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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
17 June 2019

Overview

- Following a brief period of interference from westward-moving modes, the MJO signal has renewed its eastward propagation and is now over the Maritime Continent.

- The convective anomaly field is somewhat weak, due partly to destructive interference with the low frequency ENSO state.

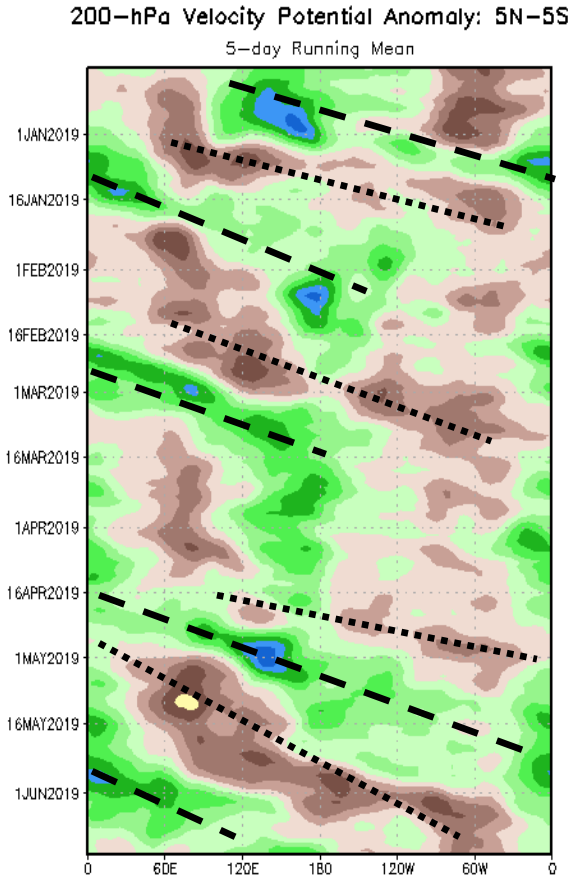
- Dynamical model forecasts depict continued MJO activity in Week-1, with considerable uncertainty regarding further evolution of the signal into Week-2.

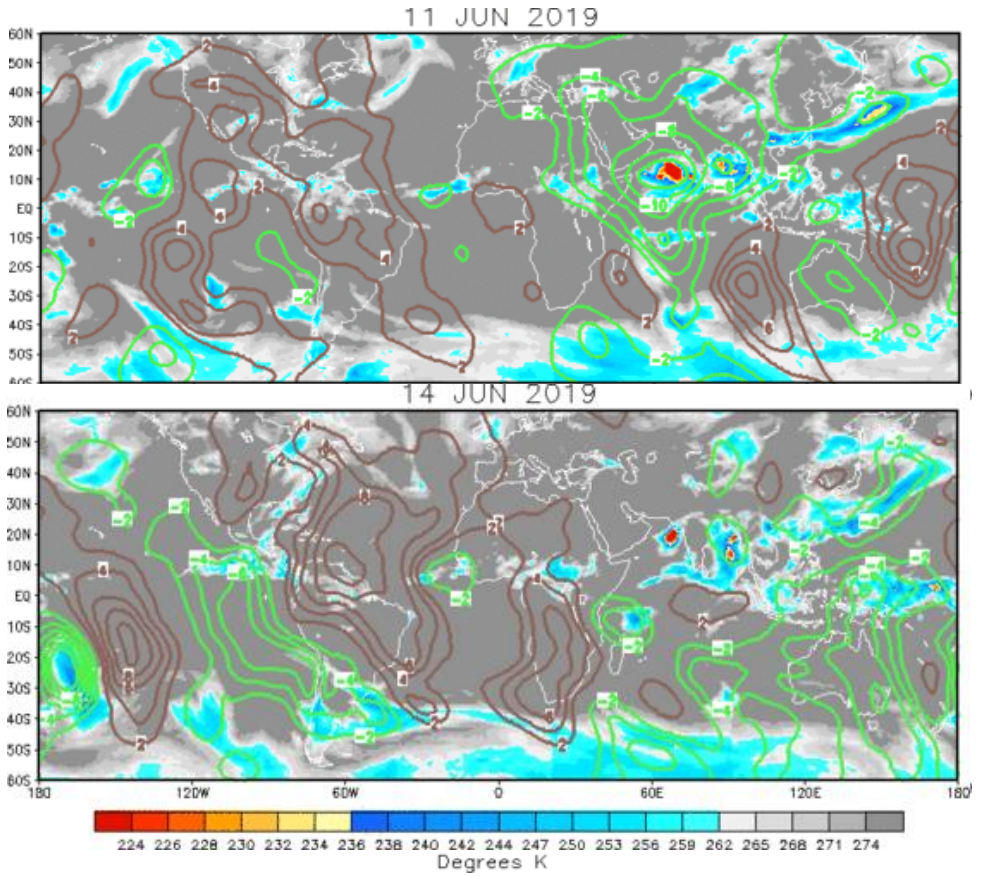
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

