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

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
19 September 2022

Overview

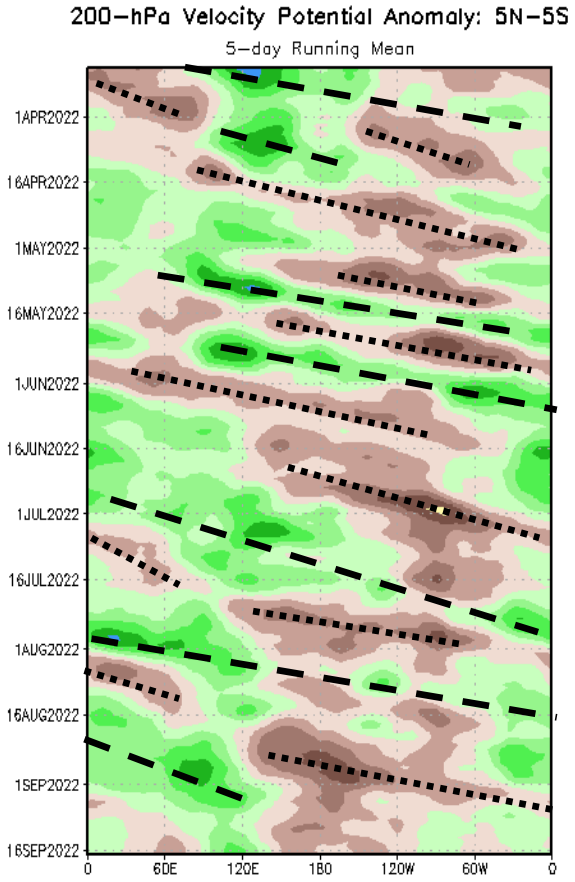
- The RMM index and upper-level velocity potential anomaly analyses indicate a weak MJO.
- The MJO is expected to remain weak during the next two weeks with La Niña the major contributor to anomalous rainfall across the global tropics.
- From late September to October, the favored area for TC genesis across the Atlantic typically shifts from the Main Development Region to the Caribbean Sea.

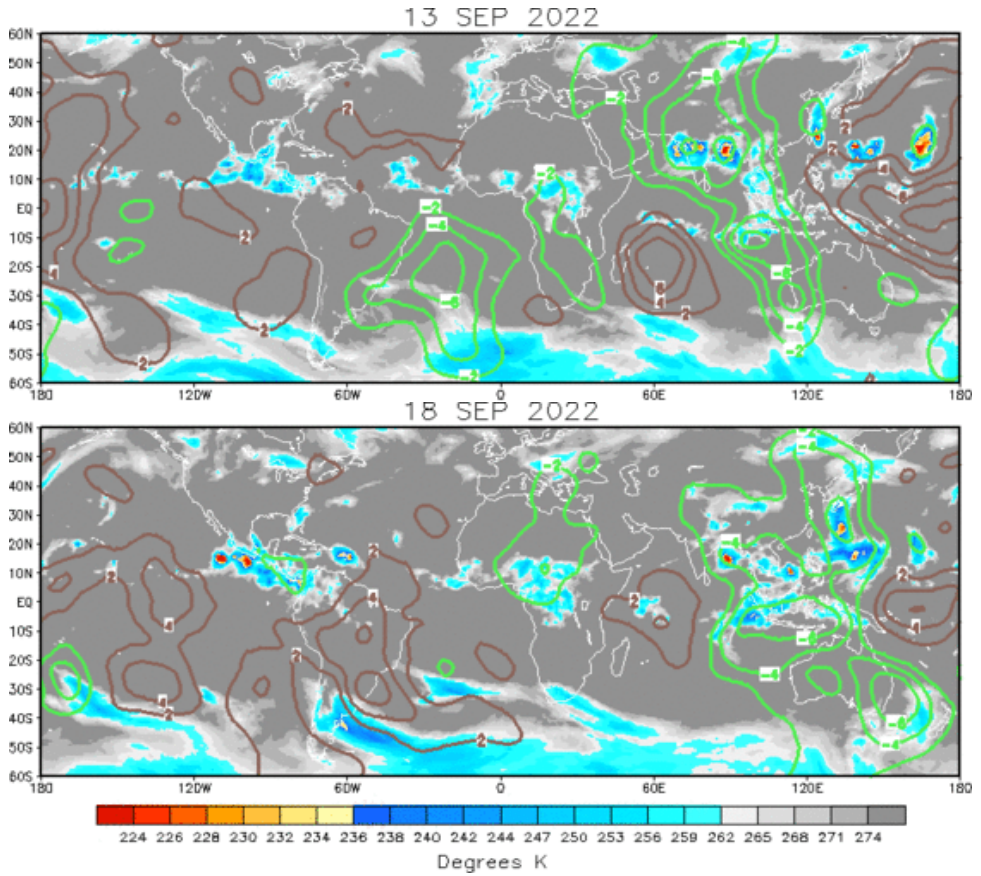
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

