherent spatial pattern.

Outgoing Longwave Radiation (OLR) Anomalies

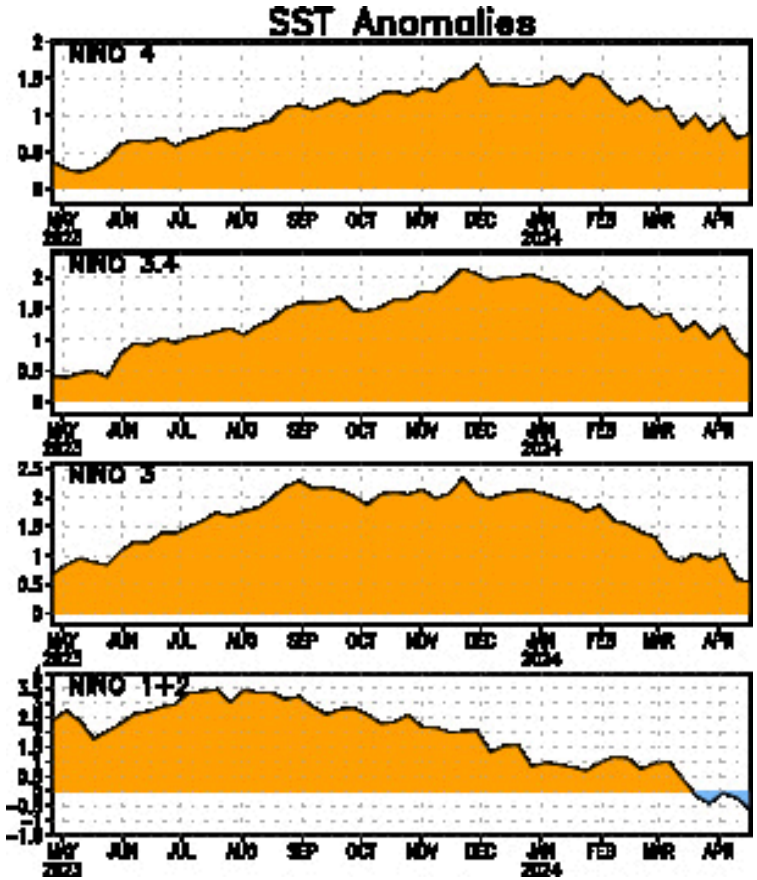
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

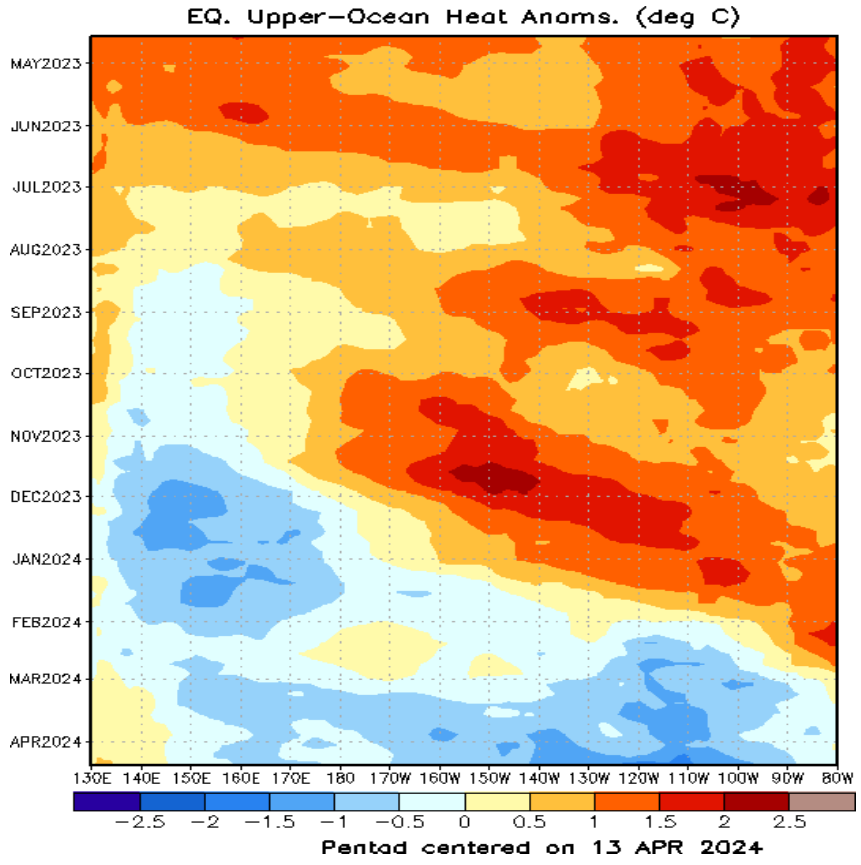




- Low-frequency features over the Tropical Pacific became much less apparent during March while and an Indian Ocean Dipole-like pattern has emerged recently and is favored to continue, enhancing convection along the eastern coast of Africa.
- During early April, enhanced convection returned and persisted over eastern Africa and parts of the western Indian Ocean along and off the equator.
- Please note the last 7-day OLR anomalies are unavailable due to the major IT outage on April 15.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

