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

Update prepared by
Climate Prediction Center / NCEP
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Outline

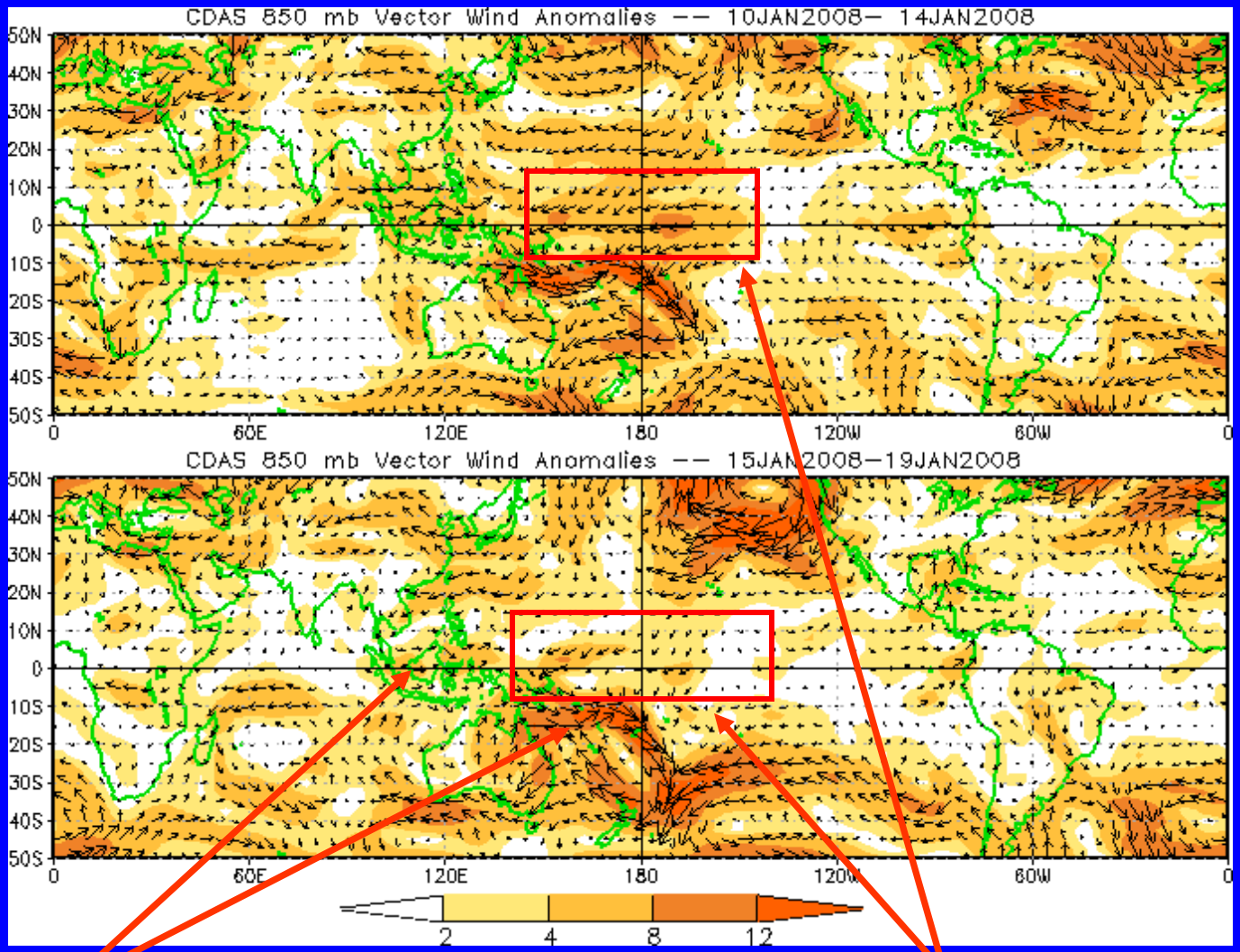
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- The MJO has weakened in recent days but remains at moderate strength.
- Based on the latest observational and forecast data, it is most likely that the MJO will continue with the enhanced phase entering the Indian Ocean during the period.
- Enhanced rainfall is expected for sections of Africa and the western Indian Ocean during week 1 and the entire Indian Ocean by the end of week 2. Dry conditions are expected across southern Indonesia and northern Australia during week 1.
- As convection increases across the Indian Ocean, a greater likelihood exists for ridge amplification in the central Pacific with subsequent troughs near and off the US west coast during weeks 2-3.

