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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
9 May 2022

Overview

- La Niña along with Kelvin and Rossby waves continue to be the major influences on anomalous global rainfall.

- Dynamical model forecasts depict a fast eastward propagation of the RMM index from the Indian Ocean to Africa during the next two weeks which is more consistent with a strong Kelvin wave.

- During week-1, reduced wind shear, enhanced convection, and model guidance support high confidence for tropical cyclone (TC) development across the eastern Pacific.

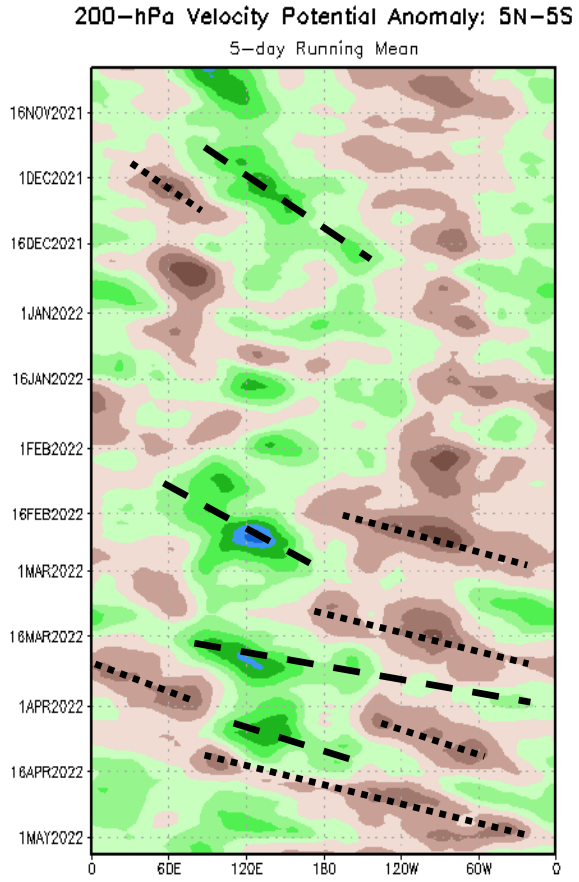
- Given the uncertainty with the evolution of the MJO, any extratropical response in the mid-latitudes is more likely to be driven by the ongoing La Niña circulation during the outlook period.

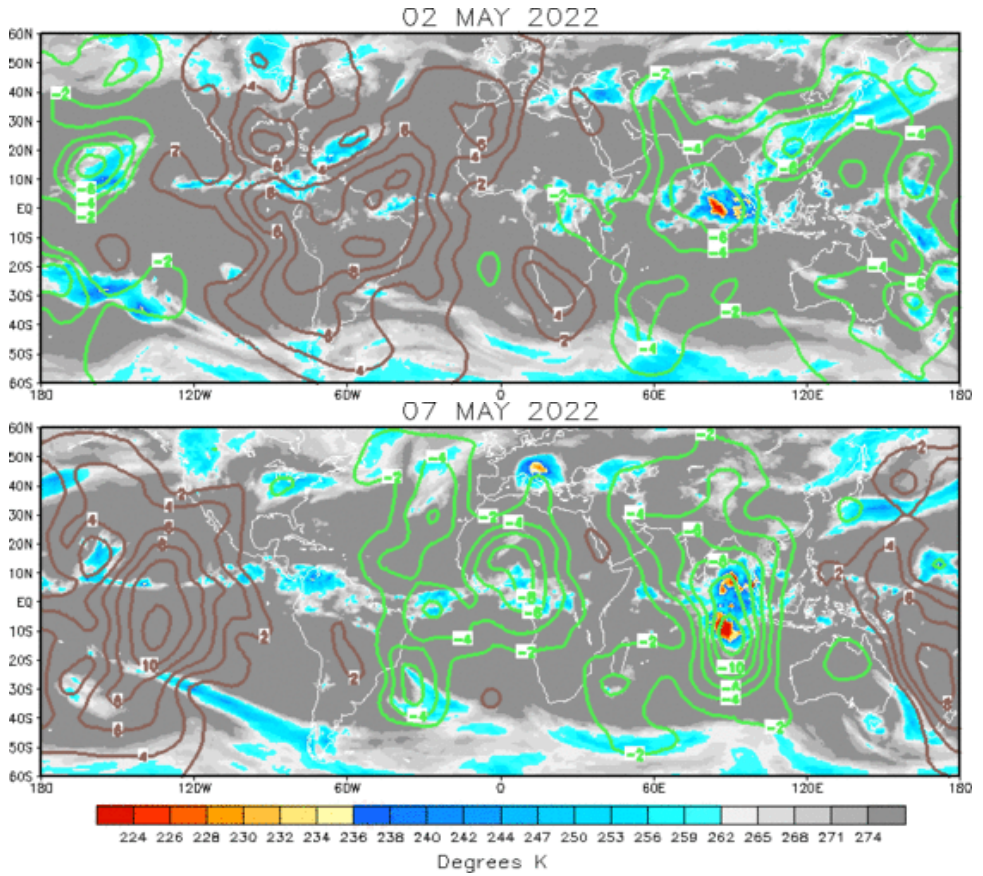
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)