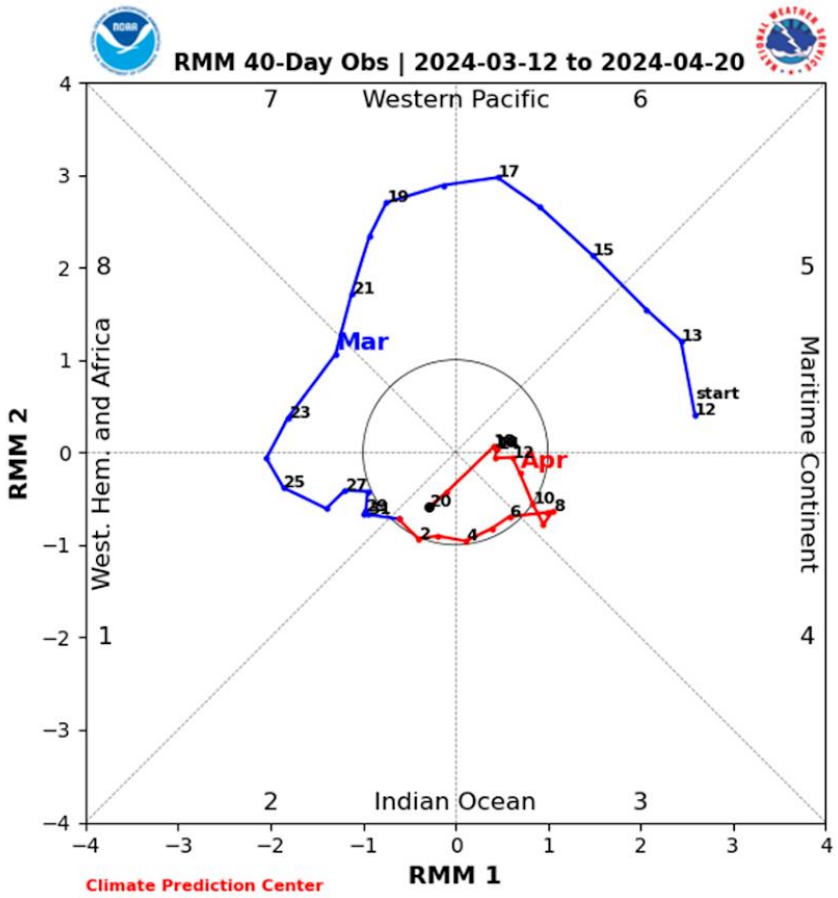




- SSTs in all NINO regions have trended downward over the past 2 months, suggestive of a decaying El Niño, with a sharp decrease across NINO 1+2 during March where the SST anomalies have flipped to negative tied to strong upwelling over the region.
- Negative subsurface temperature anomalies continue to be observed across nearly the entire Pacific, with increasing negative anomalies across the eastern Pacific.

