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

Update prepared by
Climate Prediction Center / NCEP
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Outline

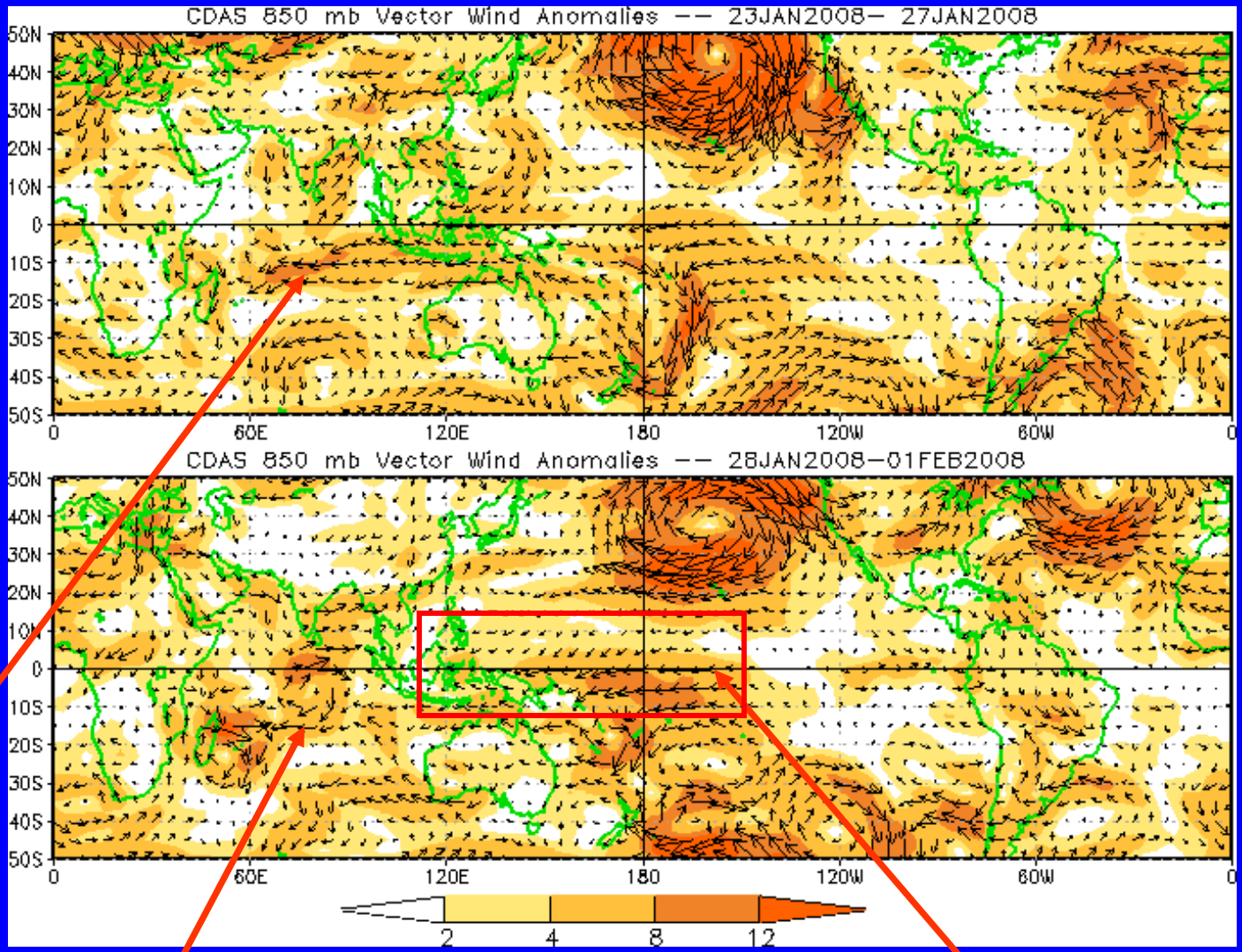
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- A moderate MJO continues with the enhanced phase centered over western Indonesia.
- The MJO is expected to continue shifting slowly eastward over the next 1-2 weeks and be centered over the eastern Maritime Continent by the end of the period.
- Impacts across the tropics include enhanced rainfall from the eastern Indian Ocean stretching to the far western Pacific by Week 2. Tropical cyclogenesis is favored for the eastern Indian Ocean and waters north-northwest of Australia.
- The expected pattern of tropical convection (MJO and La Nina) favors wet conditions for the US Pacific Northwest and Hawaii. As the MJO shifts eastward, a greater potential exists for elevated rainfall further south (northern / central California) later during week 2.

