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

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
7 October 2019

Overview

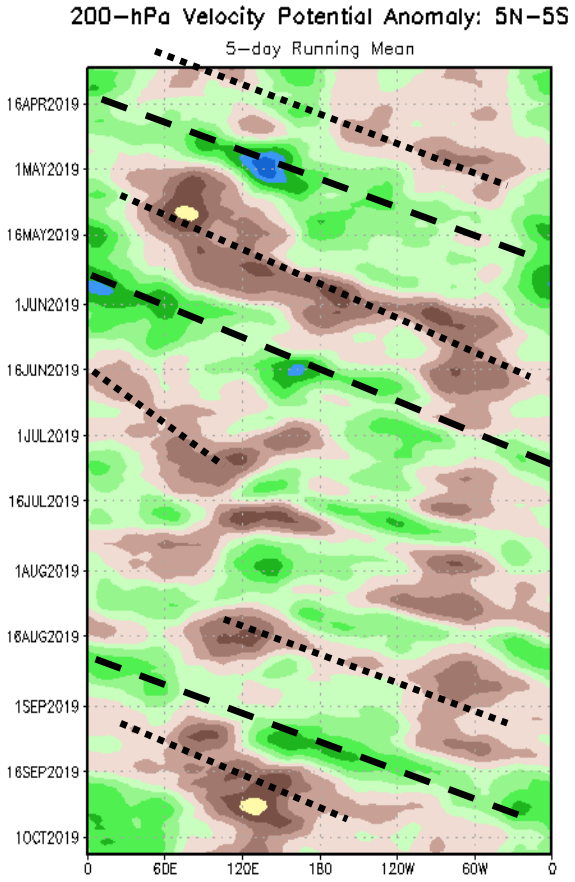
- At present, there is little evidence to support the presence of an active MJO event.
- The positive phase of the Indian Ocean Dipole continues to manifest in enhanced low-level (upper-level) anomalous easterlies (westerlies) yielding enhanced convection across the Western Indian Ocean and suppressed convection over the Maritime Continent and Australia. This signal is being aliased into the RMM index, making it appear as though there is a MJO over Africa, although the stationary presence of this feature over the last 2 weeks further emphasizes the lower frequency nature of the driving signal.
- Model guidance suggests there may be a chance that an active MJO emerges across the Indian Ocean by mid-October, which could disrupt the persistent pattern that has been observed across tropical portions of the Eastern Hemisphere for the last several weeks.
- Extratropical impacts across North America from large-scale tropical modes are anticipated to be negligible during the next two weeks, with tropical cyclone activity being the primary concern in the near-term.

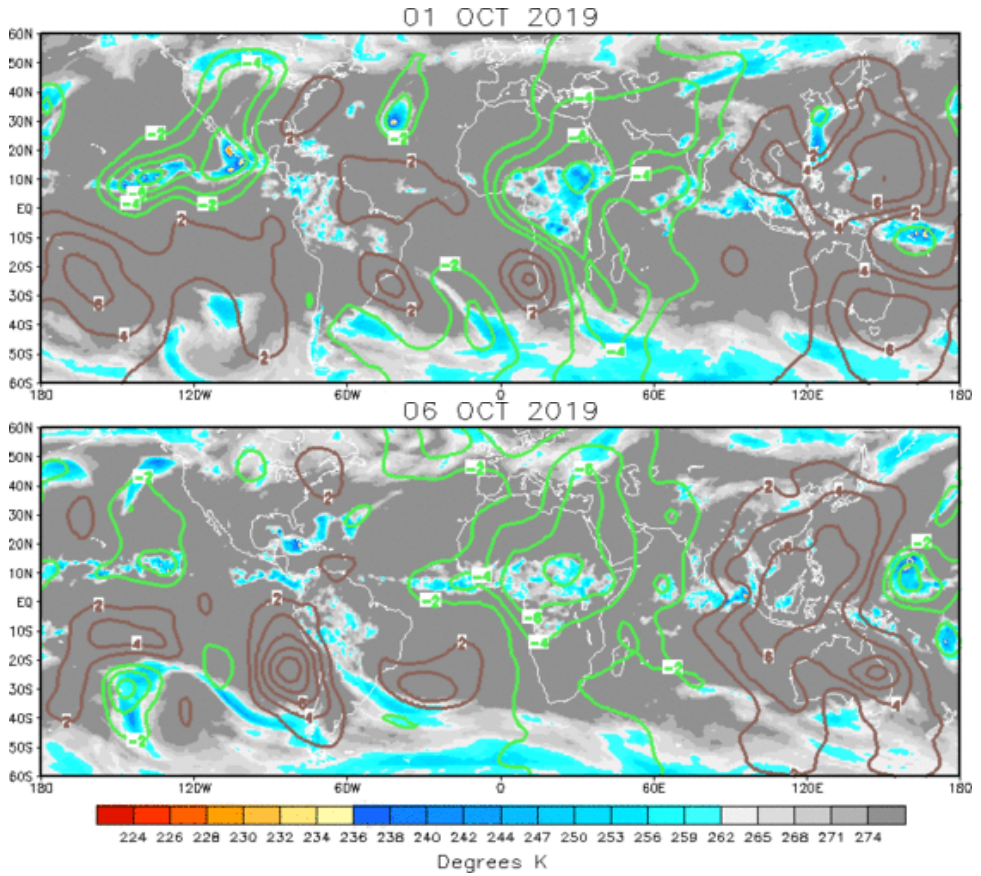
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