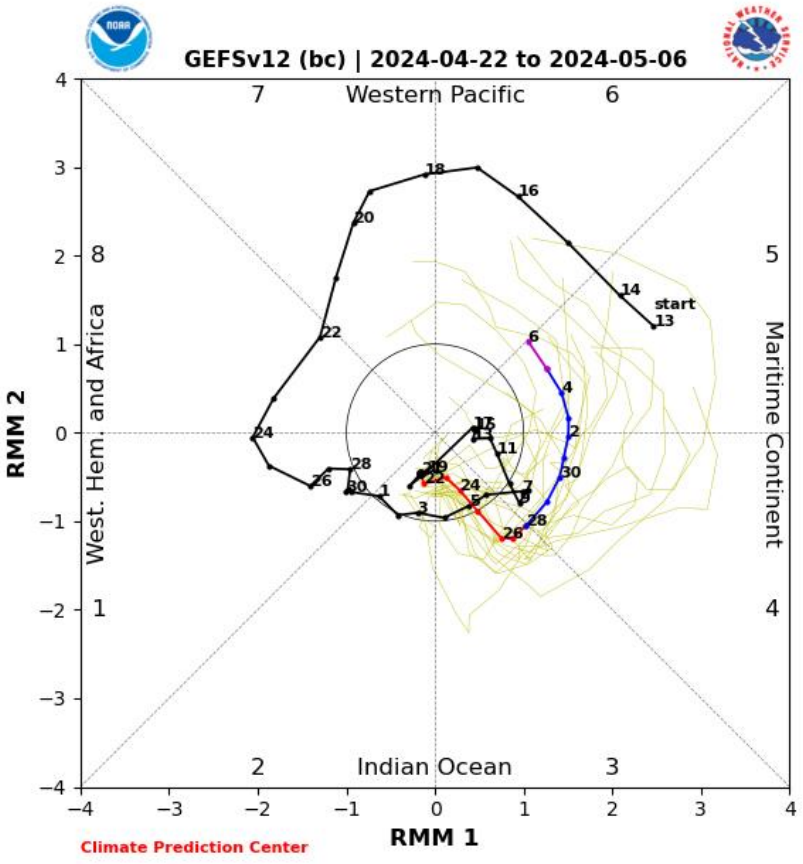
MJO Index: Recent Evolution

- Since late March, the RMM-based MJO index has considerably slowed down and weakened, with the RMM index moving near the edge and within the unit circle.
- This is consistent with a weak and incoherent MJO.
- Please note RMM obs are degraded due to IT outage.