850-hPa Vector Wind Anomalies (m s^{-1})

Note that shading denotes the magnitude of the anomalous wind vectors

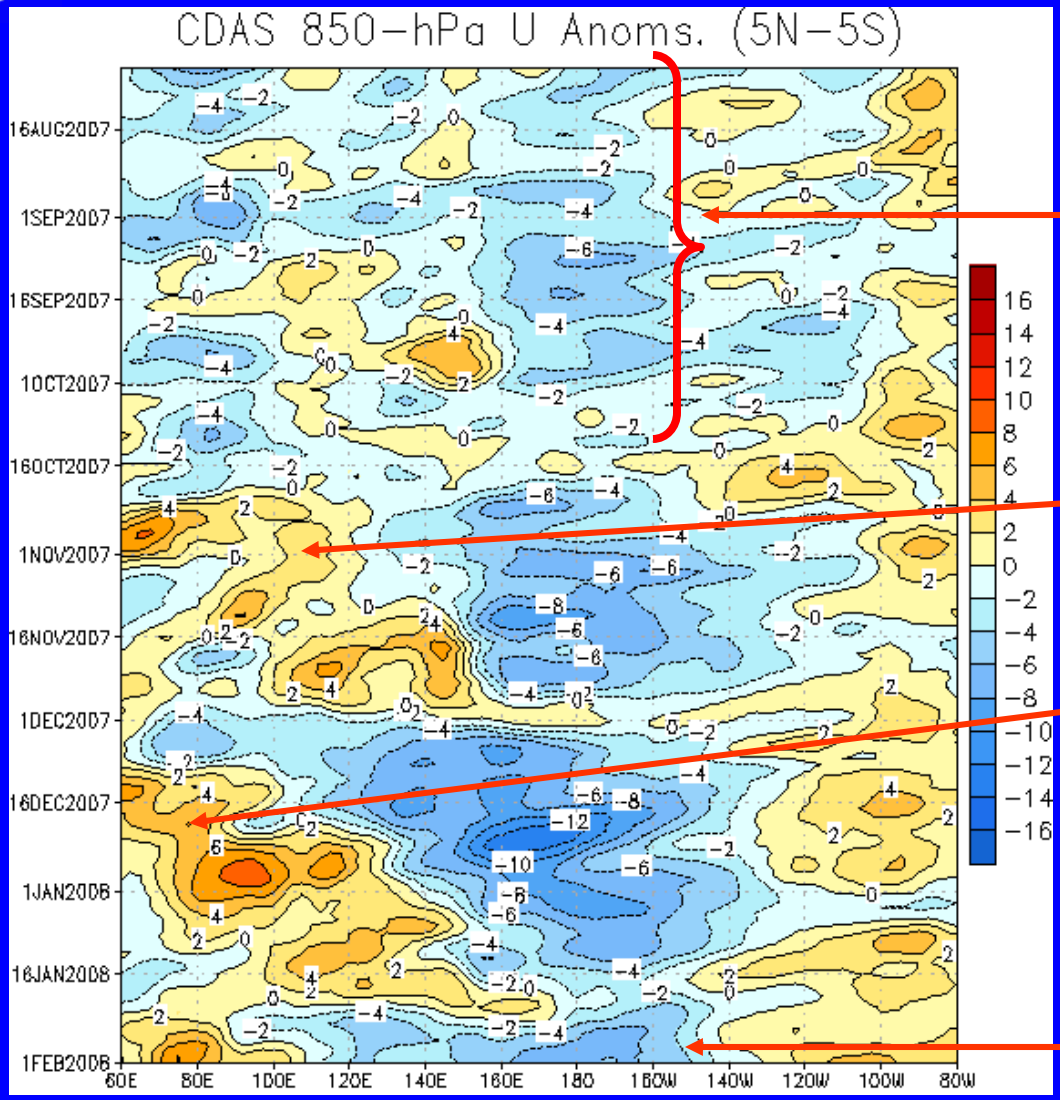


Easterly anomalies developed across the Indian Ocean south of the equator during the previous five days in response to active convection across the western Indian Ocean.

Tropical cyclone activity is clear across the Indian Ocean during the last five days.

Easterly anomalies have strengthened across the western Pacific during the last five days.

850-hPa Zonal Wind Anomalies (m s^{-1})



Time

Longitude

Westerly anomalies (orange/red shading) represent anomalous west-to-east flow.

Easterly anomalies (blue shading) represent anomalous east-to-west flow.