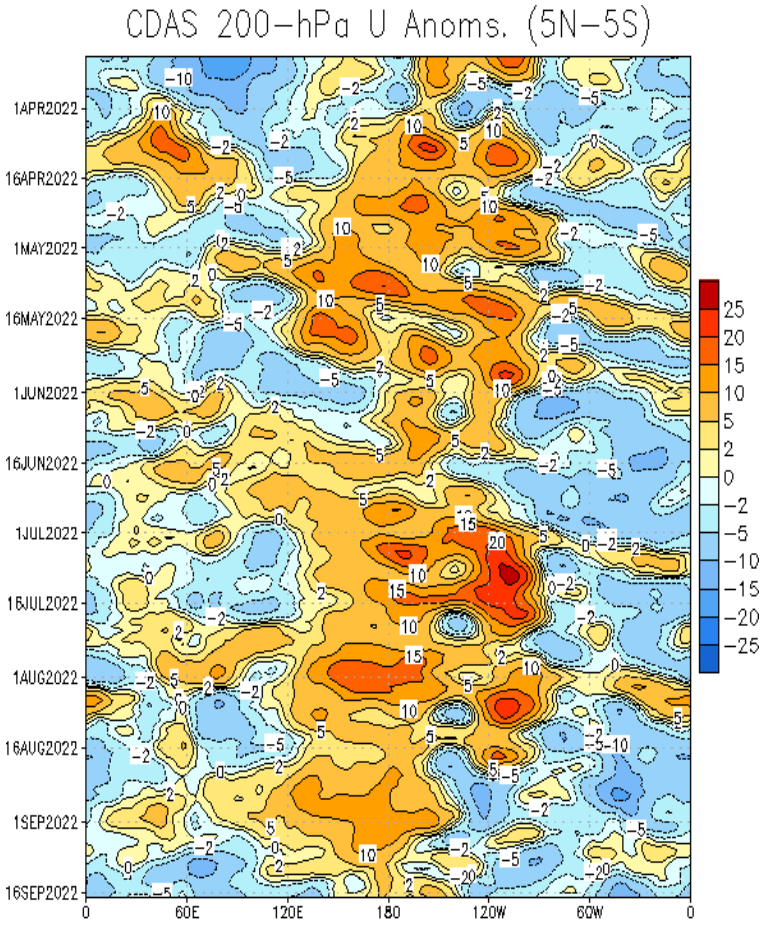


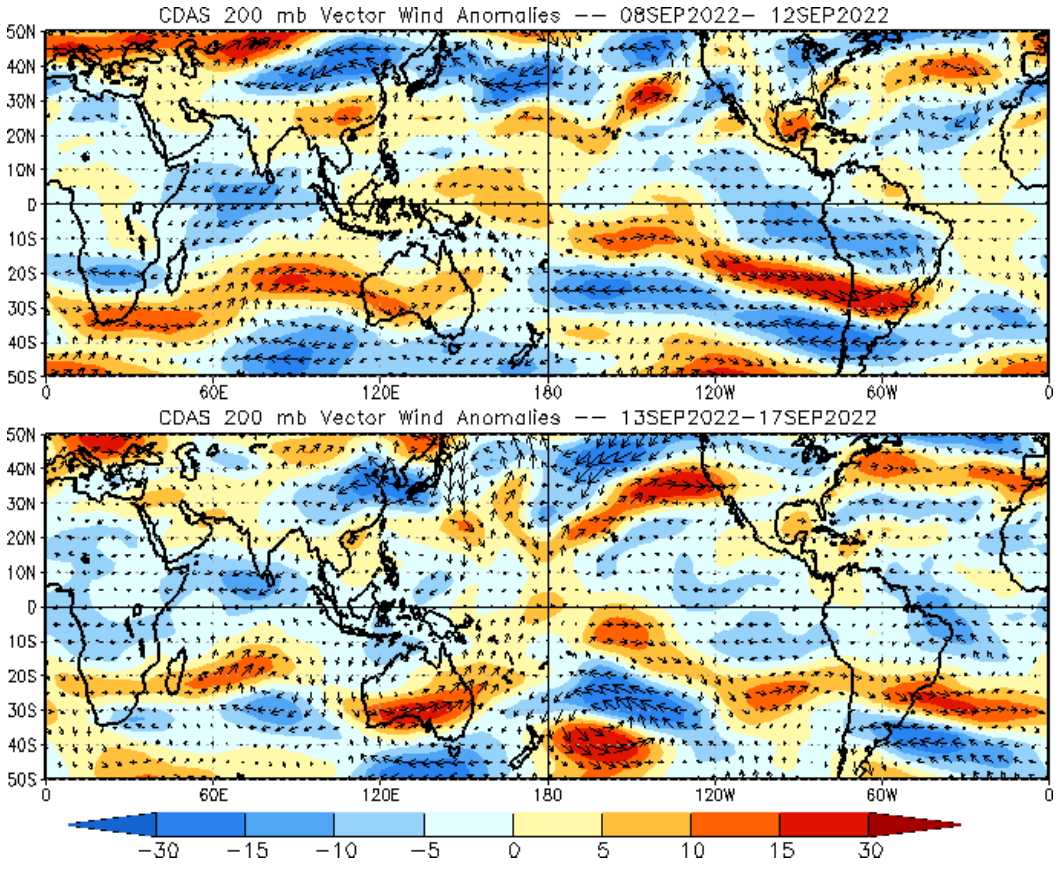


- The upper-level velocity potential pattern became more stationary during September.
- The largest anomalies of upper-level divergence remain centered over the Maritime Continent which is consistent with La Niña.