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

Note that shading denotes the magnitude of the anomalous wind vectors



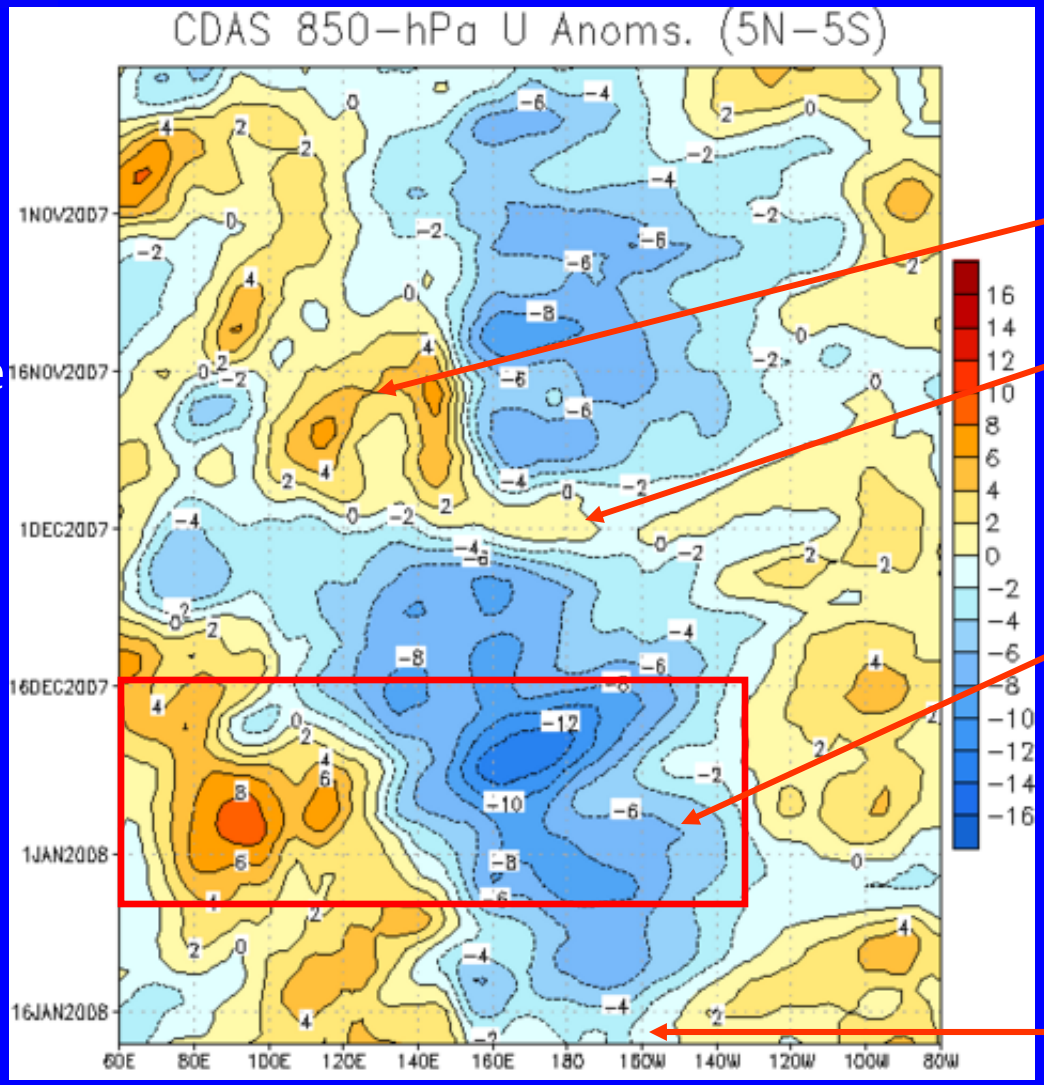
Westerly anomalies continue across much of Indonesia and south of the equator in the western Pacific but have weakened slightly.

Easterly anomalies have weakened considerably across the western Pacific Ocean during the last five days.