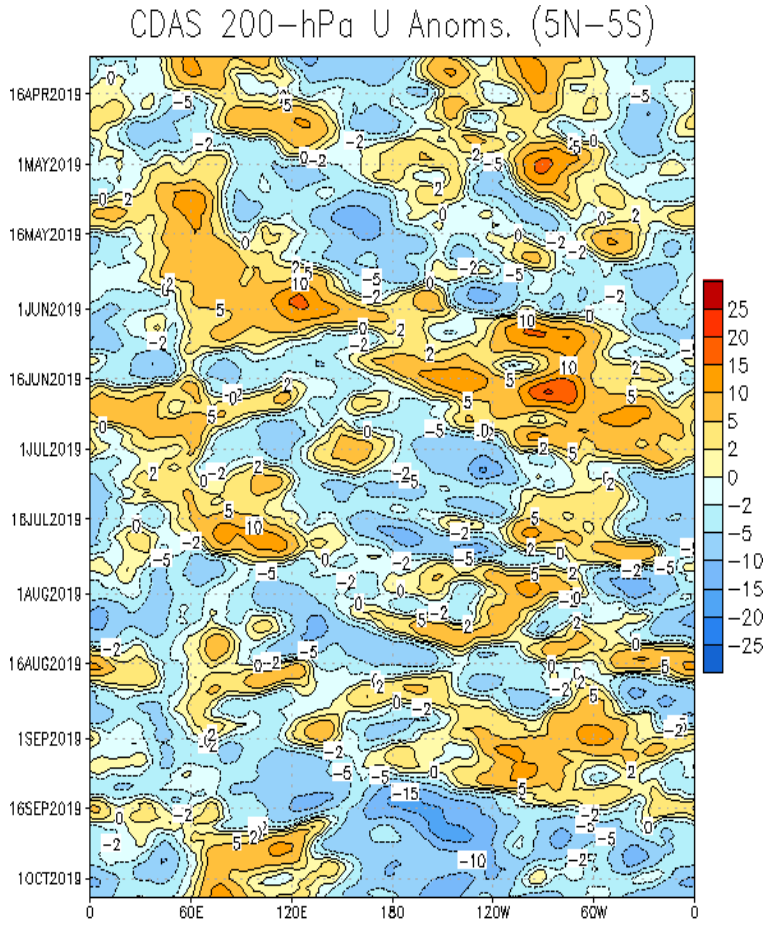


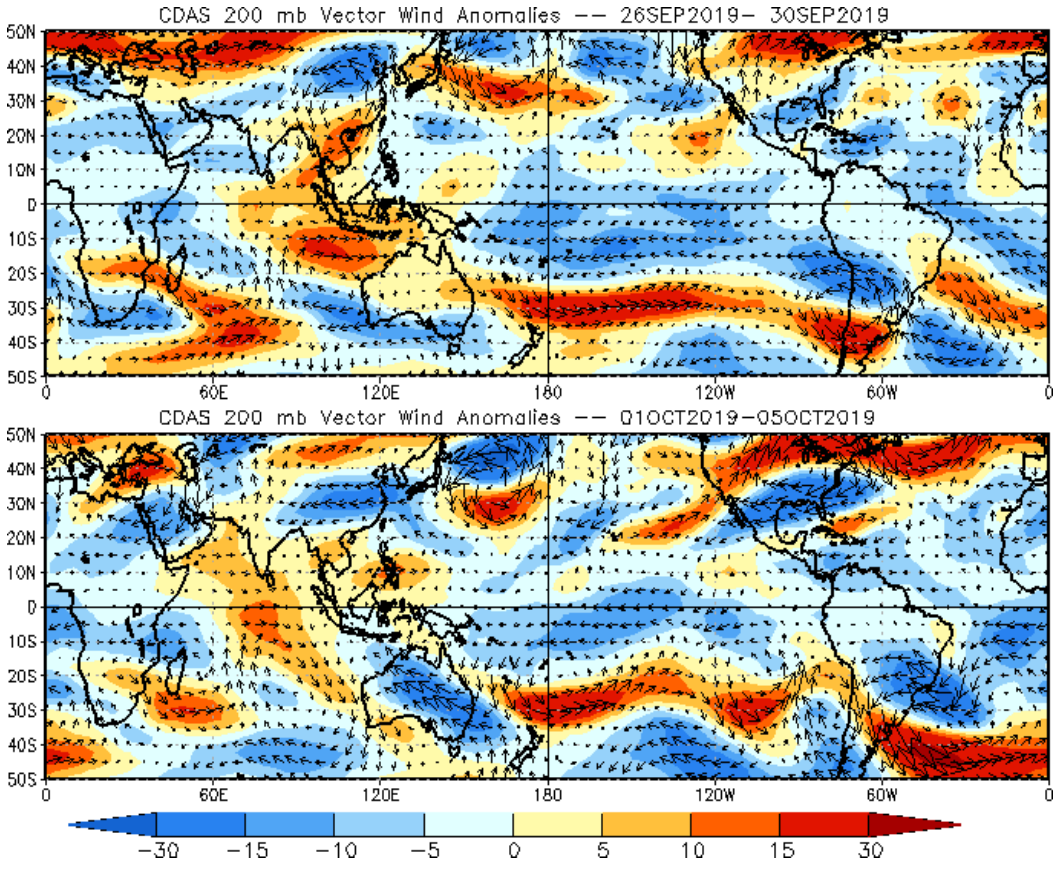


- A wave-1 pattern has remained stationary during late September into early October, with the enhanced phase centered over Africa and the Indian Ocean and the suppressed phase across the Maritime Continent. This perspective is representative of a robust positive phase of the Indian Ocean Dipole (IOD).

