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

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

Overview

- After strengthening towards the end of May, the RMM index weakened rapidly during the first few days of June.

- Interference from the evolving Pacific base state, a suppressed signal over the West Pacific, and persistent convection over the Indian Ocean appear to be weakening the intraseasonal signal.

- Dynamical models depict a weak signal over the next few weeks, though the ECMWF continues to favor a coherent eastward propagation of the weak signal across the Pacific to the Western Hemisphere.

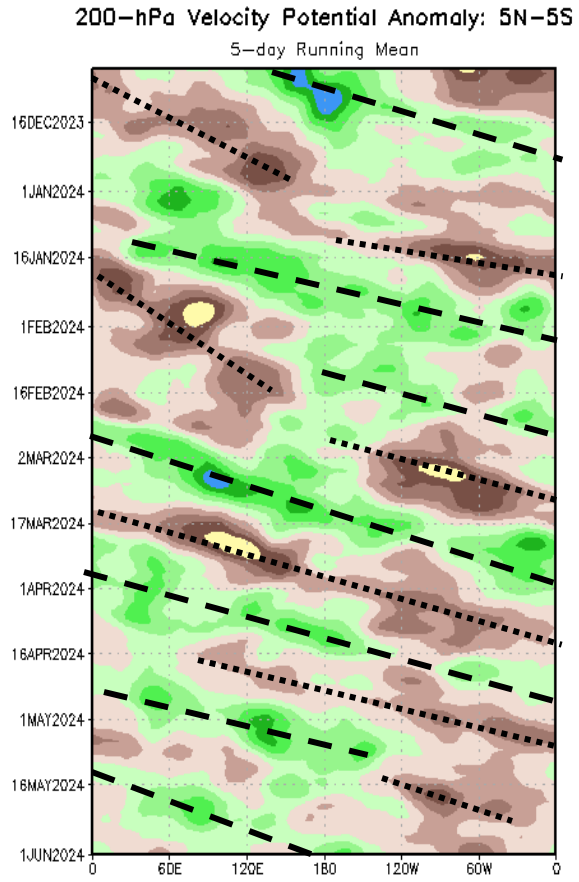
- Should remnant MJO activity cross the Pacific and Western Hemisphere during June, there would be an enhanced chance for early season tropical cyclogenesis. Much above-normal SSTs across the Atlantic basin may also favor early season TC genesis.

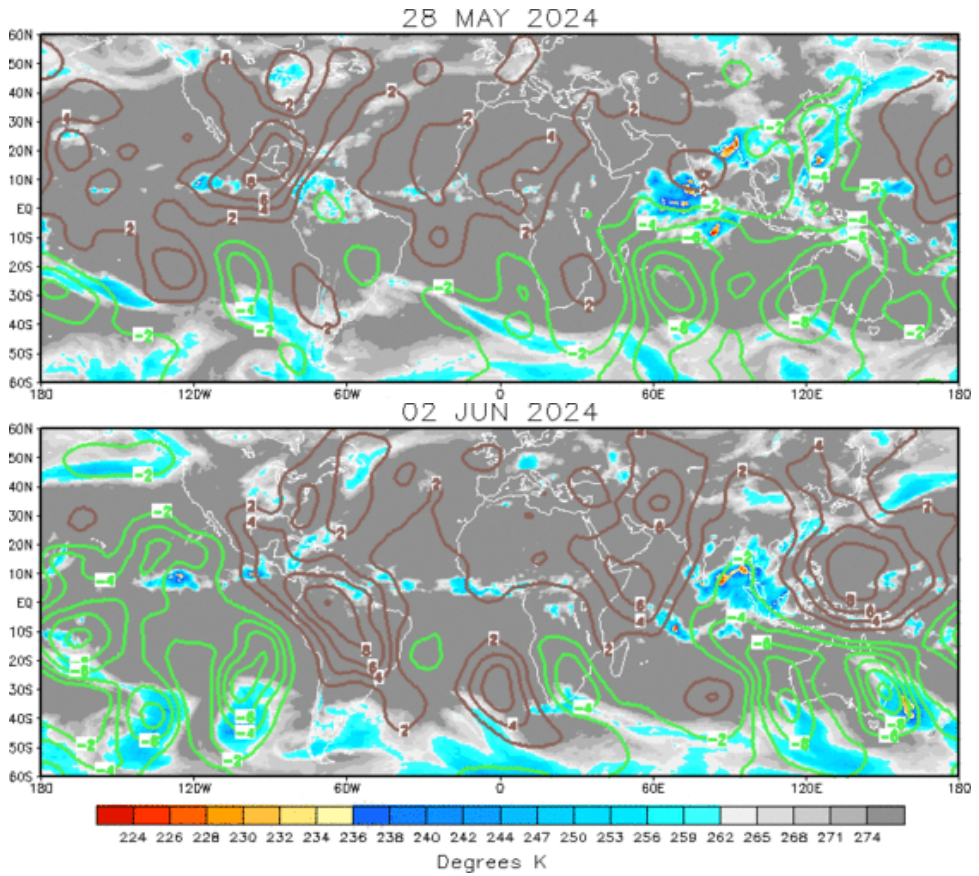
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