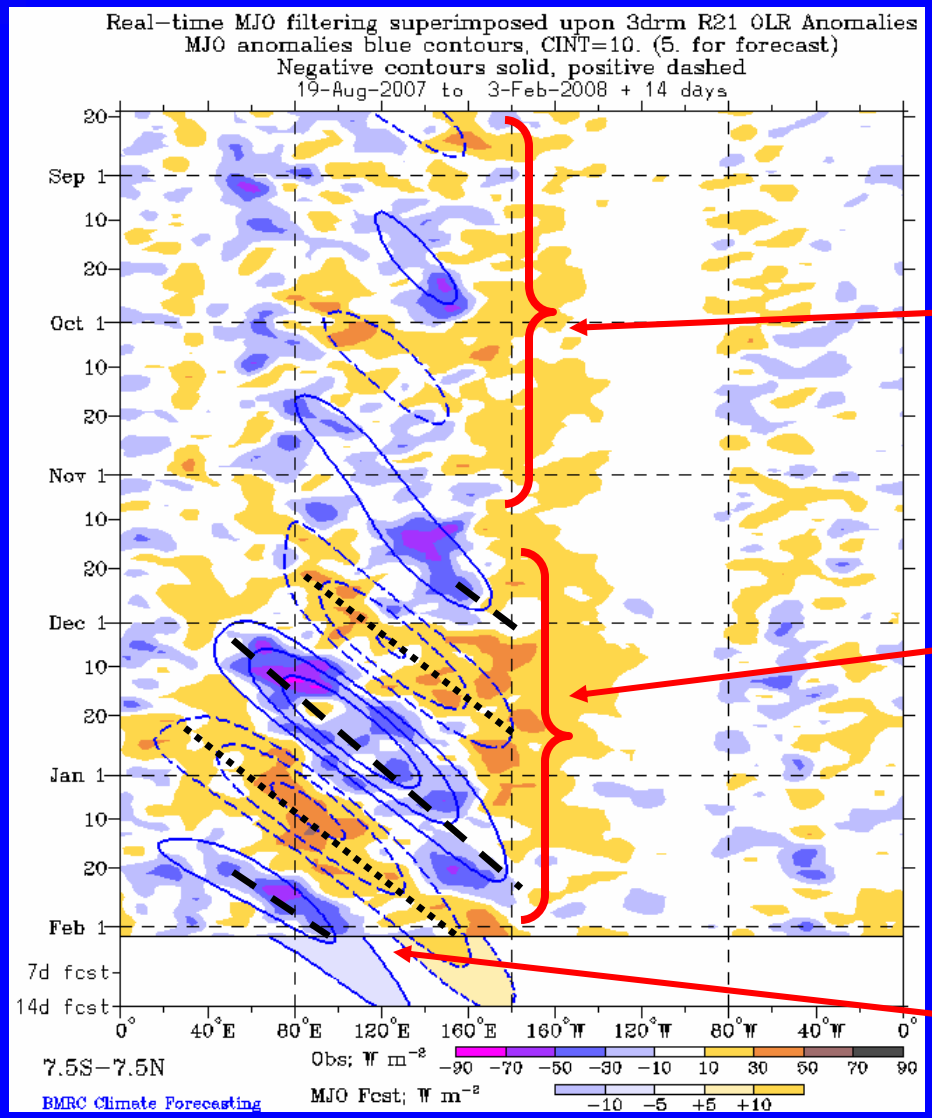
Weak intraseasonal activity was evident during August, September, and part of October. Easterly anomalies near the Date Line associated with La Nina prevailed.

Westerly anomalies shifted eastward from the Indian Ocean to the Date Line during the first cycle of the recent MJO activity in November.

During December, the second MJO cycle is evident as westerly anomalies again developed across the Indian Ocean and shifted eastward while easterly anomalies strengthened in the western and central Pacific.

The next MJO cycle is evident as westerly anomalies now appear across the Indian Ocean along with renewed easterly anomalies stretching from Indonesia to the Date Line.

Outgoing Longwave Radiation (OLR) Anomalies (7.5°S-7.5°N)



Time

Longitude

Drier-than-normal conditions, positive OLR anomalies (yellow/orange shading)

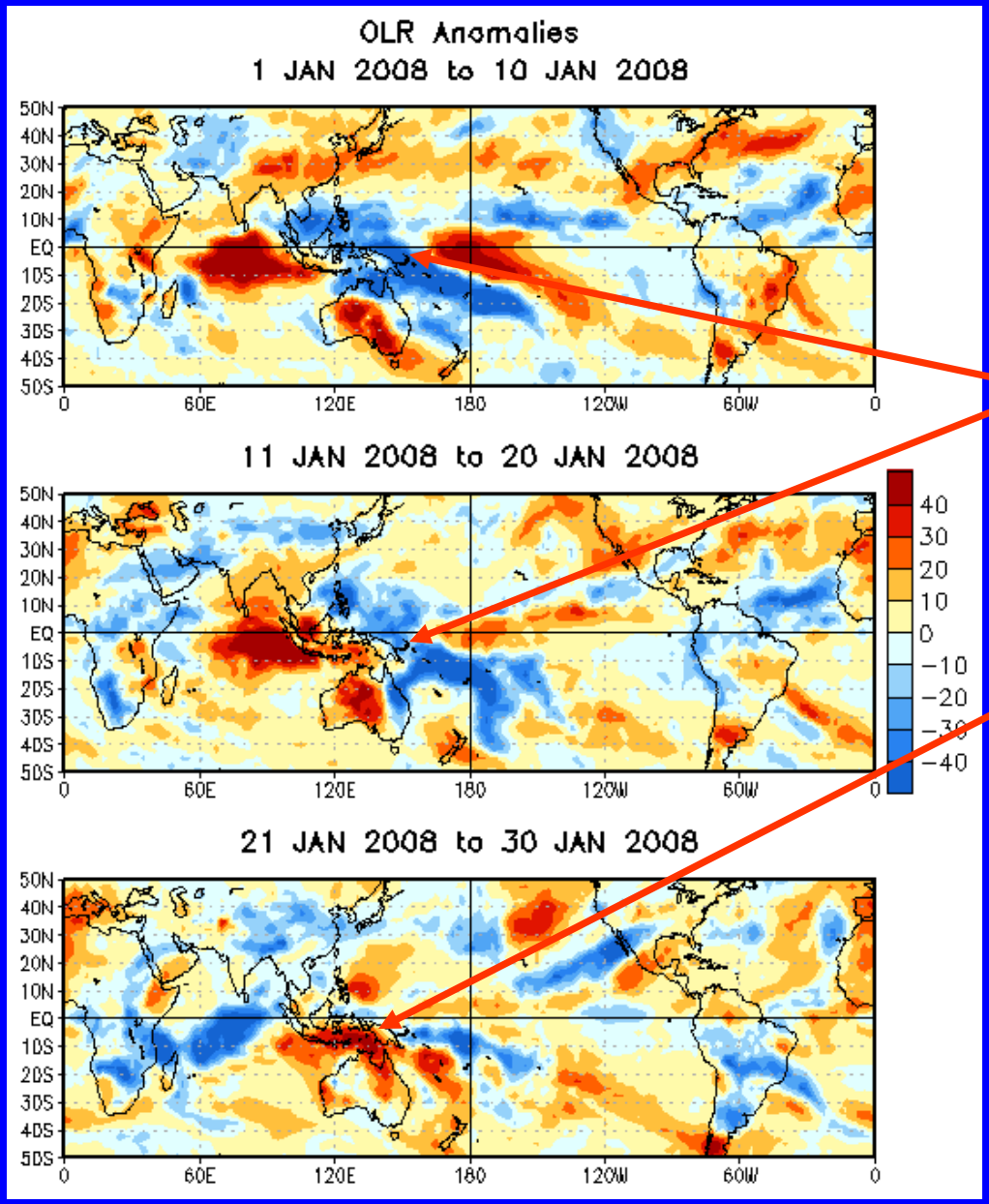
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