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

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

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



Time

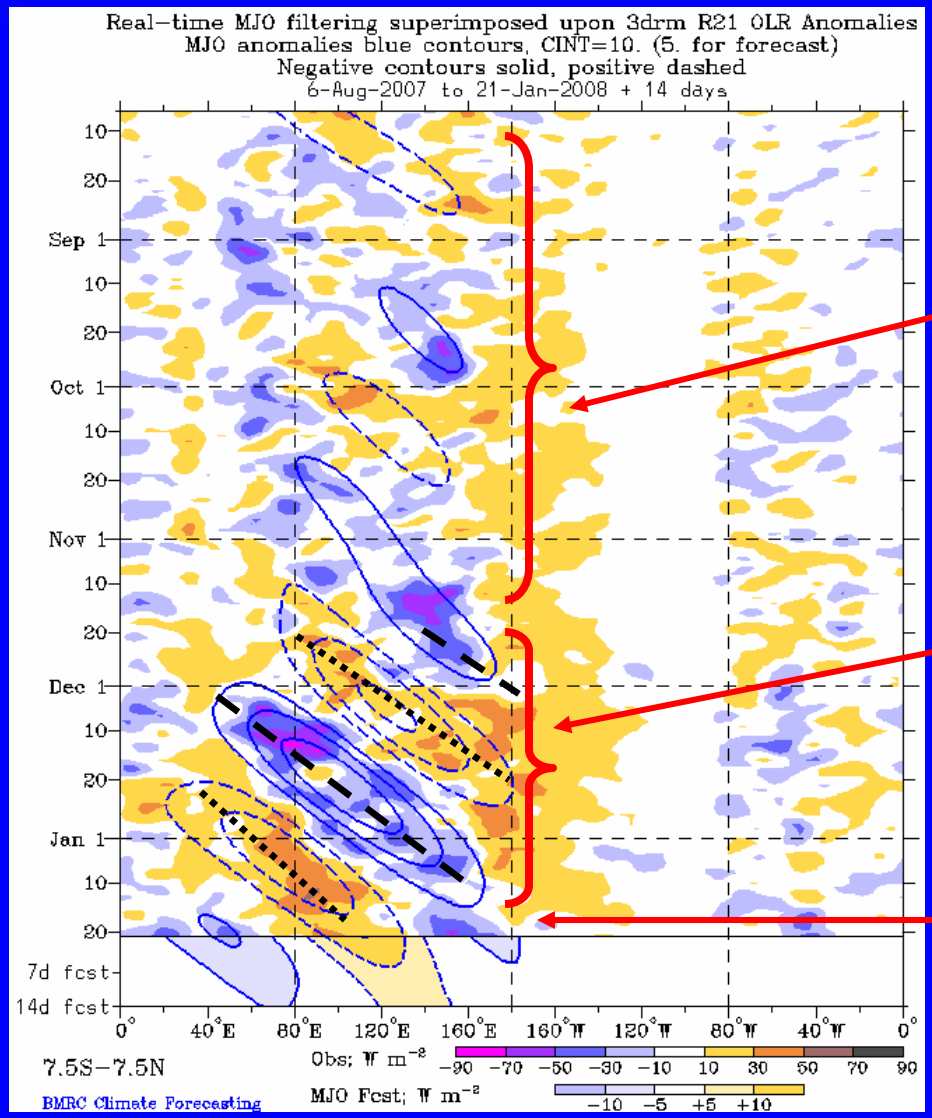
Longitude

Westerly anomalies shifted eastward, first slowly, from the Indian Ocean to the Maritime continent and later more quickly to the Date Line during the previous MJO event.

During mid December, westerly anomalies developed across the Indian Ocean and shifted eastward. At the same time, easterly anomalies strengthened in the western and central Pacific.

Easterly anomalies near the Date Line have decreased since early January and become more stationary. Westerly anomalies persist near the Maritime Continent and in the eastern equatorial Pacific.

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



Time

Longitude

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

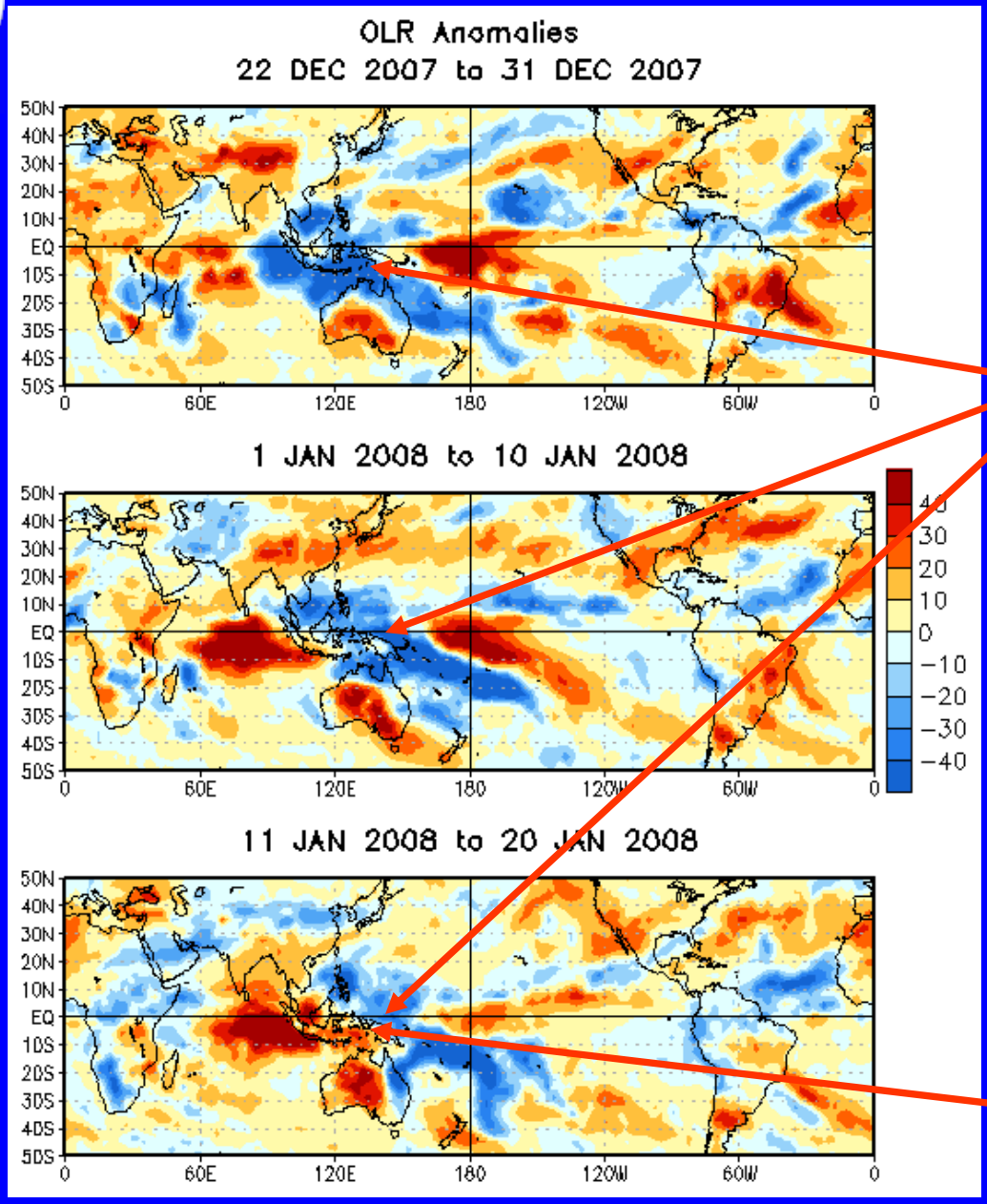
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