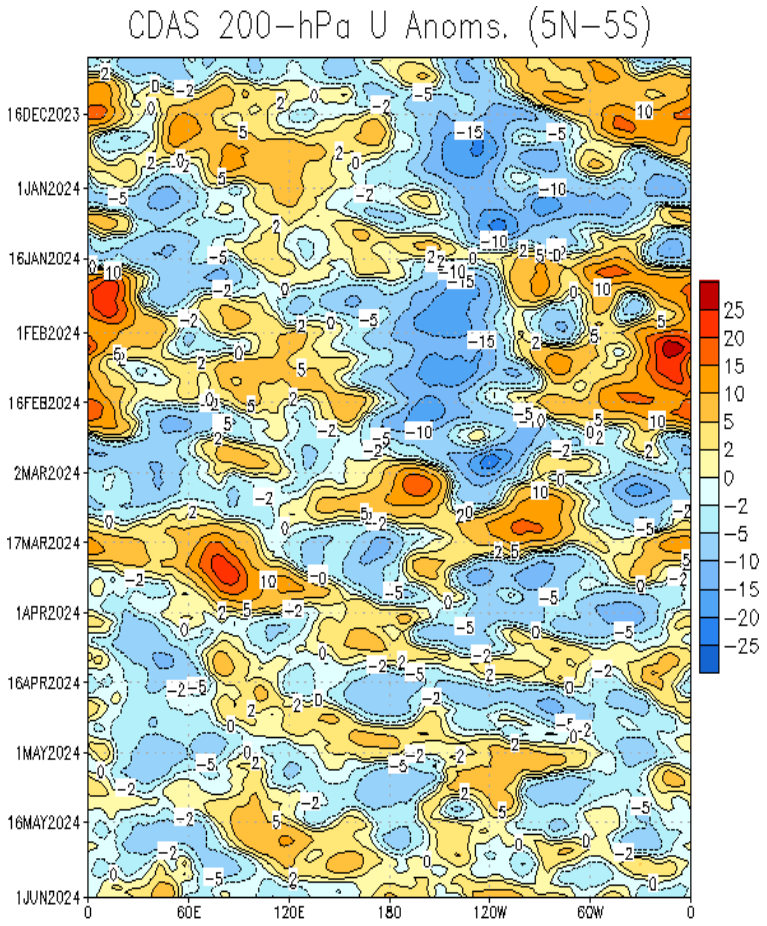


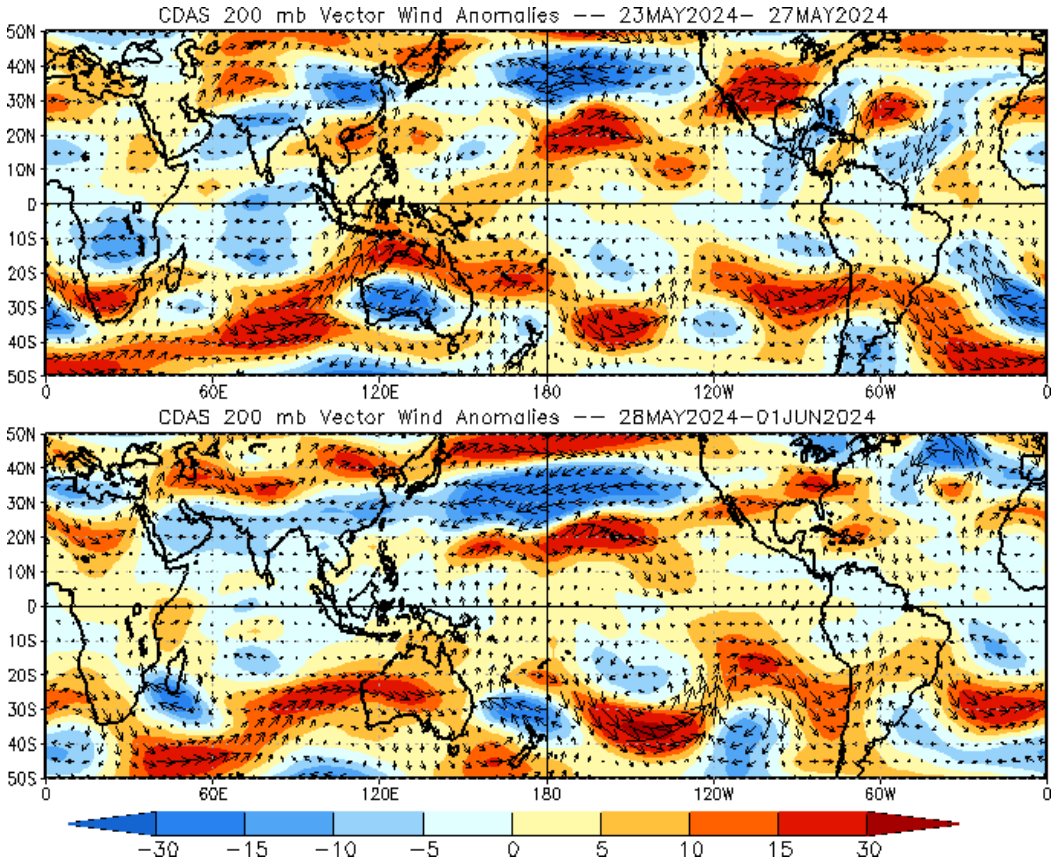


- While some signal consistent with intraseasonal MJO activity remains apparent in the upper-level velocity potential anomaly field, strong suppression over the West Pacific has interfered with the signal.
- Enhanced convection and divergence aloft persists over the Indian Ocean, which has also interfered with the MJO evolution.

