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

Update prepared by
Climate Prediction Center / NCEP
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Outline

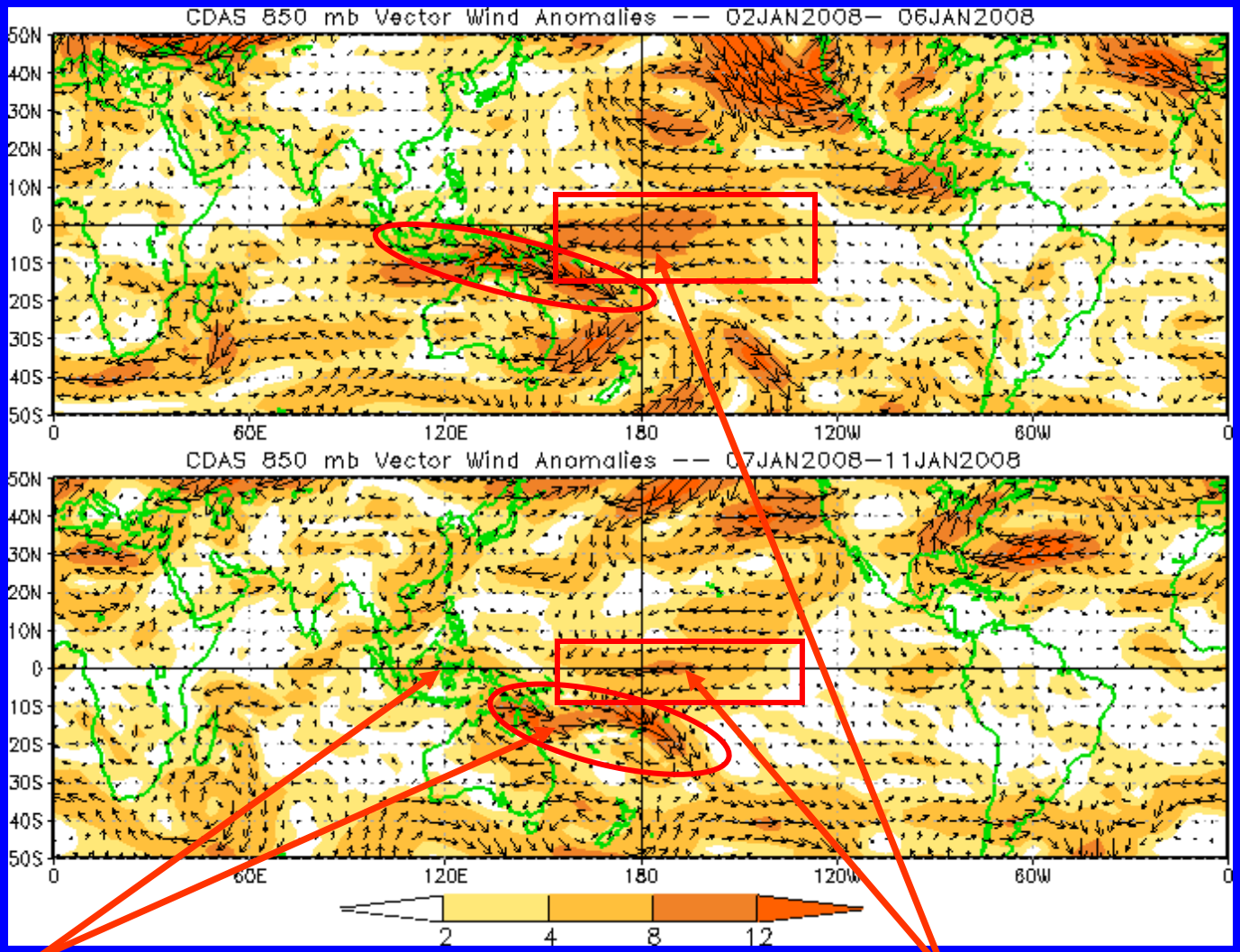
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- Moderate MJO activity continues, but it has become less coherent during the past week and eastward propagation has slowed considerably.
- The enhanced phase is currently mainly located across the Western Hemisphere and is associated with convection in the central Pacific (south of the equator) and equatorial Atlantic.
- Although uncertainty is quite high, it is most likely that the enhanced phase of the MJO will slowly shift eastward to the eastern hemisphere by the end of week 2.
- Anticipated impacts during Week 1 include enhanced rainfall for areas in southeast Africa and dry conditions across Indonesia and northern Australia.
- Enhanced rainfall is expected to shift into the Indian Ocean by Week 2 with an associated increased risk for tropical cyclogenesis for the western Indian Ocean.