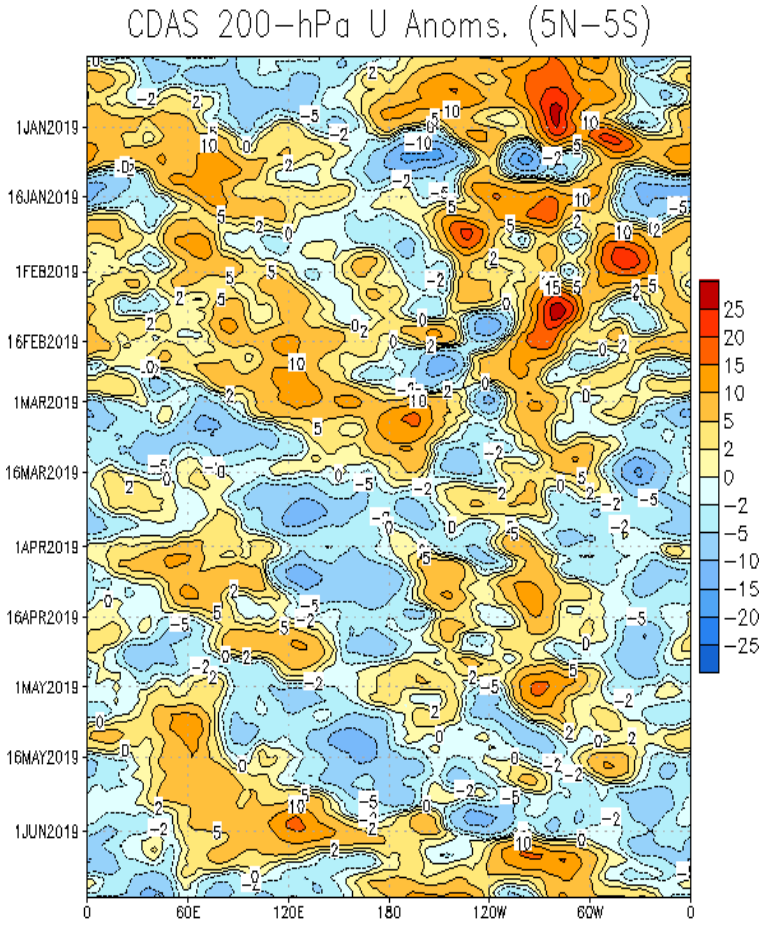


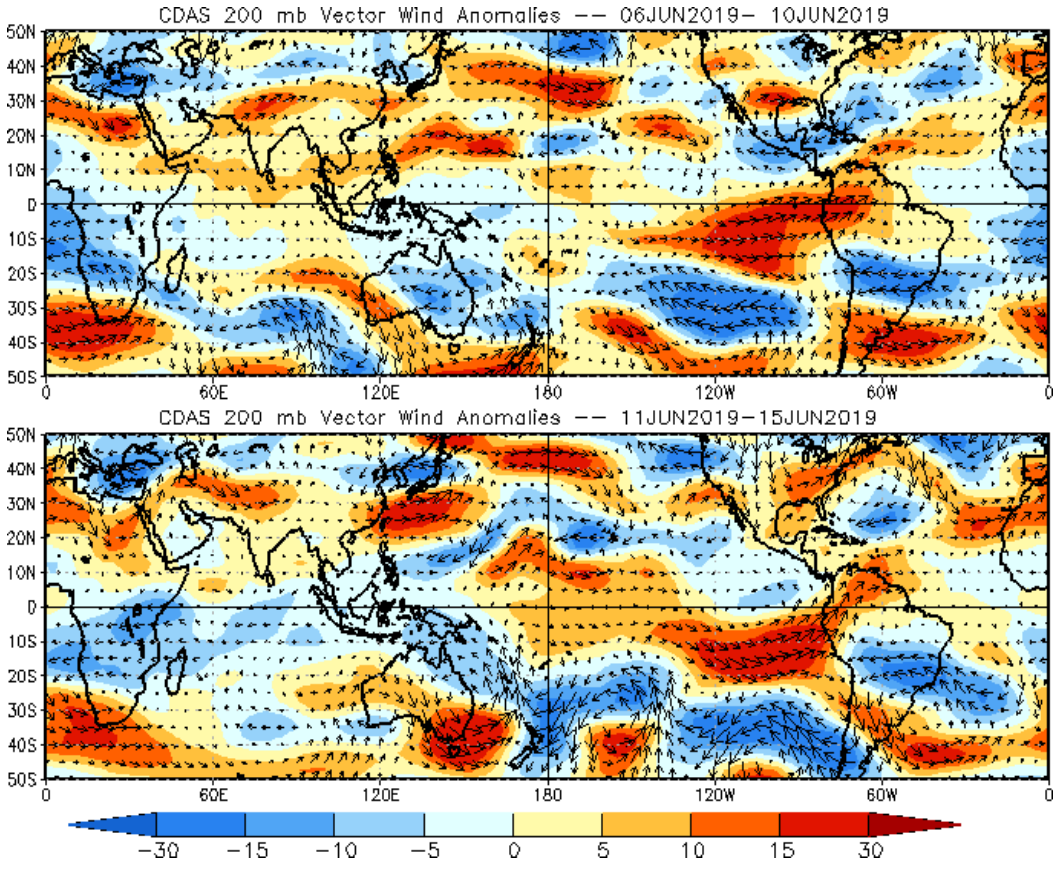


- The MJO has been active since December except for a 1.5 month pause during March and early April.
- The latest MJO event began in May and after briefly stalling over the Indian Ocean, has recently propagated to the Maritime Continent.
- The velocity potential spatial pattern is broadly consistent with MJO activity, but the canonical Wave-1 asymmetry is weakened or interrupted by interference from other modes.