200-hPa Wind Anomalies

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

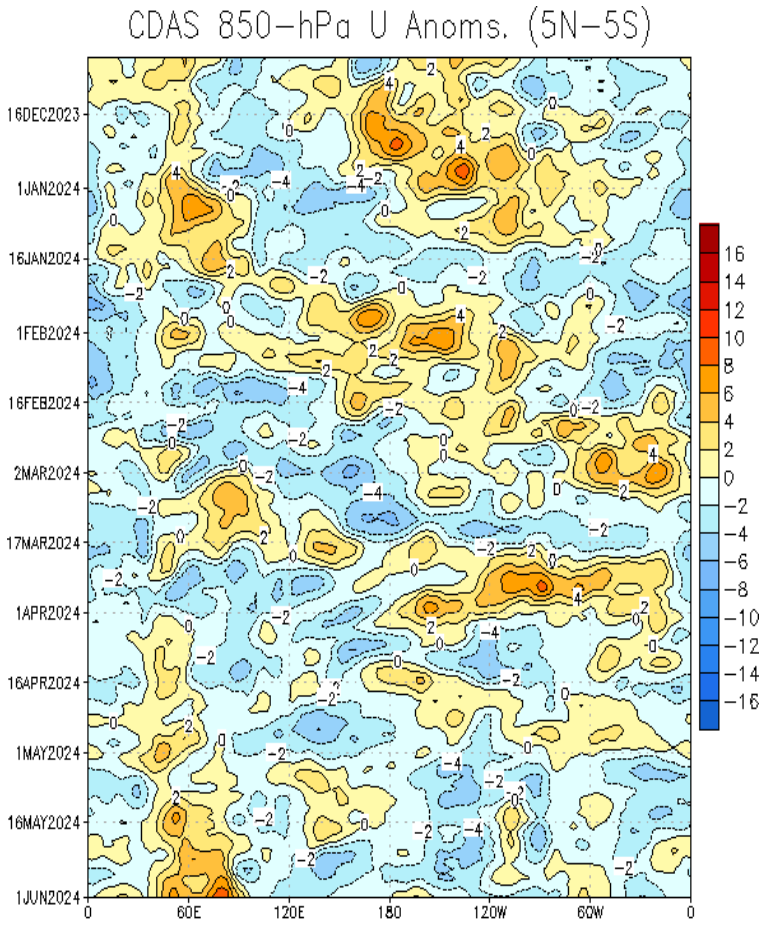


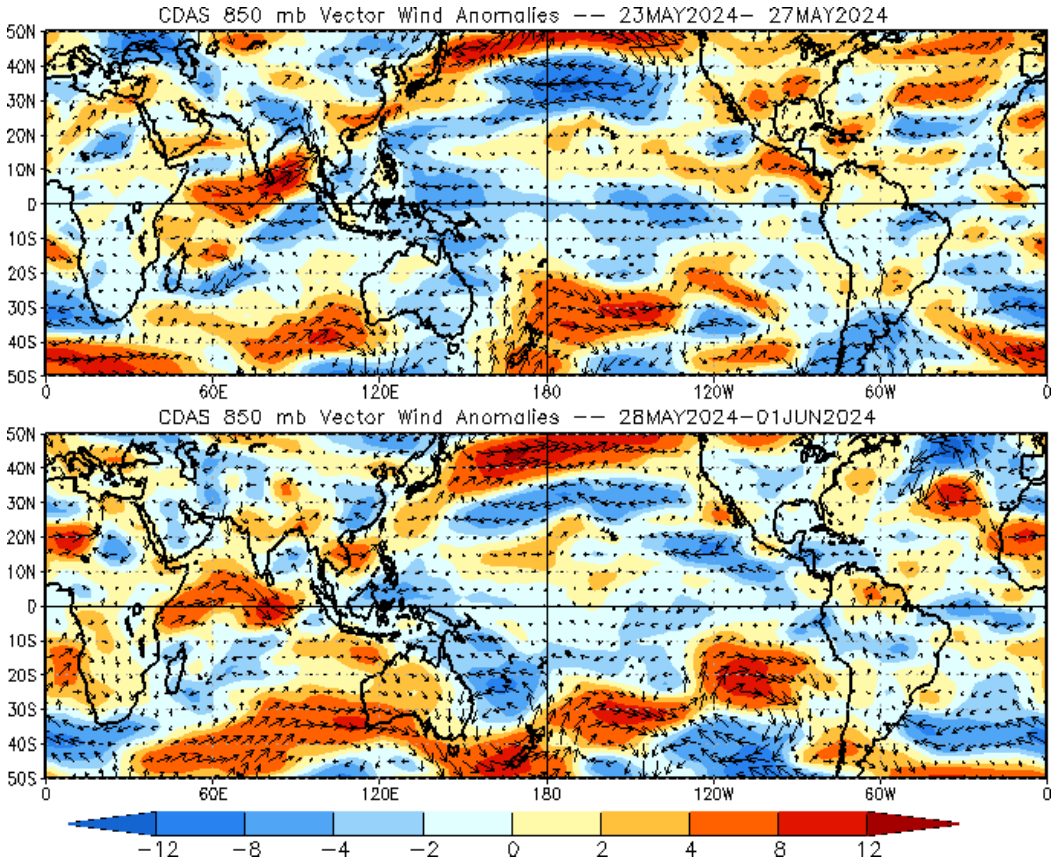


- Pronounced eastward propagation of westerly anomalies from the eastern Indian Ocean in early May to the eastern Pacific by early June is consistent with MJO activity.
- The zonal wind anomaly field has become markedly weaker during the last days of May and early June.
- A pronounced subtropical jet remains in place from the eastern Pacific through the southern CONUS.