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

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 Indonesia.

Anomalous convection became more stationary during mid-January.

OLR Anomalies: Last 30 days



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

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

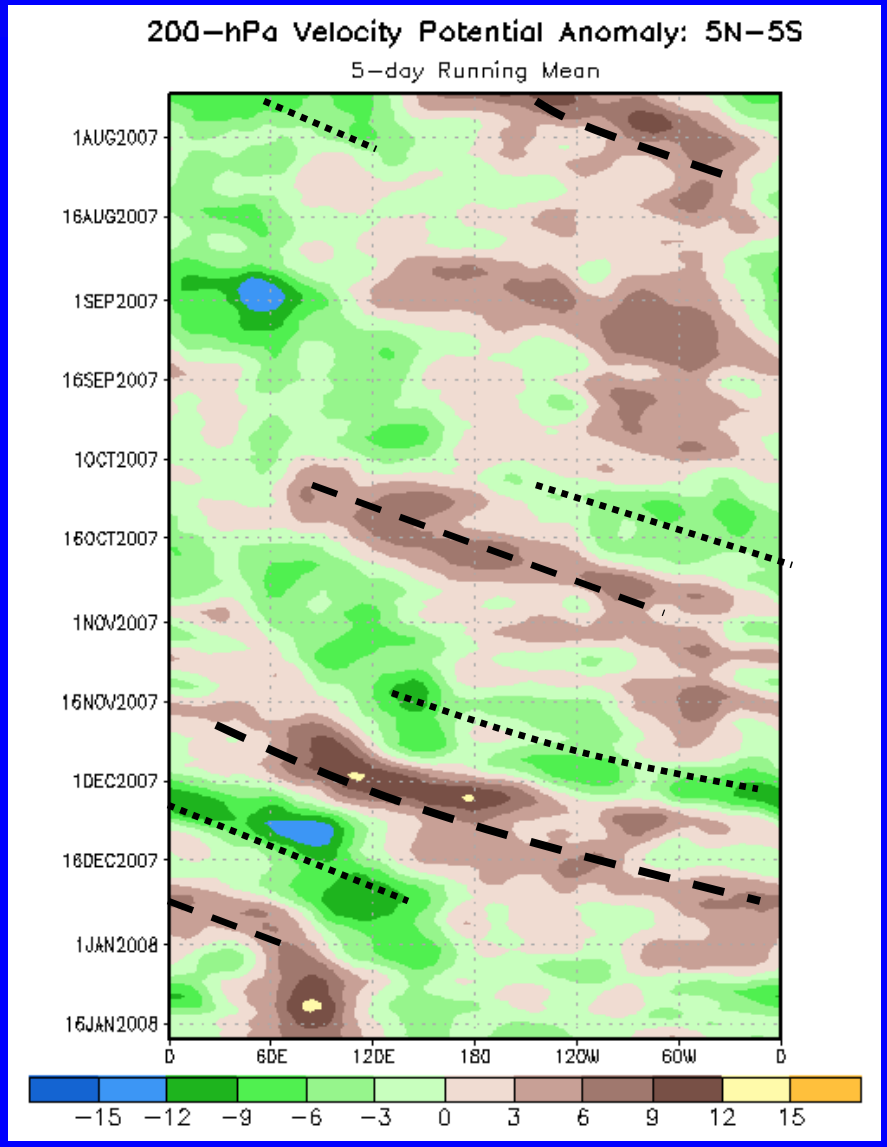
Wet conditions have shifted eastwards from the eastern Indian Ocean and Maritime continent to the western Pacific during late December and January as the MJO progressed.

Suppressed convection redeveloped across the Indian Ocean during early January and has slowly shifted eastwards to include western Indonesia.