200-hPa Wind Anomalies

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

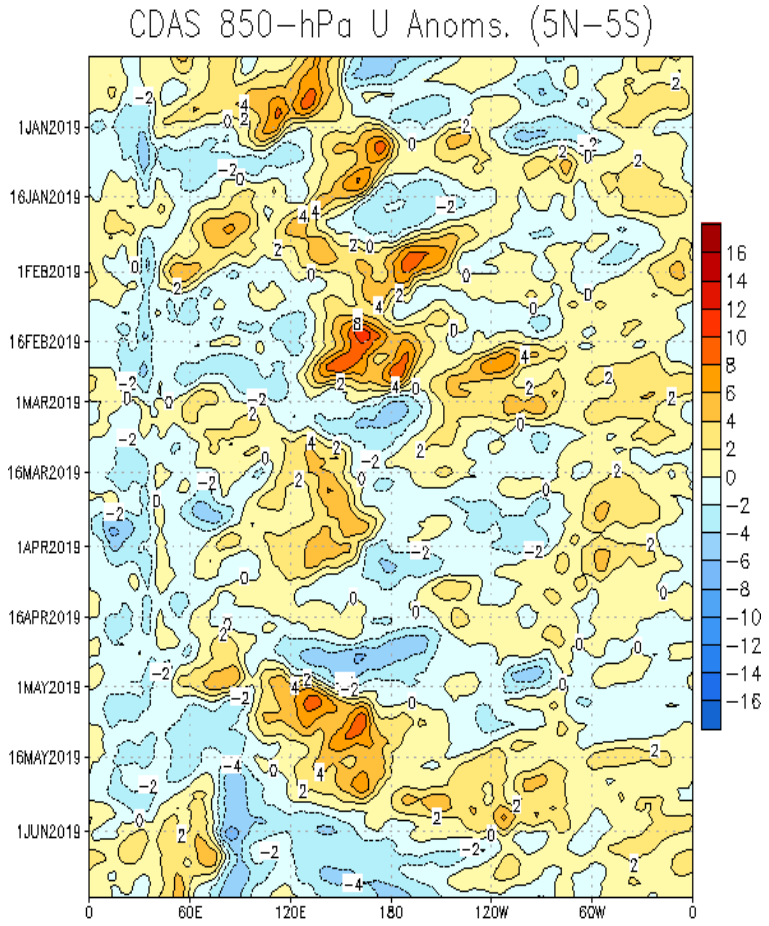


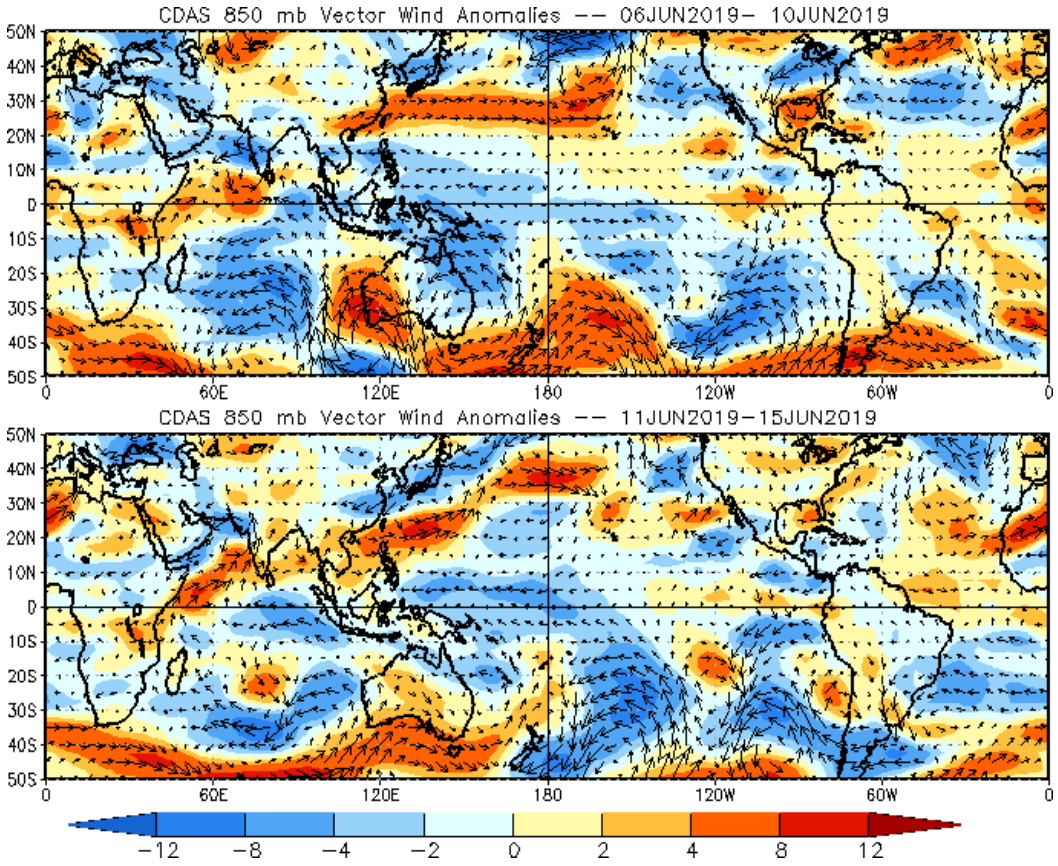


- Weak easterly anomalies have overspread the Indian Ocean and parts of the Maritime Continent, consistent with eastward propagation of the MJO.

850-hPa Wind Anomalies

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

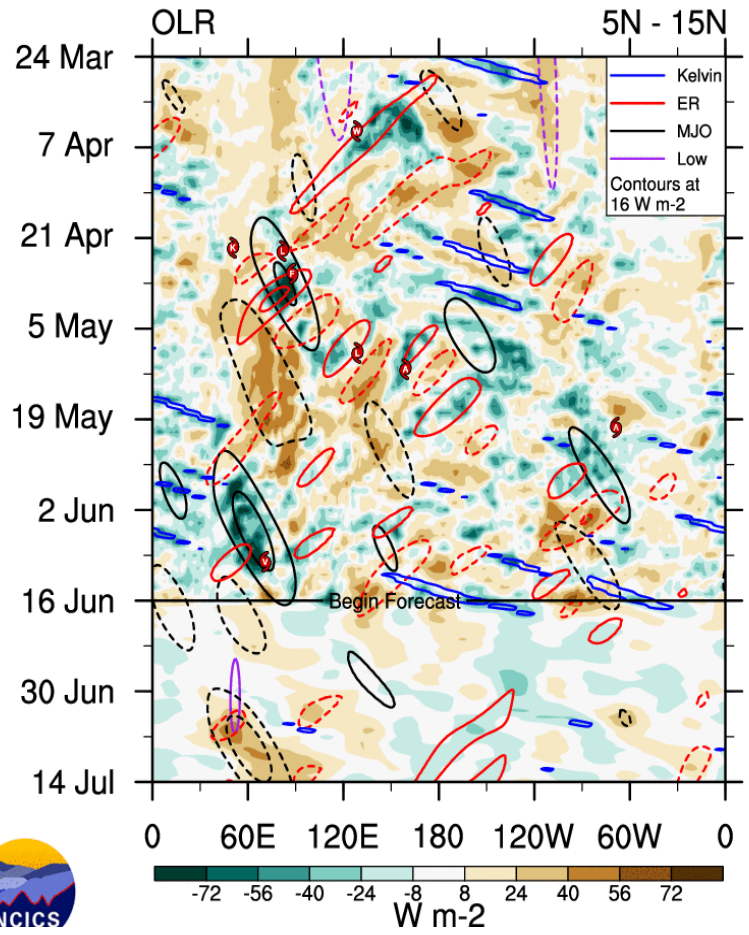


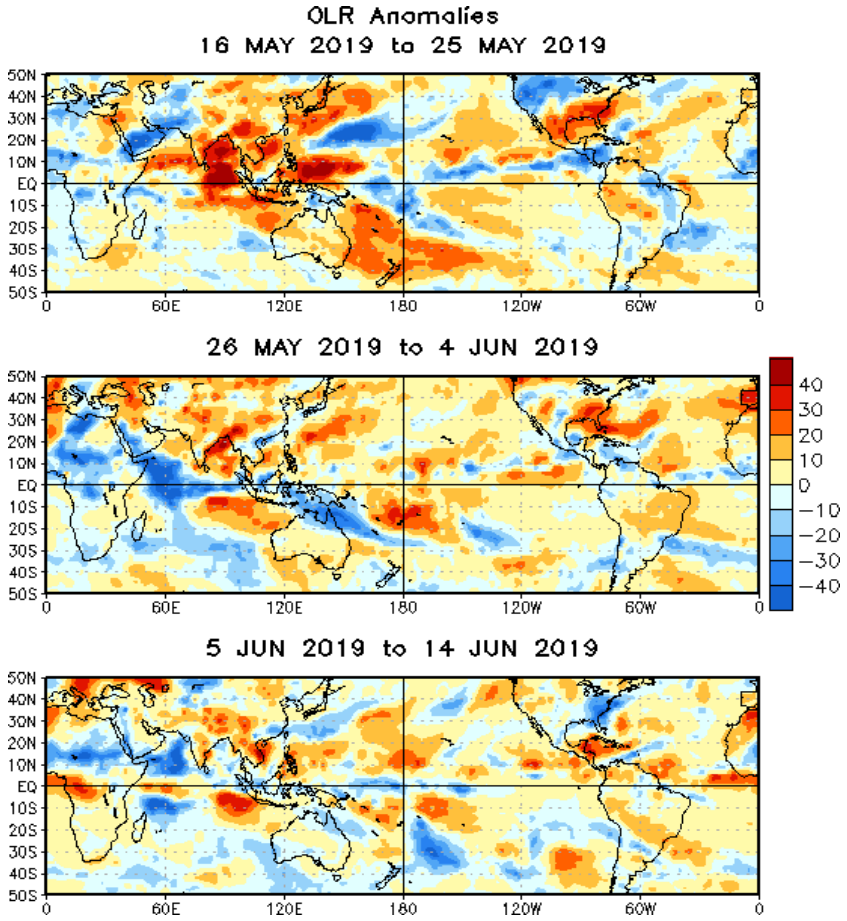


- Influence on the low-level wind field from slow-moving Cyclone Vayu is evident over the Arabian Sea.
- The onset of the monsoon over South Asia remains delayed, but westerly wind anomalies have increased recently over western India.
- Widespread easterly anomalies remain entrenched over the western and central equatorial Pacific.