200-hPa Wind Anomalies

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

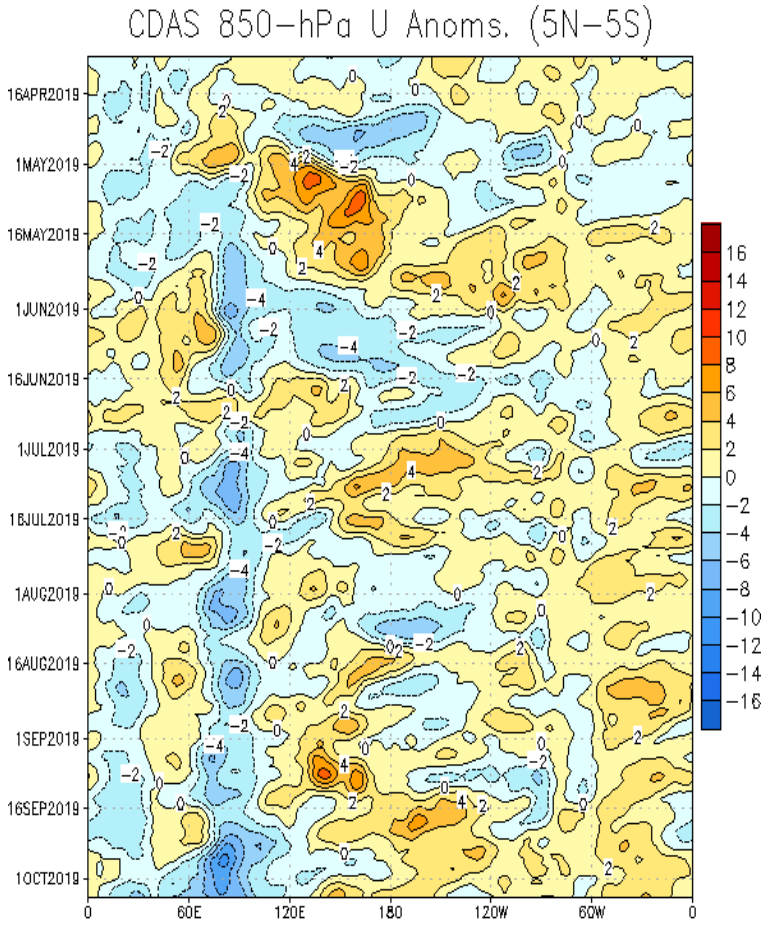


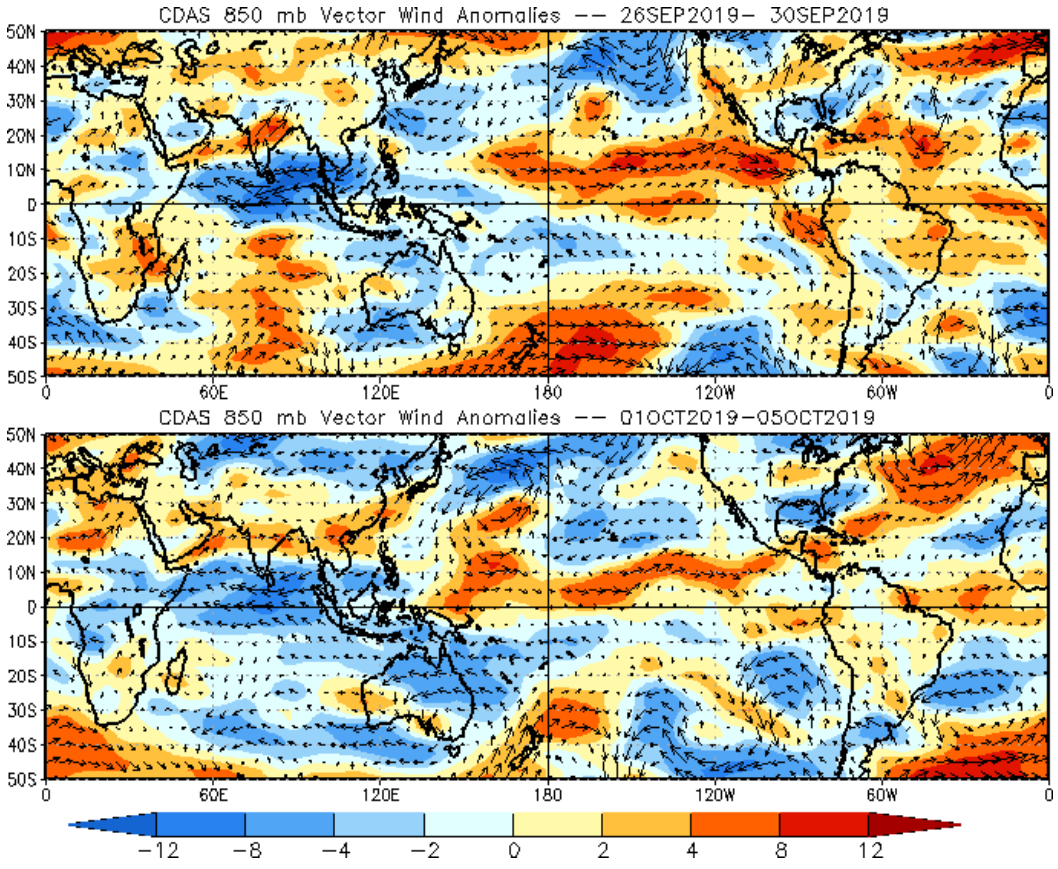


- Westerlies (easterlies) weakened somewhat across the Indian (Pacific) Ocean despite continued influence by extratropical wavebreaking.
- Anomalous easterlies over the tropical Atlantic have returned closer to climatology recently, coincident with the slow down in tropical cyclogenesis across the Main Development Region.

850-hPa Wind Anomalies

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

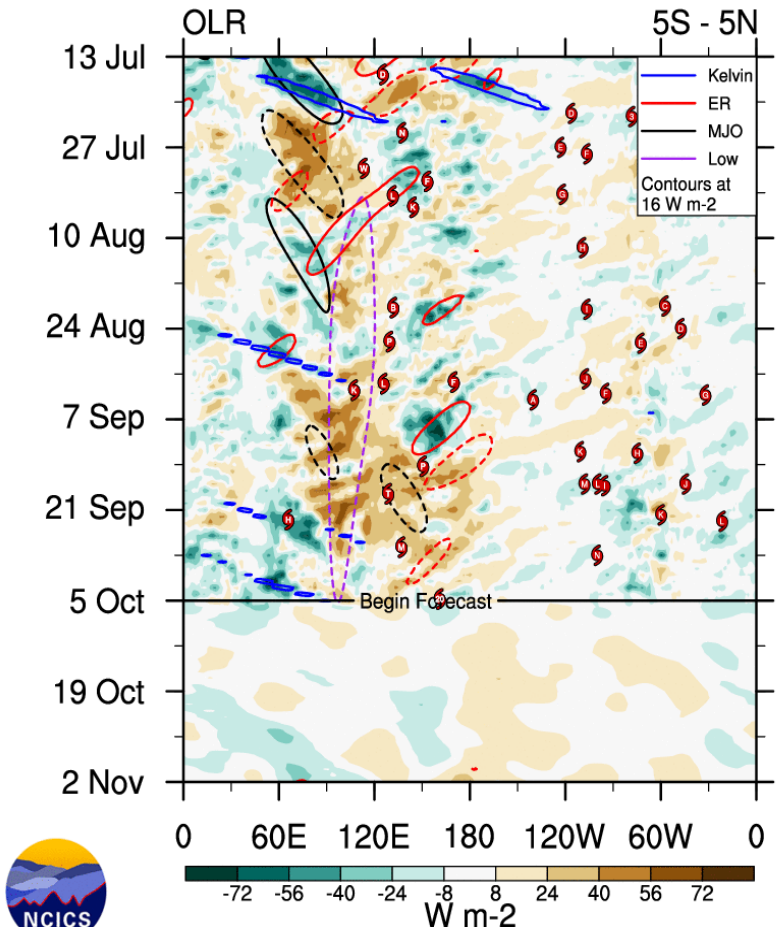


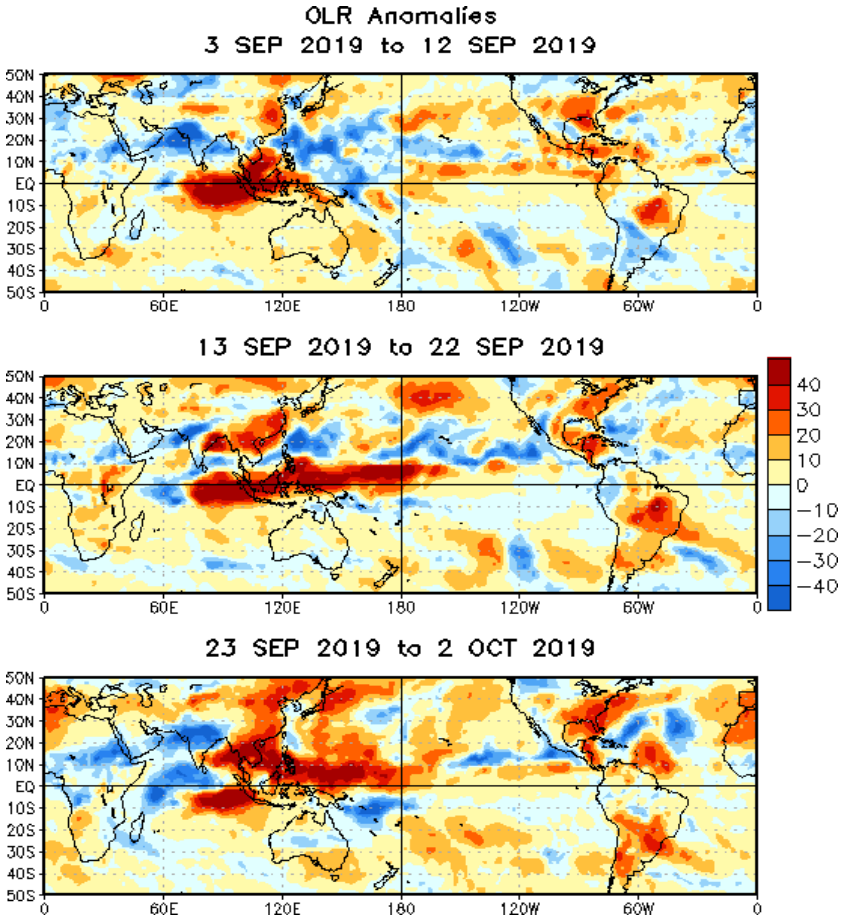


- Anomalous easterlies persisted across the Indian Ocean during early October, although at a lesser amplitude relative to late September.
- Westerlies remained across the East Pacific, while also emerging across the West Pacific in association with Super Typhoon Hagibis.