200-hPa Wind Anomalies

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

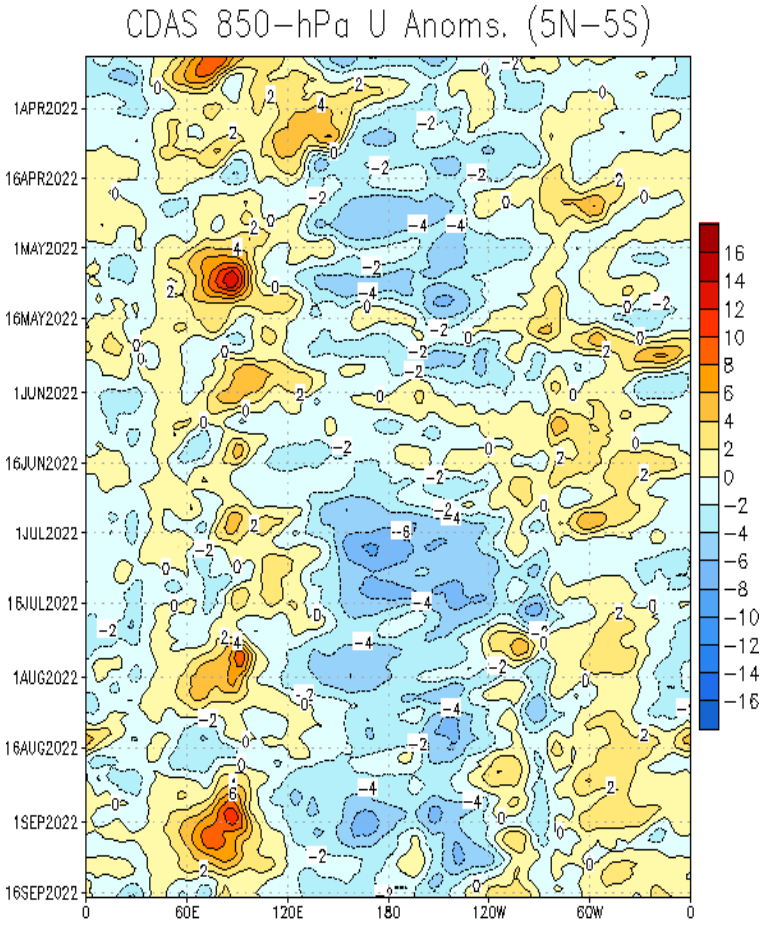


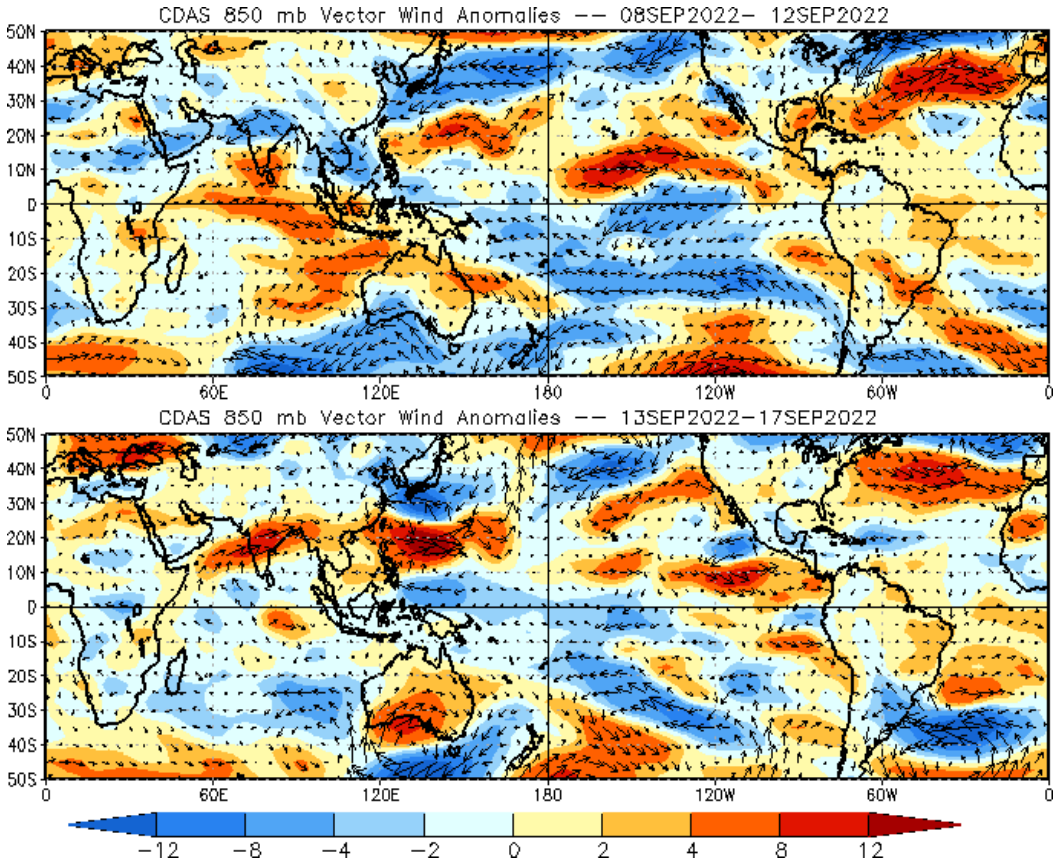


- Anomalous upper-level westerlies continue to be observed along the equatorial Pacific, but are mainly confined to the west of 120W.
- Anomalous easterlies aloft strengthened across the equatorial Indian Ocean during early September.
- Anomalous easterlies continue over the tropical Atlantic, resembling a series of eastward propagating features observed earlier this year in Time/Lon space.

850-hPa Wind Anomalies

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

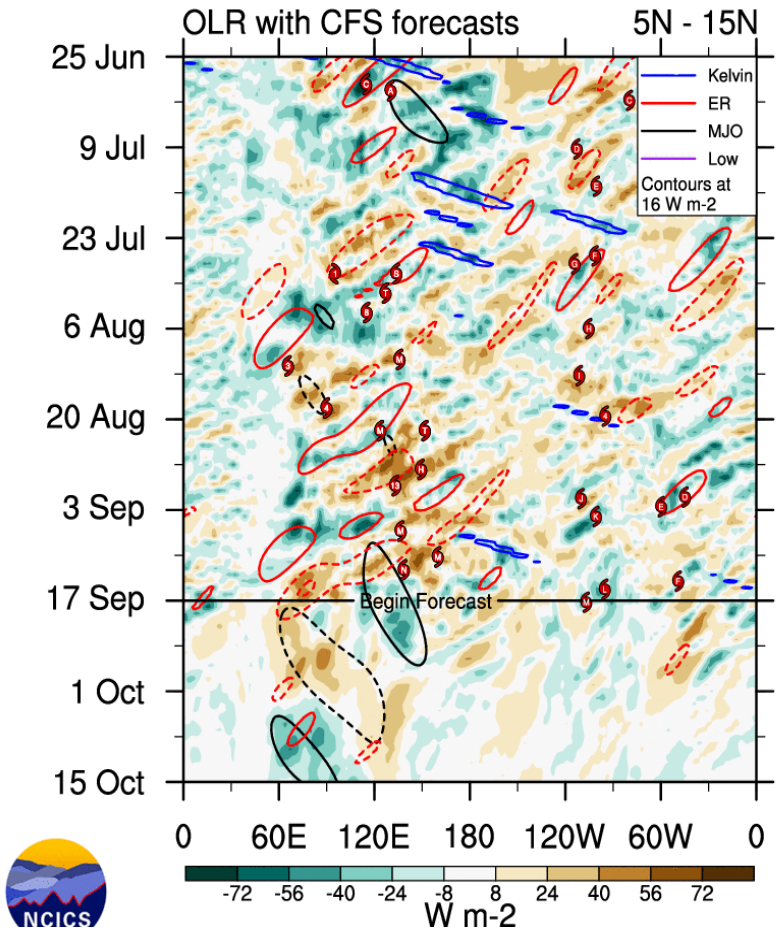


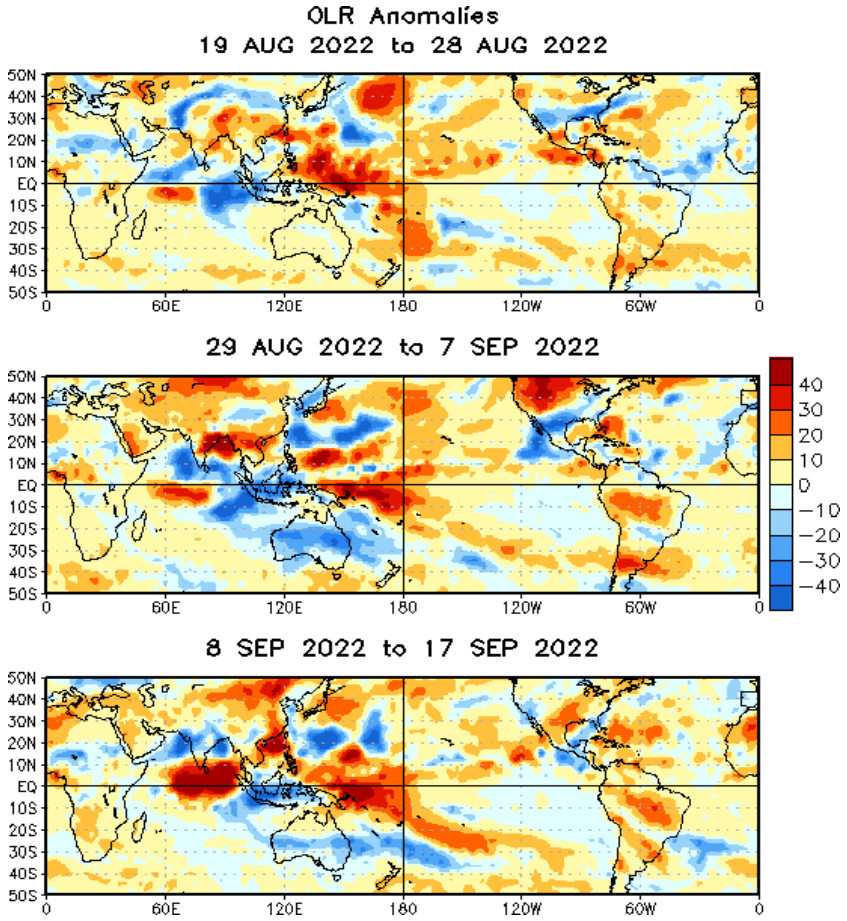


- Enhanced trades persist over much of the equatorial Pacific, consistent with the La Niña footprint.
- North of the equator, anomalous westerlies continue across much of the eastern Pacific and the Main Development Region of the Atlantic, relaxing shear for tropical cyclone development.