Outgoing Longwave Radiation (OLR) Anomalies

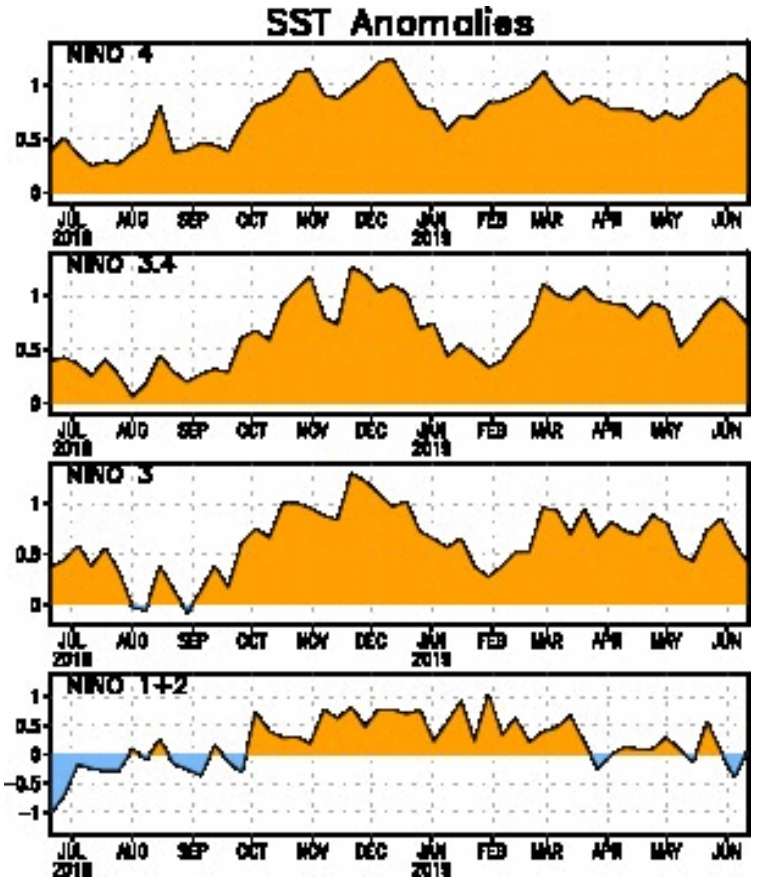
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

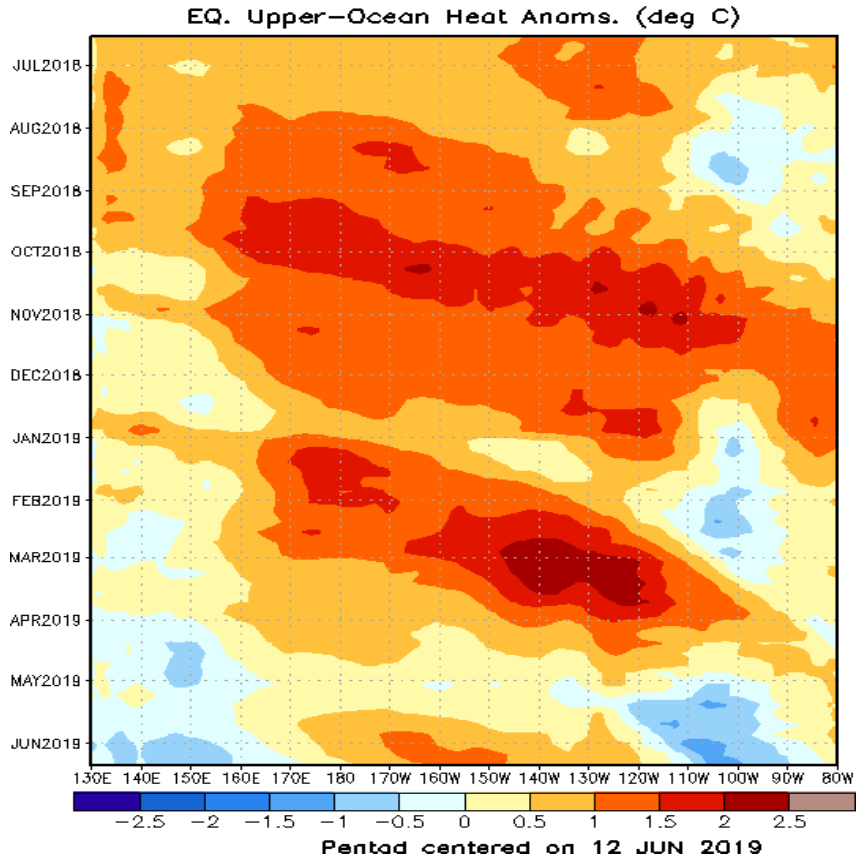




- The convective envelope of the MJO weakened as the enhanced phase moved over the Maritime Continent, destructively interfering with the low frequency state.
- Kelvin wave activity is evident over the East Pacific.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

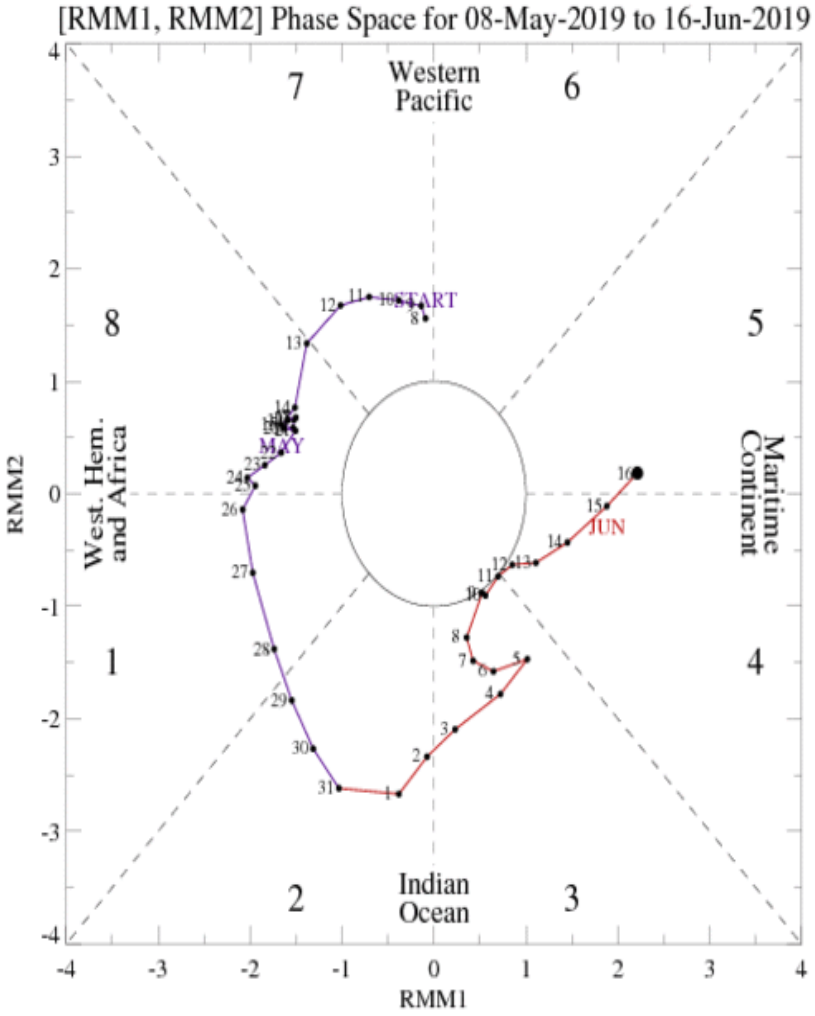




- SST anomalies remain above climatology across much of the equatorial Central and East Pacific, consistent with the ongoing El Niño event.
- Another downwelling Kelvin wave event is evident over the central Pacific, but its amplitude is weaker than what was observed in previous events.