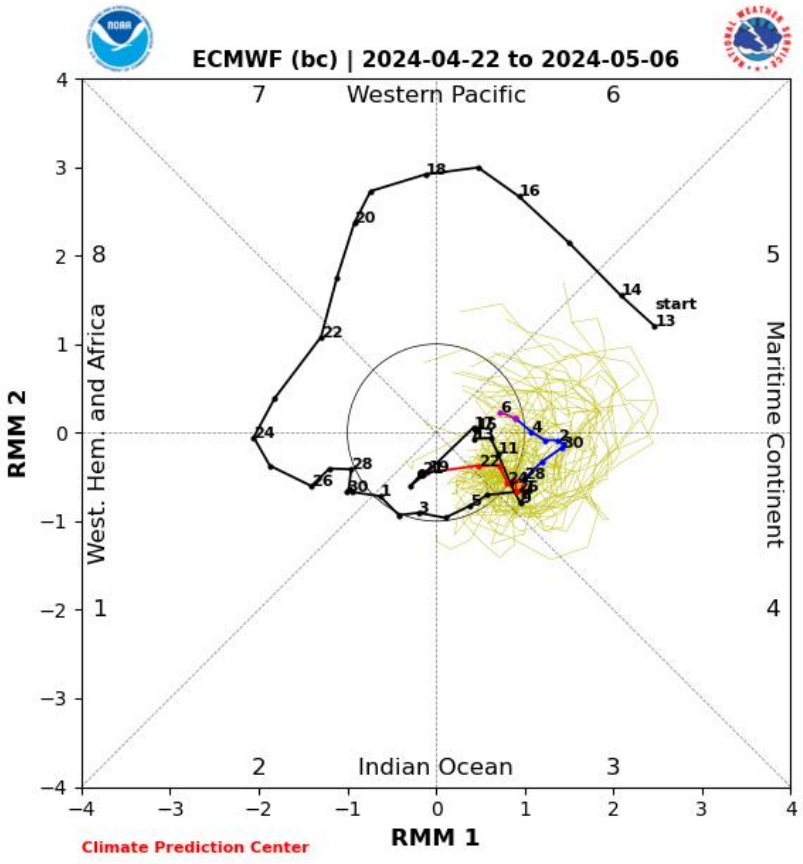


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

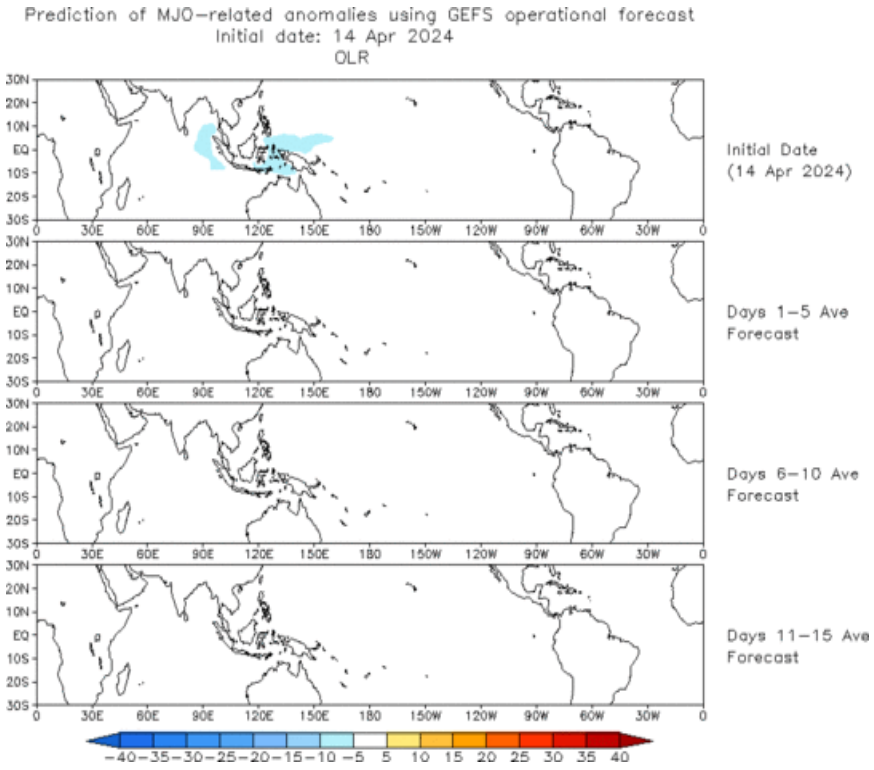


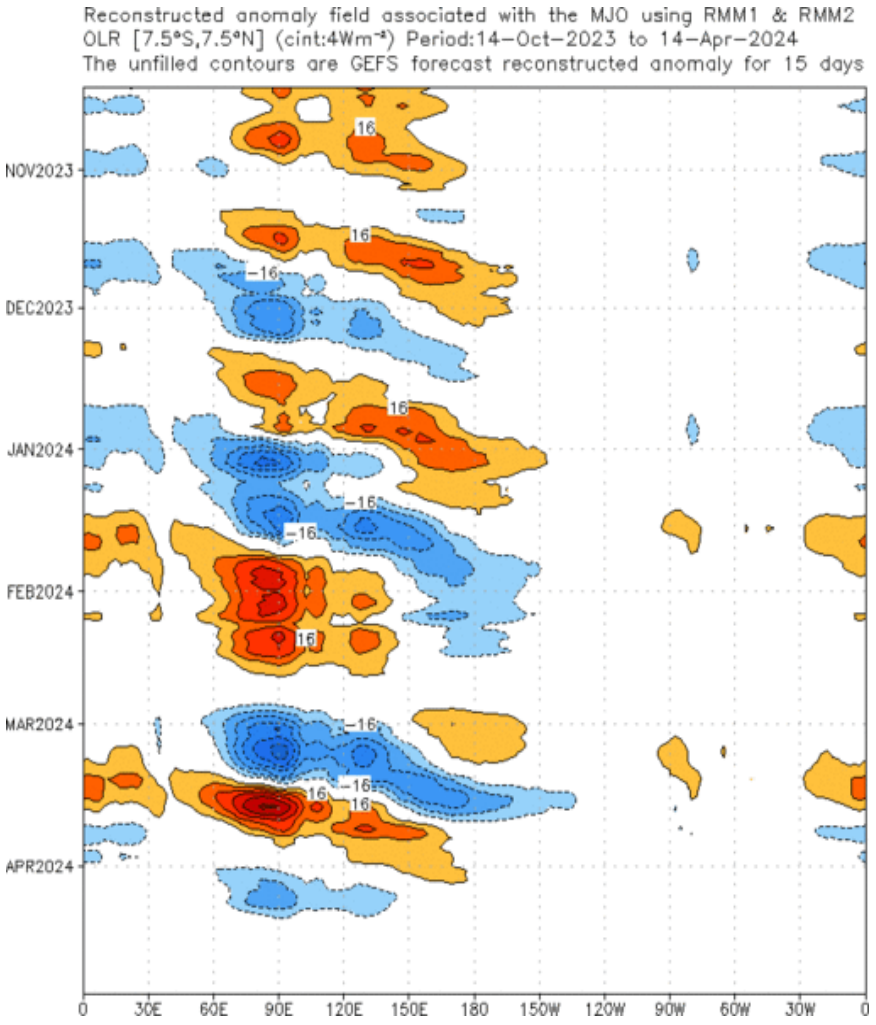
ECMWF Forecast

- The GEFS and ECMWF ensemble means favor a strengthening MJO over the Maritime Continent during the next two weeks.
- Many of the GFS ensemble members depict a much stronger MJO by the beginning of May with eastward propagation to the West Pacific.

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.)