850-hPa Wind Anomalies

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

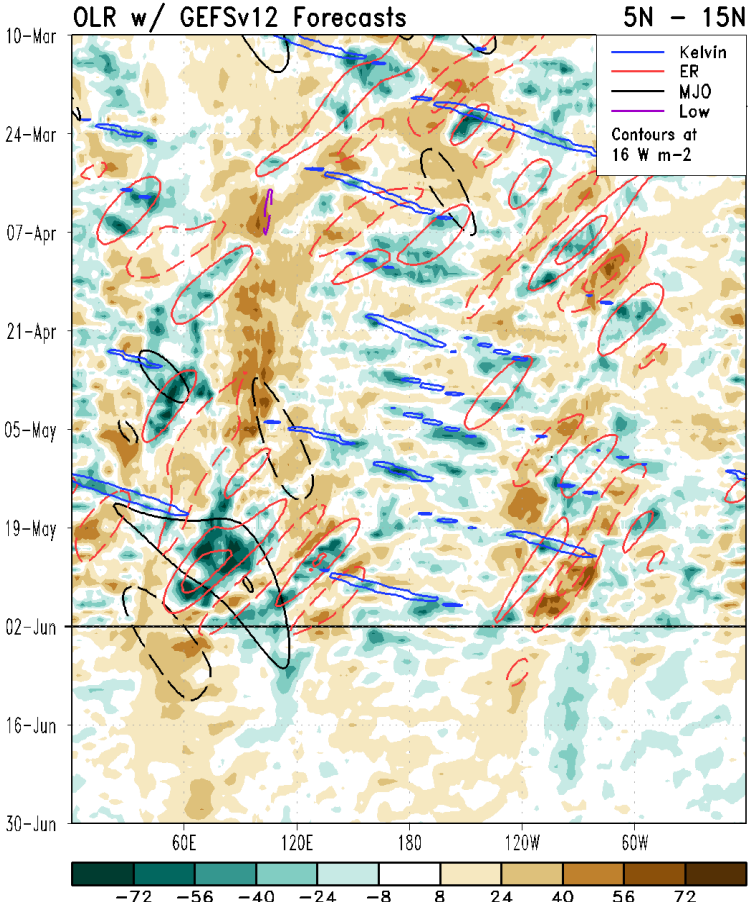


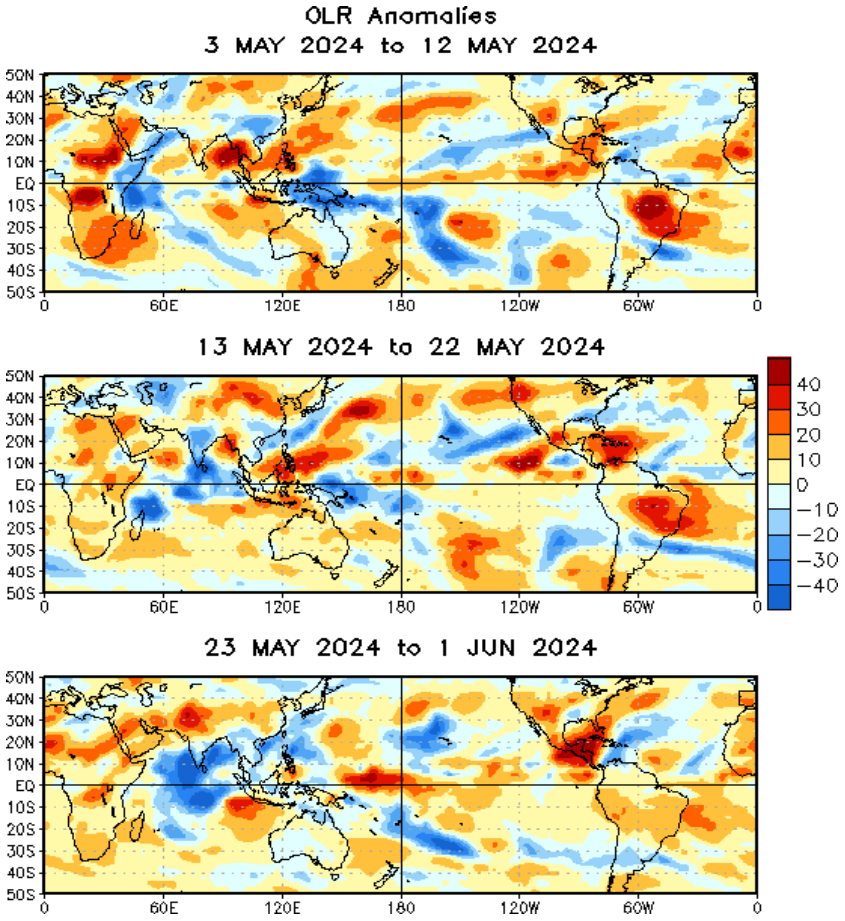


- Westerly anomalies have persisted for the past few weeks across the central Indian Ocean.
- Easterly anomalies diminished slightly over the central Pacific, a fairly lackluster response to MJO activity and may indicate a strengthening low frequency signal.

Outgoing Longwave Radiation (OLR) Anomalies

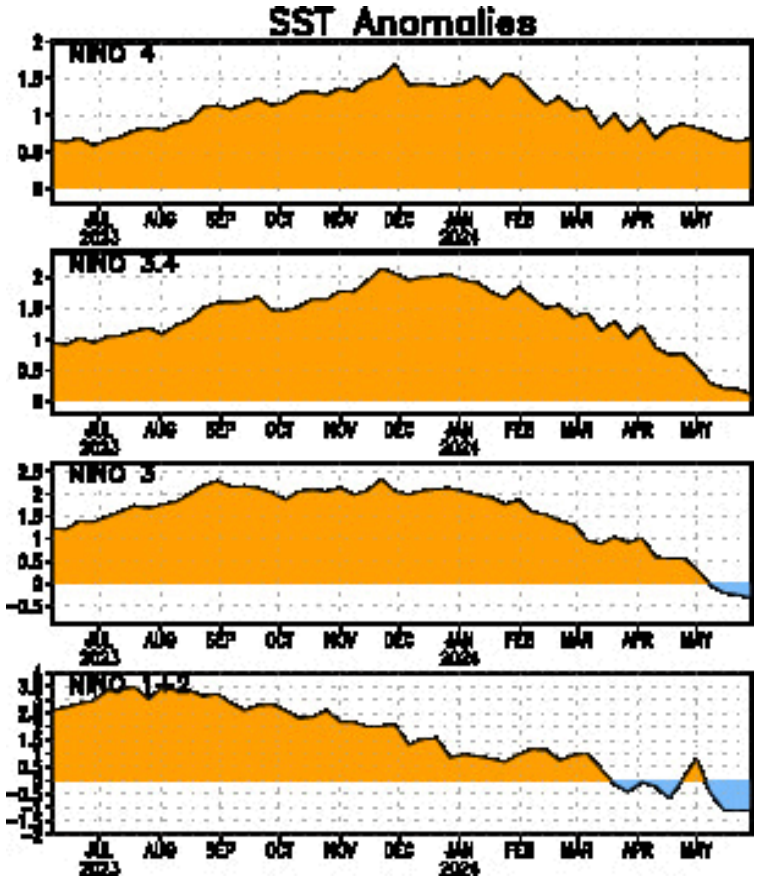
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