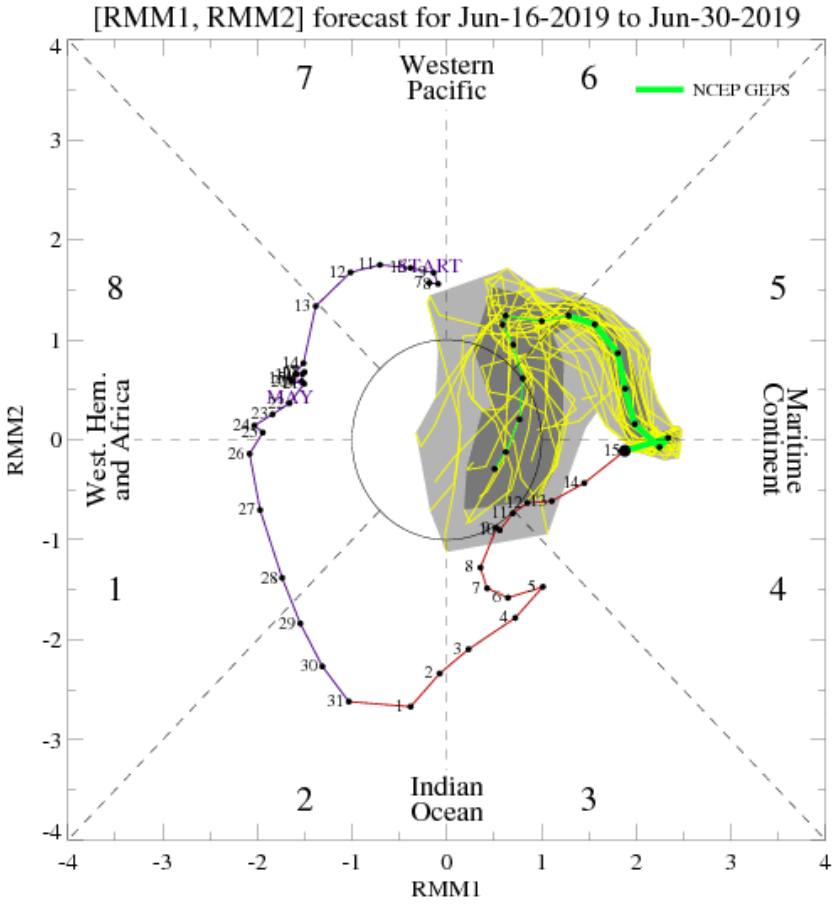
MJO Index: Recent Evolution

- The RMM index shows renewed eastward propagation of the MJO signal over the Maritime Continent.
- The leftward “turn” in the index in Phase-3 during early May may have been due to interference from Rossby wave activity, or Cyclone Vayu.