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

Note that shading denotes the magnitude of the anomalous wind vectors



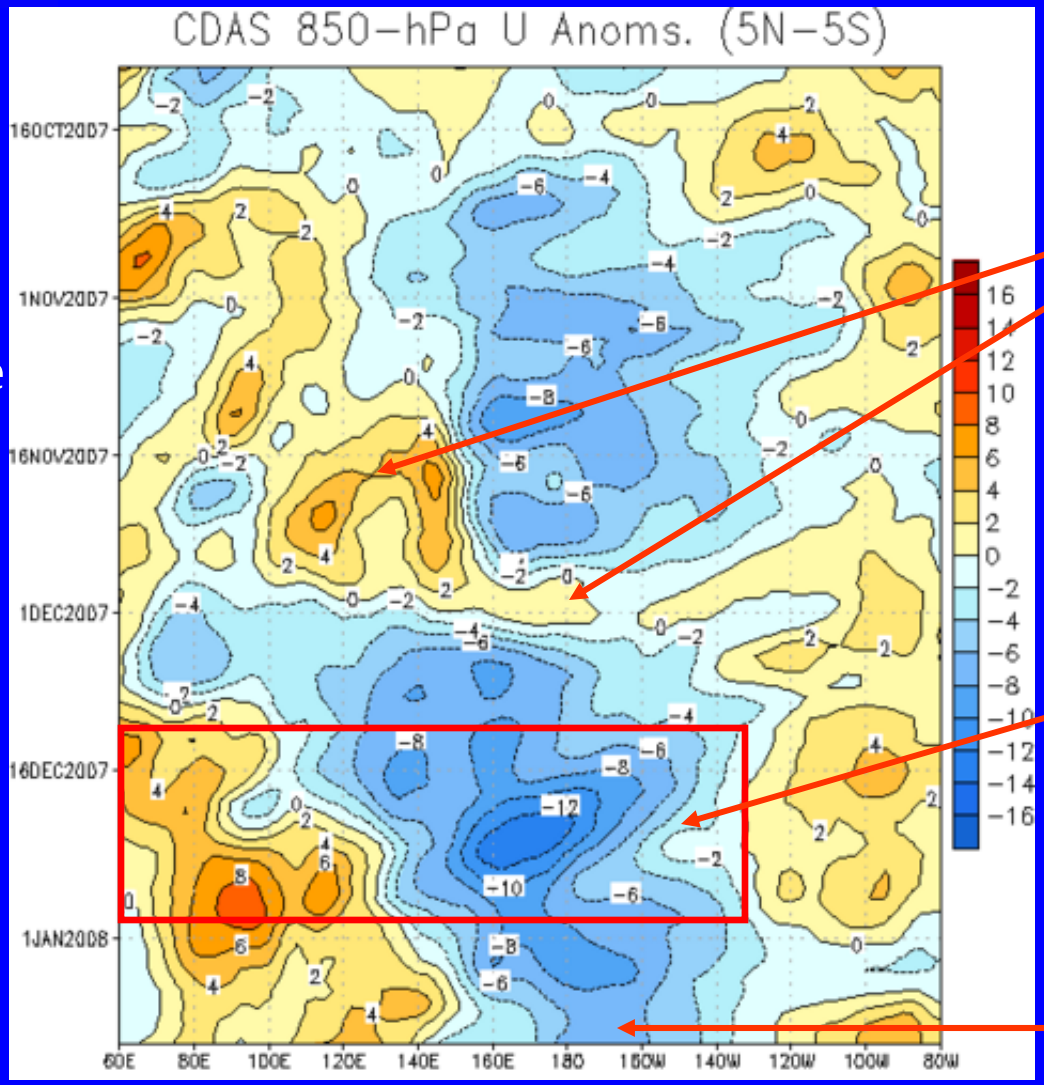
The strongest westerly anomalies south of the equator have shifted eastward. Westerly anomalies remain evident across much of the Maritime continent.

Easterly anomalies have weakened across the west-central 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