Outgoing Longwave Radiation (OLR) Anomalies

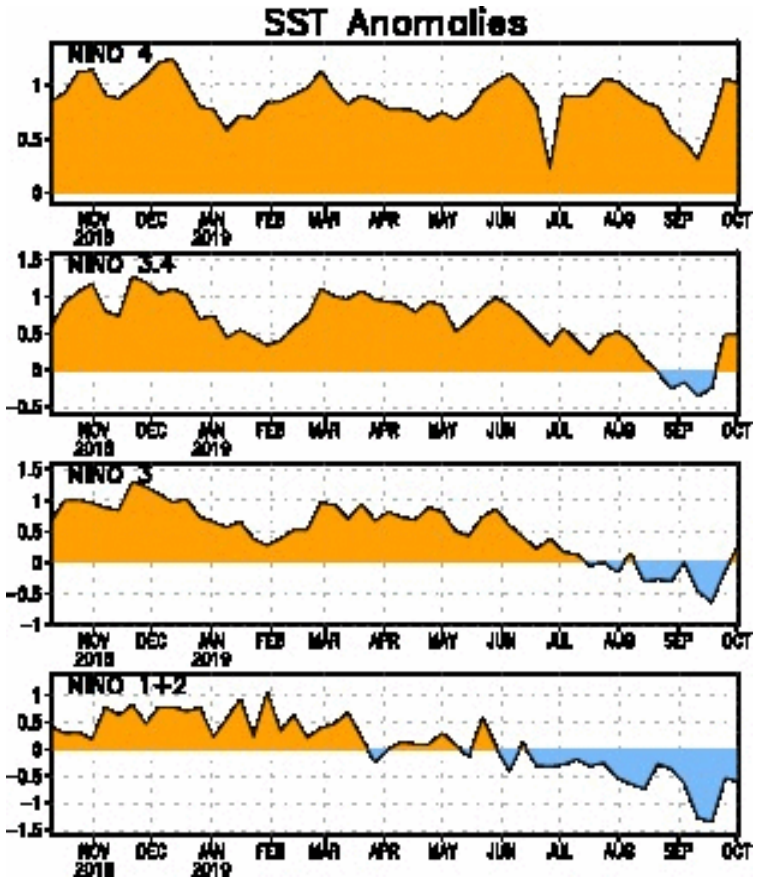
Blue shades: Anomalous convection (wetness). Red shades: Anomalous subsidence (dryness).

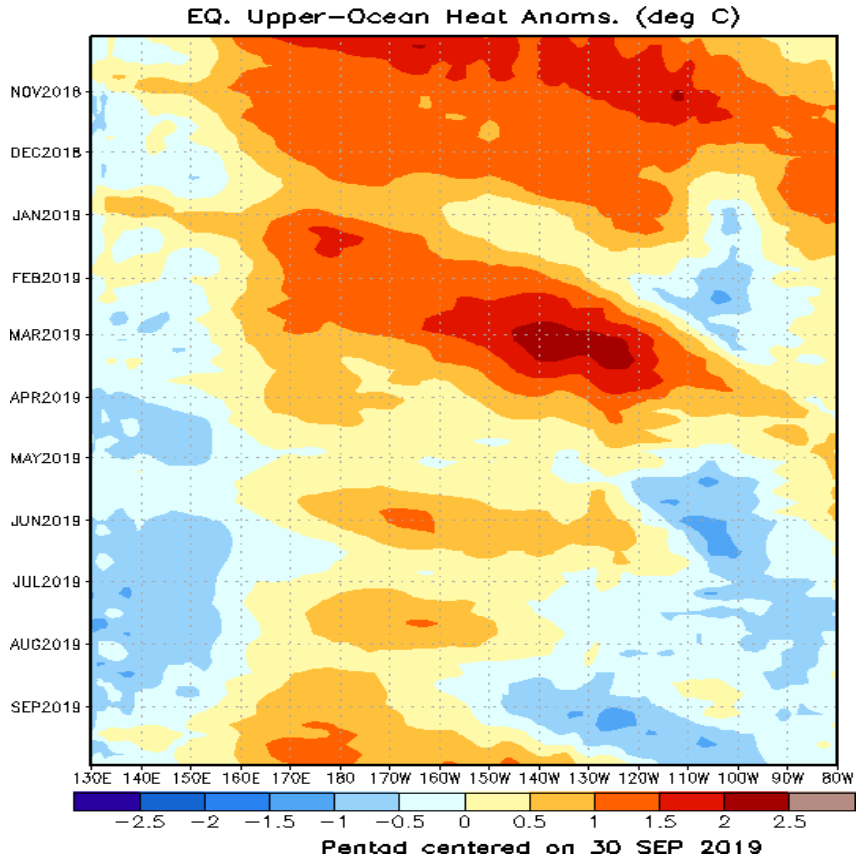




- The anomalous dipole of convection across much of the Indian Ocean and Maritime Continent tied to the ongoing +IOD event persists.
- Much of the anomalous convection across the Western Hemisphere can be attributed to tropical cyclone activity during the last 30 days.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

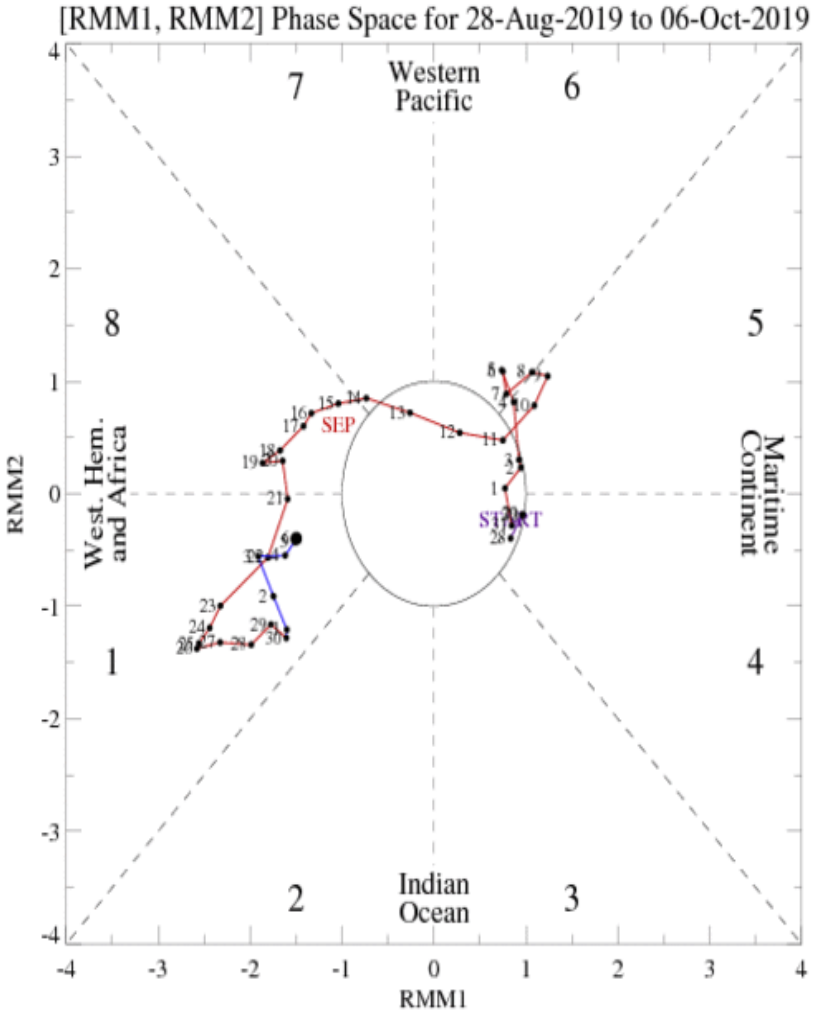




- Negative anomalies associated with the upwelling phase of an oceanic Kelvin wave increased over the East Pacific, resulting in negative SST anomalies from the Niño-3 region eastward.
- Upper-oceanic heat content remains above-average over the west-central Pacific.
- The recent strong westerly wind burst over the Central Pacific appears to have helped initiate a new downwelling Kelvin wave event that could further increase oceanic heat content in the Pacific in the near-term.

