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

Update prepared by the Climate Prediction Center
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Overview

- There was a brief resurgence of the MJO signal across the Indian Ocean during late August, but it quickly weakened by early September with La Niña remaining the dominant mode of tropical variability.

- The enhanced convective envelope remains situated across the Indian Ocean, Maritime Continent, and far Western Pacific, with limited eastward propagation forecast, supporting continued heavy rainfall in these regions, and possible tropical cyclone development.

- Kelvin Wave activity may support additional tropical cyclone formation across the Eastern Pacific and Atlantic Basins during the next 2 weeks.

A coherent wave-1 asymmetry pattern has emerged in the spatial upper-level velocity potential field in early September, consistent with a decaying MJO and a stable low frequency La Niña signal remaining intact.

The enhanced convective envelope is located across the Indian Ocean, Maritime Continent, and far Western Pacific, with suppressed convection over much of the Western Hemisphere.
200-hPa Wind Anomalies

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

- Anomalous upper-level westerlies remain prevalent across the western and central equatorial Pacific as a result of the enhanced La Niña.
- Anti-cyclonic circulation to the south of the equator led to anomalous upper-level easterlies over the equatorial eastern Pacific, thereby promoting a more west-based La Niña response during the past couple of weeks.
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.

- Strong low-level anomalous westerlies developed over the Indian Ocean associated with increased convective activity across the region and a brief resurgence of the MJO signal.
- The eastward propagation of this low-level wind burst appears to have stalled as anomalous low-level easterlies persist over much of the western and central equatorial Pacific associated with La Niña.
Outgoing Longwave Radiation (OLR) Anomalies

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

During the past week, negative OLR anomalies expanded across the Indian Ocean and Maritime Continent signaling an uptick in convection over the region.

OLR filtering through the CFS forecast depicts some eastward propagation of this signal in the next 2 weeks along with constructive interference with Rossby Wave activity, favoring increasing convection across the far western Pacific and continued increased chances for tropical cyclone development.
Following a warming trend in subsurface temperatures over the equatorial Pacific in May and June, enhanced trade winds tied to La Niña resulted in a subsequent upwelling Kelvin Wave leading to a renewed subsurface cooling during July and August.

SSTs remain below average across all Niño basins, although there has been a slight warming noted in all of the Niño basins except Nino 4, which is furthest west.
• There was a brief amplification of the MJO signal over the Indian Ocean during late August; however, the signal quickly retreated back into the RMM-unit circle in early September.

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
The GEFS and ECMWF ensembles depict an incoherent signal in regards to MJO propagation during the next 2 weeks, with the ensemble means remaining within the RMM-unit circle and large variability noted among the individual members.
There is little to no signal in the GEFS-based OLR anomaly field during the next few days, with weak negative OLR anomalies (enhanced convection) emerging across the Indian Ocean, Maritime Continent, and far western Pacific by the end of 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 of RMM-based OLR depicts little signal during the first 10-days of the forecast, with areas of positive OLR anomalies (suppressed convection) developing over the West Pacific toward the end of week-2, indicating some uncertainty in terms of the eastward propagation of the convective signal.
MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies

Precipitation Anomalies
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.

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.