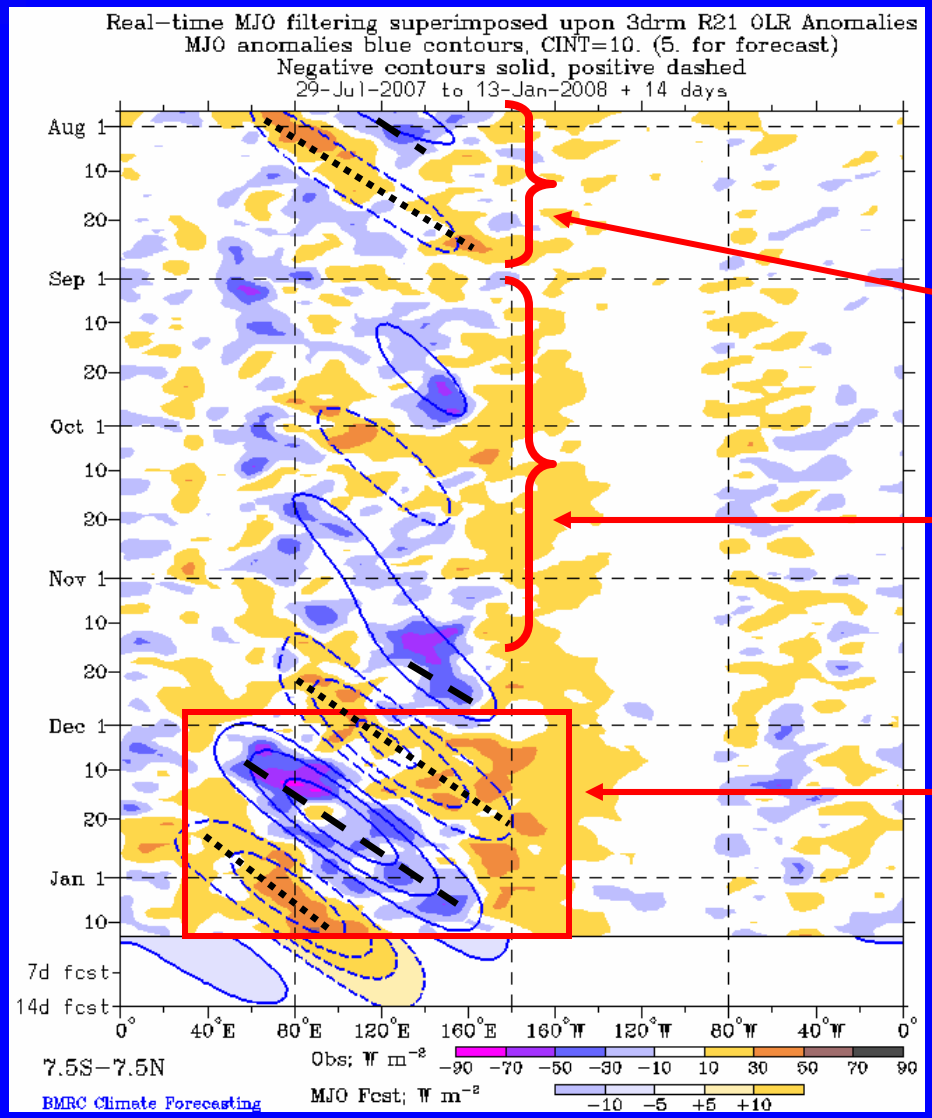
Longitude

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.

Most recently, easterly anomalies continue to weaken near the Date Line while the eastward shift of westerly anomalies along the equator has slowed.

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



Time

Longitude

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

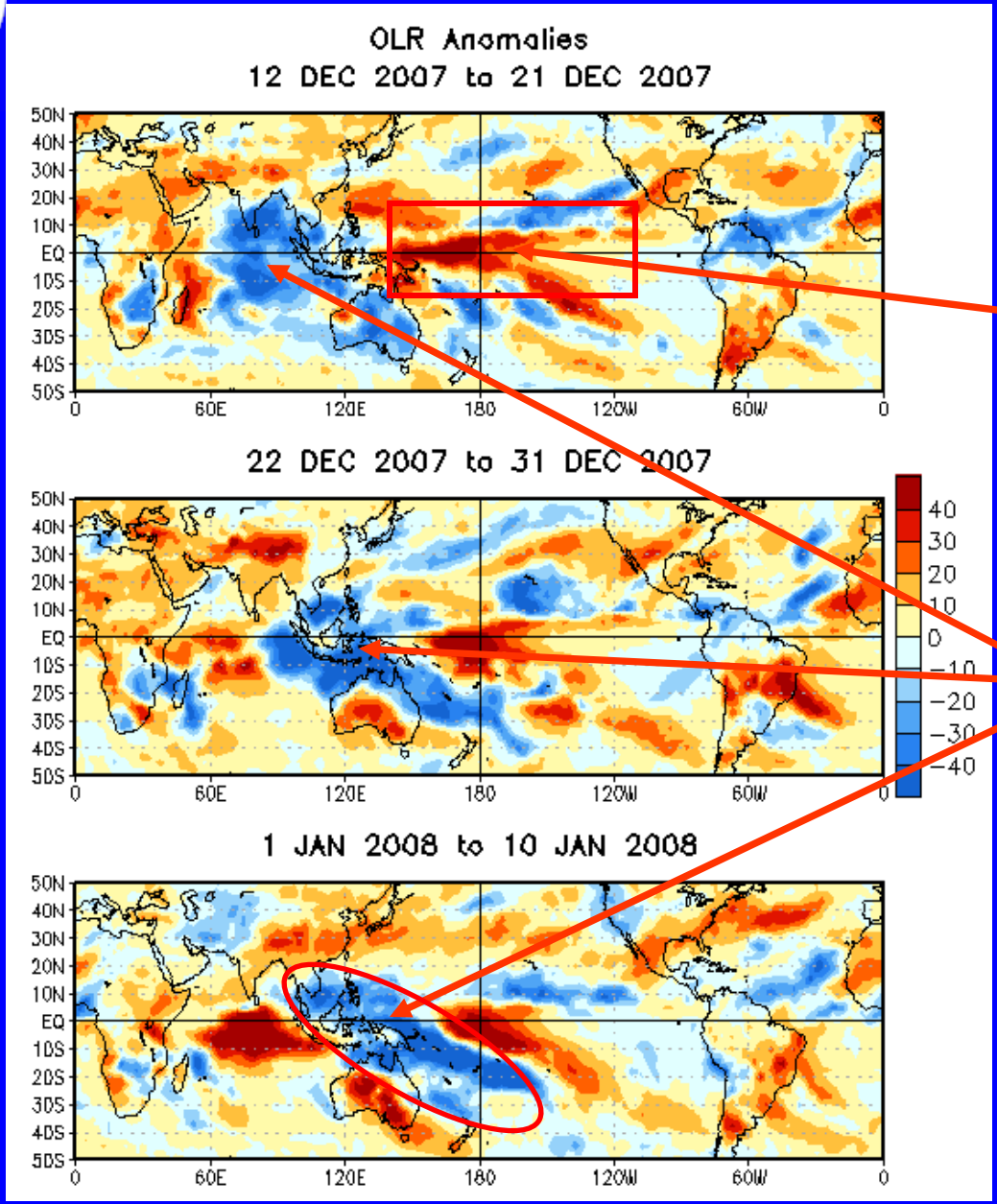
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