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

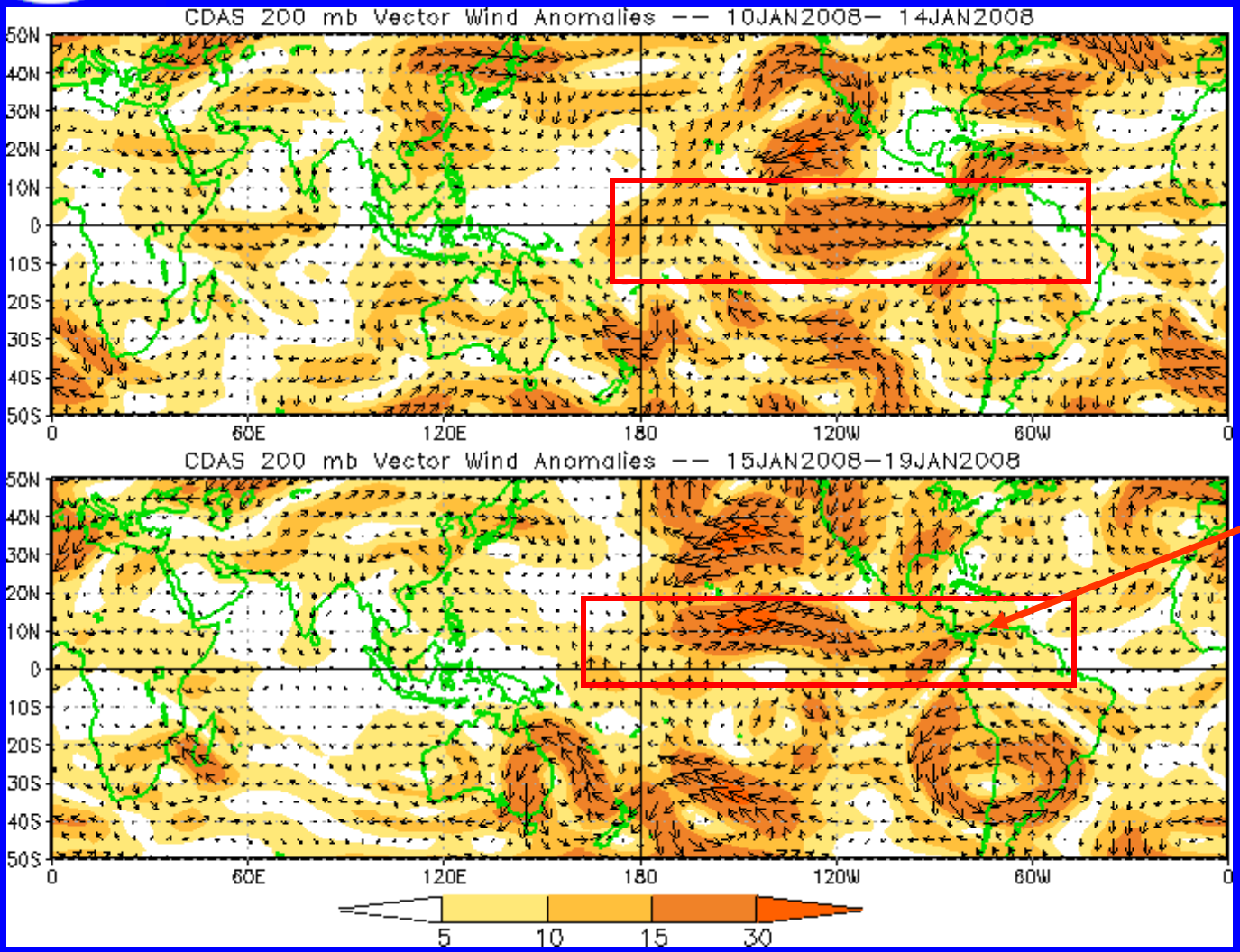
The MJO was weak or incoherent during much of August and September.

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

Moderate-to-strong MJO activity developed in mid-November and continued into early January.

The MJO has weakened some in early-mid January as large-scale anomalies in velocity potential have become less-coherent and more stationary in nature.