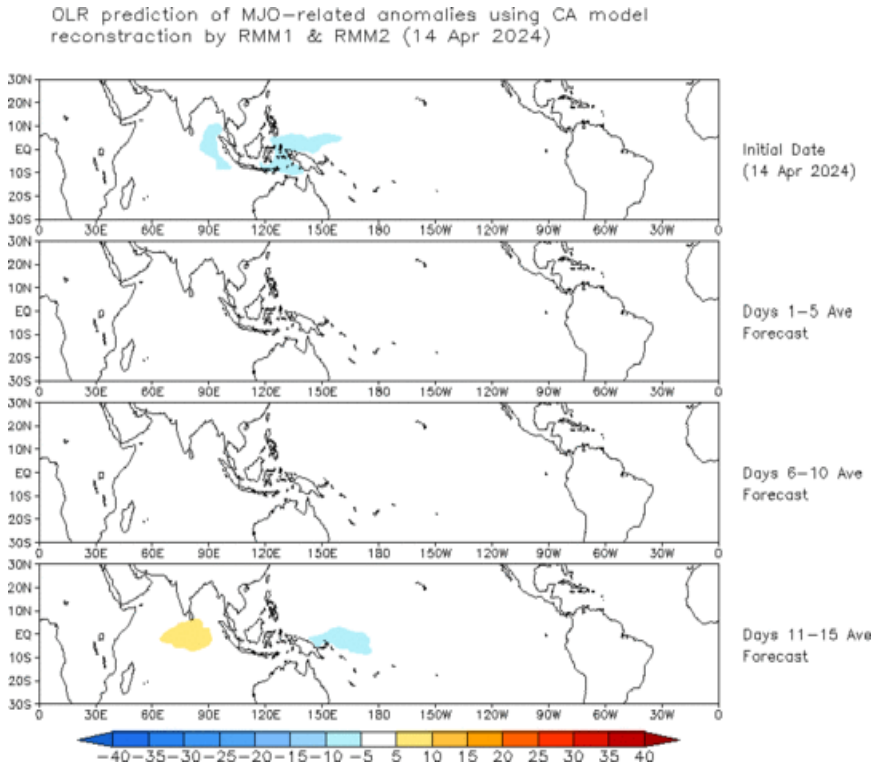


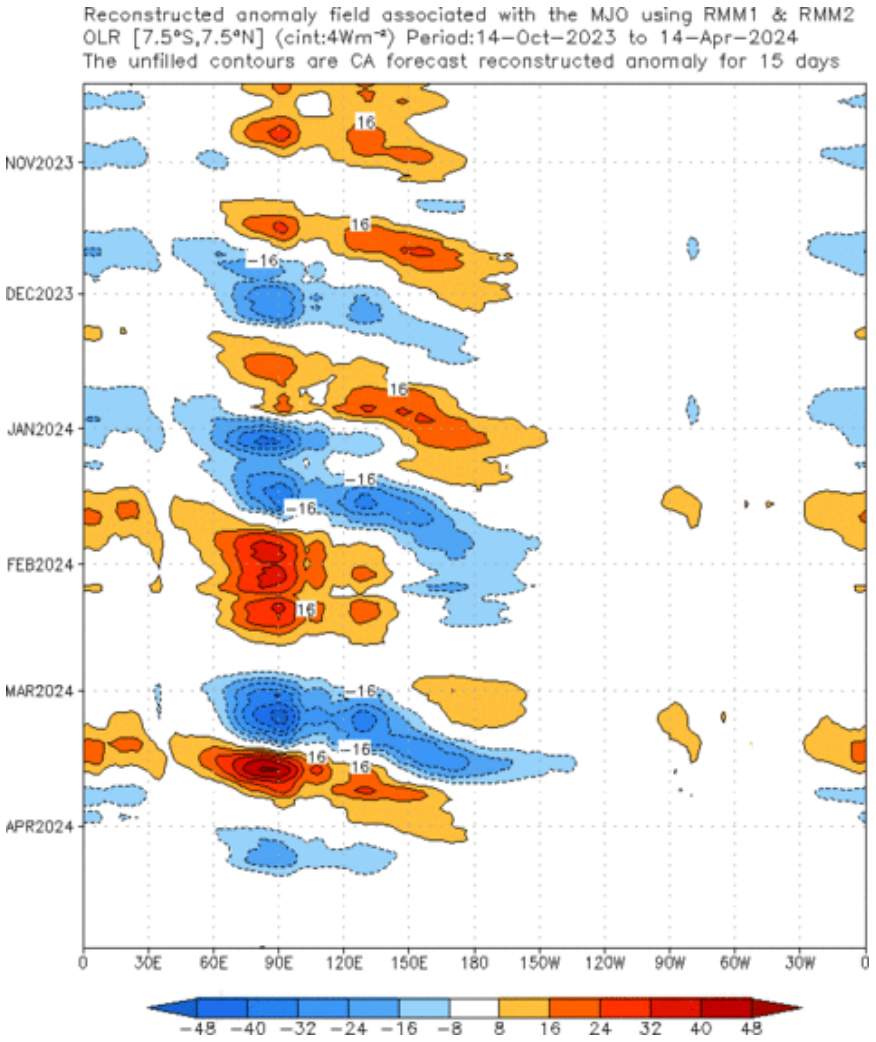


- Not updated due to the major IT outage on April 15.