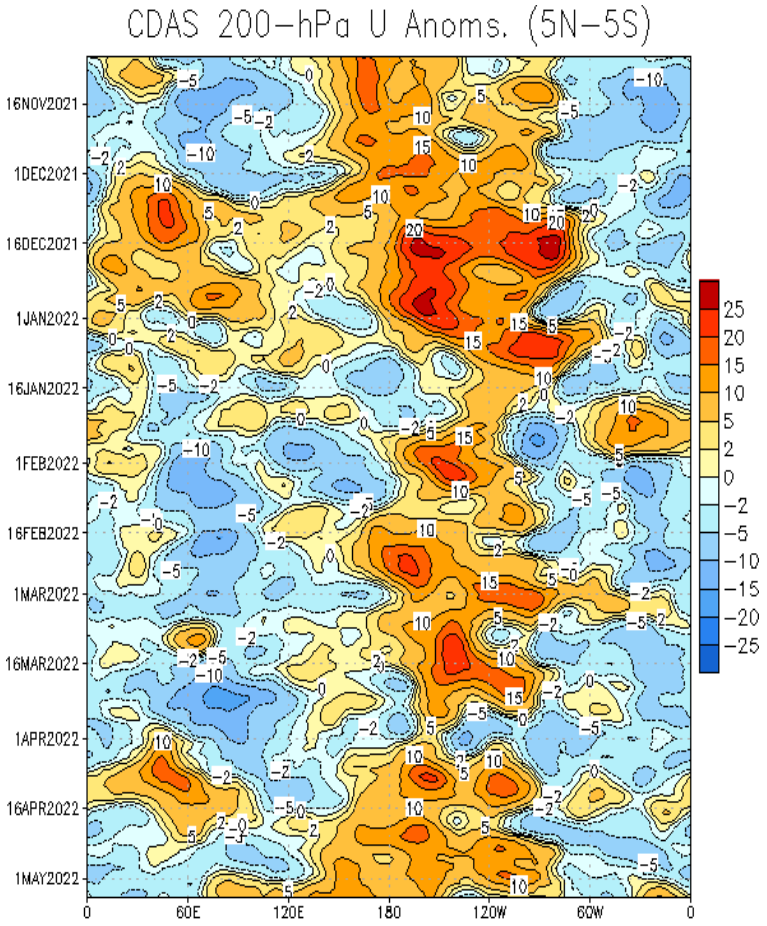


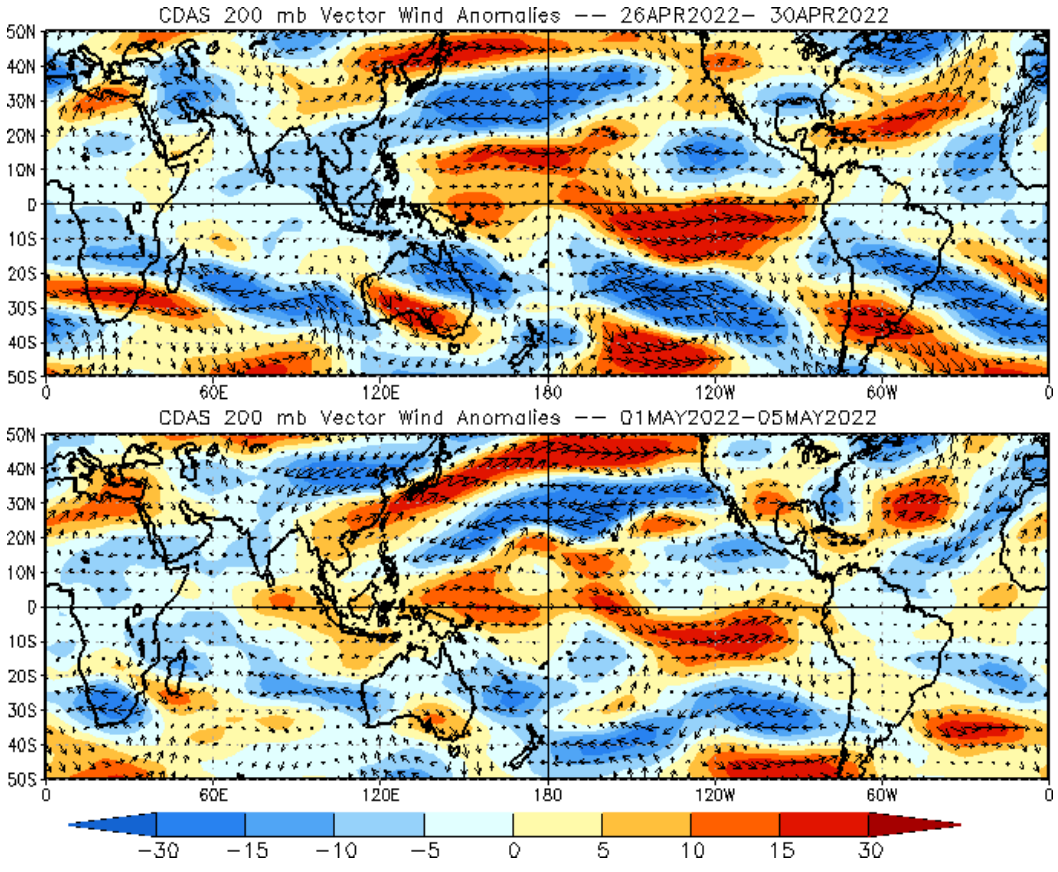
- Anomalous upper-level divergence persists over the western Maritime Continent although it waned recently due to other modes of tropical variability.

- After a Kelvin wave progressed well eastward to Africa, anomalous upper-level convergence resumed over the equatorial central Pacific.

200-hPa Wind Anomalies

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



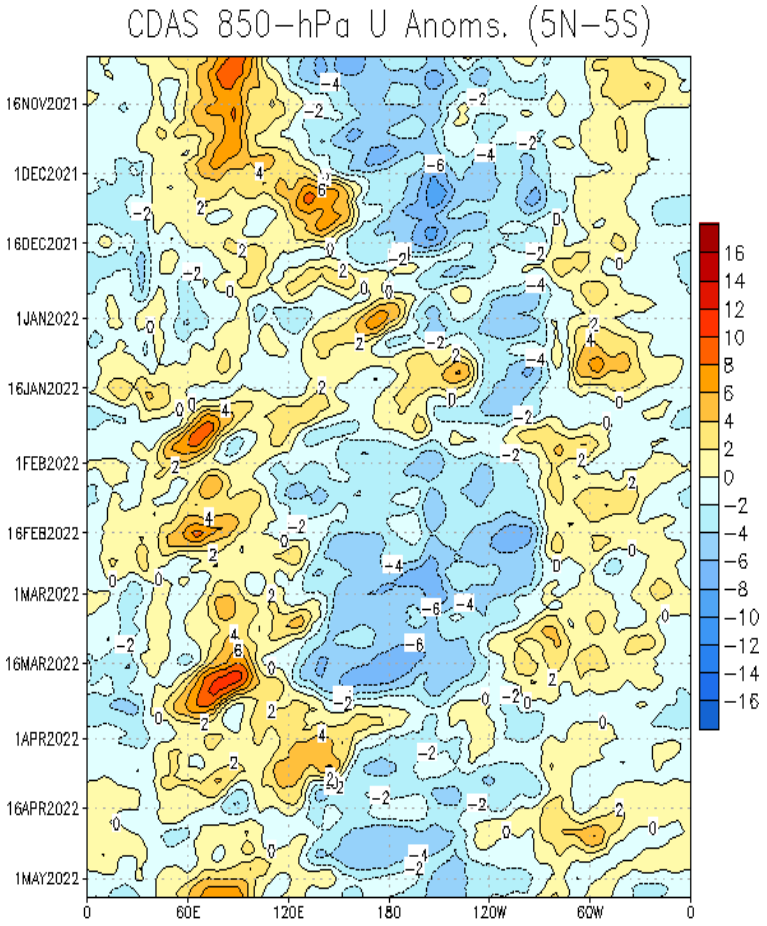


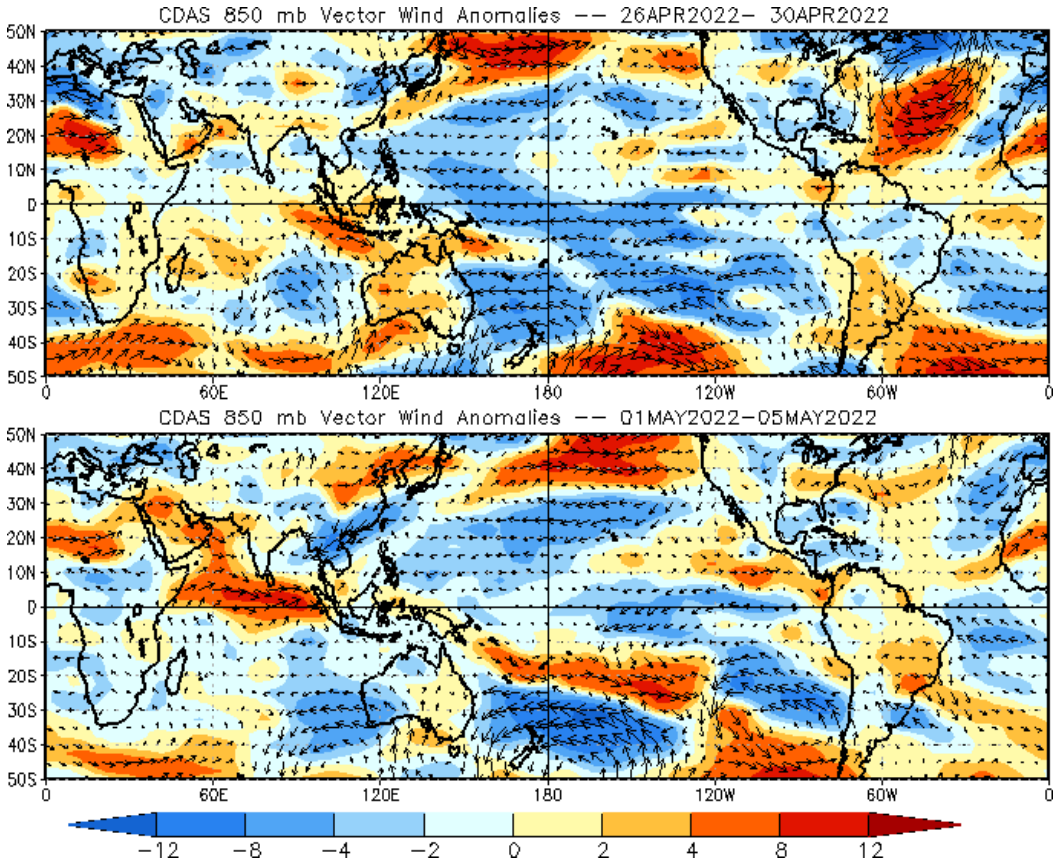
- Anomalous upper-level westerlies persist throughout the equatorial Pacific, consistent with ongoing La Niña conditions.