Weak-moderate MJO activity was observed during July and August as regions of suppressed and enhanced convection shifted eastward.

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

The MJO became strong in mid-November and continues as enhanced convection has shifted eastward from the Maritime continent to the western Pacific and suppressed convection is now evident across the Indian Ocean and western Maritime continent.

OLR Anomalies: Last 30 days



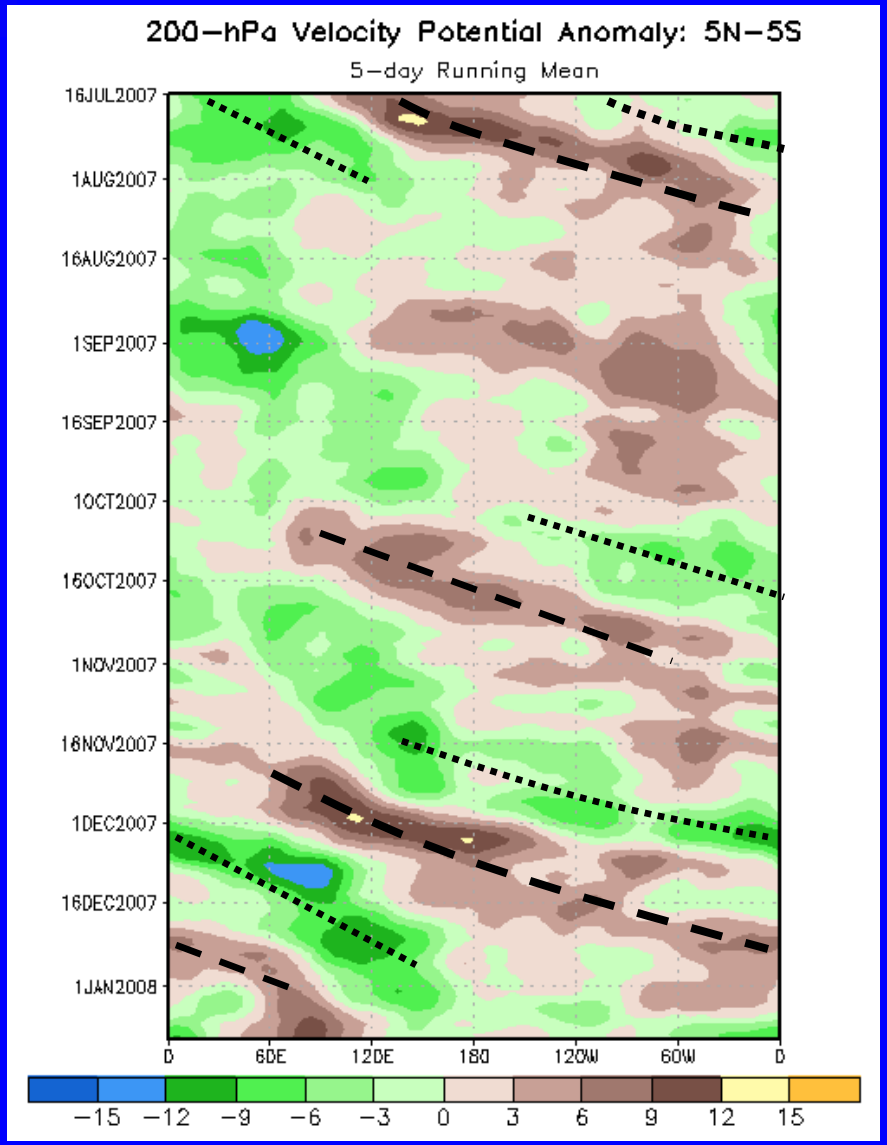
Drier-than-normal conditions, positive OLR anomalies (/red shading)

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

Mainly dry conditions prevailed across the western and central Pacific Ocean during mid December.

Wet conditions developed in the Indian Ocean and shifted eastwards to the Maritime continent, northern Australia and later the western Pacific Ocean during late December and early January as the MJO progressed.