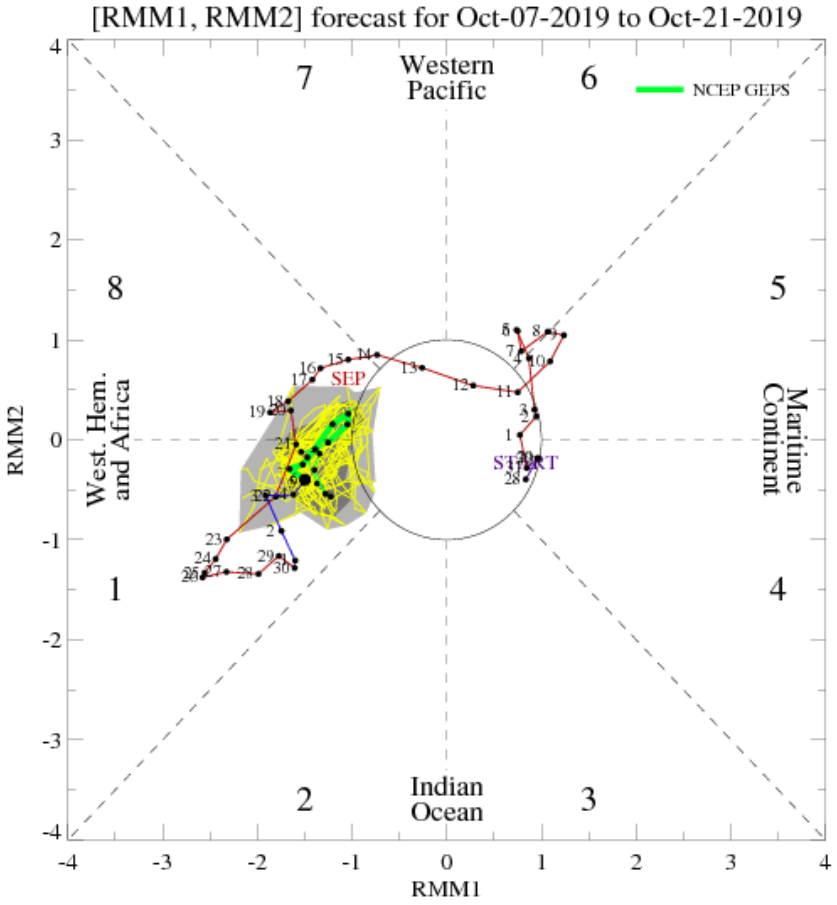
MJO Index: Recent Evolution

- The RMM index shows a relatively stagnant intraseasonal signal over Africa over the past 2+ weeks. This is rooted in the +IOD seemingly dominating other intraseasonal modes at this time, supporting the lack of a robust MJO at present.