- Anomalous easterlies aloft continue across Africa and the western Indian Ocean.

850-hPa Wind Anomalies

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



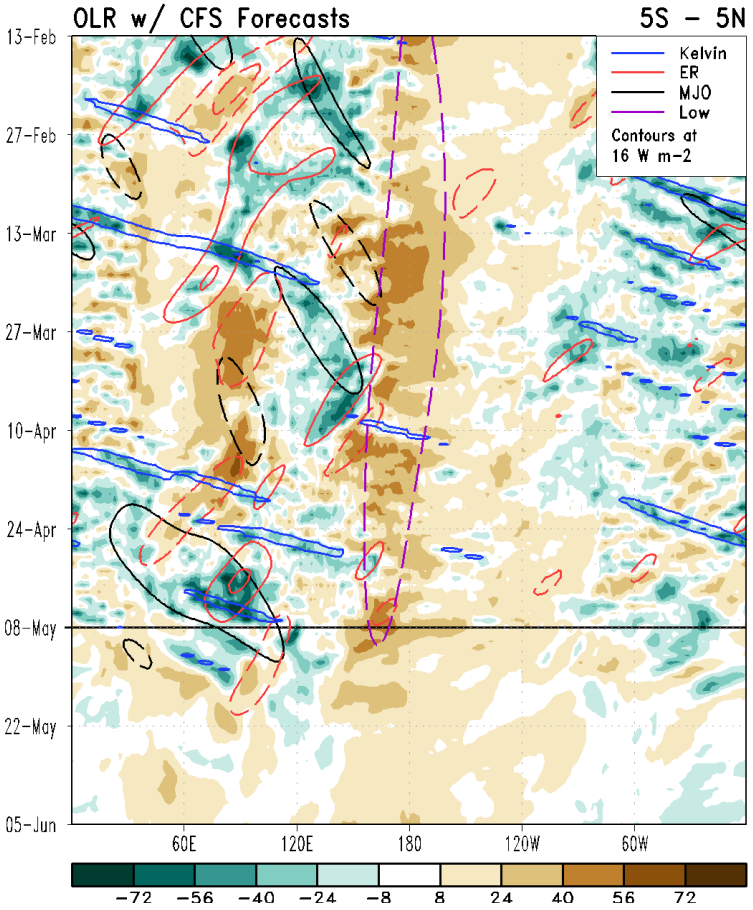


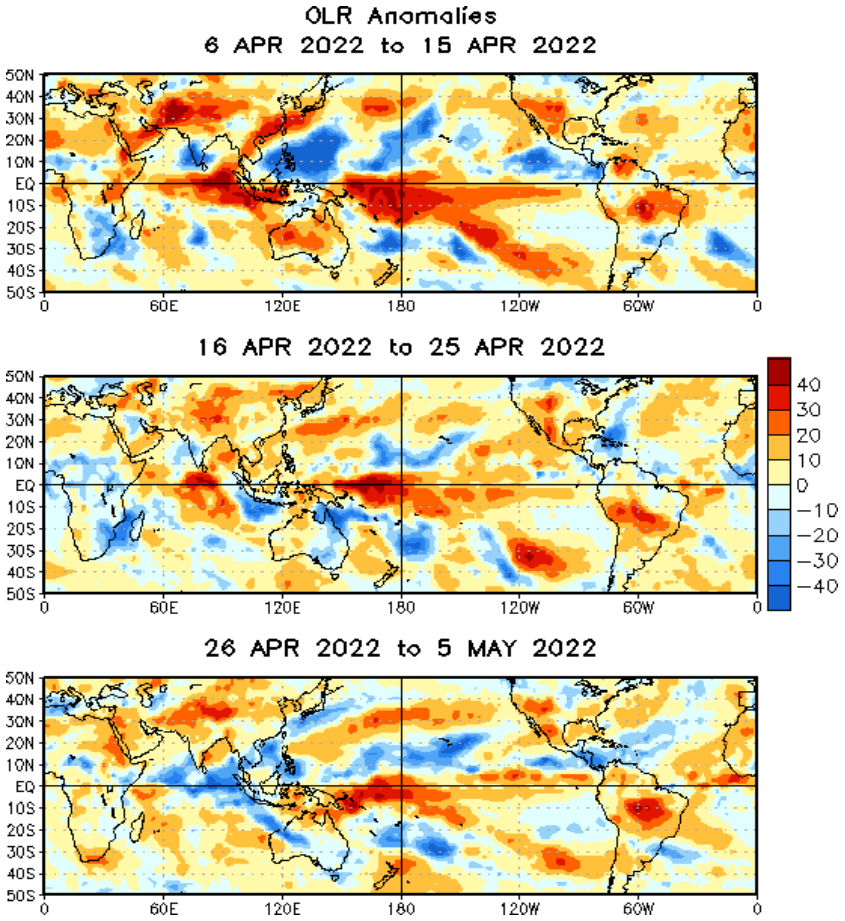
- La Niña conditions continue to support enhanced trade winds across the equatorial Pacific.

- Lower-level westerly anomalies strengthened throughout the equatorial Indian Ocean at the beginning of May. Also, westerly anomalies developed north of the equator across the eastern Pacific which is conducive for the formation of an early season tropical cyclone.