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.

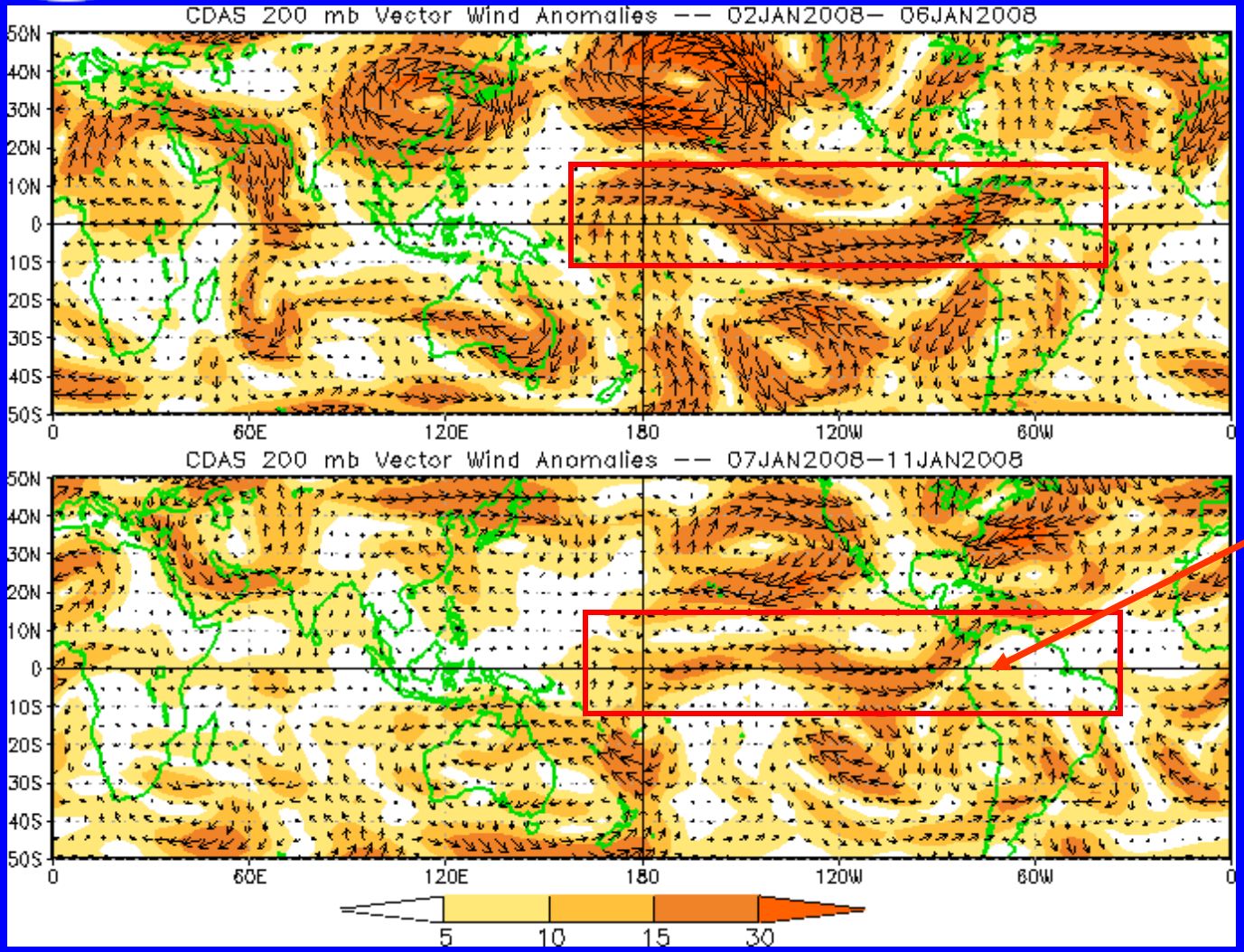
During July and early August, weak to moderate MJO activity was observed as velocity potential anomalies increased and propagated eastwards.

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 continues. Eastward propagation, however, has slowed in recent days and the MJO has become somewhat less coherent.