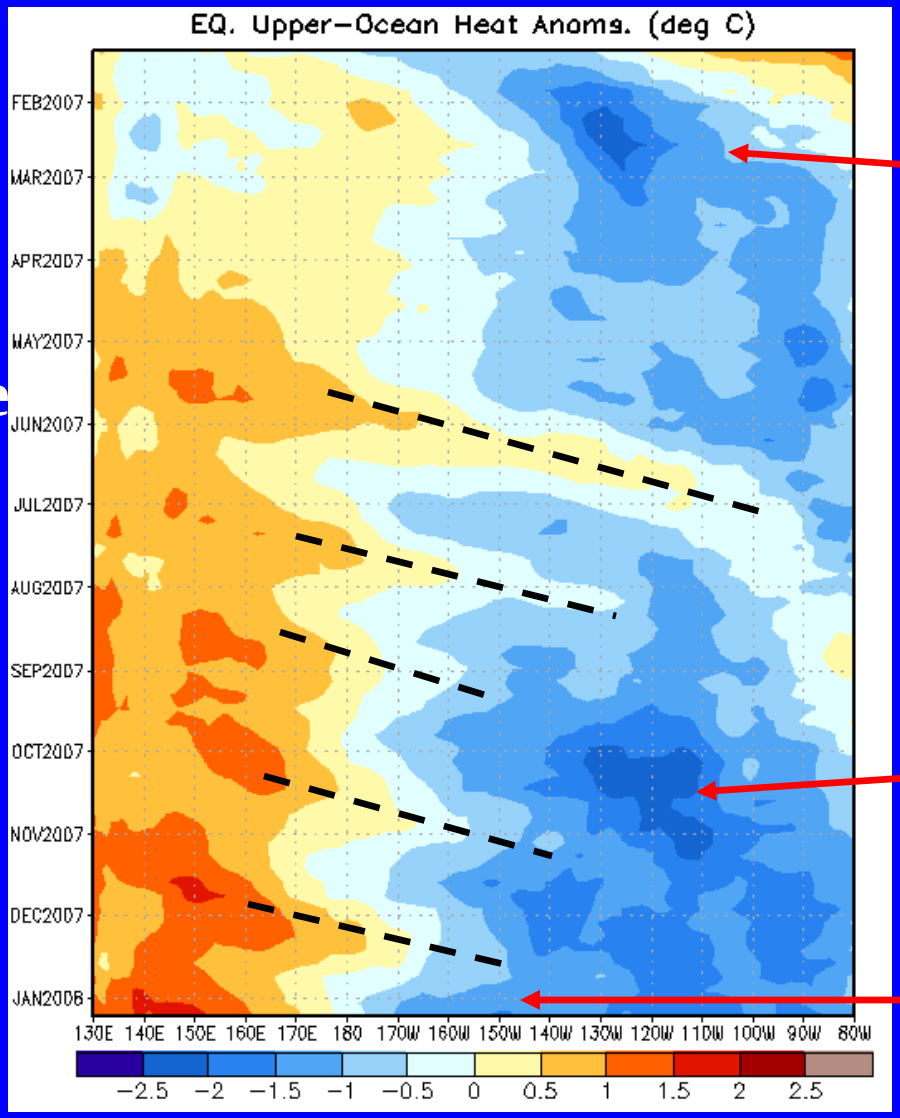
200-hPa Vector Wind Anomalies (m s^{-1})



Note that shading denotes the magnitude of the anomalous wind vectors

Westerly anomalies across the western hemisphere have been generally stationary during the last ten 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.

Weak Kelvin wave activity 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.

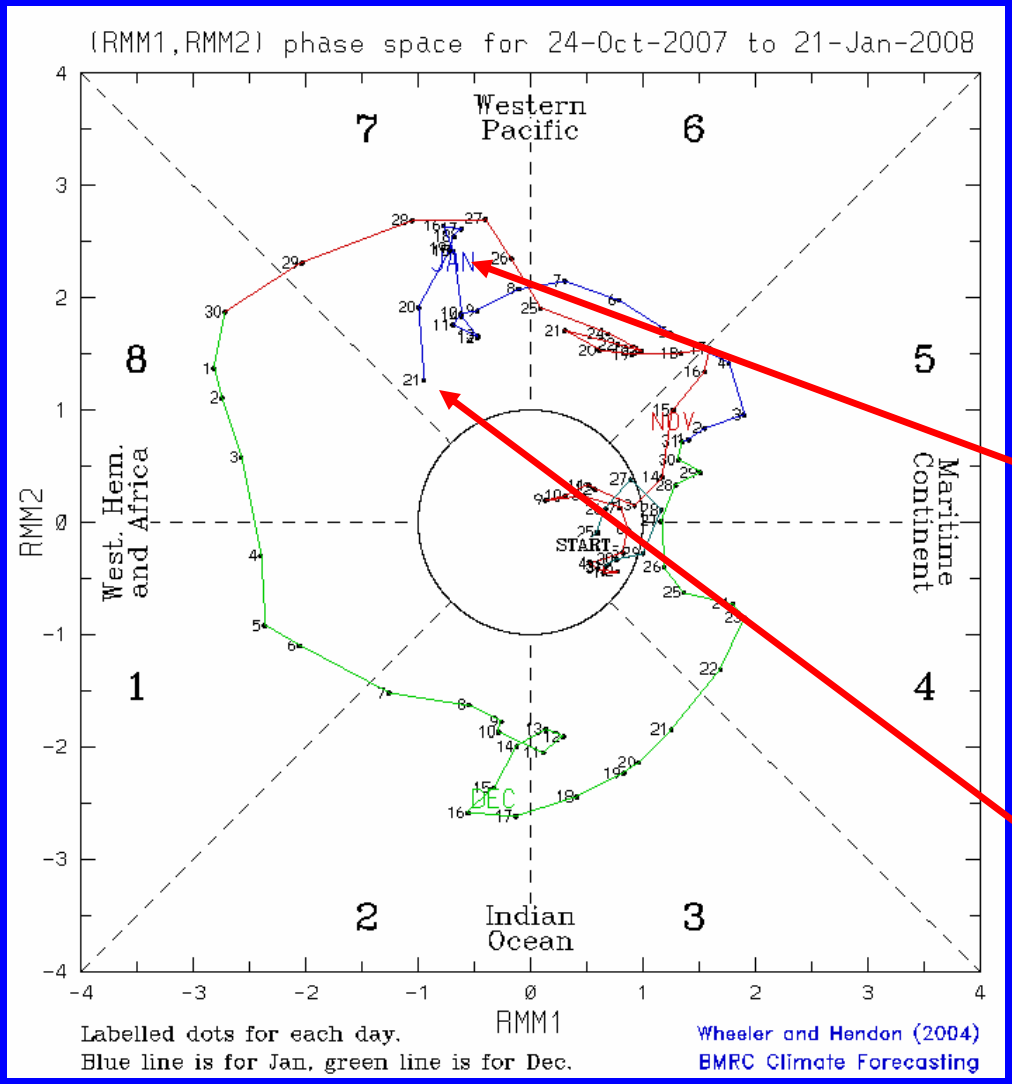
During September and October, negative heat content anomalies increased markedly across the eastern Pacific Ocean.