Outgoing Longwave Radiation (OLR) Anomalies

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

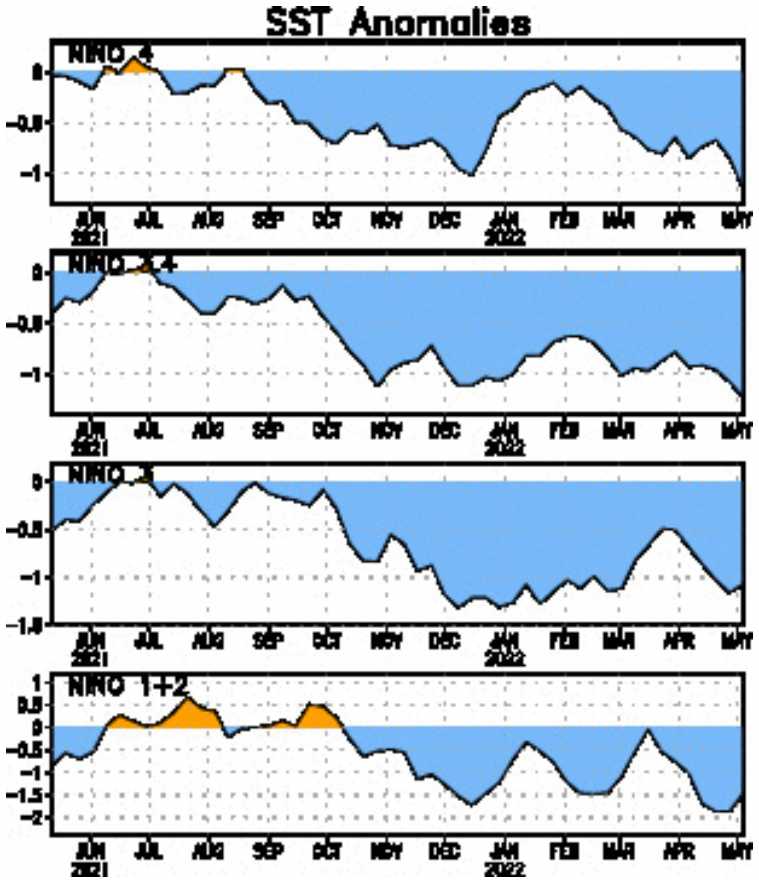


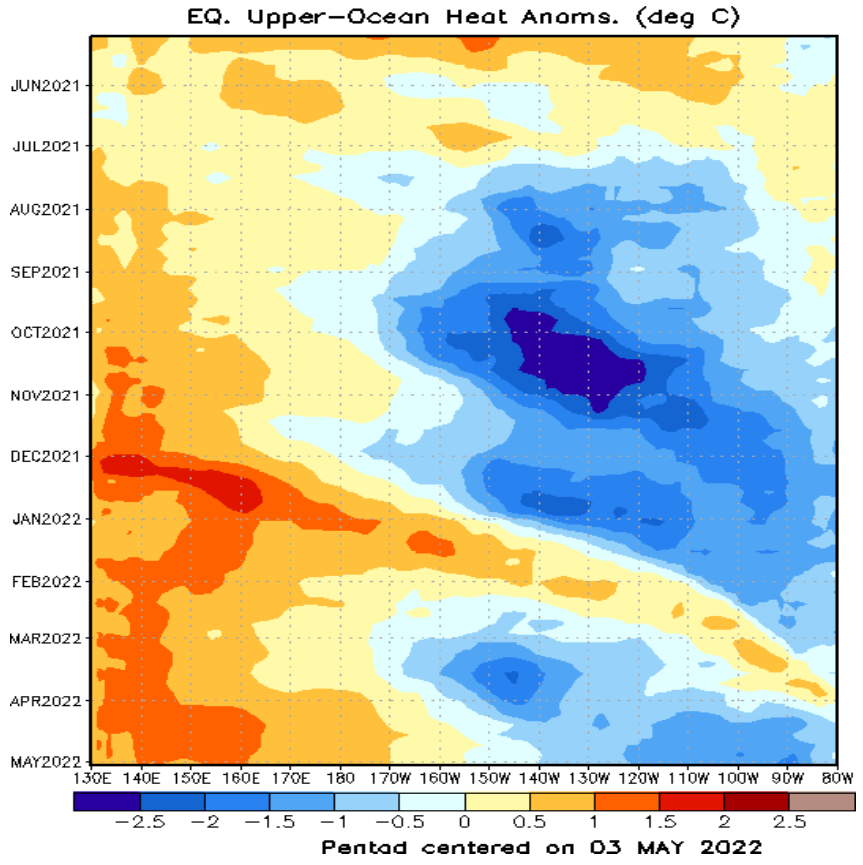


- Tied to the ongoing La Niña, strongly suppressed convection along and to the west of the Date Line remains the most prominent feature in the OLR field over the past several months.

- The passage of a Kelvin wave recently enhanced convection along the ITCZ in the eastern Pacific and across Central America.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



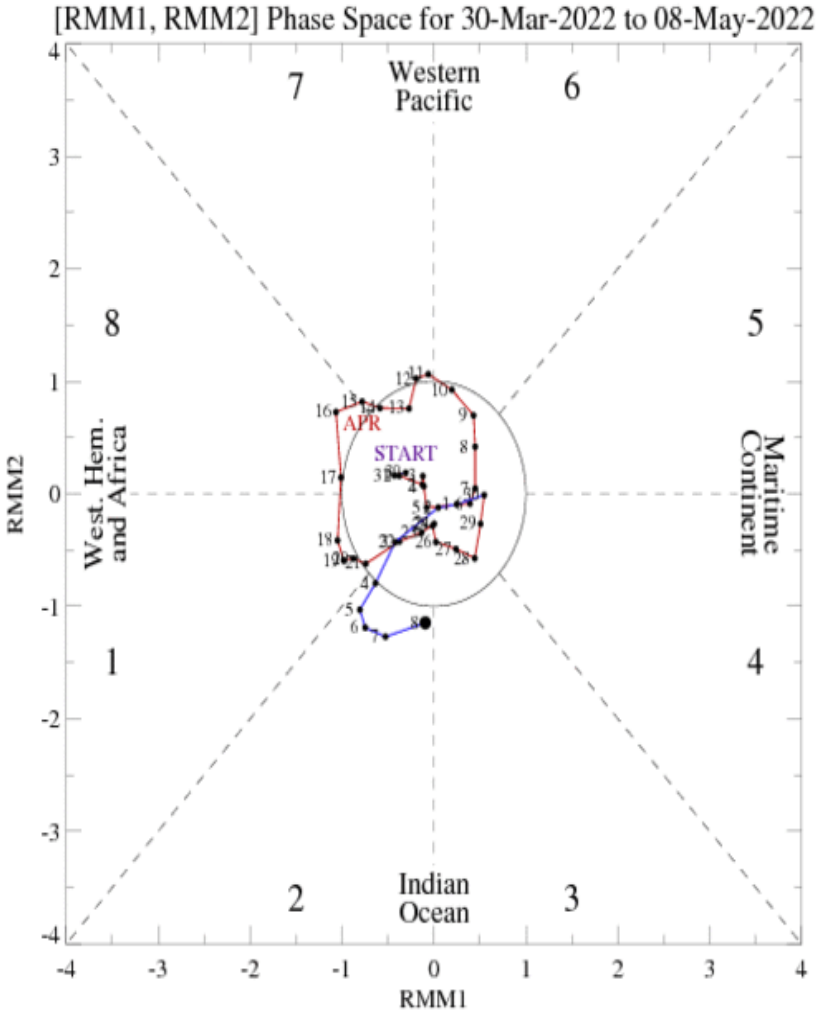


- Following a moderation of sea surface temperatures (SSTs) in parts of the central and eastern Pacific likely tied to an oceanic downwelling Kelvin wave this past winter, SSTs have re-cooled considerably since mid-March.

- With strengthening above-normal upper-ocean heat content observed west of 150W along the equator since March, this suggests that anomalous cold waters in the Nino 4 region have become more shallow.