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.)





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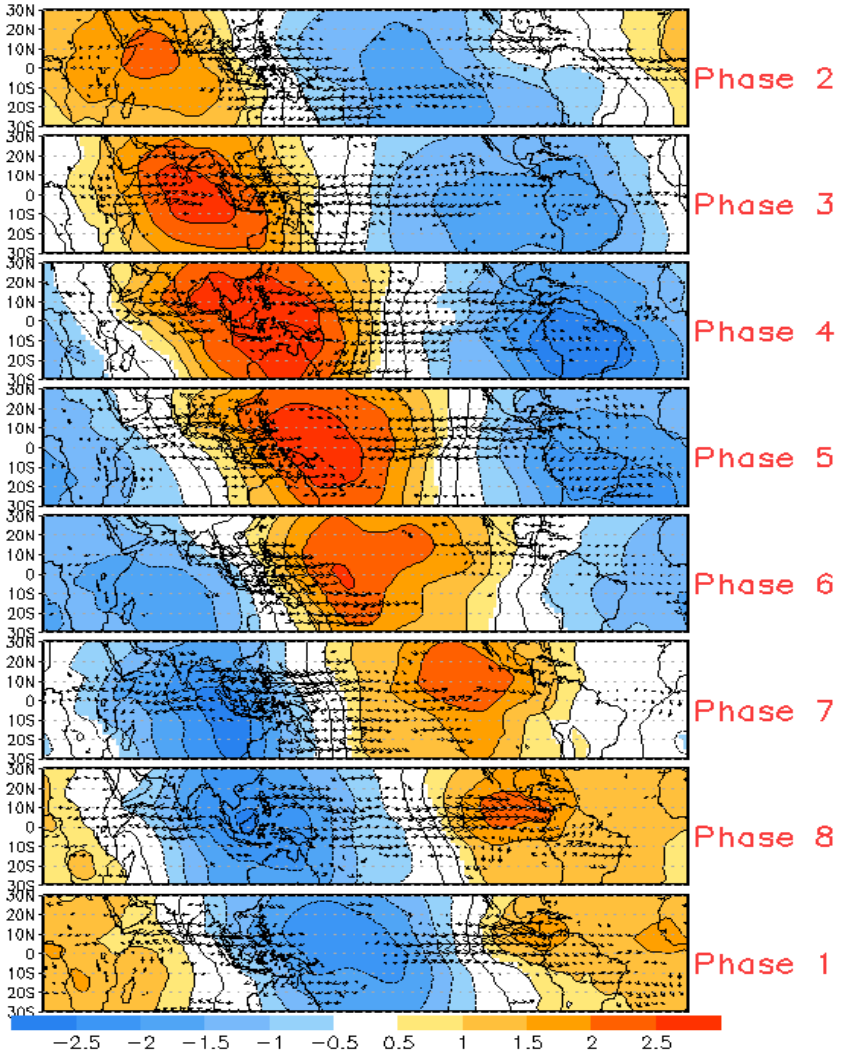
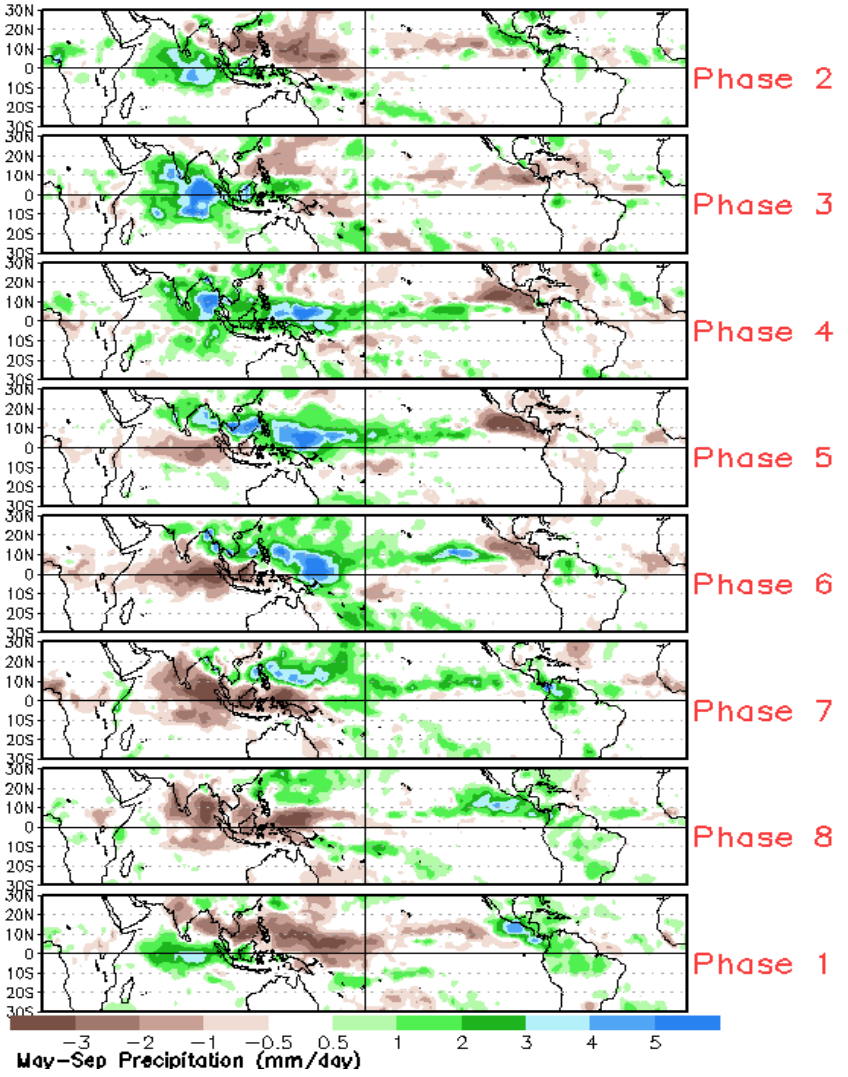
MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



