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

- The amplitude of the RMM-based MJO index is the highest its been since July 2021, and is currently located in phase 7 (Western Pacific).

- The GEFS and ECMWF ensembles depict the MJO continuing to propagate eastward over the western and central Pacific during mid to late December.

- This MJO event is likely to destructively interfere with La Niña, and there remains uncertainty as to whether the MJO will maintain an organized structure as it moves near the Date Line, as evidenced by large ensemble spread in the RMM forecasts.

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-2 velocity potential pattern is observed, with an active MJO resulting in enhanced convection over the Maritime Continent and West Pacific, and enhanced upper level divergence over Africa in its wake.
- Suppressed convection remains over much of the eastern Pacific, North Atlantic, and Indian Ocean.
Easterly upper level wind anomalies over the Indian Ocean have transitioned to westerly anomalies in the wake of the departing MJO.

Anomalous westerlies persist across much of the equatorial Pacific, consistent with La Niña.
850-hPa Wind Anomalies

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

- Westerly wind burst observed over the Maritime Continent and western Pacific resulting from eastward propagation of the MJO.
- Along the equator, anomalous easterlies remain across the central and eastern Pacific, consistent with the low frequency La Niña state.
Outgoing Longwave Radiation (OLR) Anomalies

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

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

- Convection has been suppressed to the west of the Date Line, and over the central and eastern Pacific north of the equator since October.
- However, the CFS ensemble depicts enhanced convection developing near the Date Line during the next 2 weeks, and destructively interfering with the established low-frequency base state.
• Negative upper-ocean heat content anomalies have relaxed across the central and eastern equatorial Pacific, with much of the sub-surface cooling continuing to expand eastward since early October.
• Positive upper-ocean heat content anomalies have increased across the West Pacific during the past month.
• Consistent with La Niña, below-normal sea surface temperatures (SSTs) continue to be observed within all Niño regions, with SSTs holding steady or decreasing during November and early December.
The RMM based MJO index features eastward propagation from the Maritime Continent since late November and an increase in amplitude over the West Pacific during early December.

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
Both the GEFS and ECMWF ensembles depict a robust MJO event currently in RMM phase 7.

In the near term, propagation over the West Pacific is forecast to slow down or perhaps retrograde due to destructive interference with the low frequency base state and enhanced Rossby Wave activity.

Renewed eastward propagation is forecast by week-2, although uncertainty remains high as some individual ensembles considerably weaken the intraseasonal signal.
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 anomaly forecast depicts enhanced convection shifting eastward toward the Central Pacific during the next two weeks, while suppressed convection expands east from Indian Ocean to the Maritime Continent.
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 depicts a similar evolution to the GEFS, with enhanced convection overspreading the equatorial Pacific and suppressed convection developing across the Maritime Continent.
MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies

Precipitation Anomalies

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 7

Phase 8

Phase 1

Nov-Mar Precipitation (mm/day)
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.