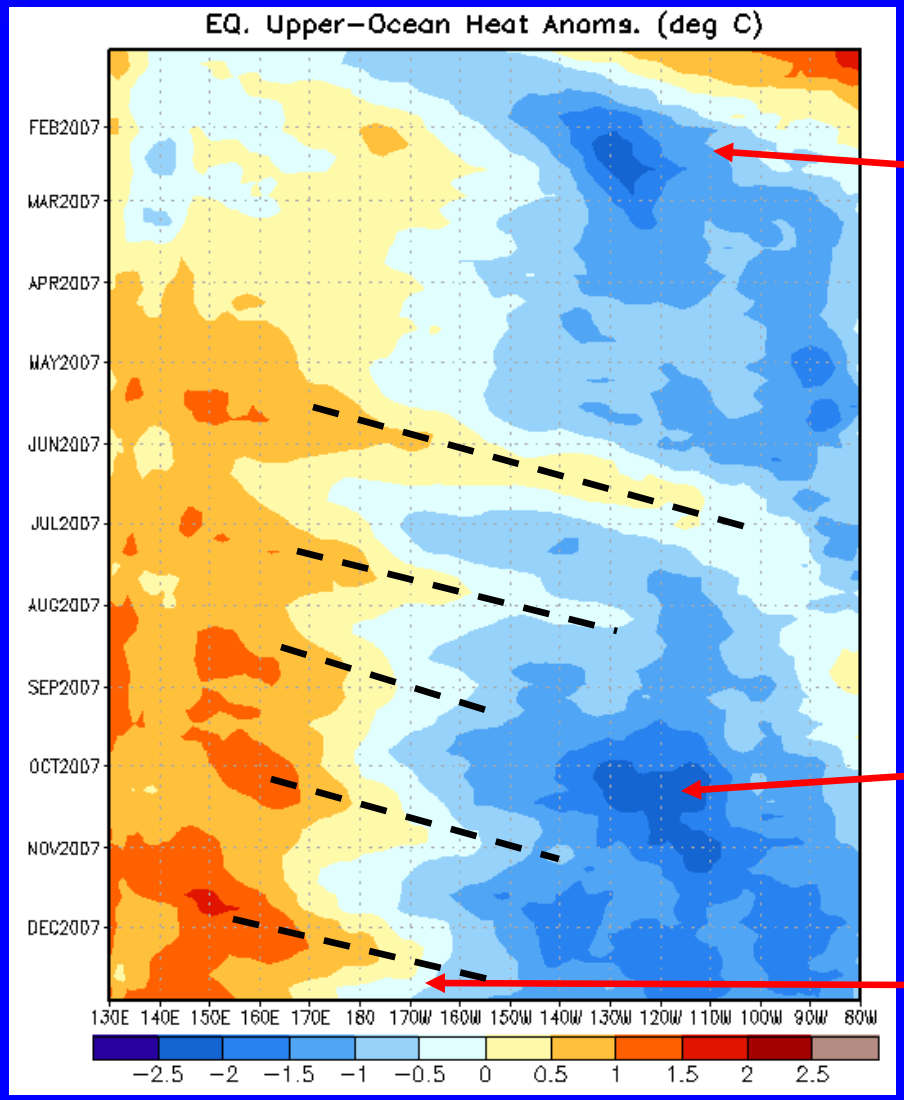
200-hPa Vector Wind Anomalies (m s^{-1})



Note that shading denotes the magnitude of the anomalous wind vectors

Westerly anomalies across the western hemisphere have decreased and shown little eastward movement during the last five days.

Weekly Heat Content Evolution in the Equatorial Pacific



Time

Longitude

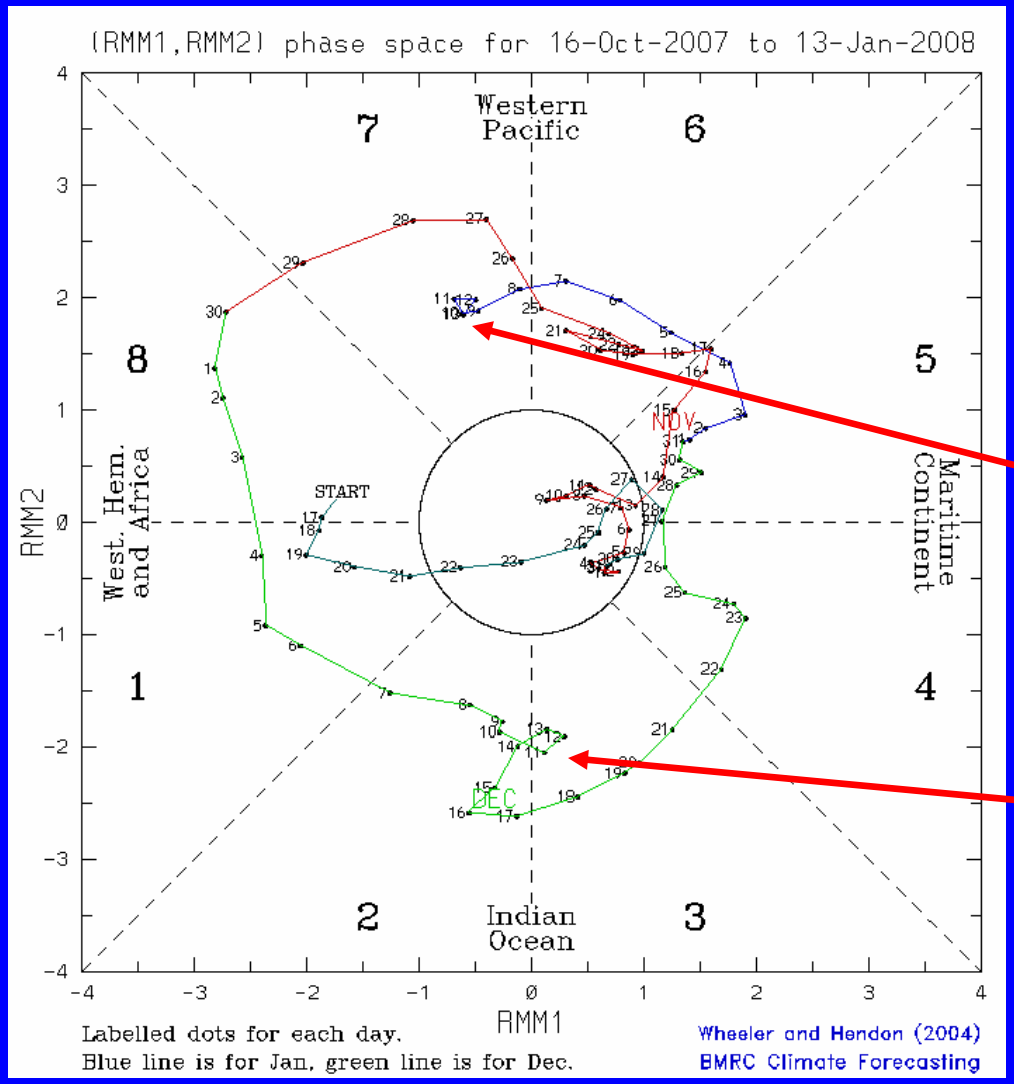
Beginning in February, negative heat content anomalies developed across the eastern equatorial Pacific and continued until June 2007.