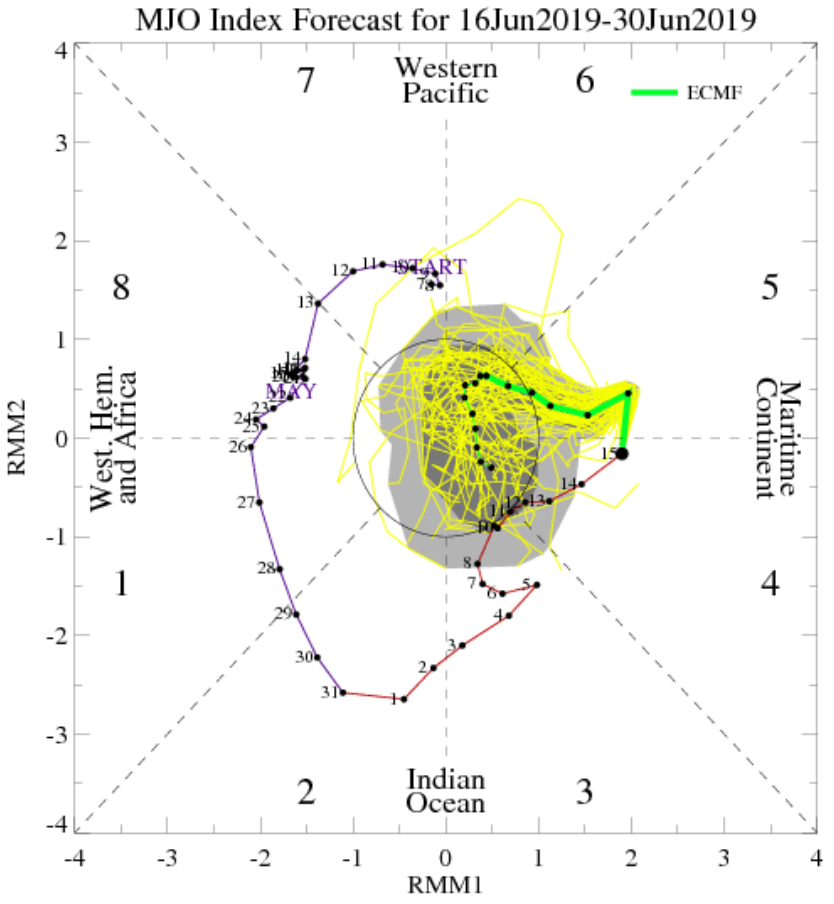


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

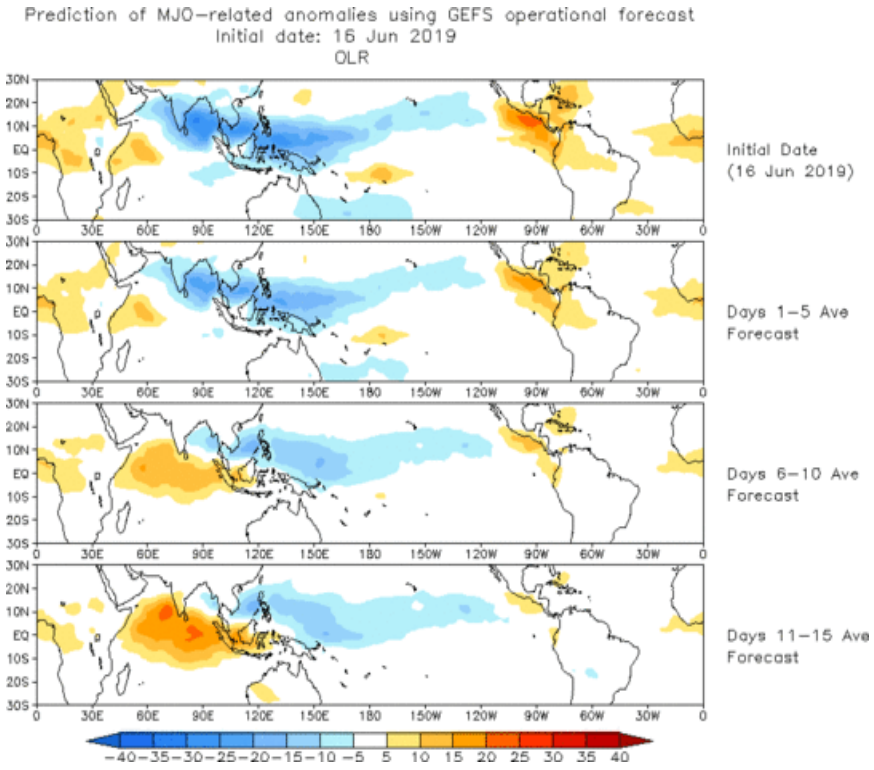


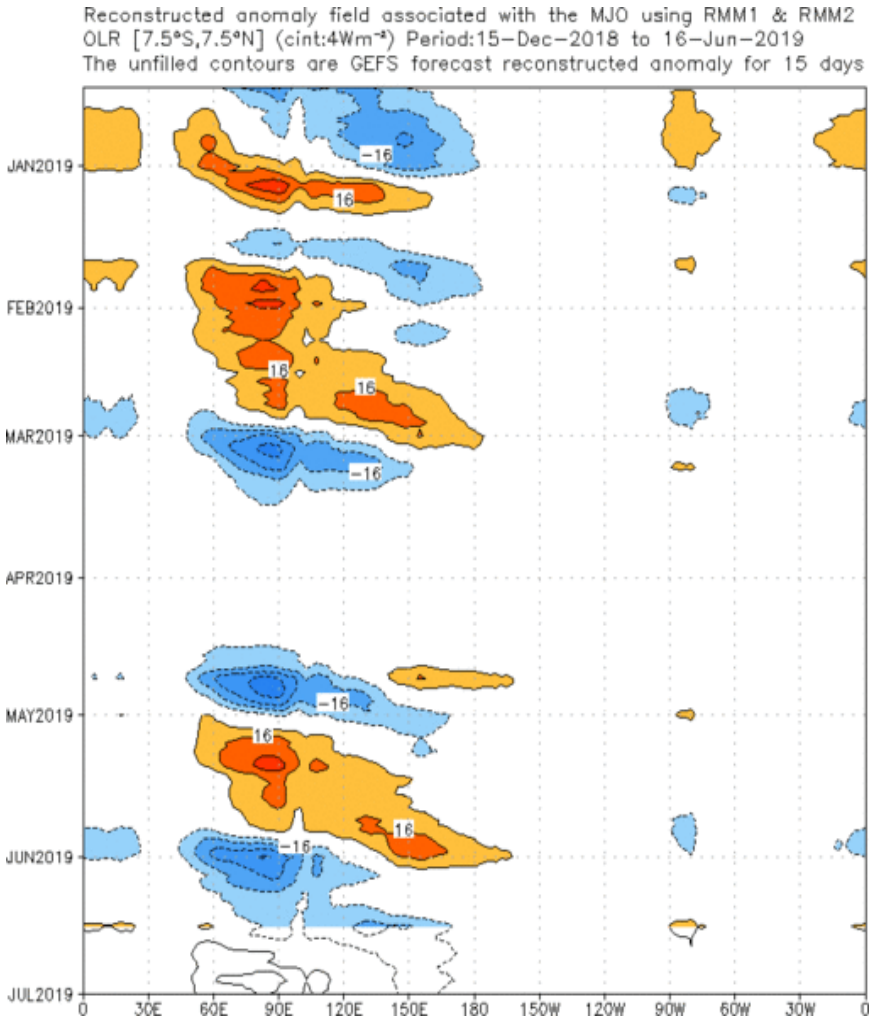
ECMWF Forecast

- The GEFS forecasts continued MJO activity over the Maritime Continent during Week-1, with a rapid weakening of the signal during Week-2. The ECMWF ensemble mean is similar, with a more rapid weakening of the MJO. The spread of the ensemble members is greater, however, and some ensemble forecasts depict continued MJO activity over 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.)

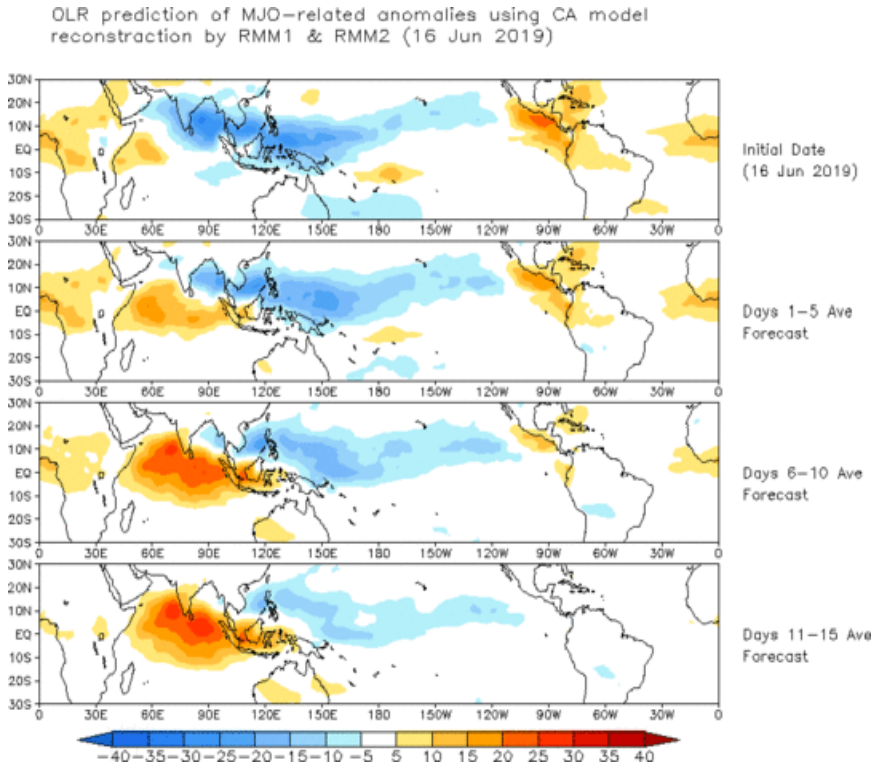


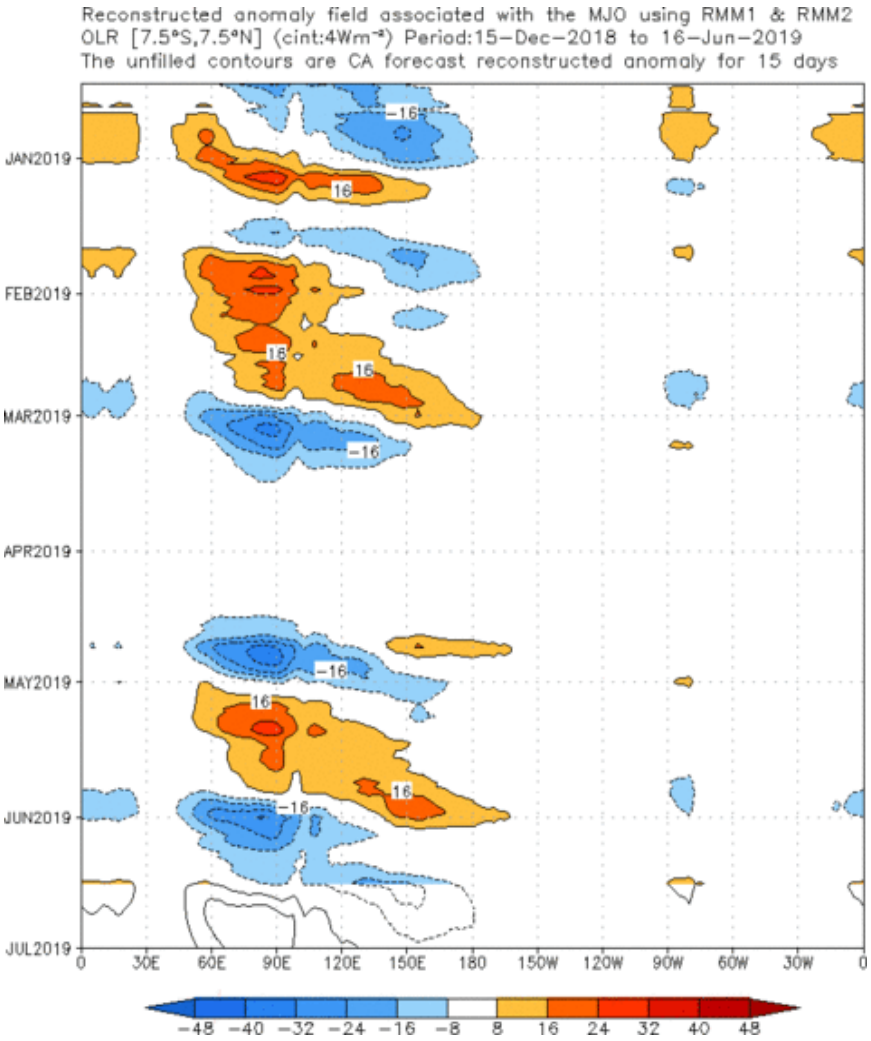


- The spatial anomaly field based on the GEFS RMM-index forecast depicts continued eastward propagation through the beginning of Week-2.
- Despite the weakening index, the OLR anomaly field remains robust through Week-2.