Outgoing Longwave Radiation (OLR) Anomalies

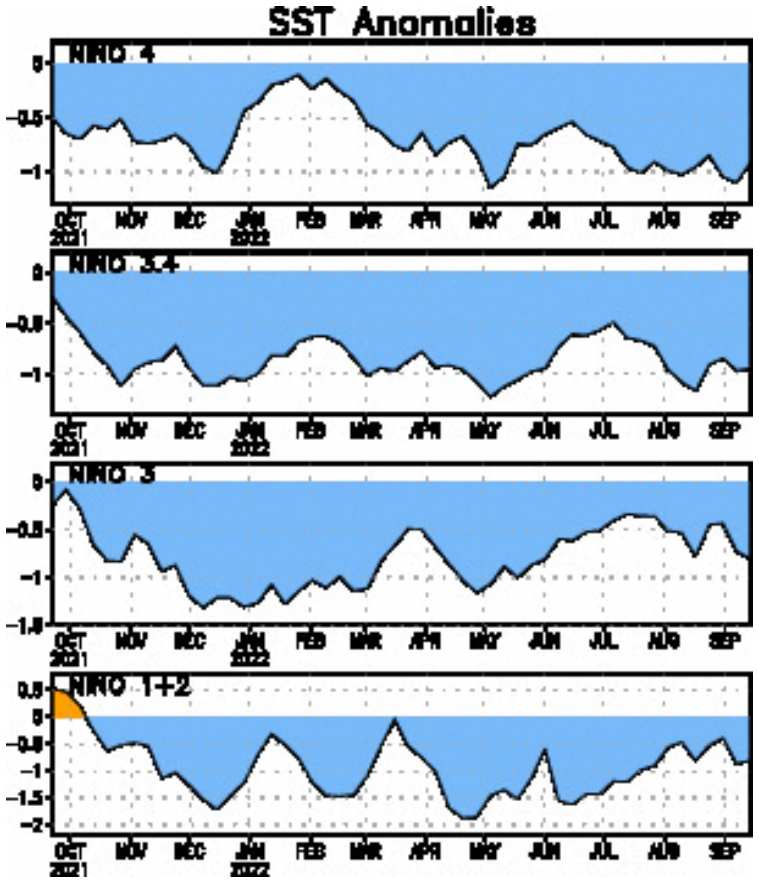
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

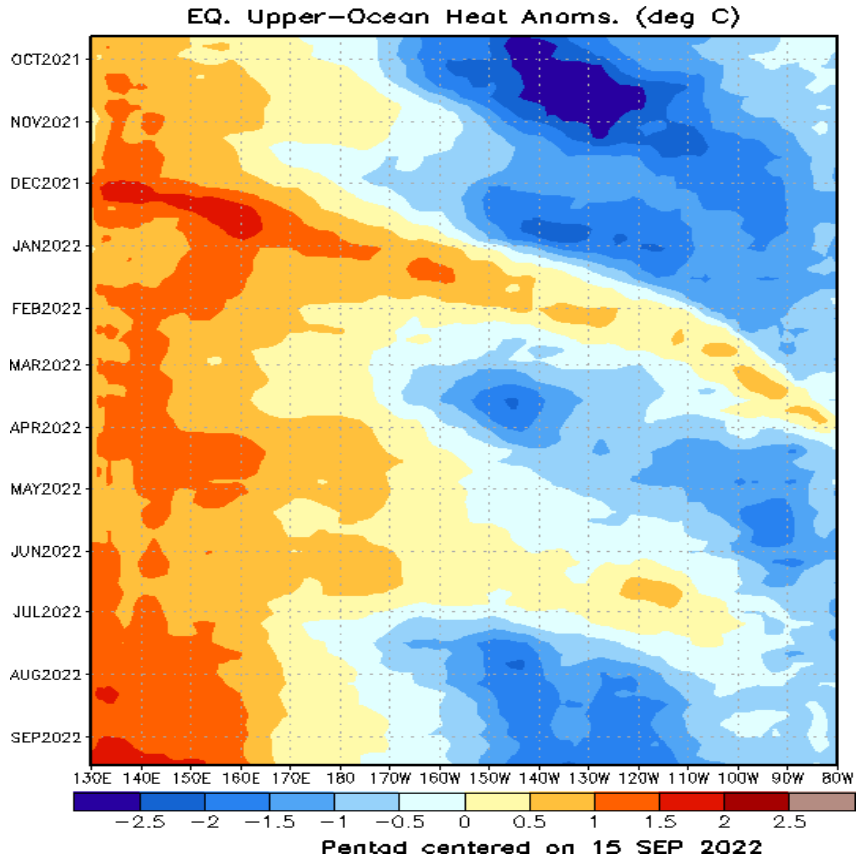




- Enhanced convection shifted northward from the equatorial Indian Ocean to South Asia during late August and early September.
- Enhanced (suppressed) convection remains anchored over the Maritime Continent (equatorial central Pacific) due to La Niña.
- Since the end of August, enhanced convection resumed across the East Pacific with multiple tropical cyclones forming.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

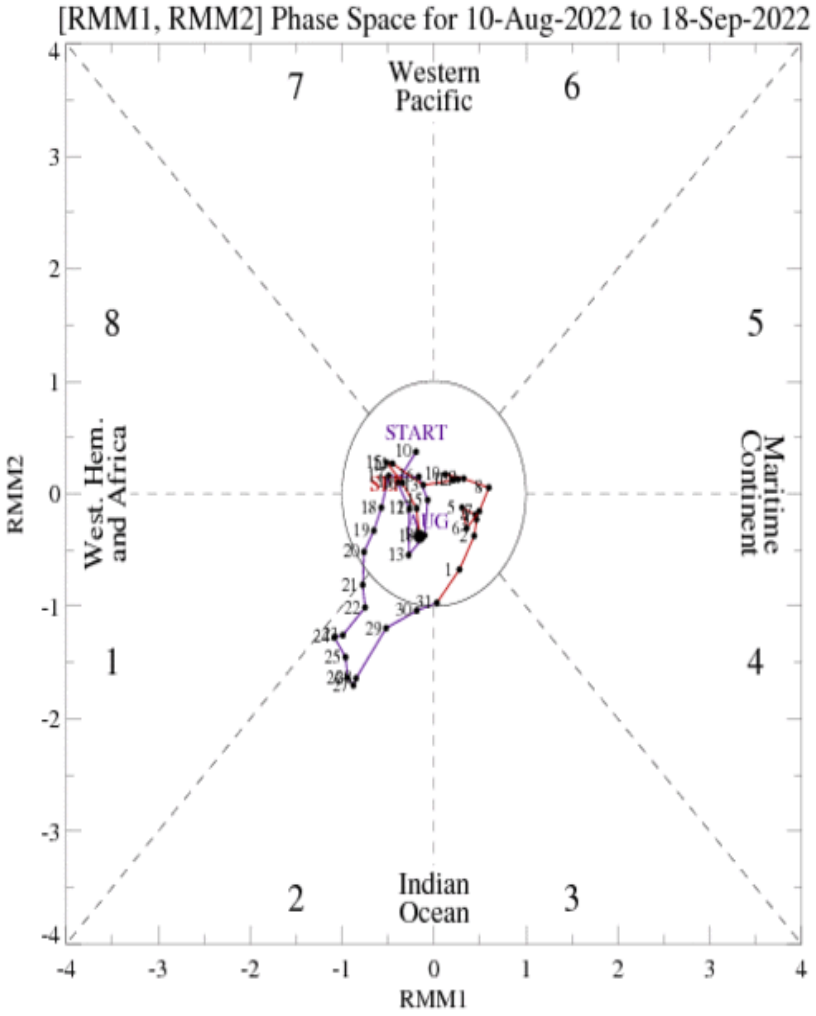




- Following a warming trend in subsurface temperatures over the equatorial Pacific in May and June, enhanced trades tied to the ongoing La Niña have led to continued subsurface below-normal heat content mainly east of the Date Line since July.
- SSTs remain below average across all Niño basins, with the magnitude of the negative anomalies generally unchanged from the previous week.