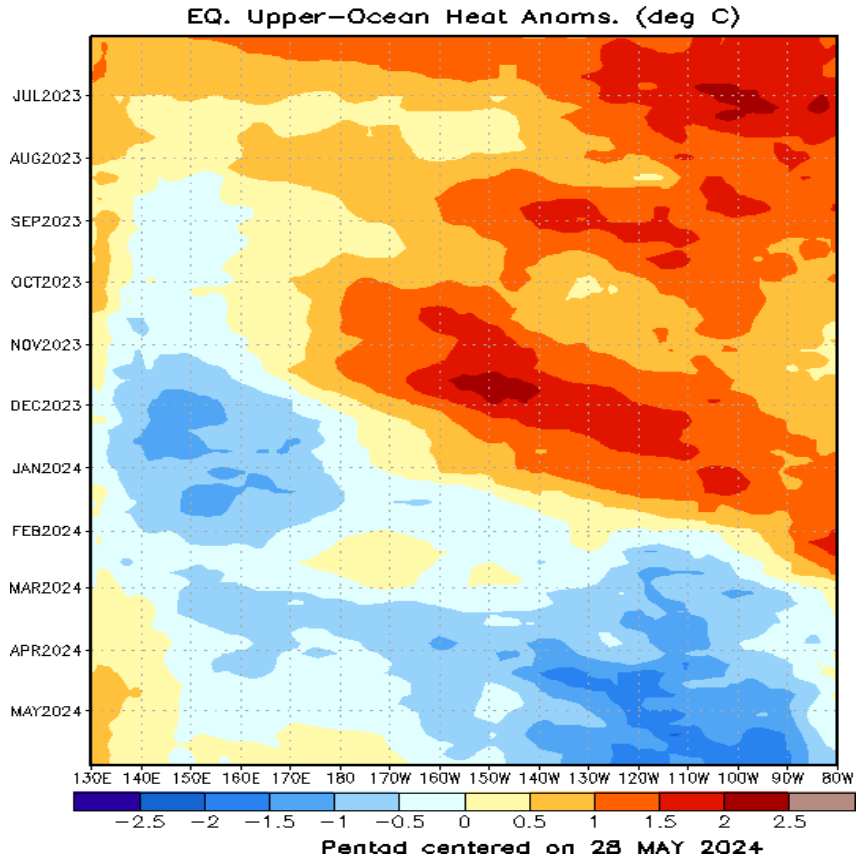




- Enhanced convection persisted through early June across the eastern Indian Ocean, possibly due to Rossby wave activity.
- Suppressed convection remains across the far East Pacific, western Caribbean, and southern Gulf of Mexico regions.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

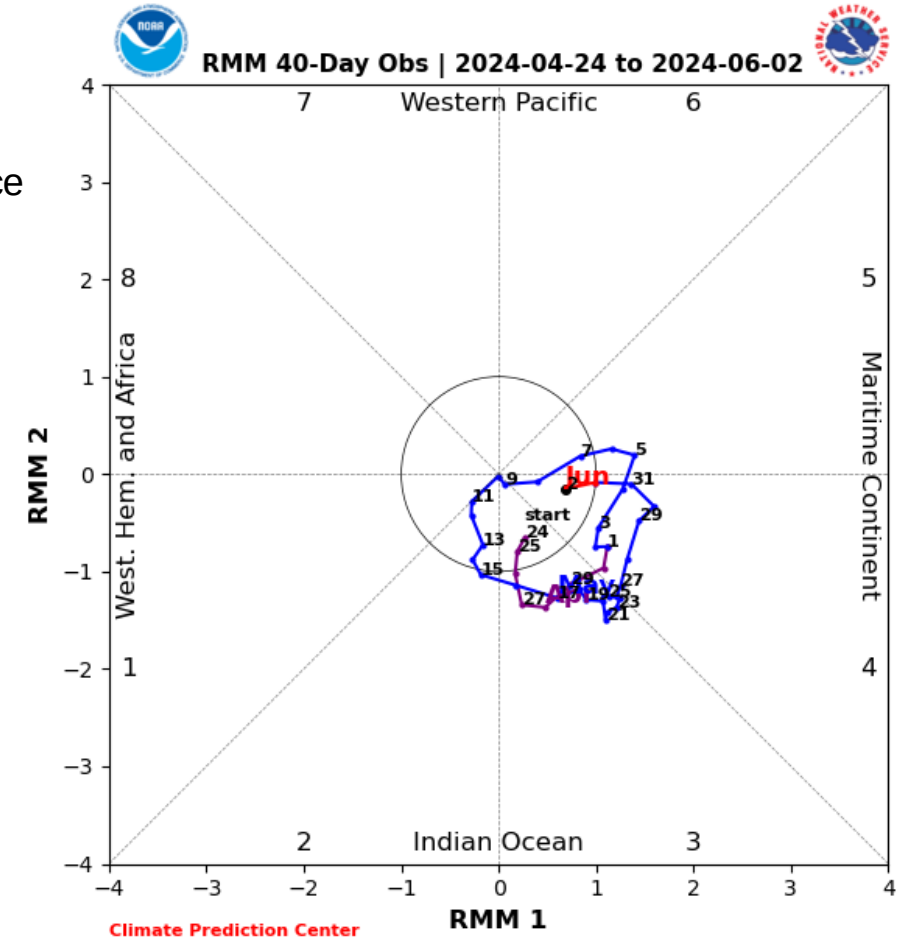




- SSTs in the easternmost Niño regions continue to trend downward since February, indicative of a decaying El Niño and potentially developing La Niña.
- Negative subsurface temperature anomalies continue to be observed across nearly the entire Pacific, with cooling most pronounced across the Eastern Pacific.