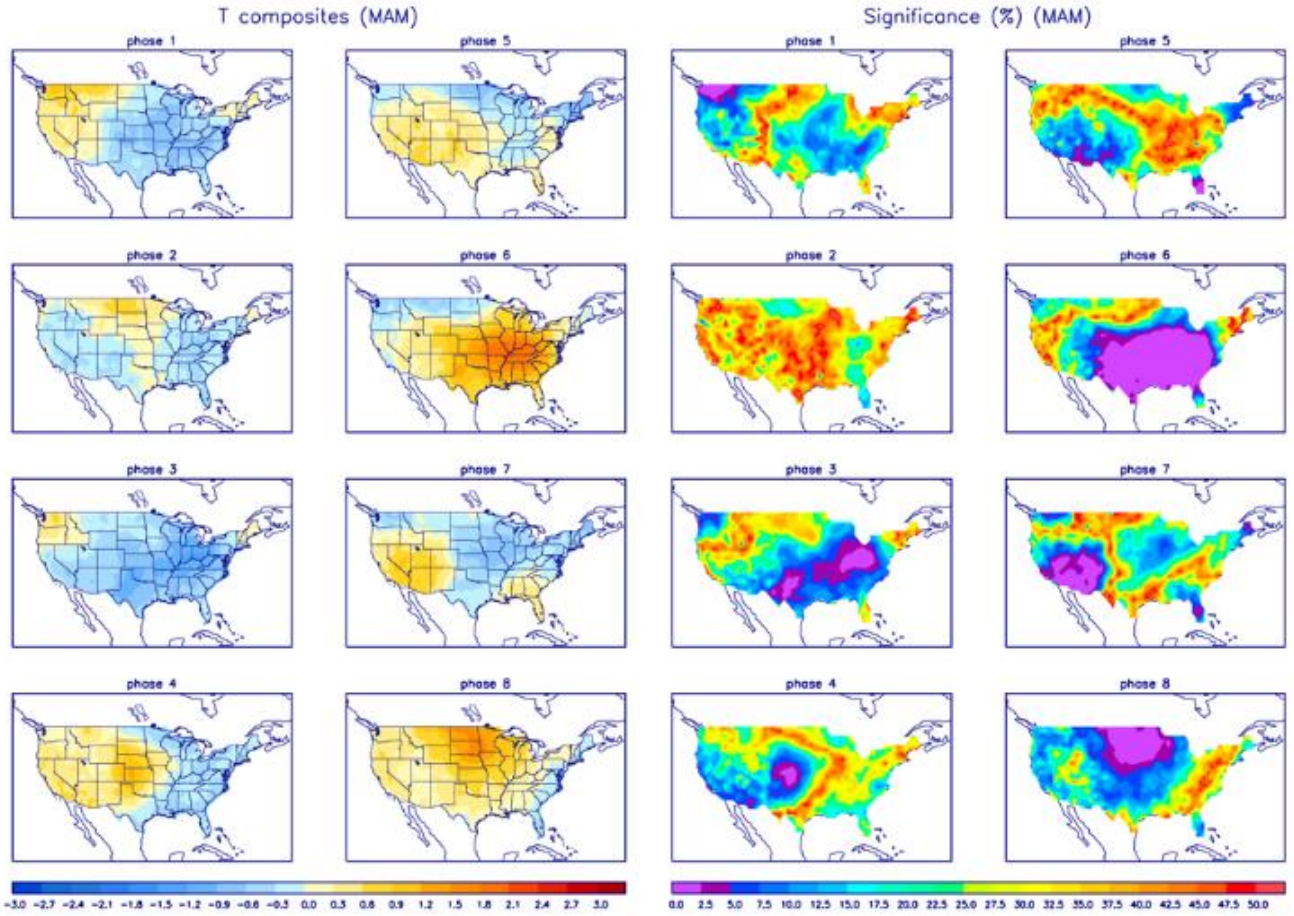
Precipitation Anomalies



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.