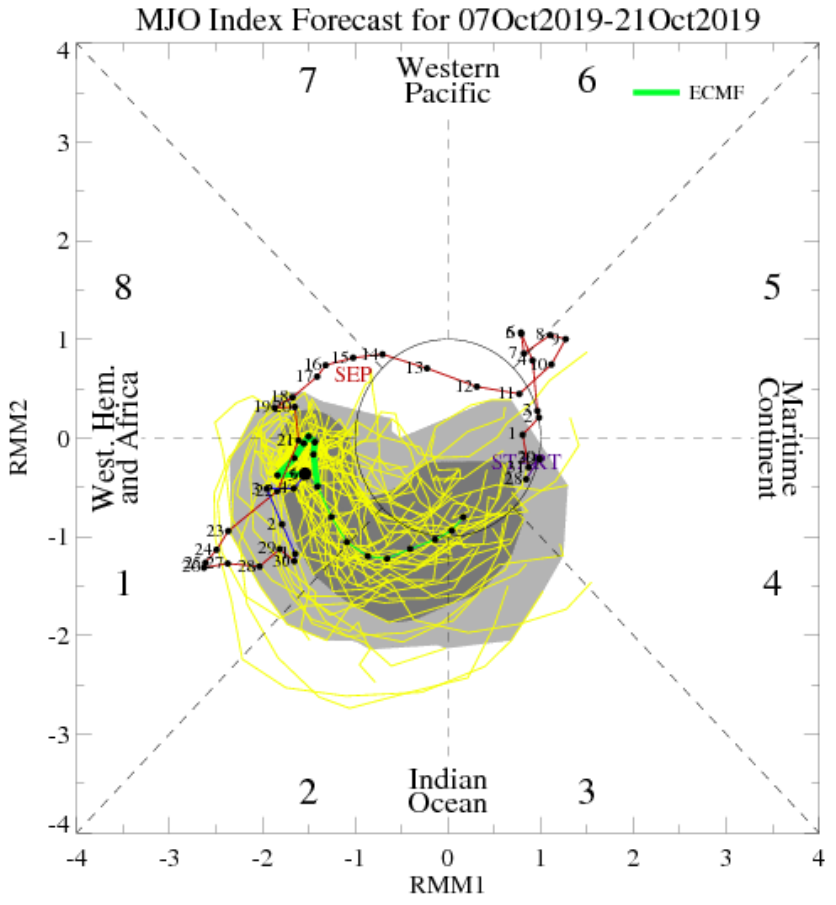


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

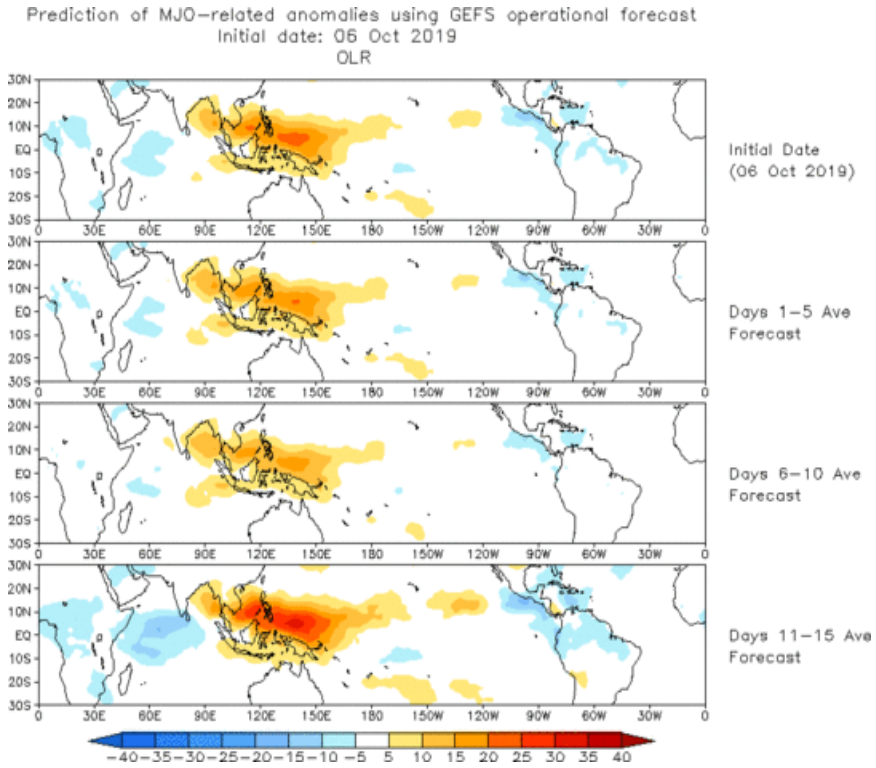


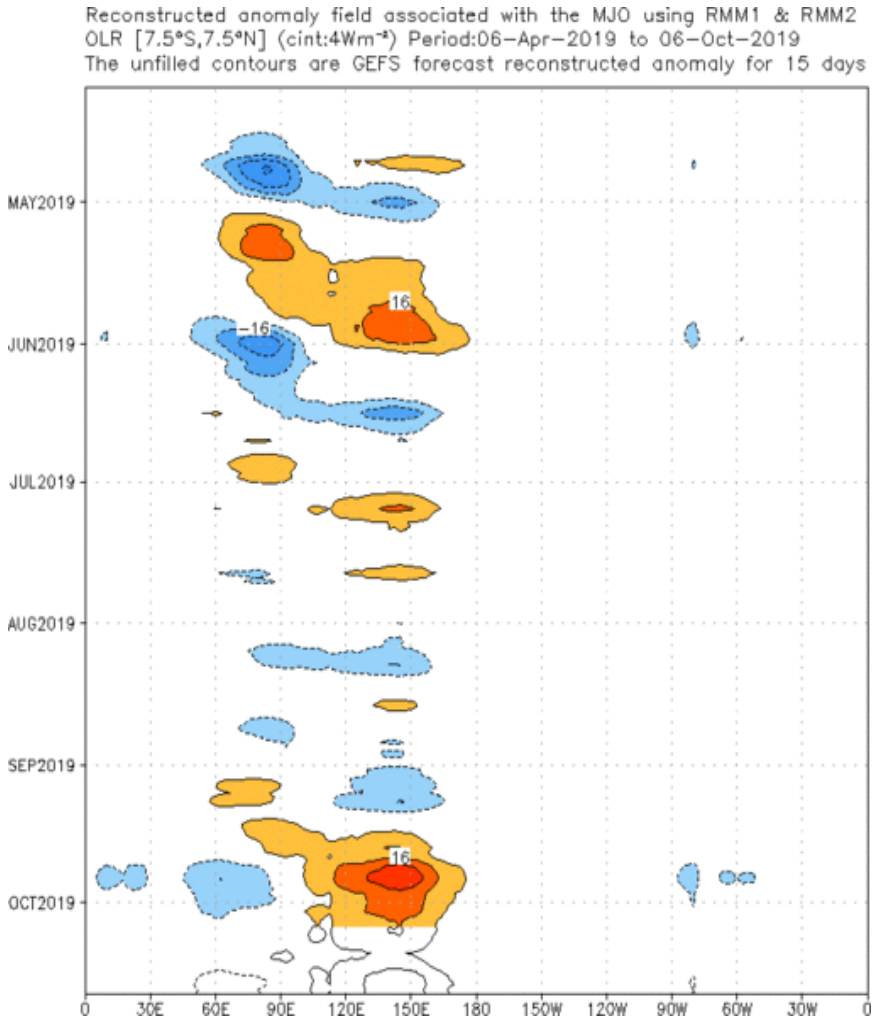
ECMWF Forecast

- The GEFS forecasts the continued lack of a coherent MJO, while emphasizing the +IOD.
- The ECMWF model features an eastward propagating envelope possibly emerging by mid-October after some initial emphasis of the lower frequency state during the first week of its forecast.

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.)