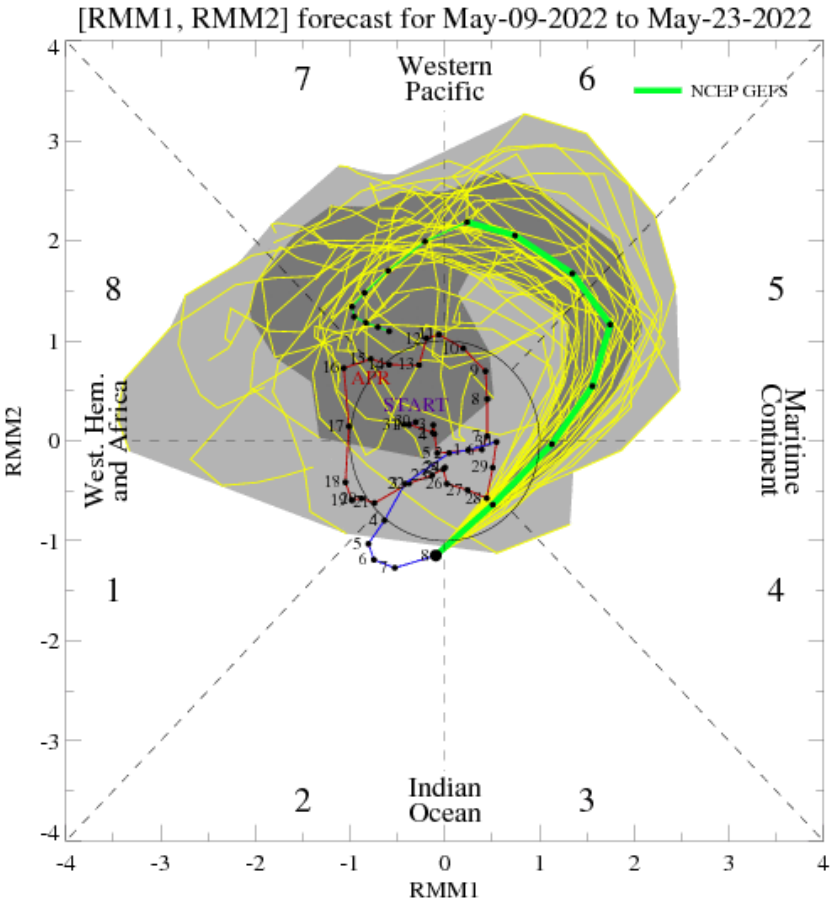
MJO Index: Recent Evolution

- The amplitude of the RMM index increased during early May which is likely related to the constructive interference between a Kelvin and Rossby wave.