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, an upwelling Kelvin wave is contributing to increasingly negative sub-surface temperature departures near the Date Line.

MJO Index



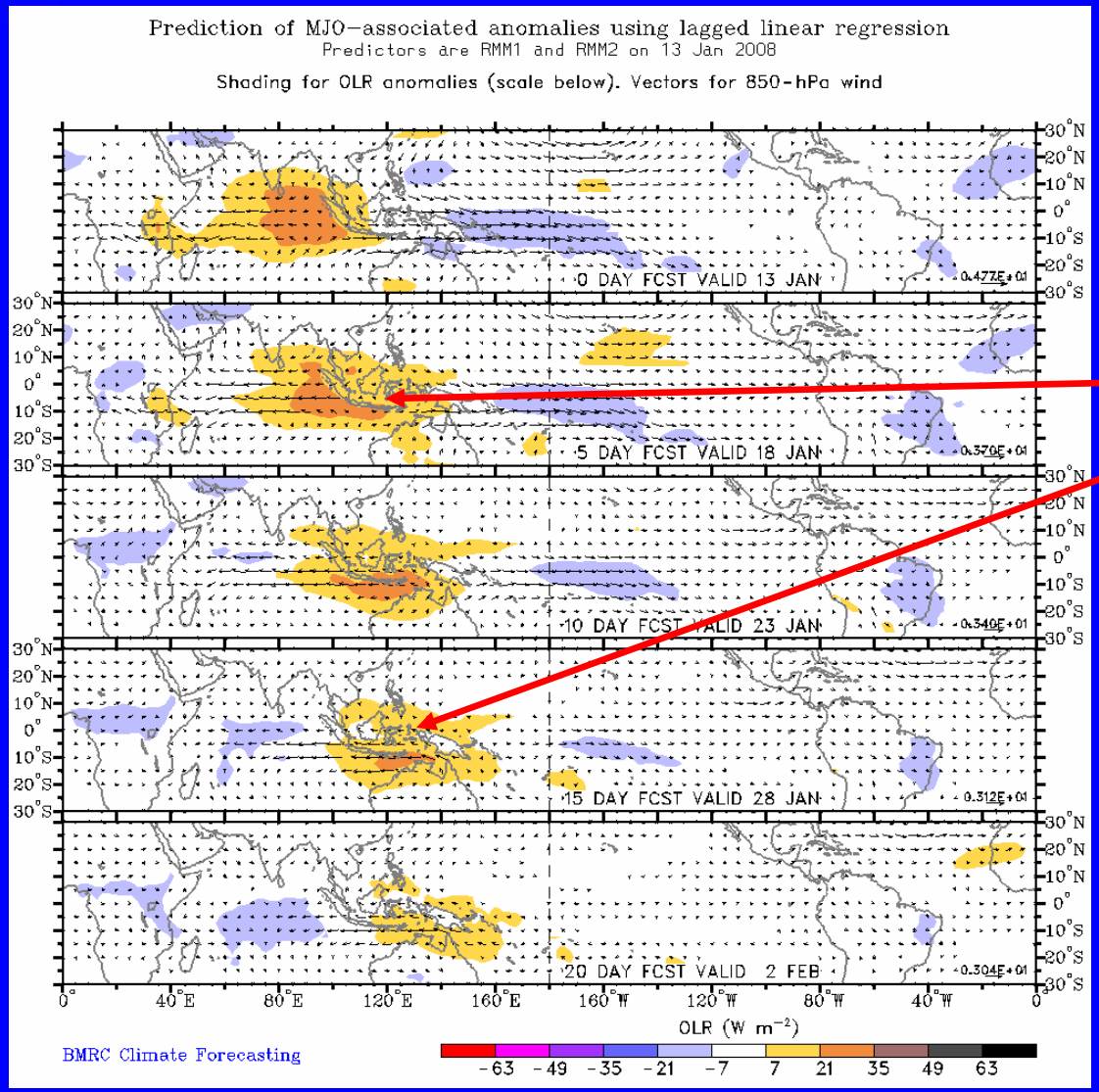
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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 enhanced phase of the MJO is now centered across the central Pacific Ocean and eastward propagation has slowed in recent days.