Most recently, the upwelling portion of the latest Kelvin wave is contributing to increasingly 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).

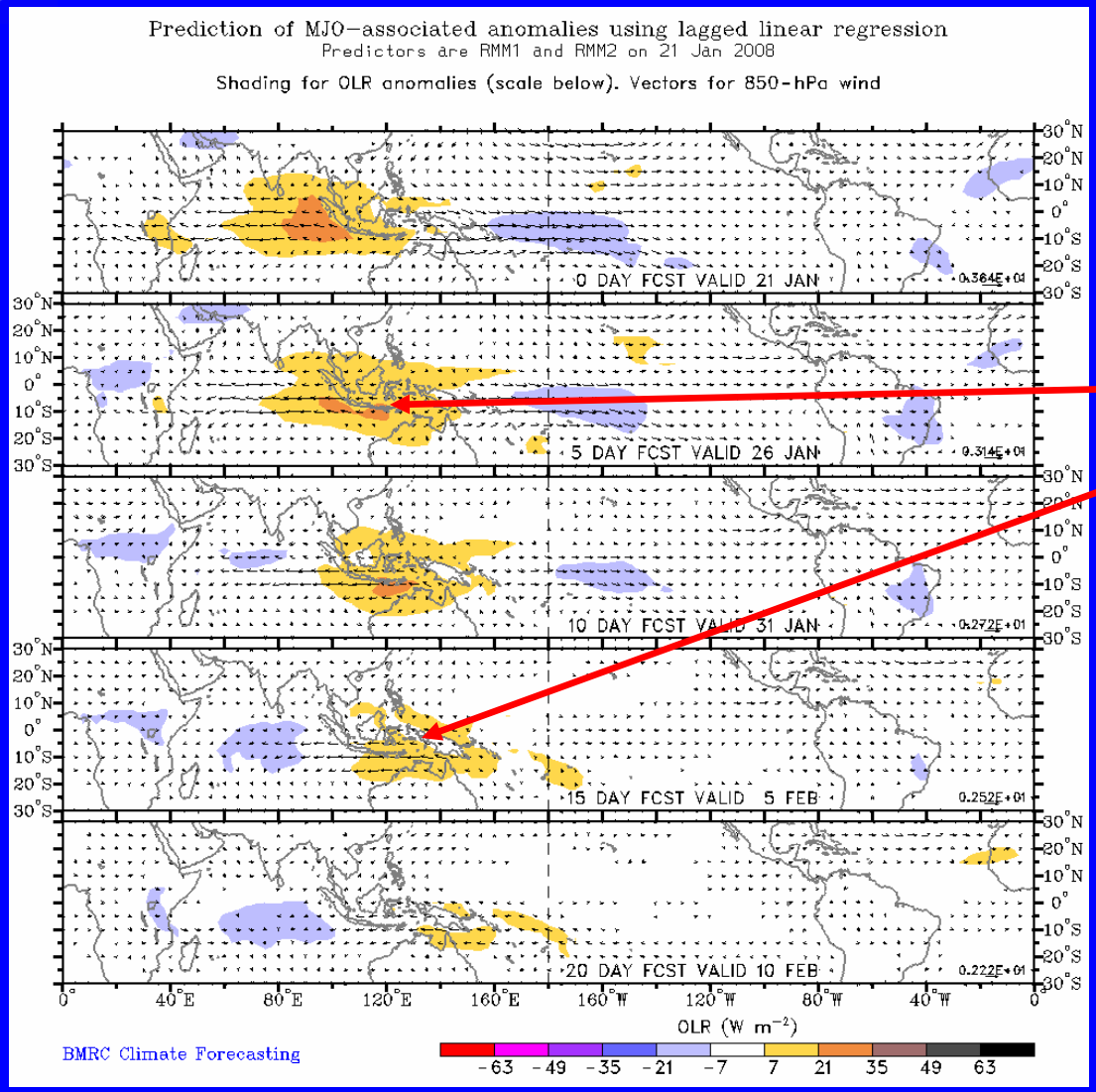
The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate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



The second cycle of the current MJO event slowed during mid-January as eastward propagation decreased markedly. The enhanced phase was centered across the central Pacific Ocean and had a large amplitude.