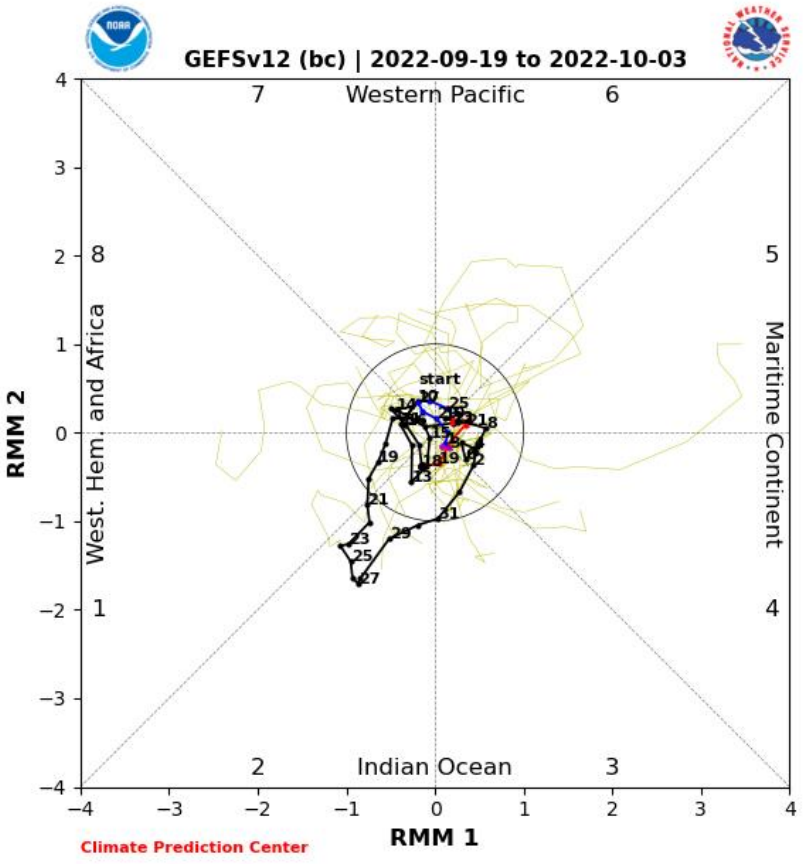
MJO Index: Recent Evolution

- Following eastward propagation of a MJO signal through the beginning of September, the RMM index has remained inside the unit circle as any remnant MJO weakened.