Intraseasonal variability was evident during September and October with a longer period and included some extended regimes of more stationary anomalous convection.

Moderate-to-strong MJO activity has been evident since mid-November. Enhanced convection shifted from the Indian Ocean to the southwest Pacific during December and January while suppressed convection has shifted from Africa to the Pacific.

During the past week, enhanced convection has shifted eastward to impinge upon the Maritime continent.

OLR Anomalies: Last 30 days



Drier-than-normal conditions, positive OLR anomalies (/red shading)

Wetter-than-normal conditions, negative OLR anomalies (blue shading)

Wet conditions were observed across the Maritime continent and western Pacific during early to mid January.

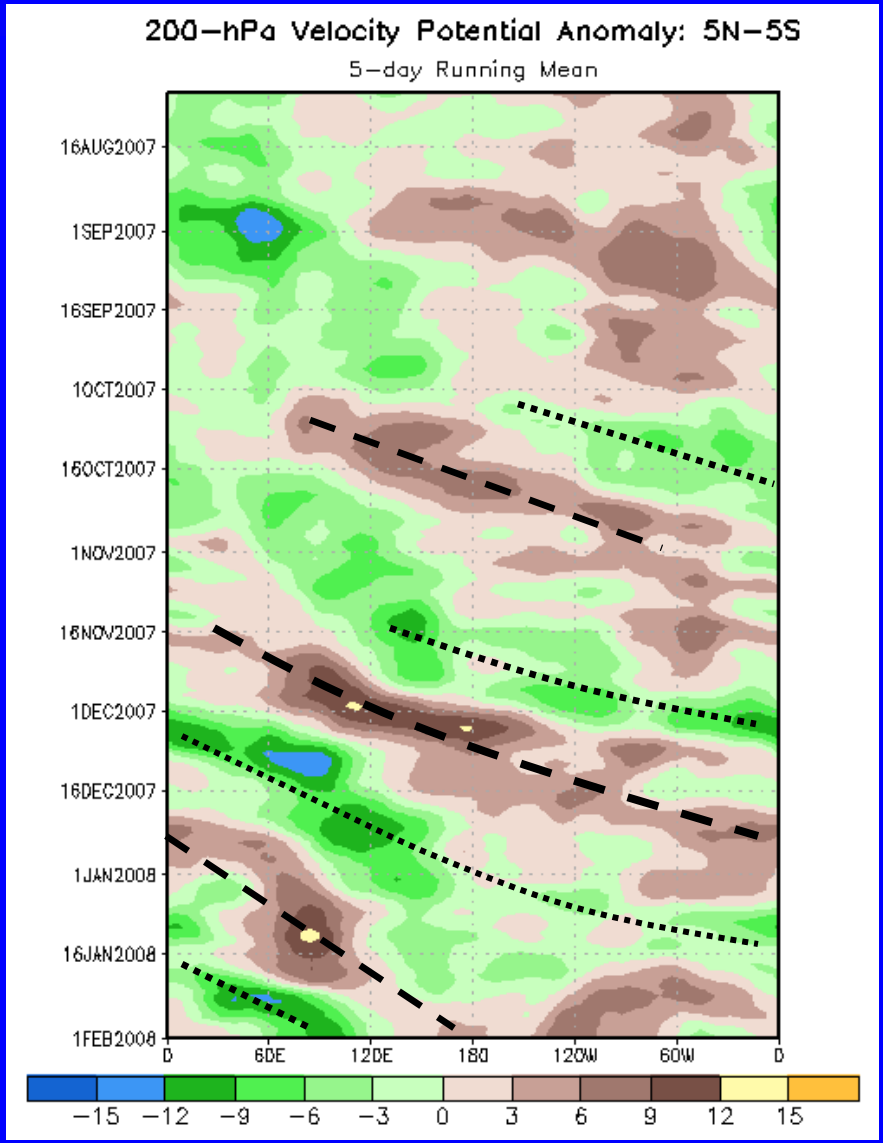
The suppressed phase of the MJO has resulted in dry conditions shifting from the Indian Ocean to Indonesia and northern Australia by late January.