In recent days, slight eastward propagation is evident with a decrease in amplitude.

Statistical MJO OLR Forecast

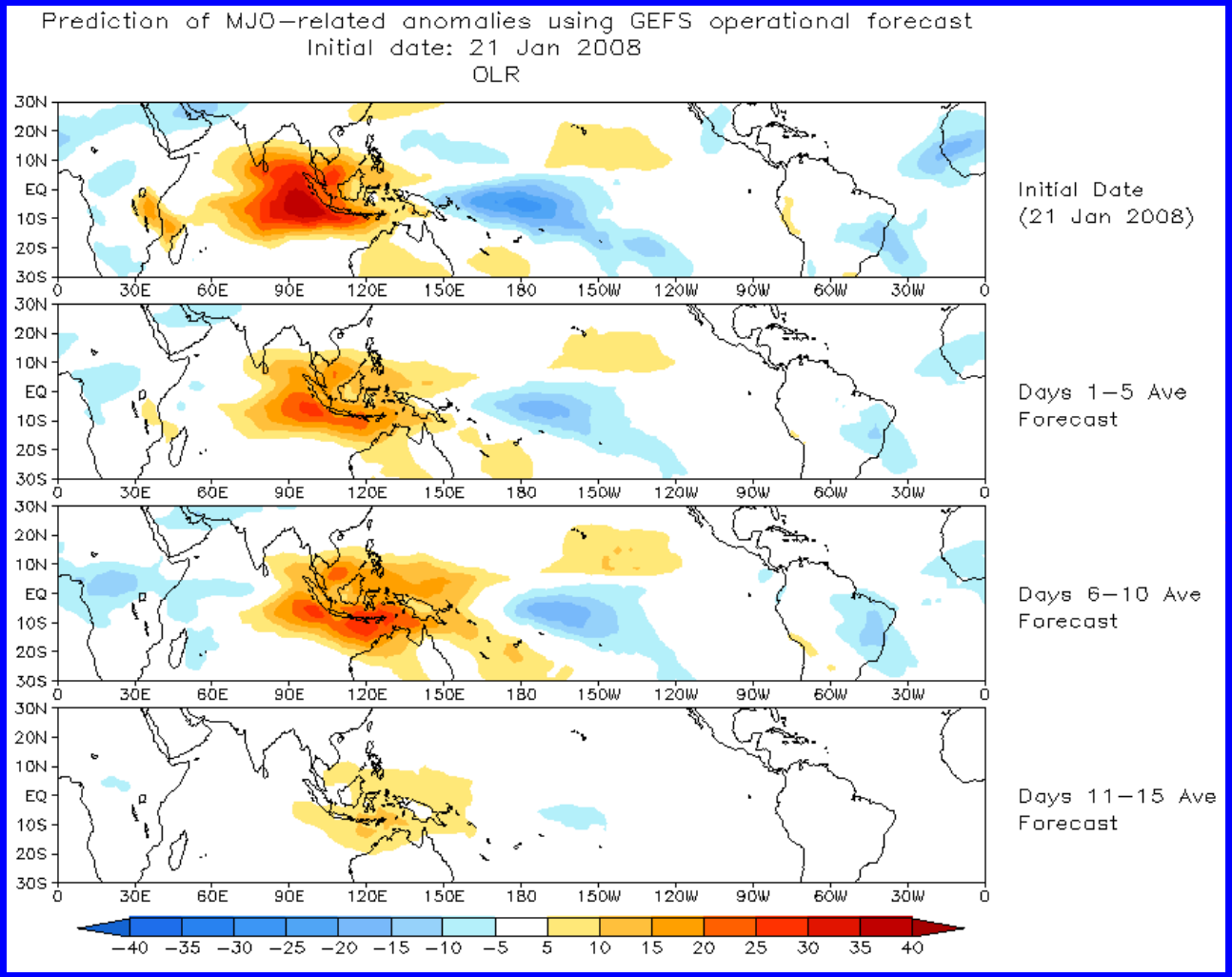


The statistical MJO forecast indicates moderate MJO activity during the upcoming 1-2 week period.

Dry conditions are forecast for the eastern Indian Ocean and Maritime Continent during the period.

Wet conditions are forecast to redevelop across the Indian Ocean during week 2.

Experimental GFS MJO OLR Forecast



The GFS forecasts a moderate MJO-related signal with some eastward propagation during the period.

Dry conditions are forecast for the Maritime continent during the period with wet conditions across Africa.

The MJO forecast amplitude is expected to weaken by the end of week 2.