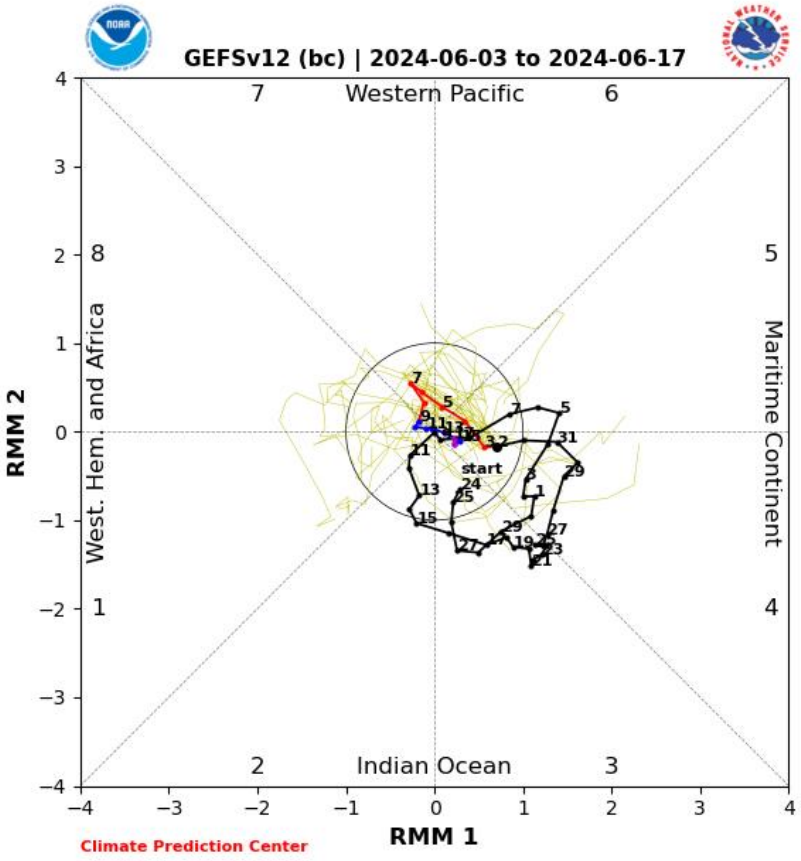
MJO Index: Recent Evolution

- The RMM index showed an increased MJO signal towards the end of May, but crashed inside the unit circle during early June, possibly due to interference from both the evolving Pacific base state and persistent Indian Ocean convection.