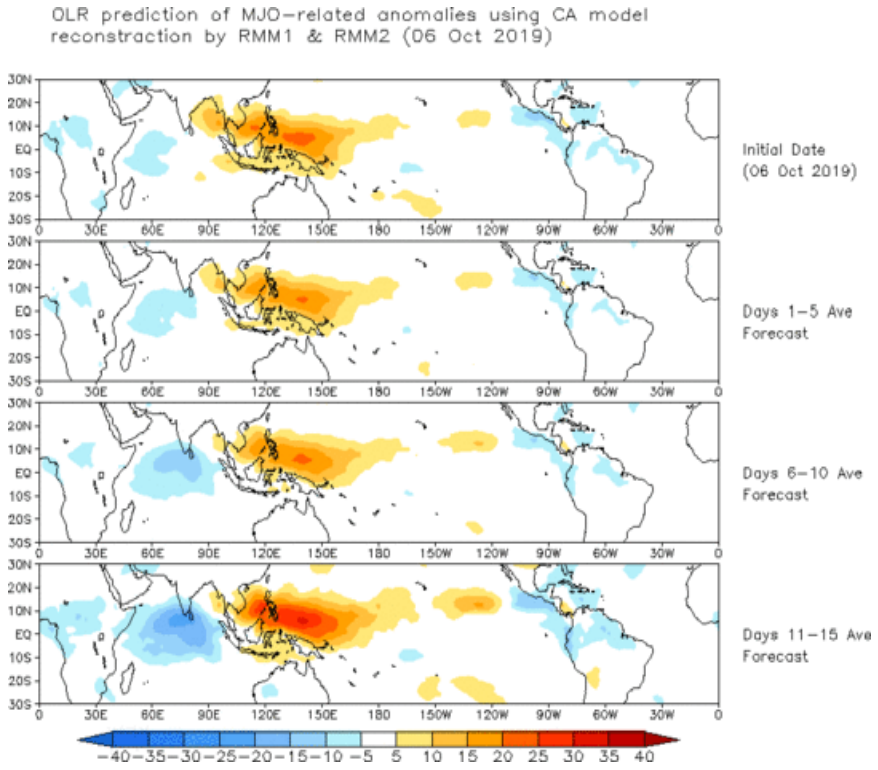


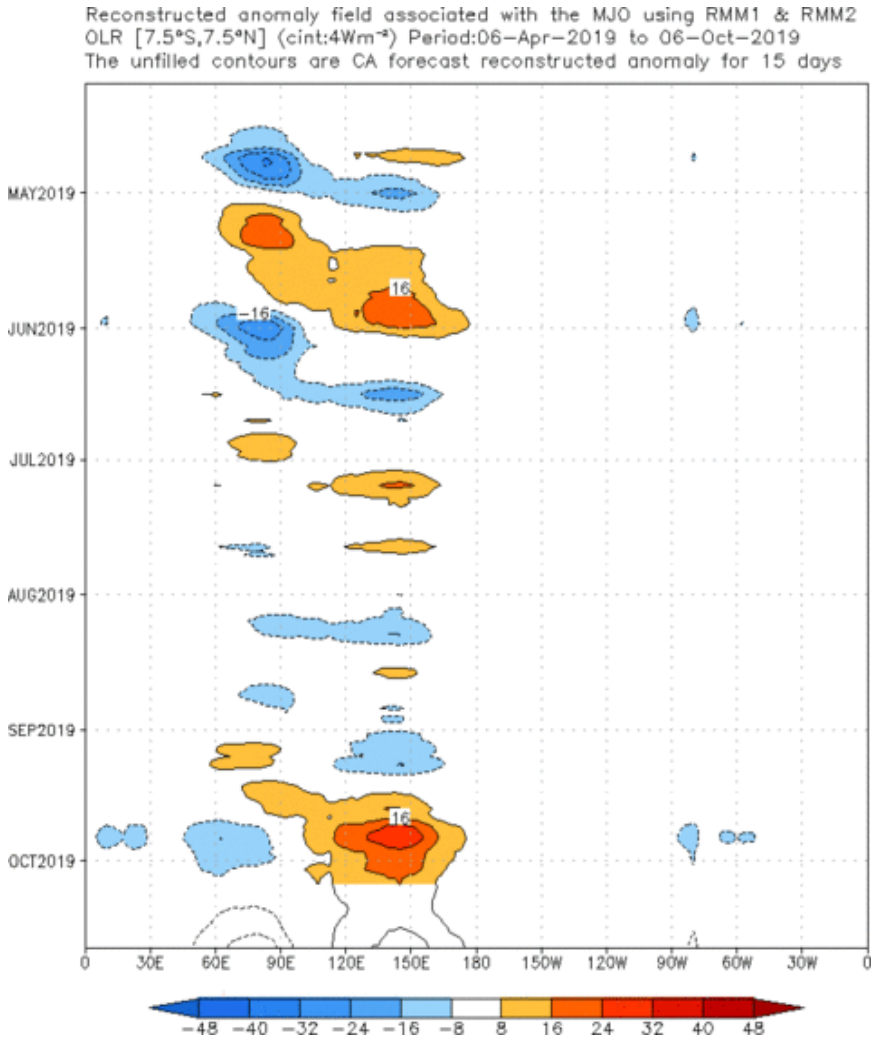


- OLR anomalies based on the GEFS reflect a fairly stationary pattern favoring Western Hemisphere convective enhancement over the Eastern Pacific and suppression over the Maritime Continent and West Pacific consistent with the +IOD. There is some eastward progression by days 11-15 with convection building over the Western Indian Ocean that could suggest an emerging MJO very late.

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.)

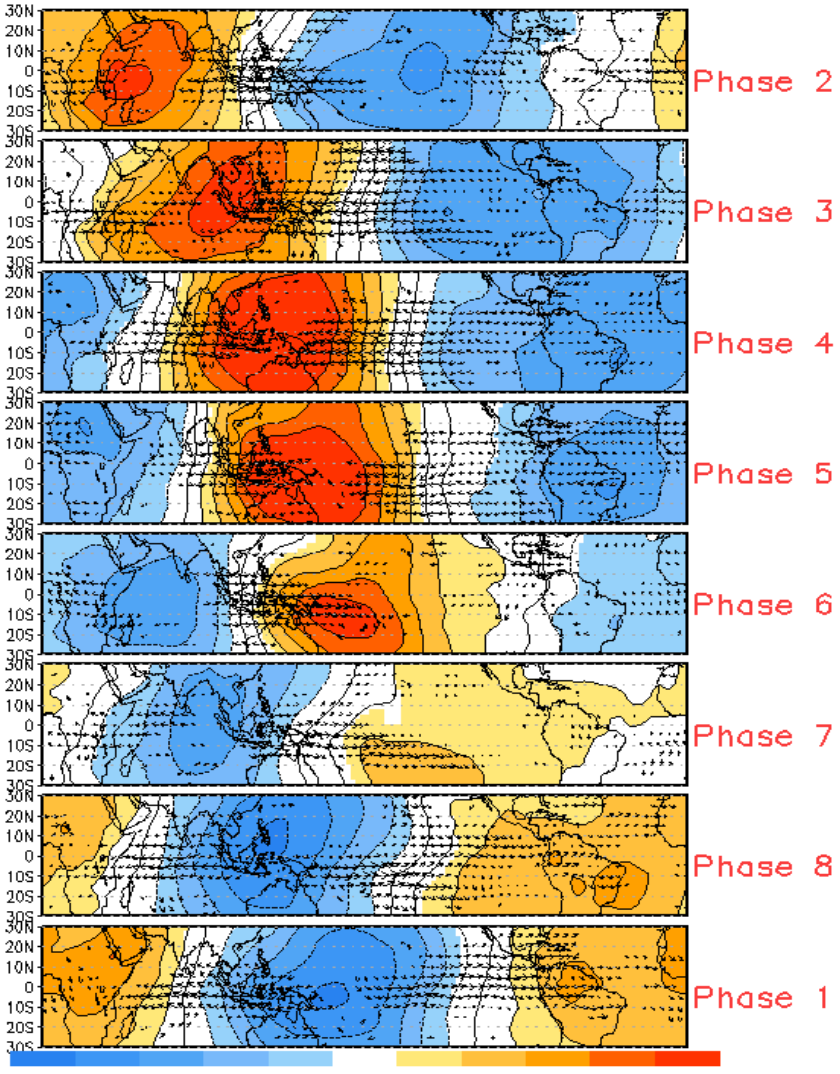




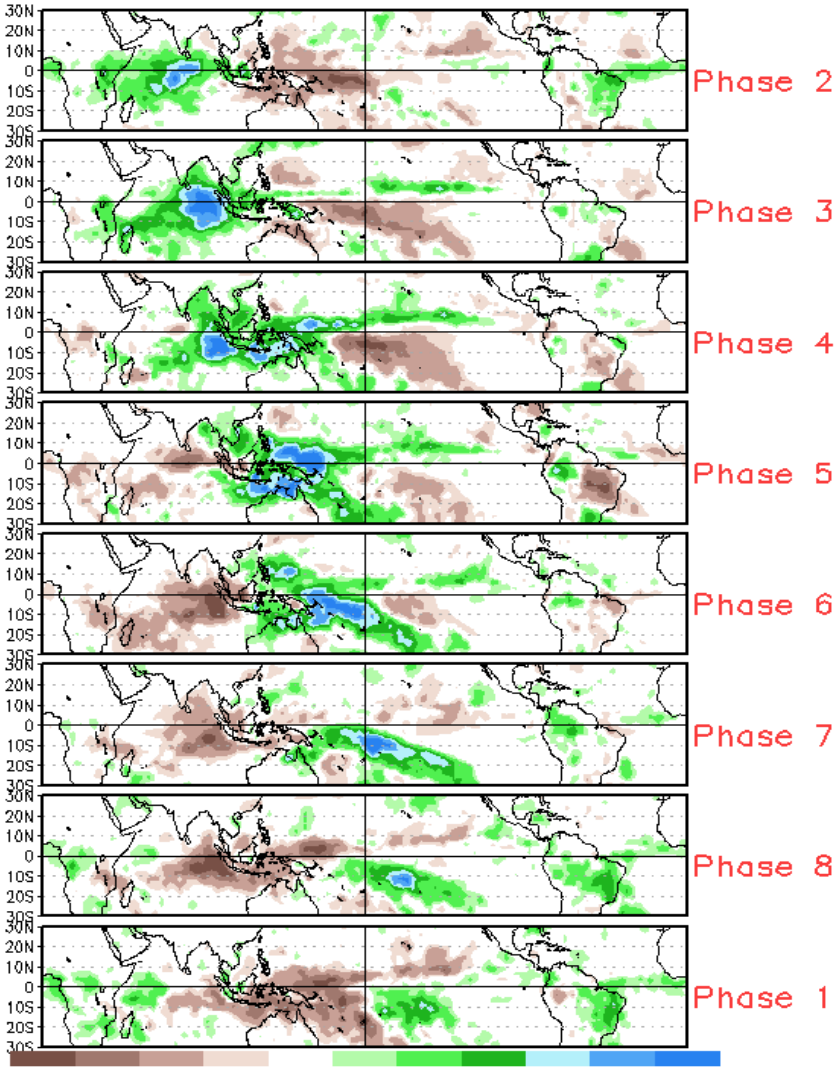
- The constructed analog forecast is more progressive in propagating the convective dipole across the Eastern Hemisphere, while growing its amplitude with time. This would be more supportive of a robust subseasonal influence as opposed to the lower frequency perspective of the GEFS.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