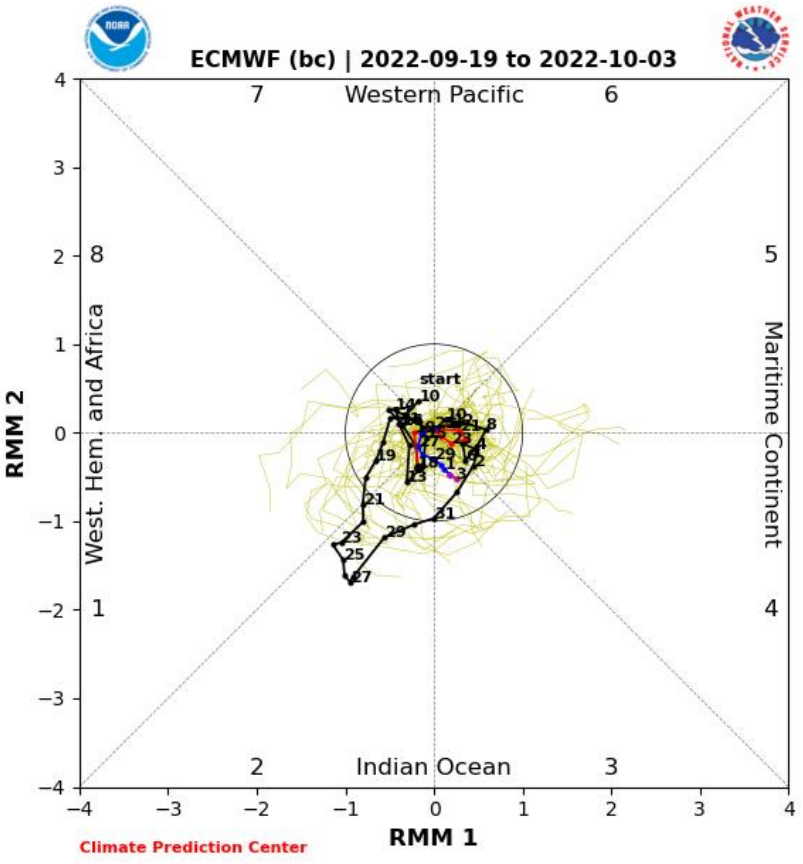


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

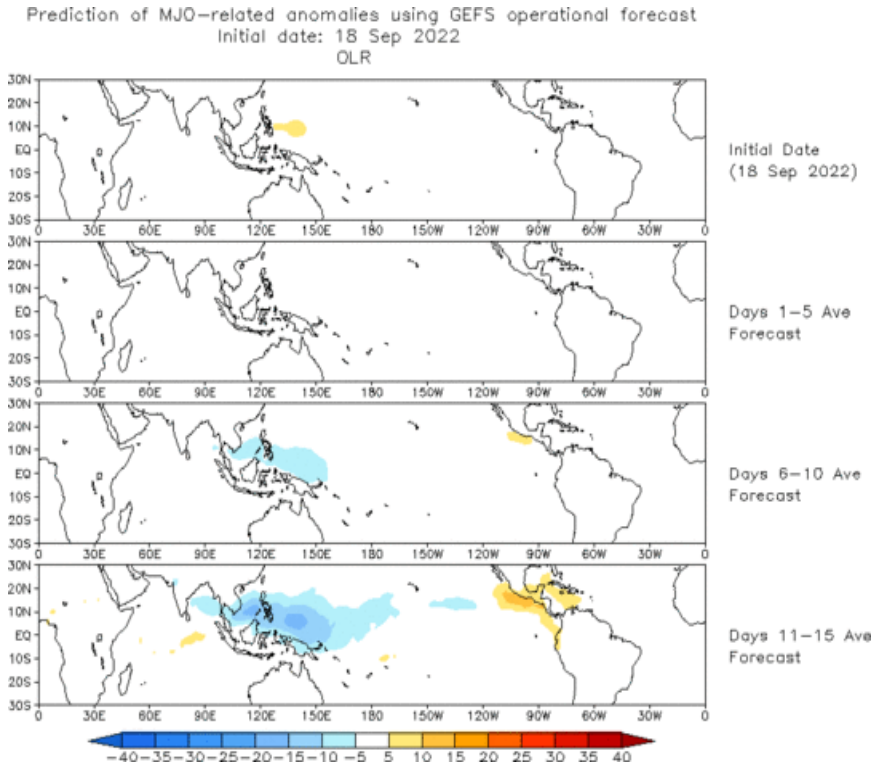


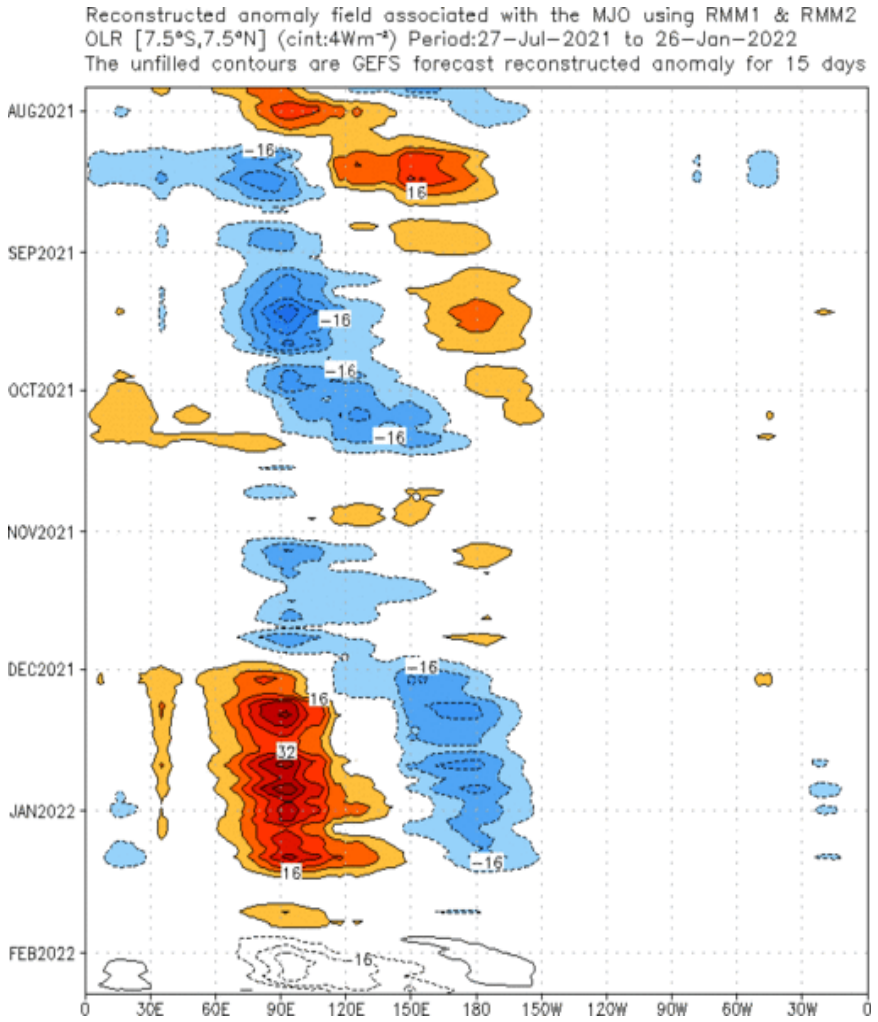
ECMWF Forecast

- Large spread exists among the GEFS and ECMWF ensemble members, but the most likely outcome during the next two weeks is for a continued weak MJO.

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.)

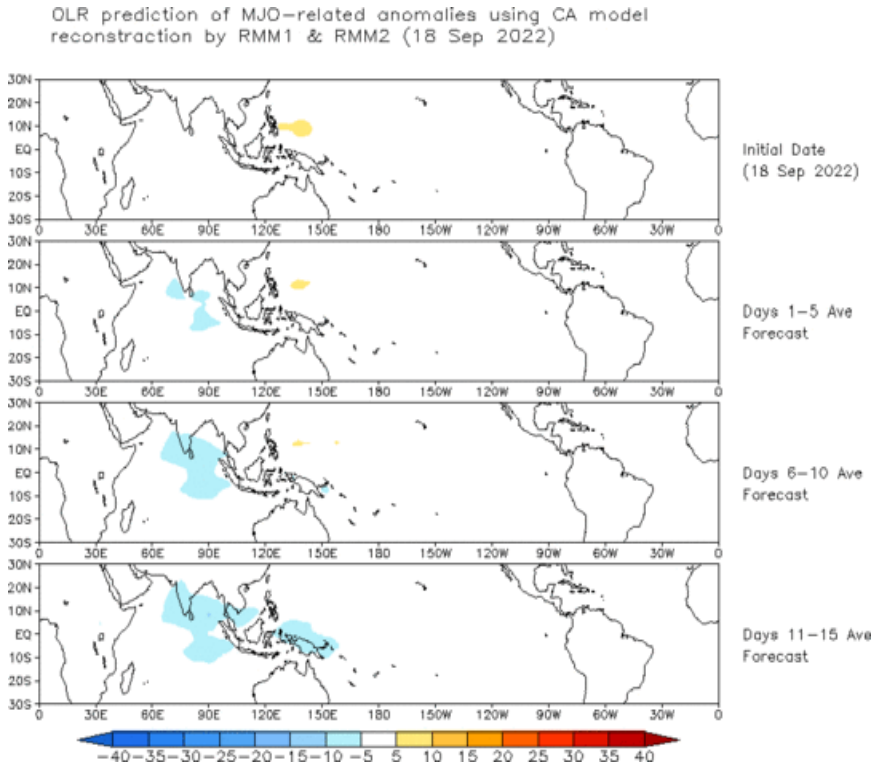


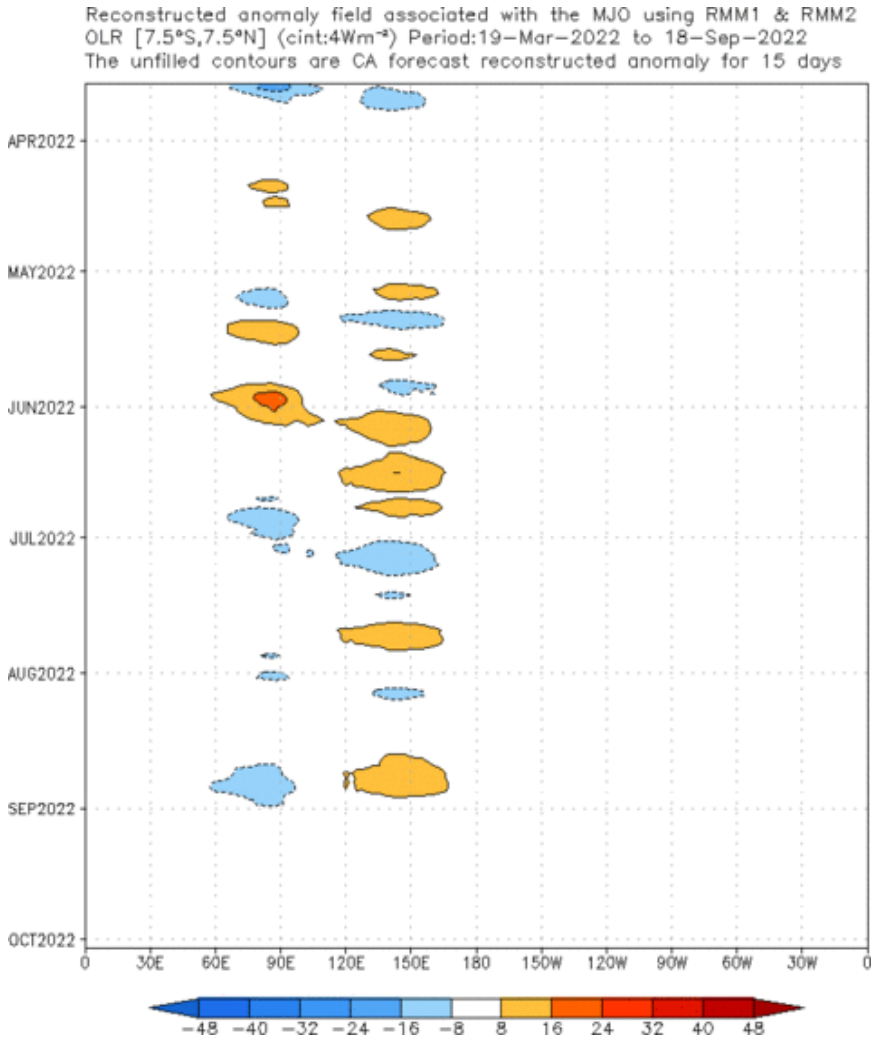


- The GEFS-based OLR anomaly fields favor the development of enhanced (suppressed) convection over the western (eastern Pacific) by the end of September.