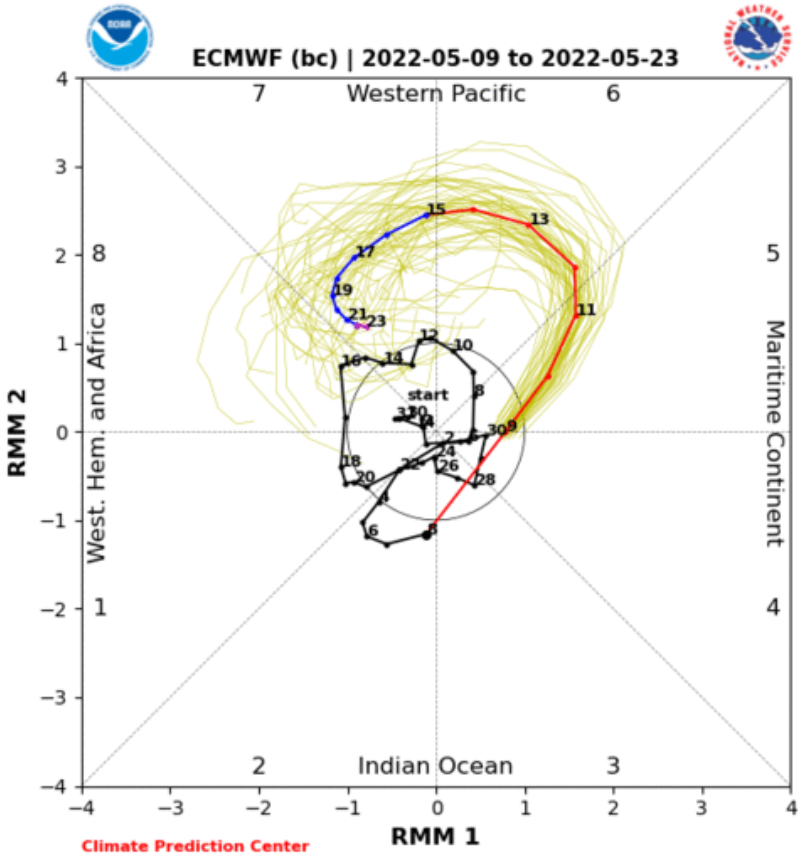


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



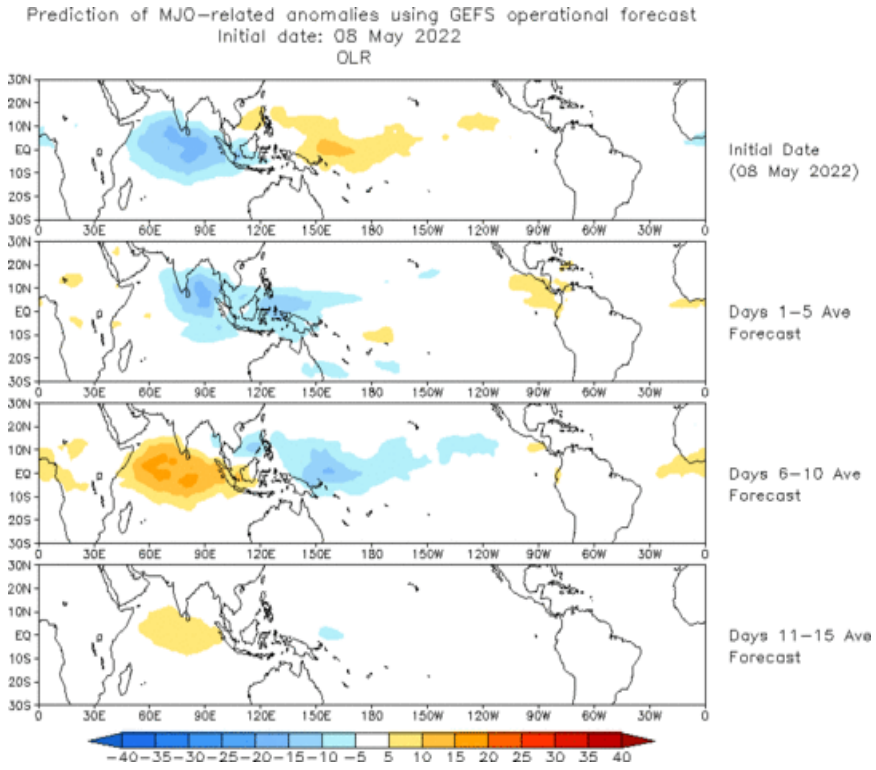
ECMWF Forecast

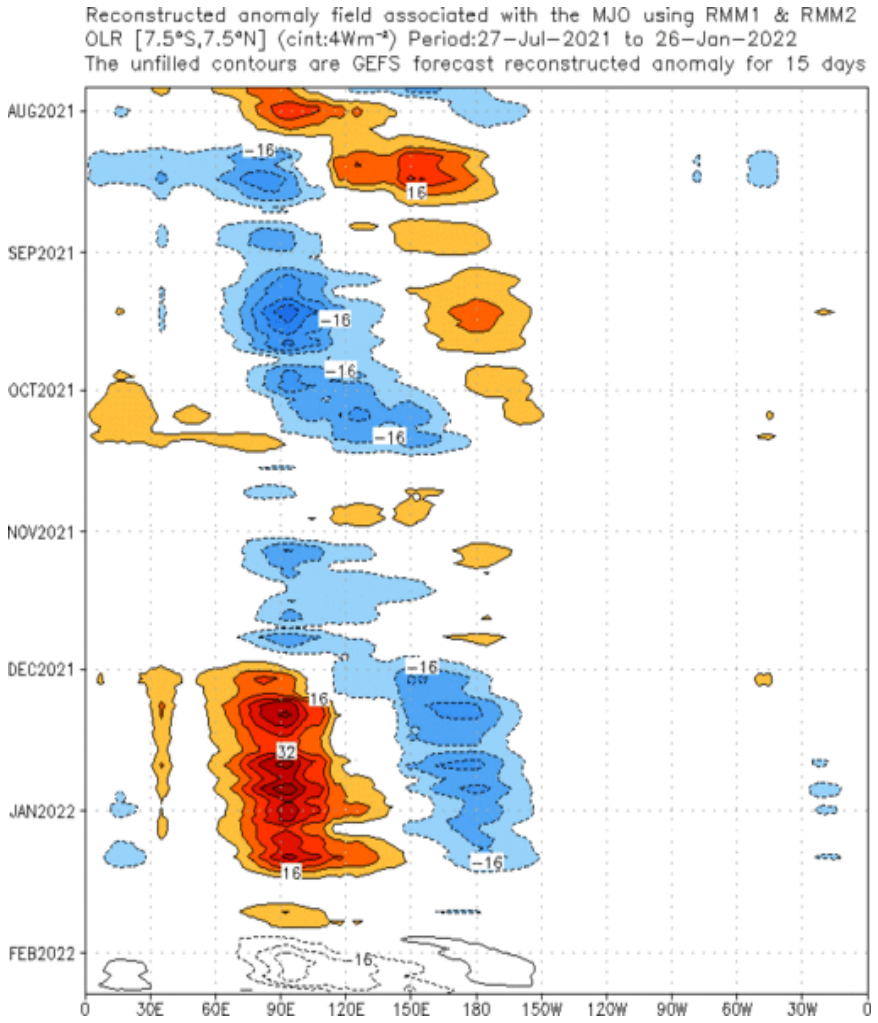
- Dynamical model RMM forecasts depict a fast eastward propagation of a signal from the Indian Ocean to Africa during the next two weeks.

- This fast phase speed is consistent with a convectively coupled Kelvin wave.

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.)

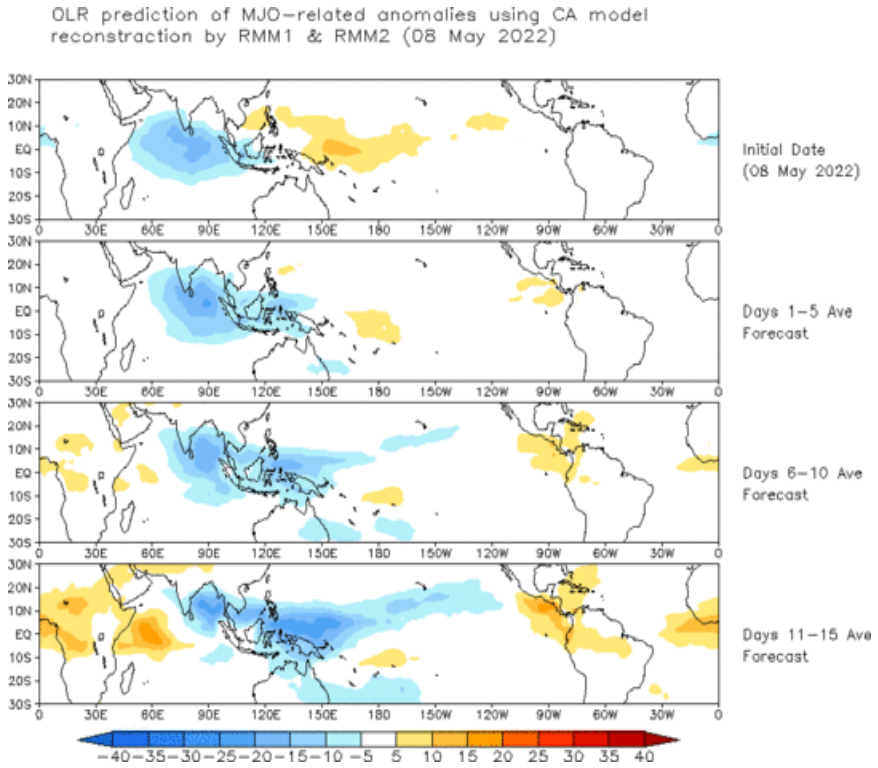


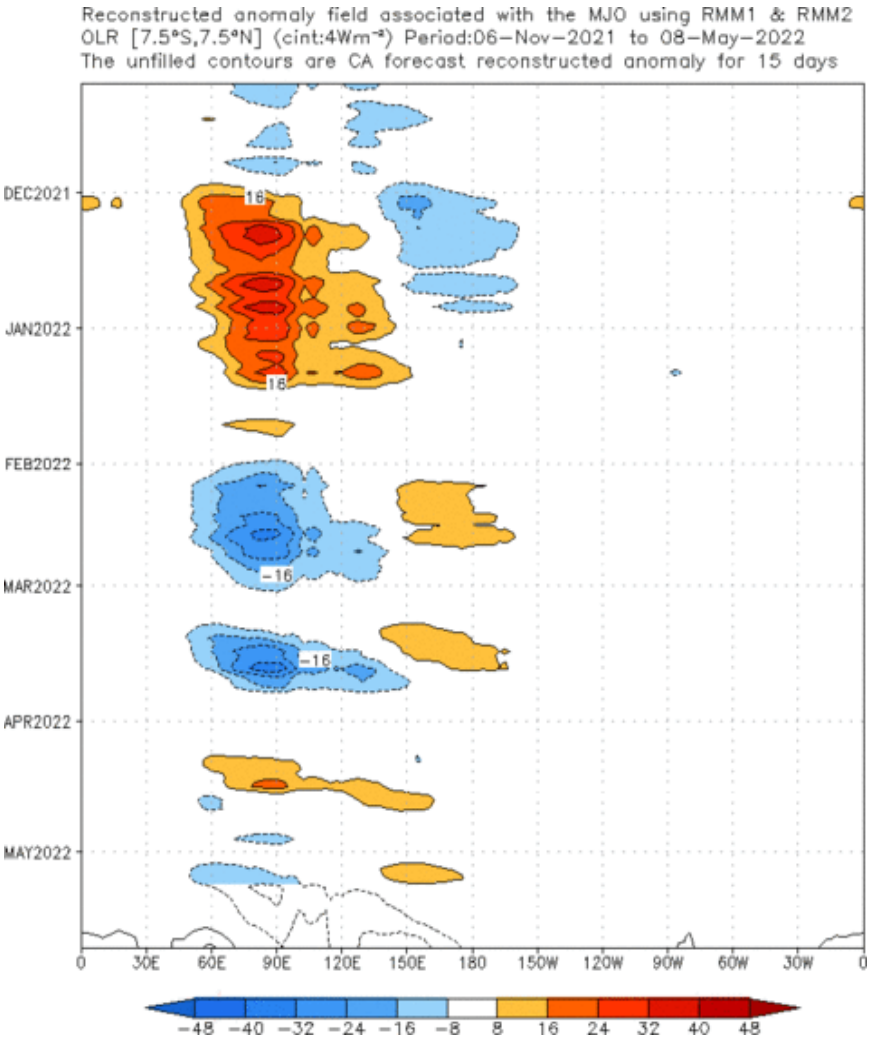


- The GEFS RMM-based OLR field depicts a rapid transition from enhanced to suppressed convection over the Indian Ocean during the next week to ten days. Also, a renewal of enhanced convection is forecast across parts of the Pacific.