Enhanced convection has redeveloped in the Indian Ocean during late January.

200-hPa Velocity Potential Anomalies (5°S-5°N)

Positive anomalies (brown shading) indicate unfavorable conditions for precipitation.

Negative anomalies (green shading) indicate favorable conditions for precipitation.



Time

Longitude

The MJO was weak or incoherent during much of August and September.

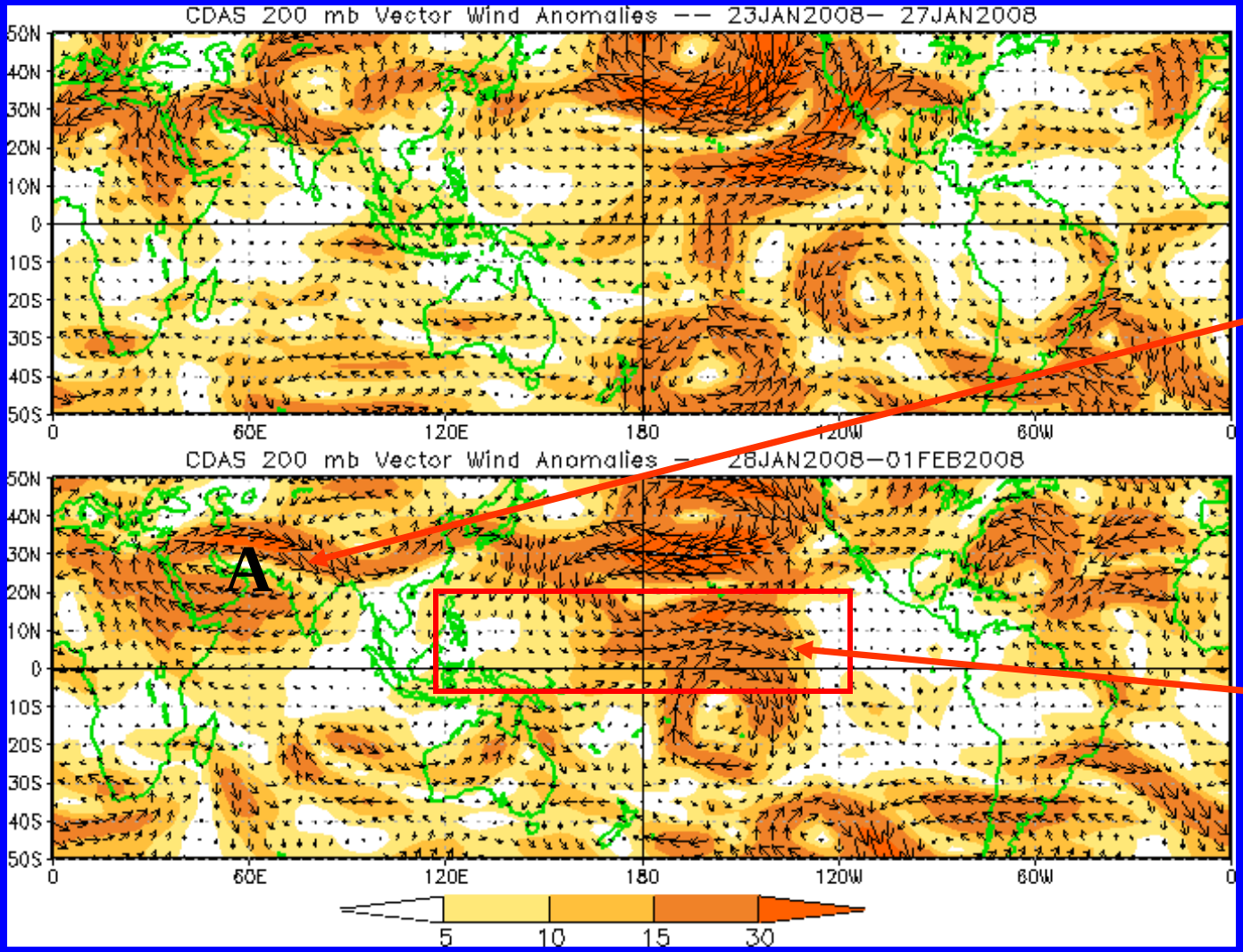
The MJO strengthened during October but coherent propagation was short-lived.

Moderate-to-strong MJO activity developed in mid-November and has continued into February.

The MJO did weaken somewhat in early January as velocity potential anomalies became less coherent.

Recently the MJO has become more organized once again.