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.)

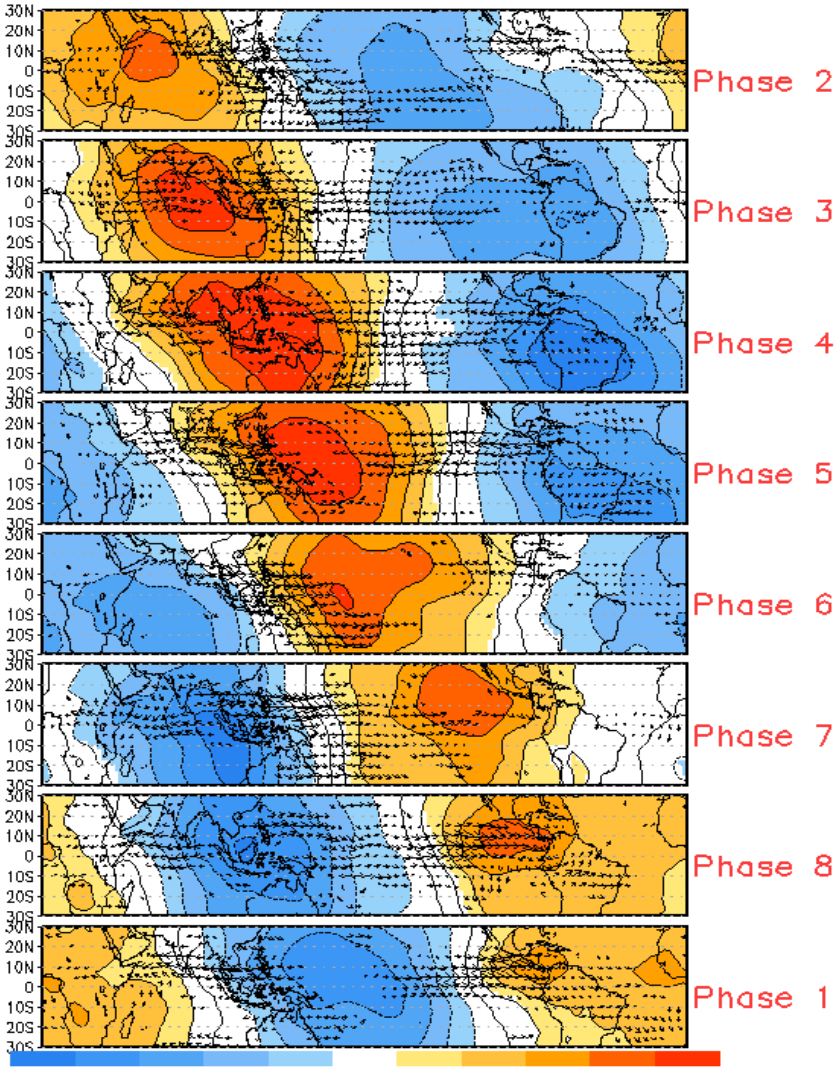




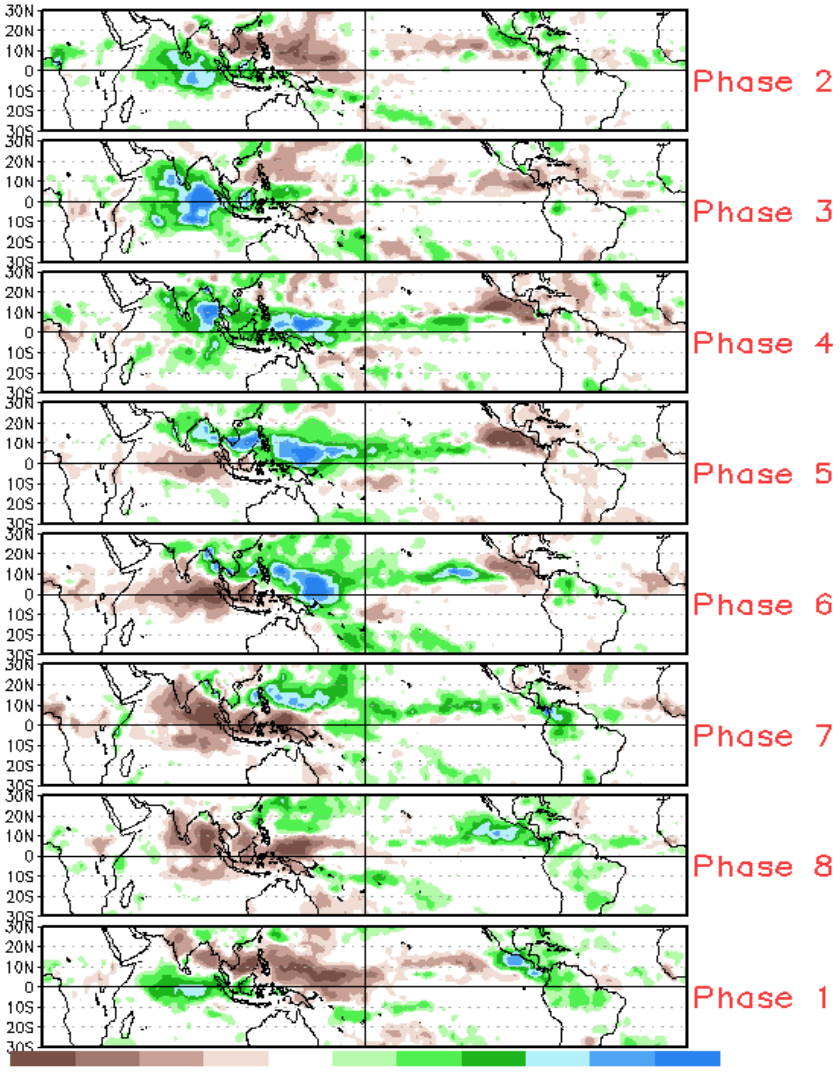
- The constructed analog forecast depicts canonical eastward propagation of MJO-related OLR anomalies.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