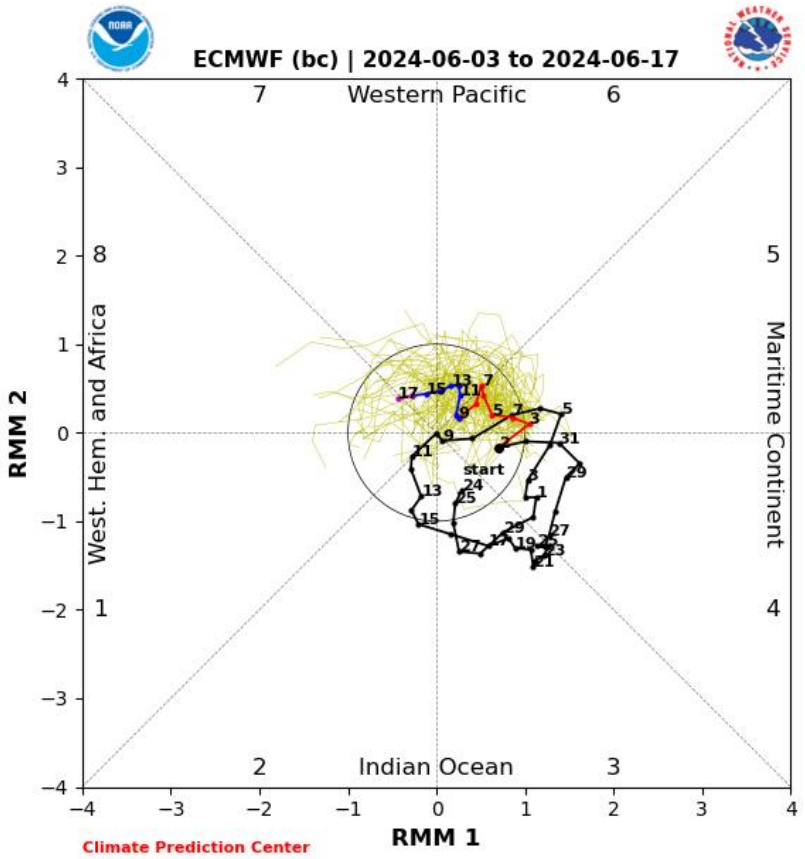


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

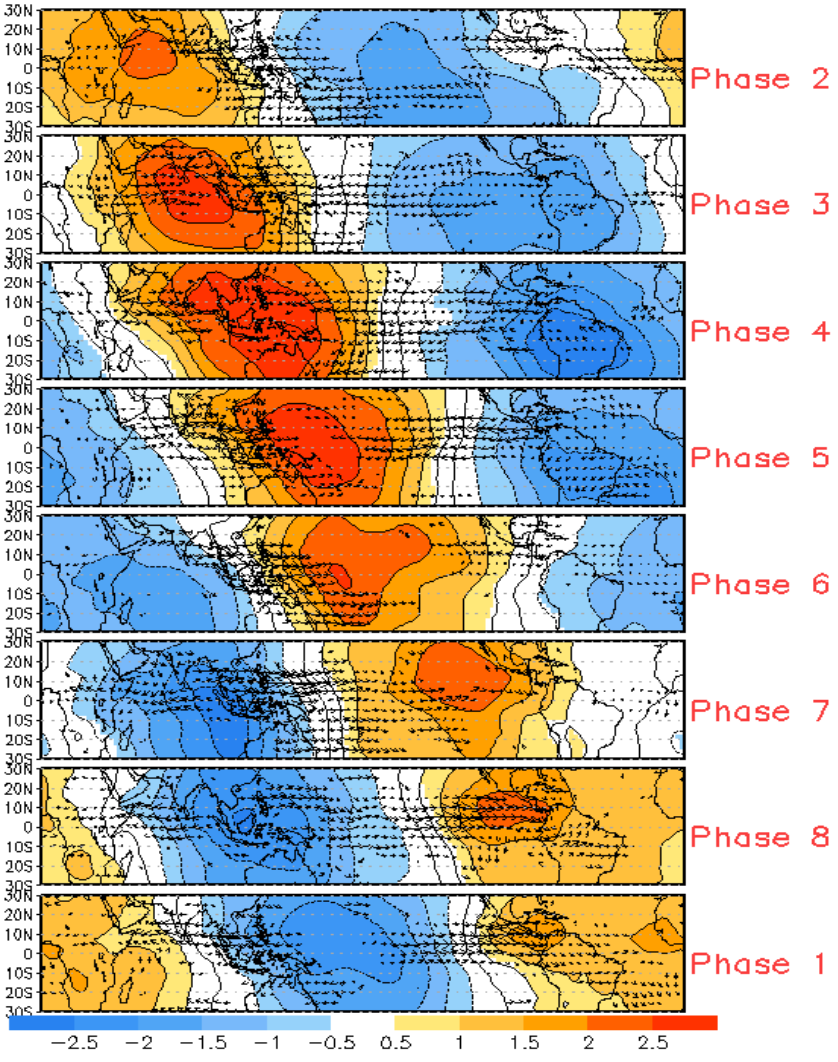


ECMWF Forecast

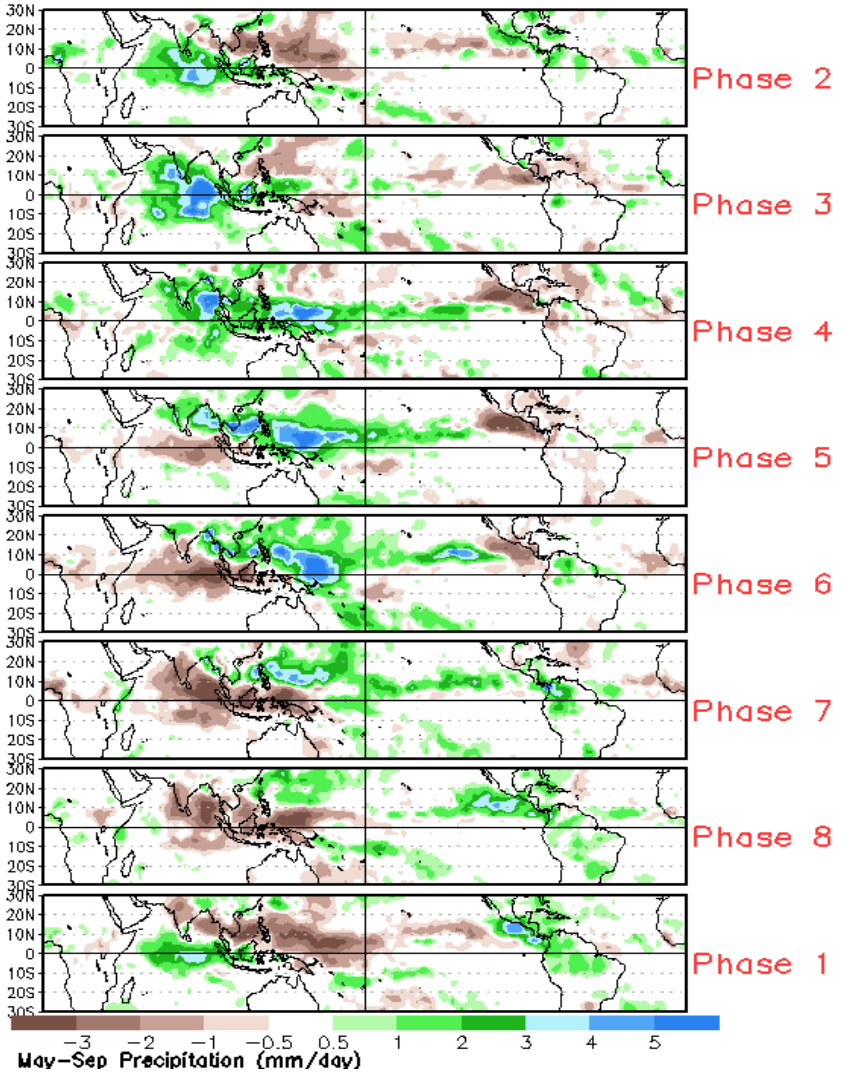
- Both the GEFS and ECMWF depict fairly weak MJO activity over the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