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.)

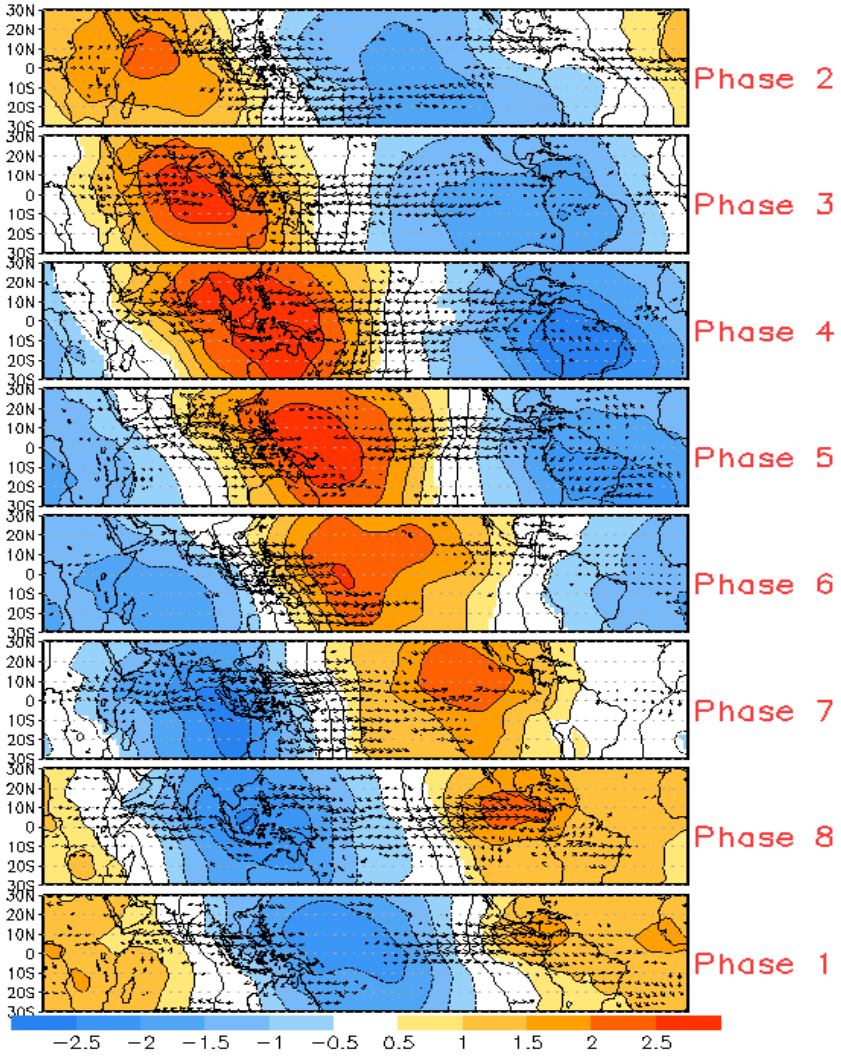




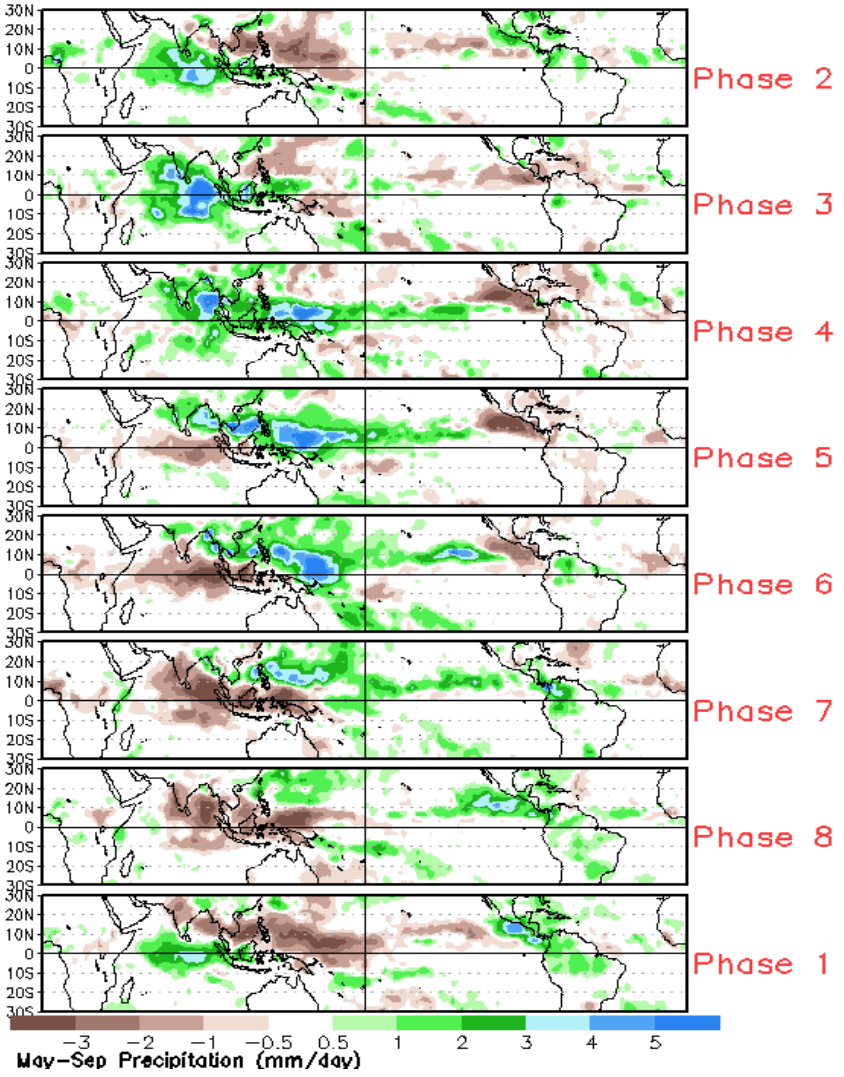
- The constructed analog forecast of RMM-based OLR anomalies indicates a slower progression of anomalous convection and suggests that a developing MJO from the Indian Ocean could evolve during May.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