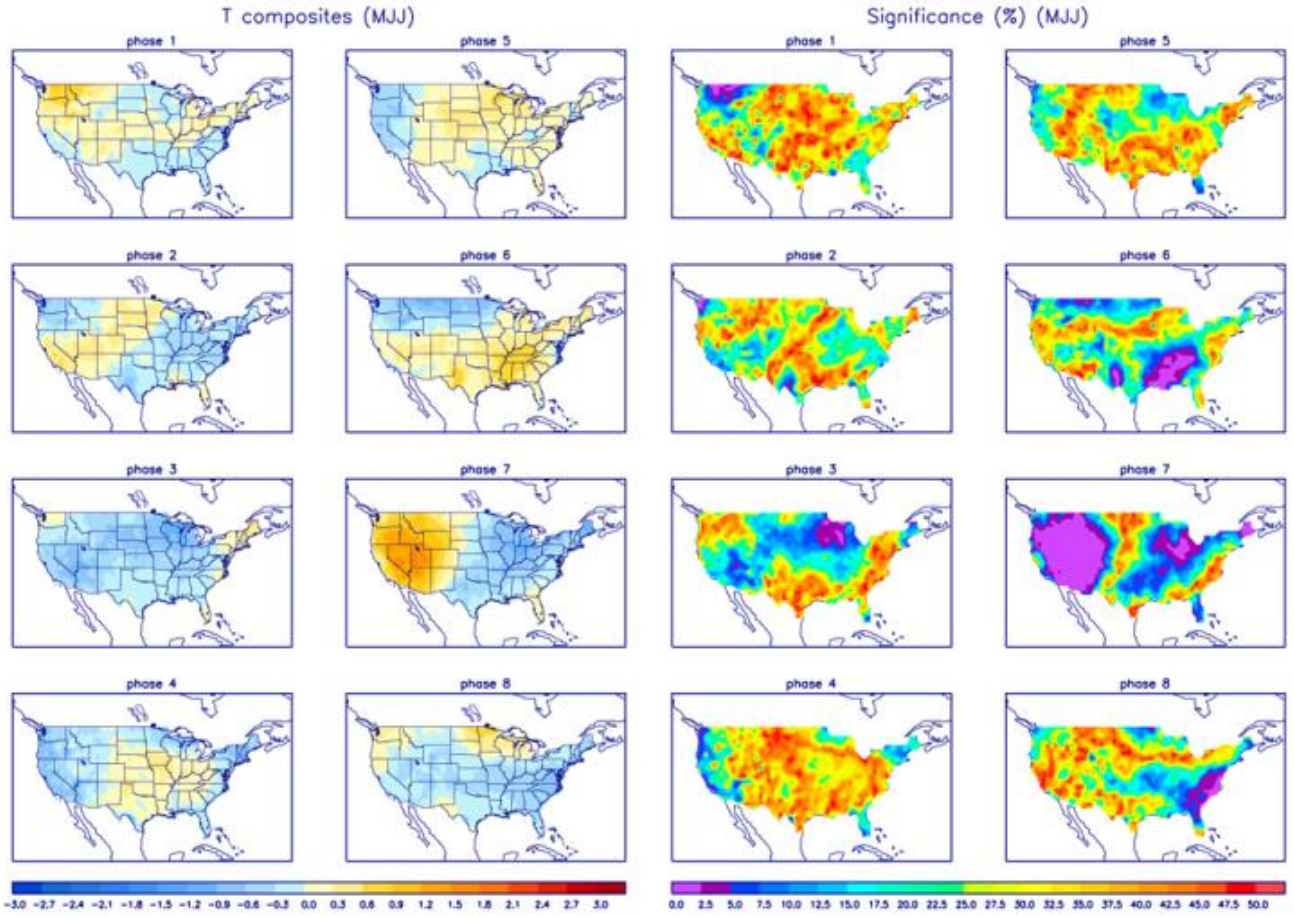
Precipitation Anomalies



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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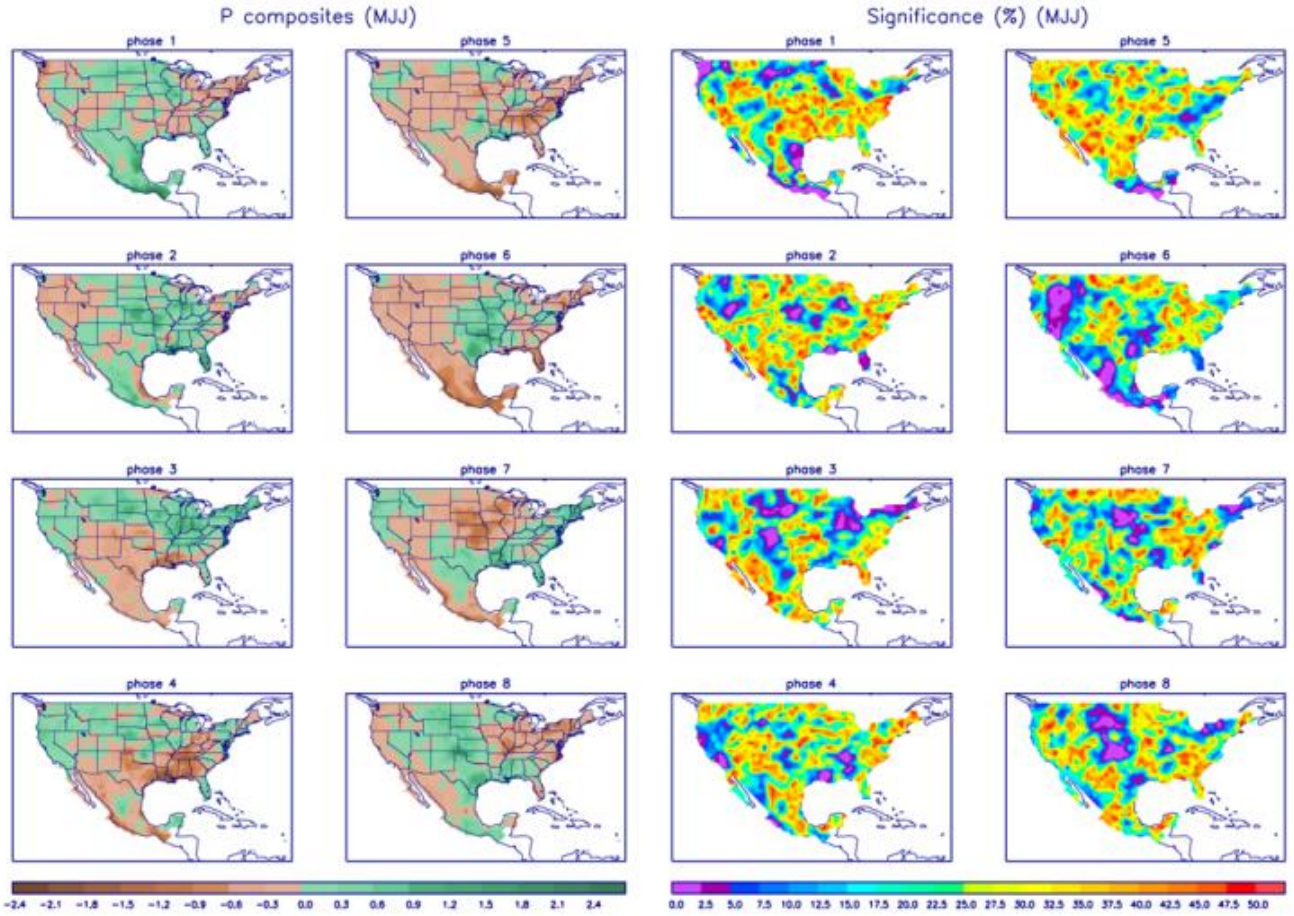

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