200-hPa Vector Wind Anomalies (m s^{-1})

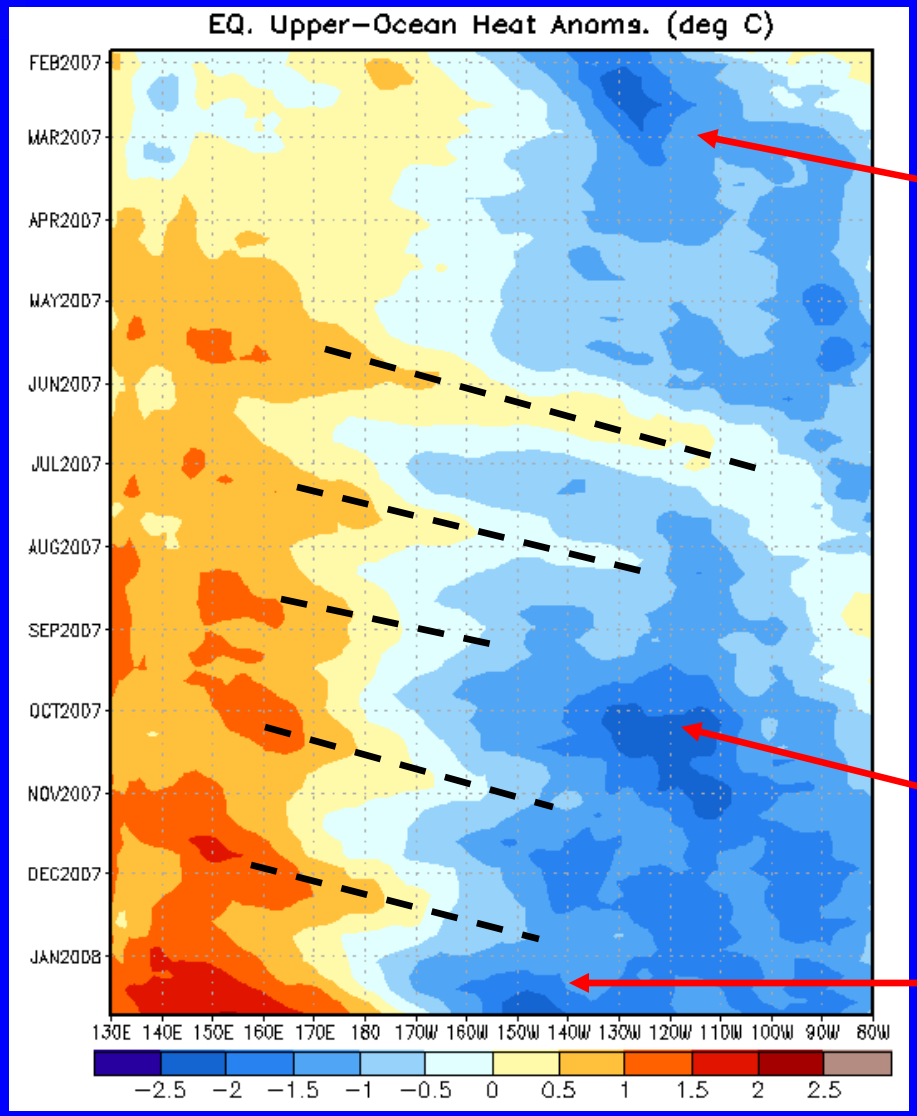


Note that shading denotes the magnitude of the anomalous wind vectors

A well-defined anti-cyclonic circulation is evident across southwest Asia in response to active convection in the Indian Ocean during the past ten days.

Westerly anomalies have shifted eastward to the western Pacific during the last five days.

Weekly Heat Content Evolution in the Equatorial Pacific



Time

Longitude

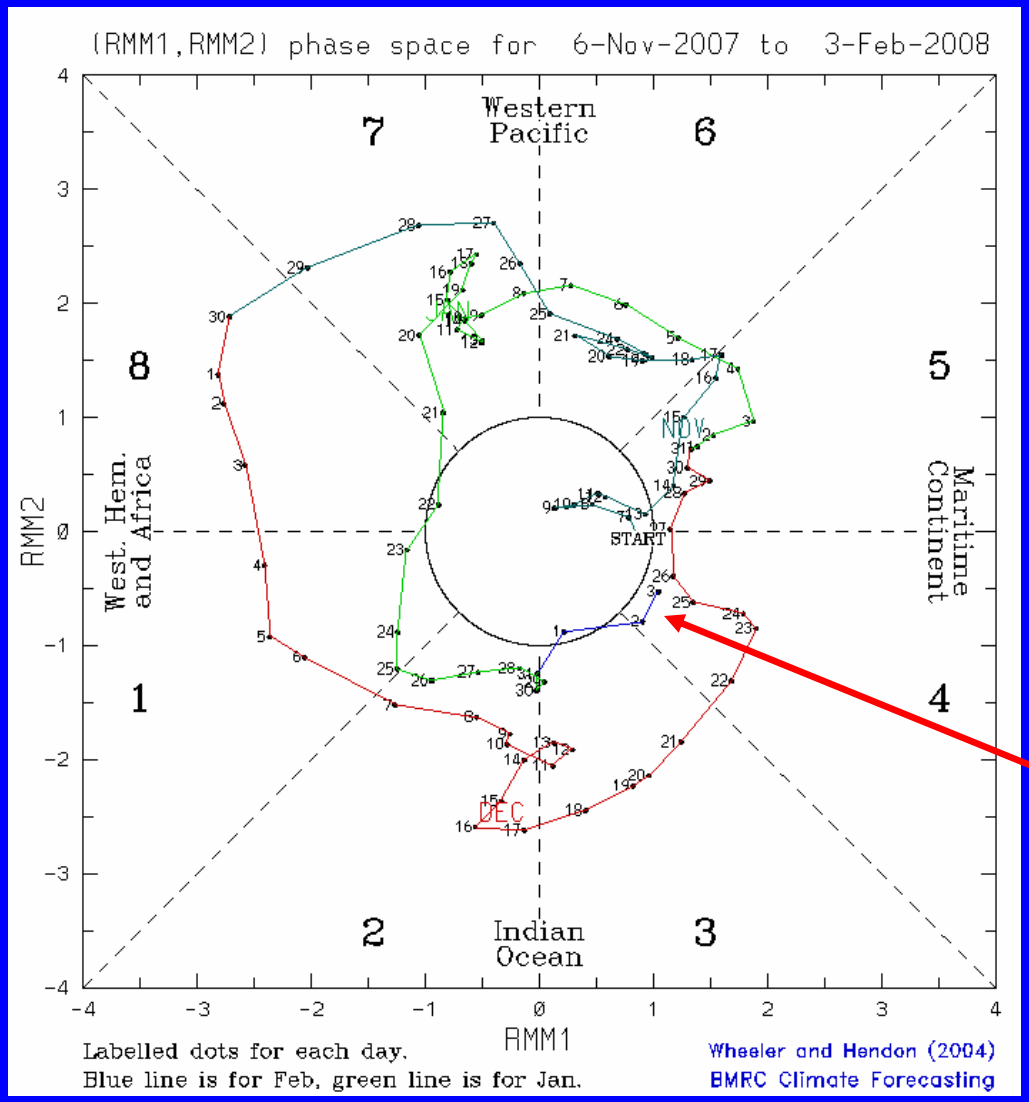
Beginning in February, negative heat content anomalies developed across the eastern equatorial Pacific and continued until June 2007.