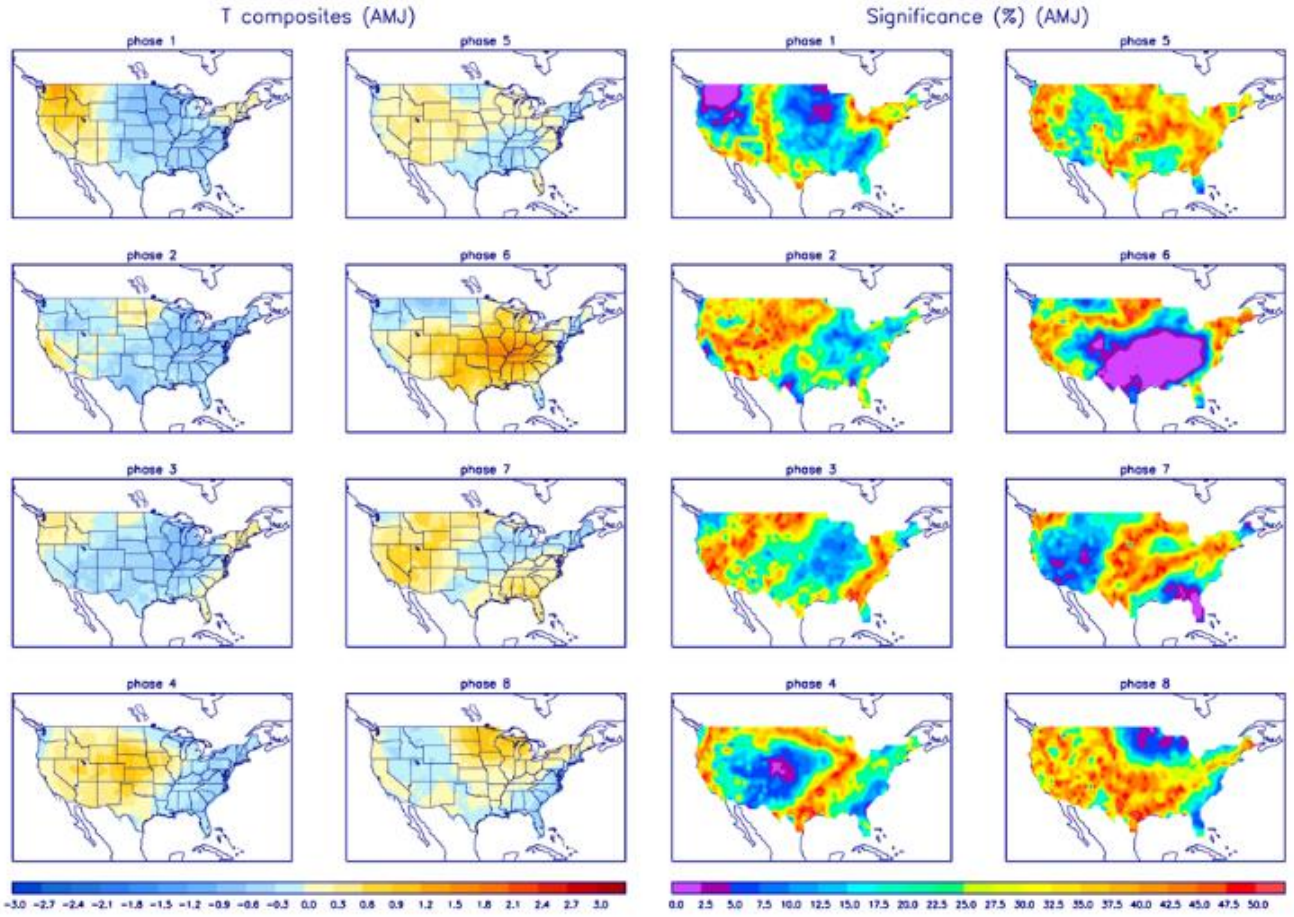
Precipitation Anomalies



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.

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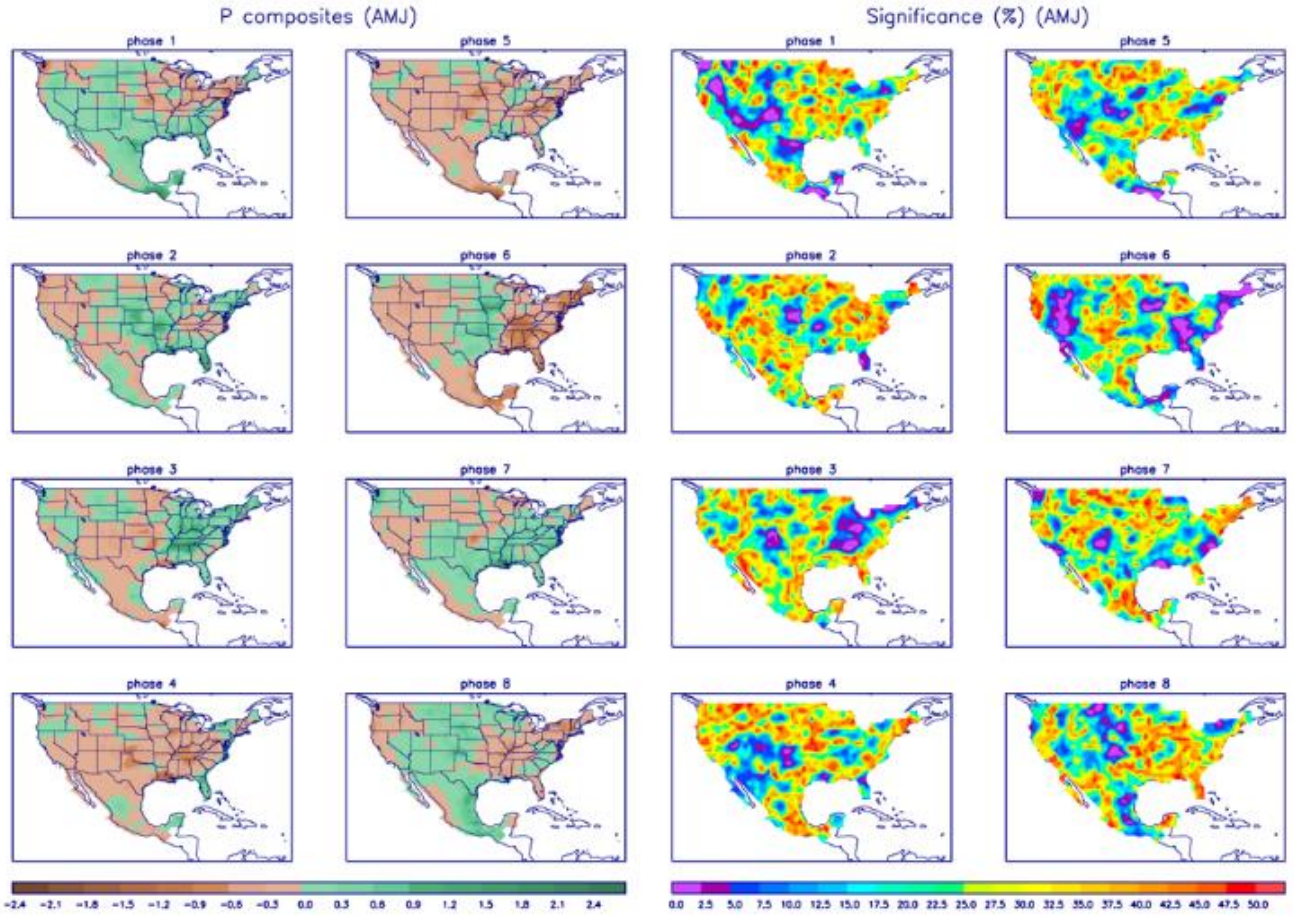

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