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.)

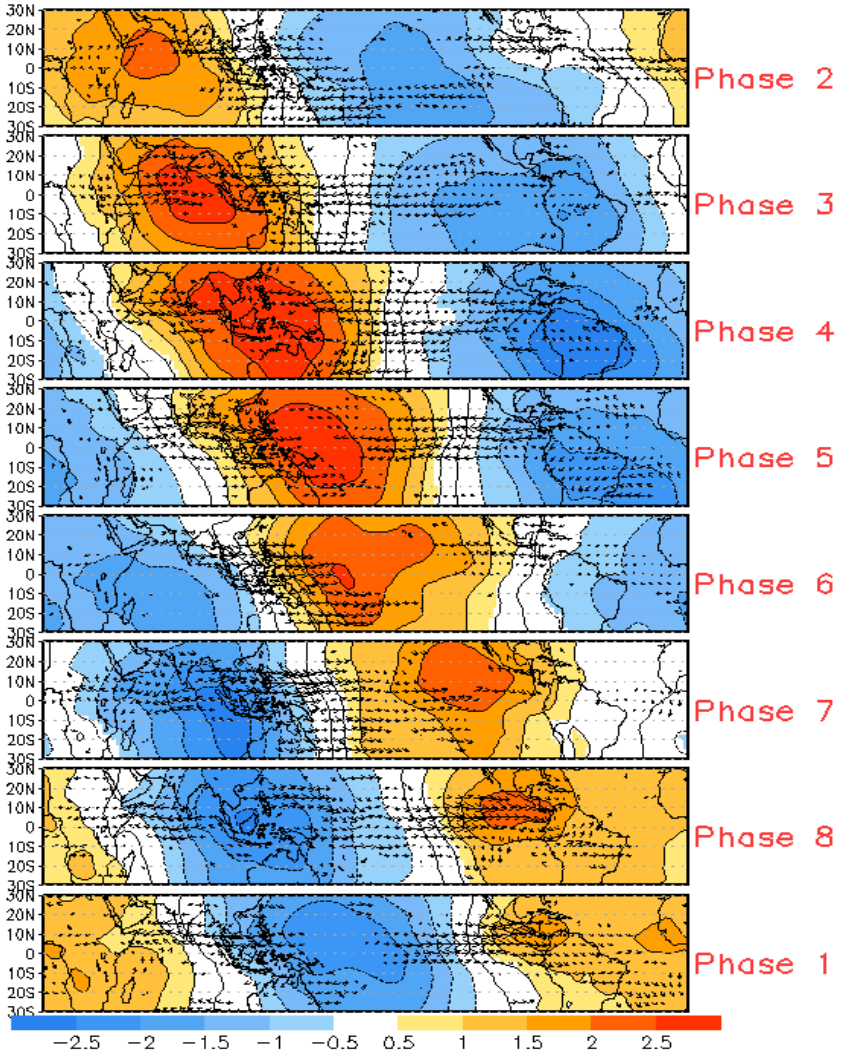




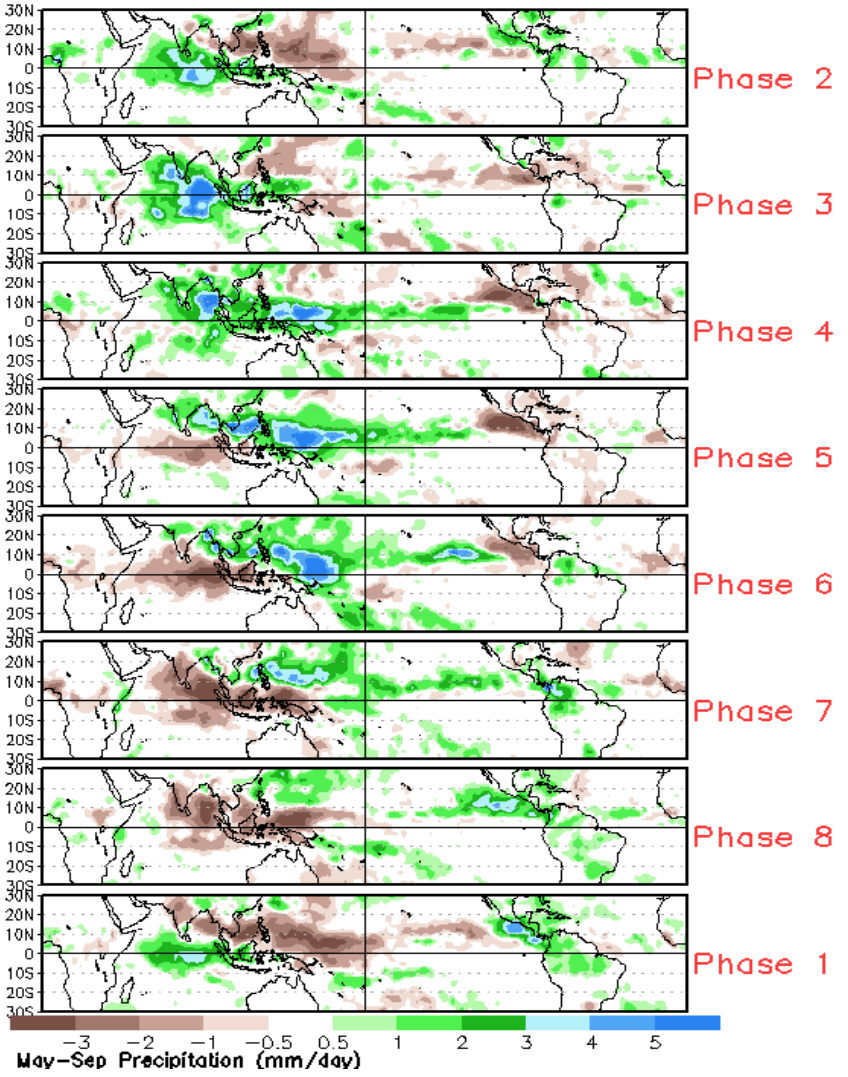
- The constructed analog forecast of RMM-based OLR depicts a convective dipole developing over the eastern Hemisphere, with enhanced convection also emerging over the western Pacific later in week-2.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