Kelvin wave activity (downwelling phases indicated by dashed lines) has been observed since May and has affected the sub-surface temperature departures at varying levels across the Pacific Ocean. The strongest wave occurred during May and June.

During September and October, negative heat content anomalies increased markedly across the eastern Pacific Ocean.

Most recently, the upwelling portion of the latest Kelvin wave contributed to an increase in negative sub-surface temperature departures near and just east of the Date Line.

MJO Index



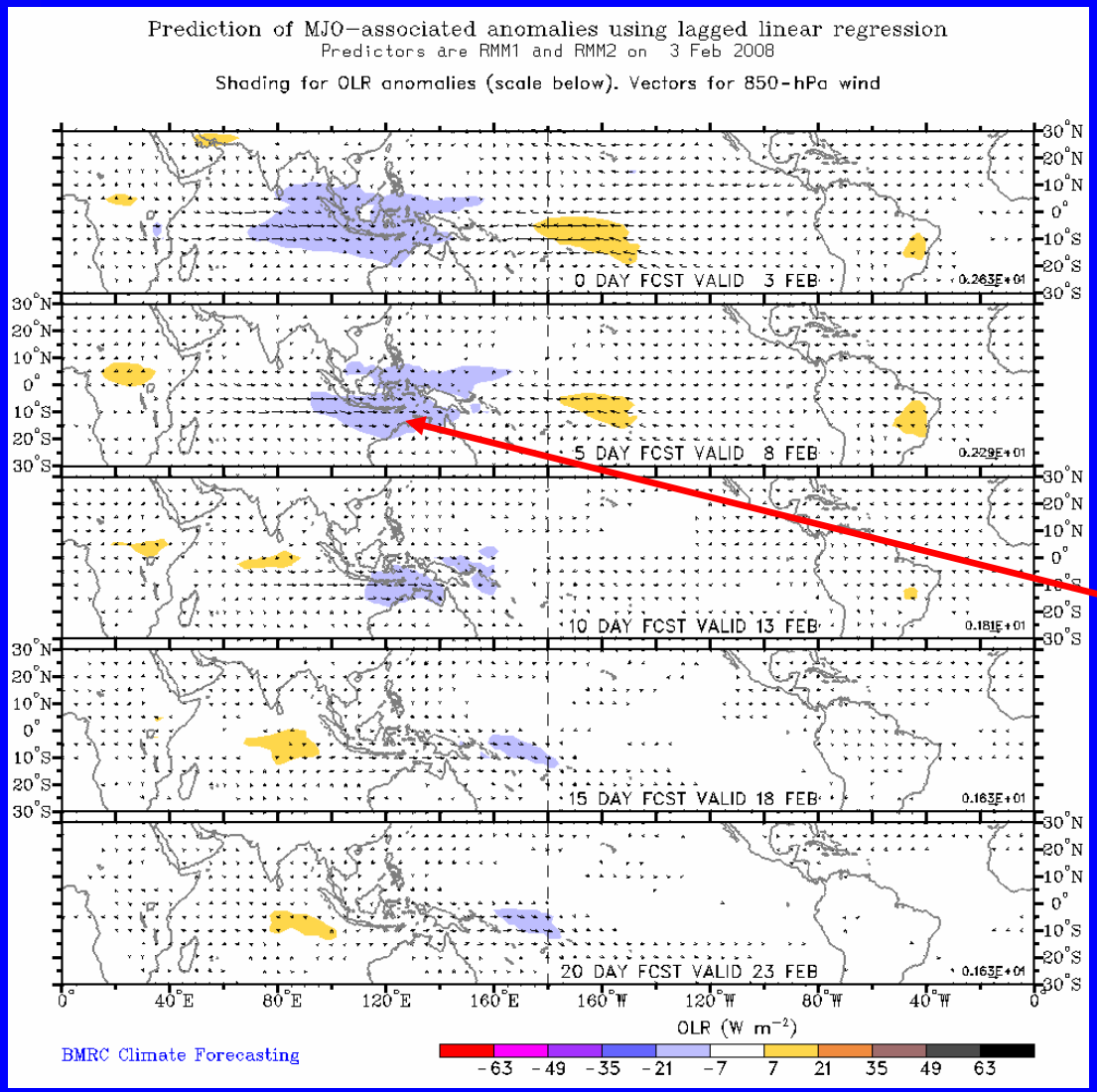
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate different months.