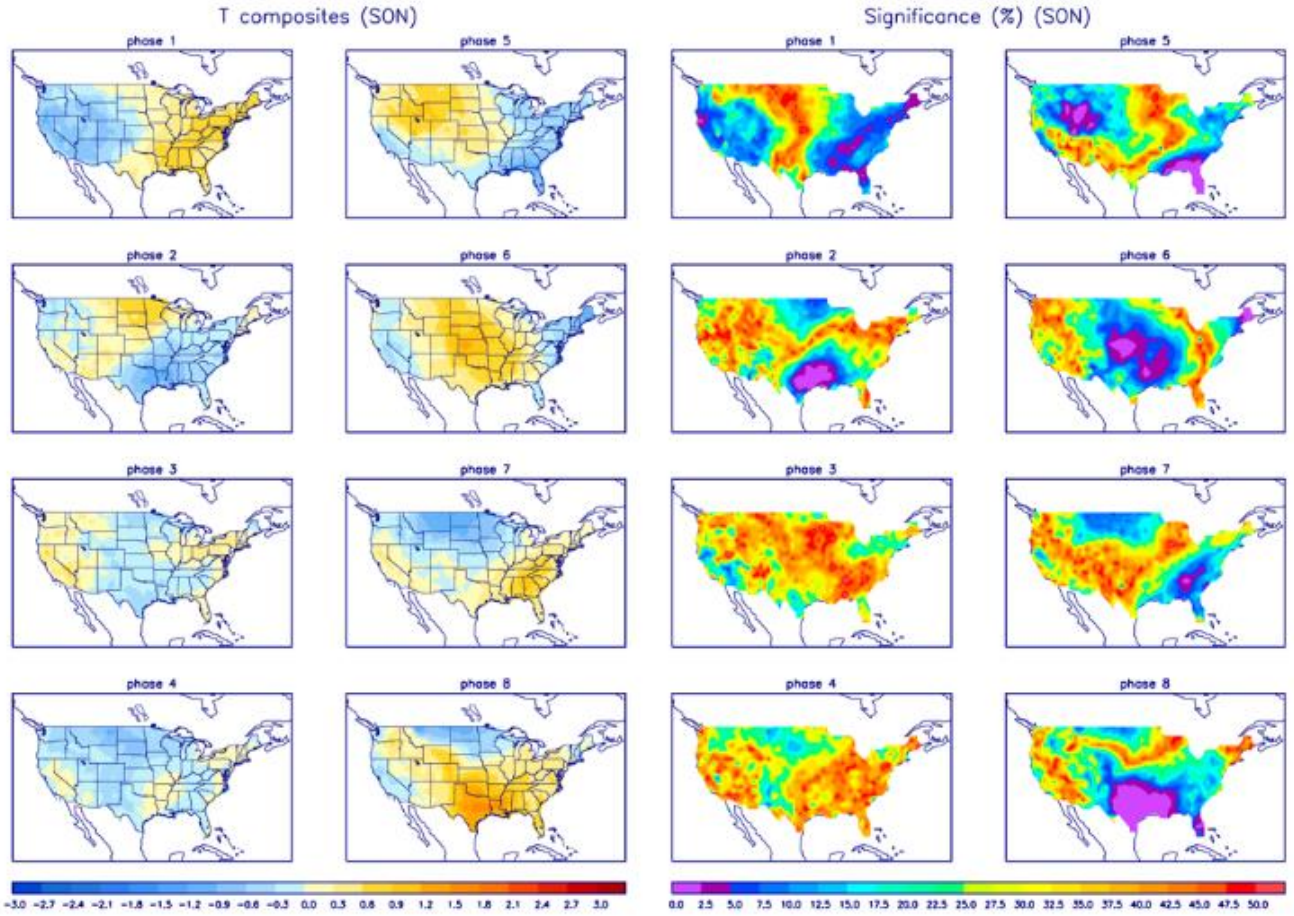
Precipitation Anomalies



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.

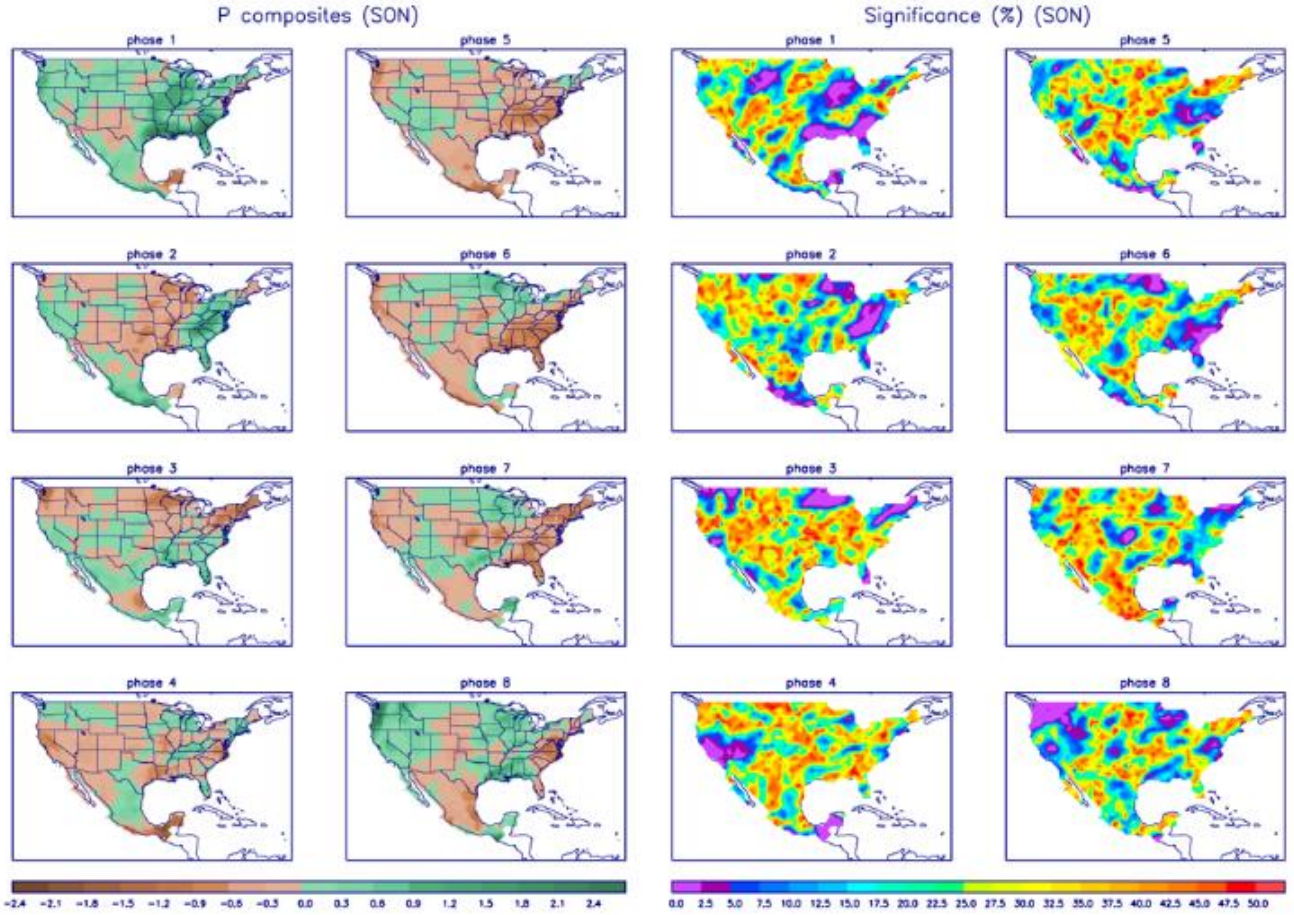


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

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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