Eastward propagation of the MJO ceased briefly in mid-December after rapid eastward movement earlier in the month.

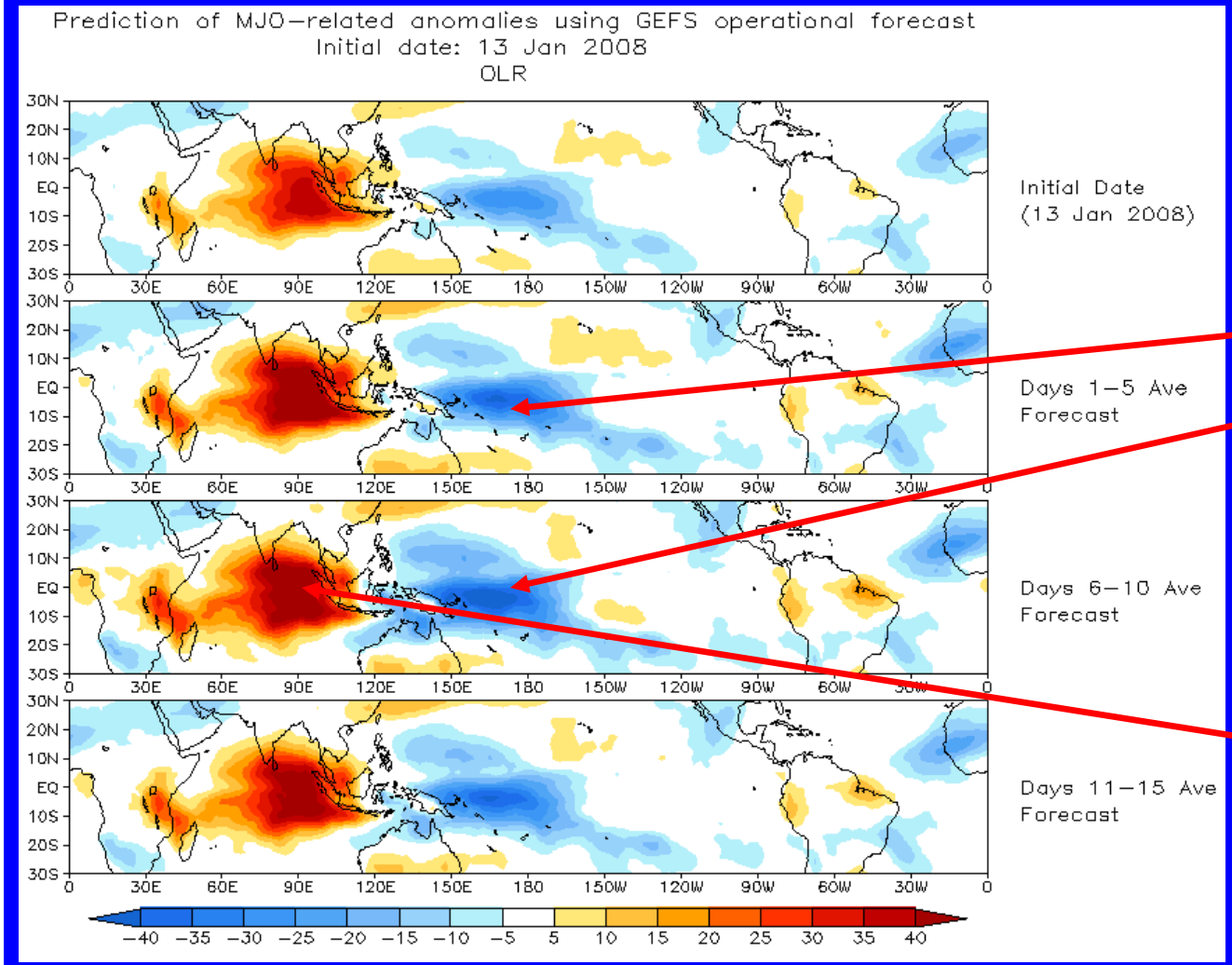
Statistical MJO OLR Forecast



The statistical MJO forecast indicates moderate – strong 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 expected for Africa during the period.

Experimental GFS MJO OLR Forecast



The GFS forecasts a strong MJO associated signal but little to no eastward propagation during the period.

Wet conditions are expected for the eastern Maritime continent and western Pacific Ocean throughout the period.

Suppressed convection is forecast for sections of Africa and the Indian Ocean.