The second cycle of the current MJO activity has been weaker then the previous event during November and December.

During the past week, the phase of the MJO has shifted eastward from the western Indian Ocean to the western Maritime continent. The amplitude of the MJO has remained generally constant.

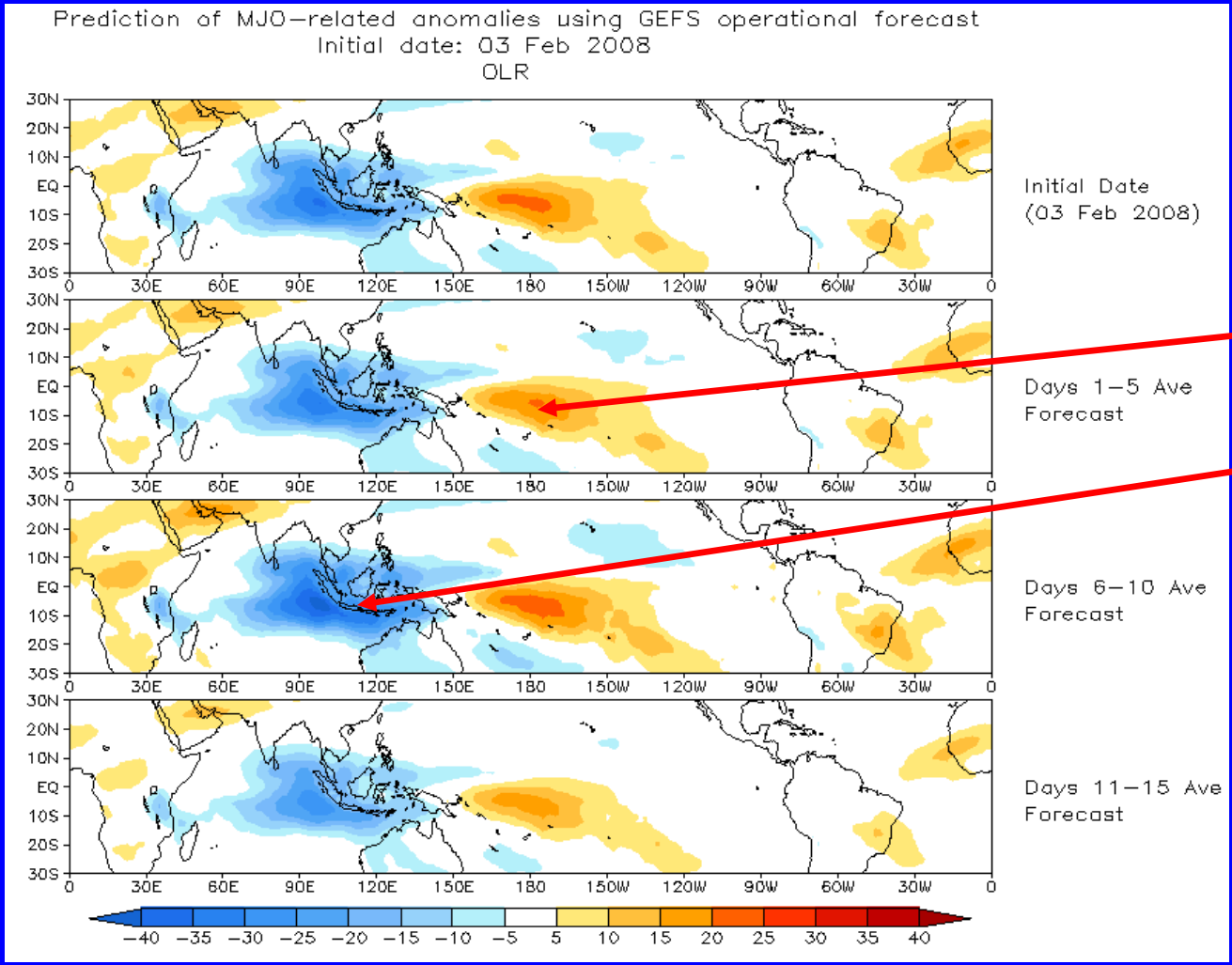
Statistical MJO OLR Forecast



The statistical MJO forecast indicates weak-moderate MJO activity during the upcoming 1-2 week period.

Wet conditions are expected for the Maritime continent during the period.

Experimental GFS MJO OLR Forecast



The GFS forecasts a moderate MJO signal with little eastward propagation during the period.

Dry conditions are forecast for the west-central Pacific Ocean throughout the period with enhanced convection across the eastern Indian Ocean and most of the Maritime continent.