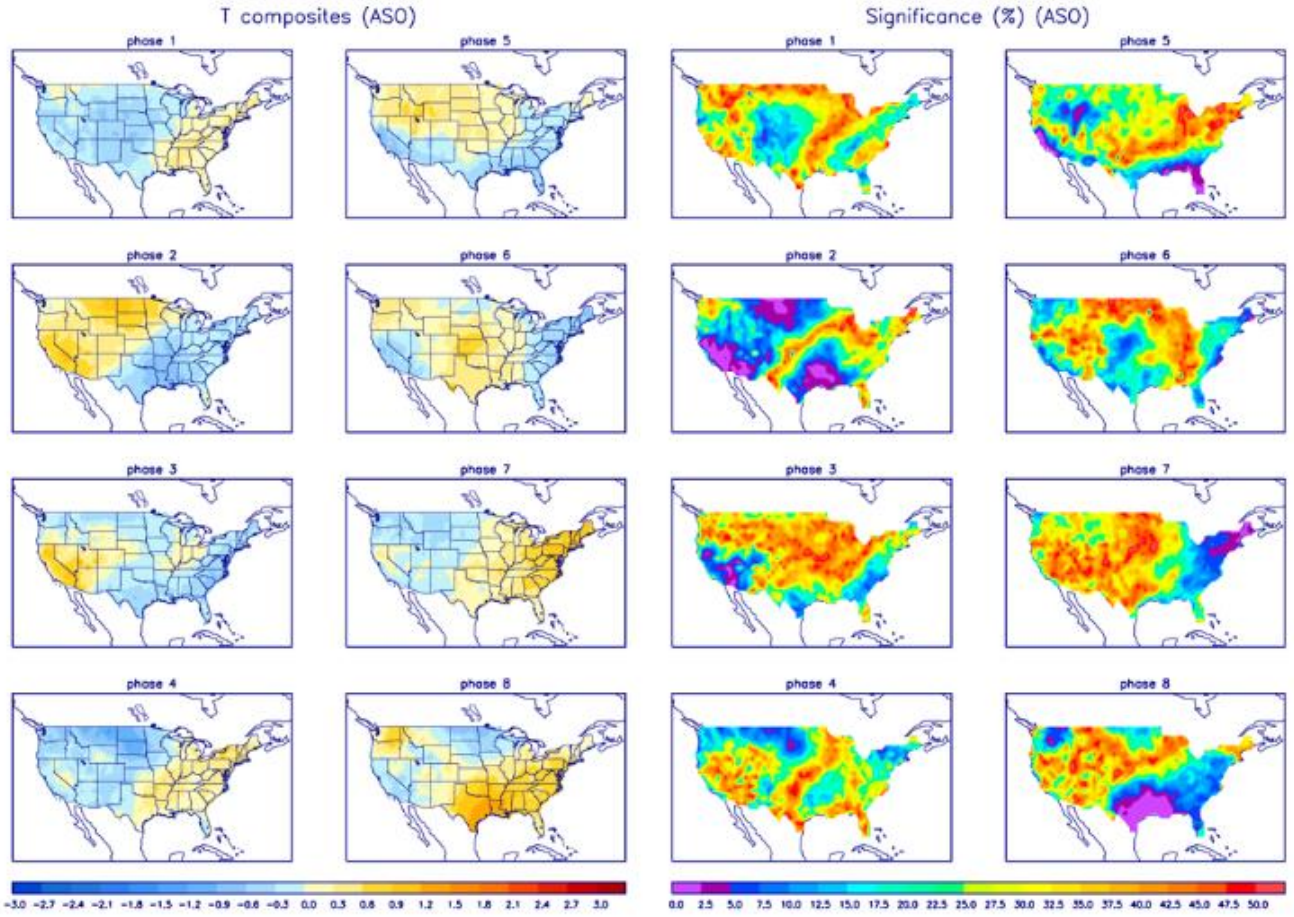
Precipitation Anomalies



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.

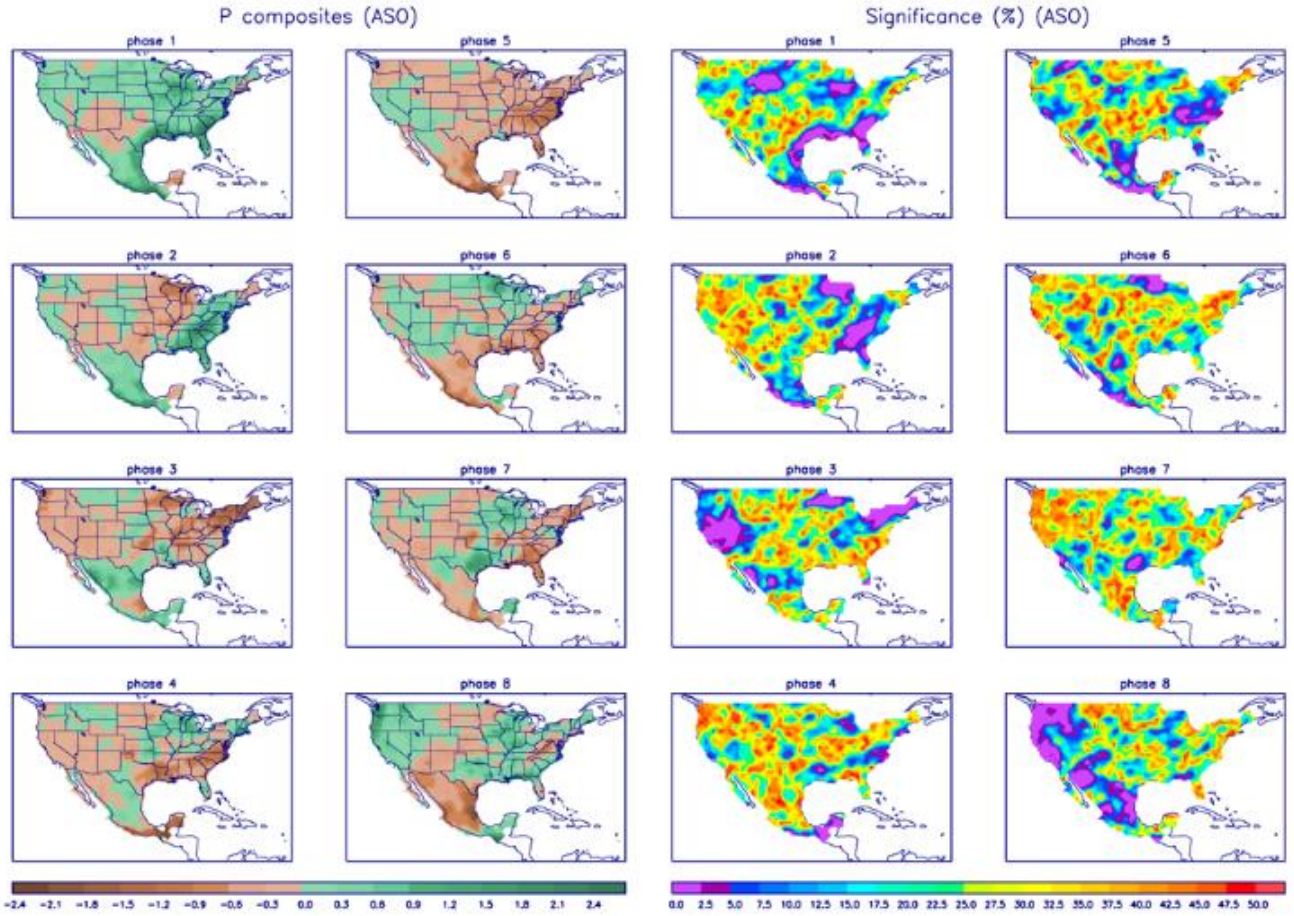


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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