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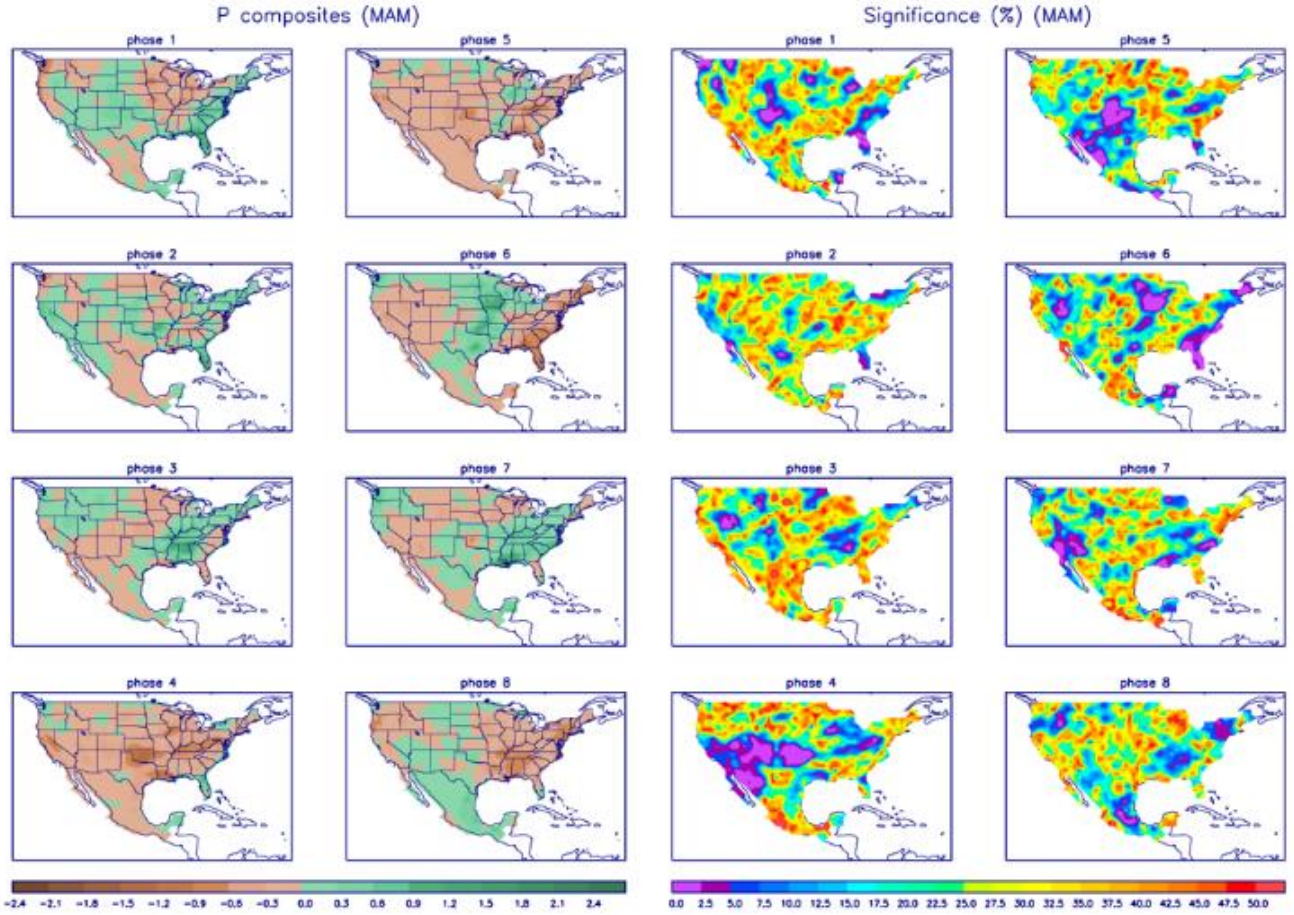

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