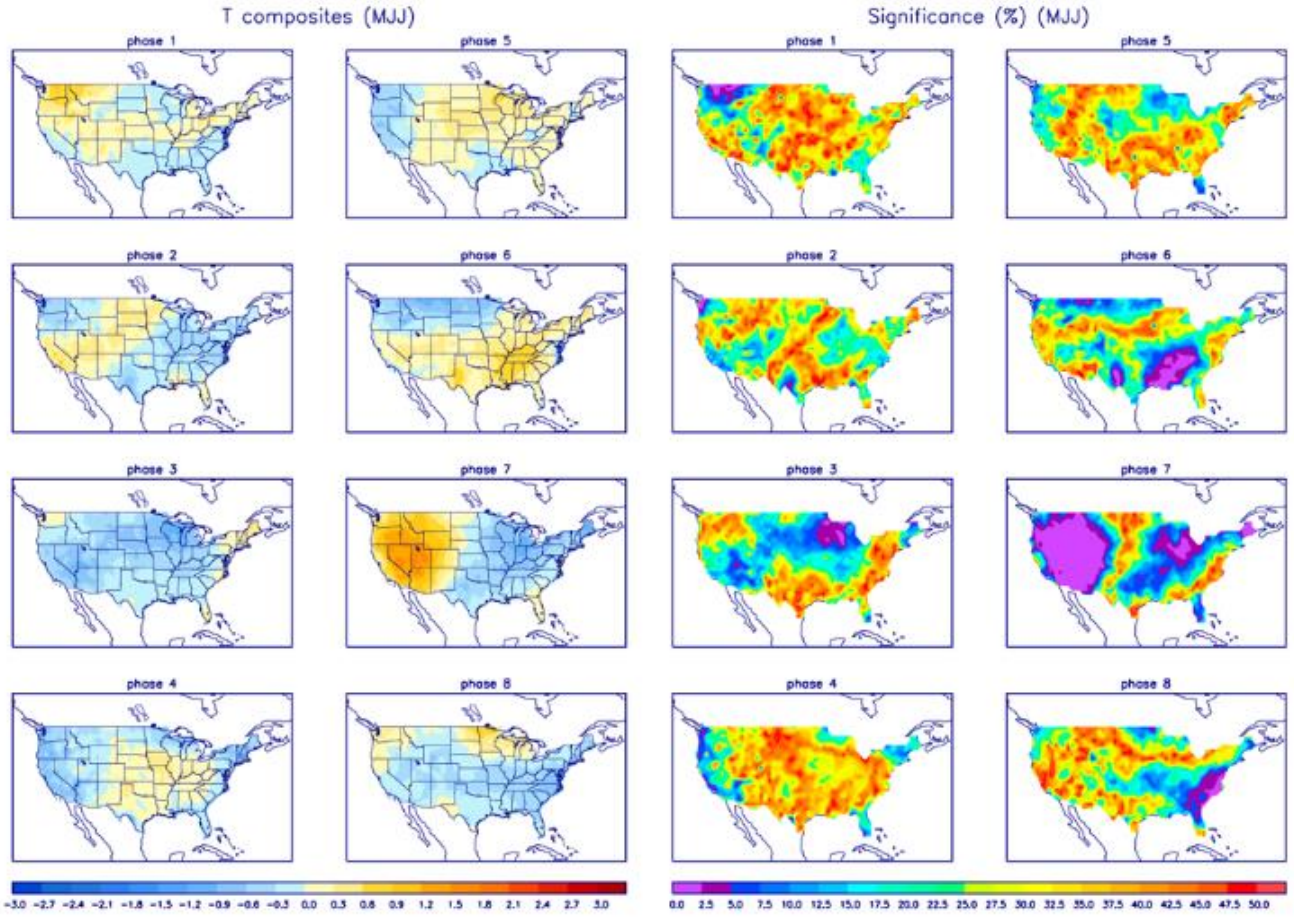
Precipitation Anomalies



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.

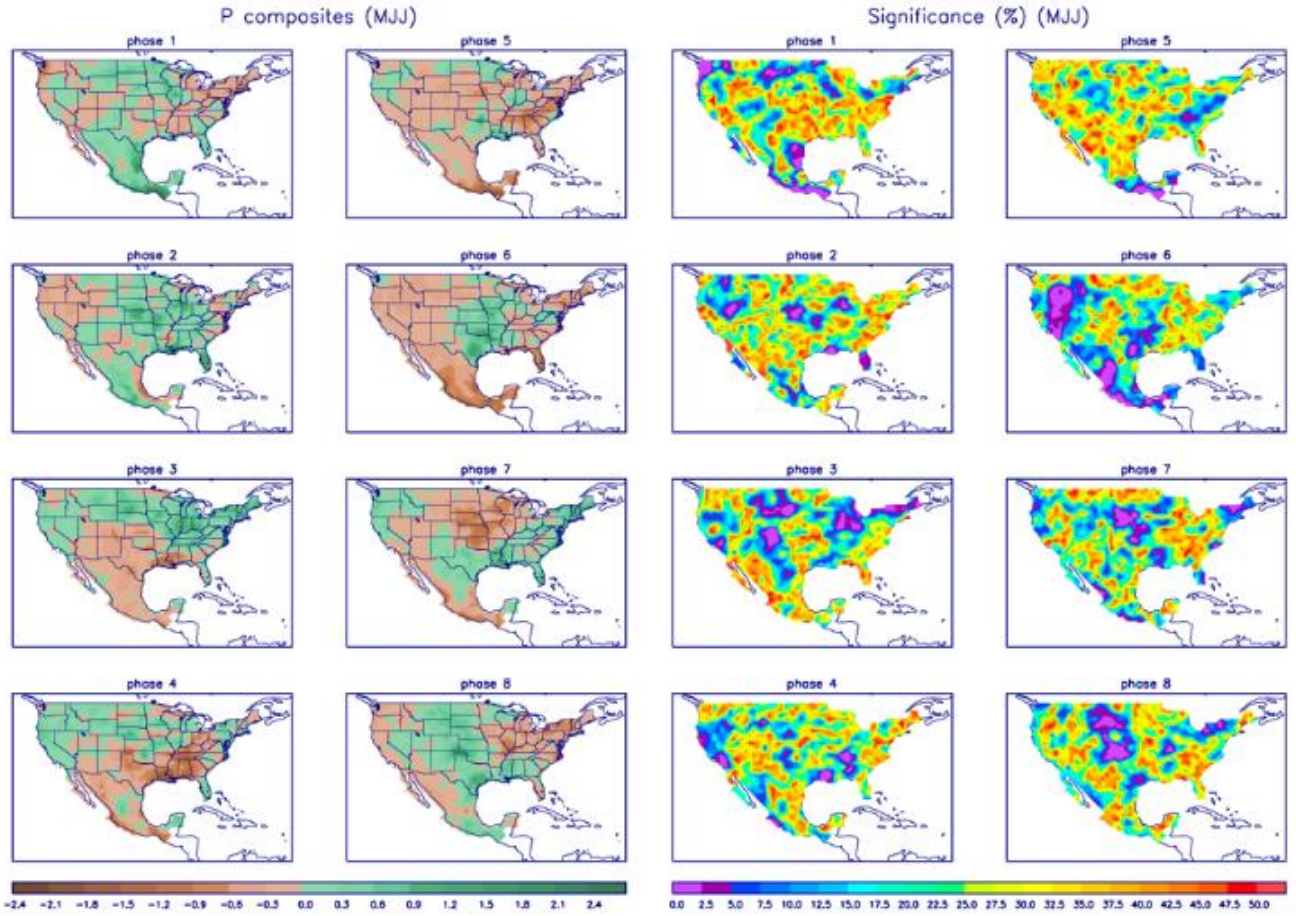


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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.



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