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

Update prepared by
Climate Prediction Center / NCEP
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Outline

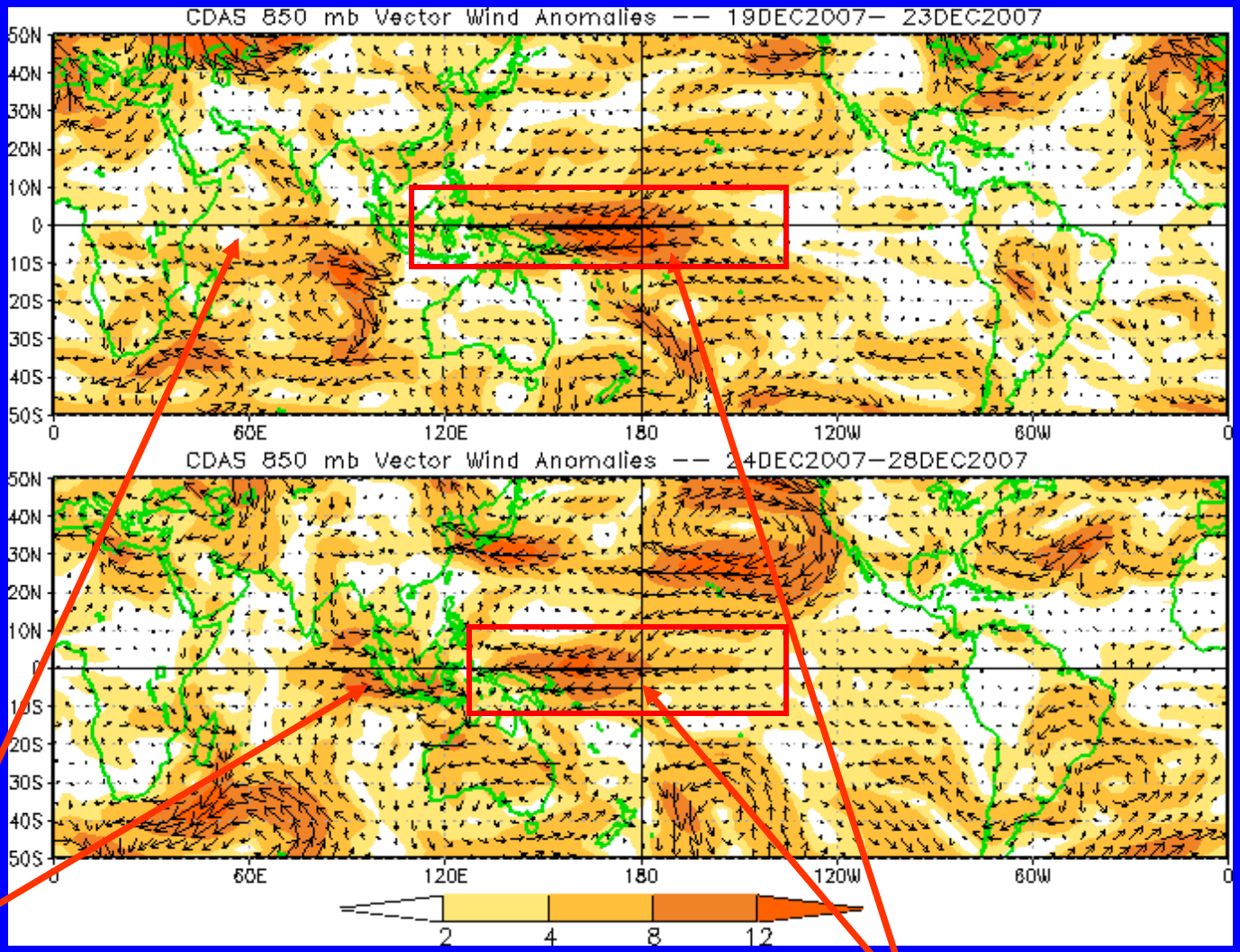
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- A moderate MJO signal continues but eastward propagation has slowed markedly in recent days and tropical convection may be becoming more stationary in nature consistent with La Nina conditions.
- The enhanced phase is centered across the eastern Maritime continent region.
- The latest observations and forecast tools indicate continued moderate-weak MJO activity but very slow eastward movement of enhanced convection into the western Pacific Ocean during the next 1-2 weeks.
- Considerable spread is shown by MJO forecast tools.
- Expected impacts associated with the MJO include wet conditions stretching from the Maritime continent into the far western Pacific Ocean during the period and an elevated risk of tropical cyclogenesis for the waters near Australia.

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

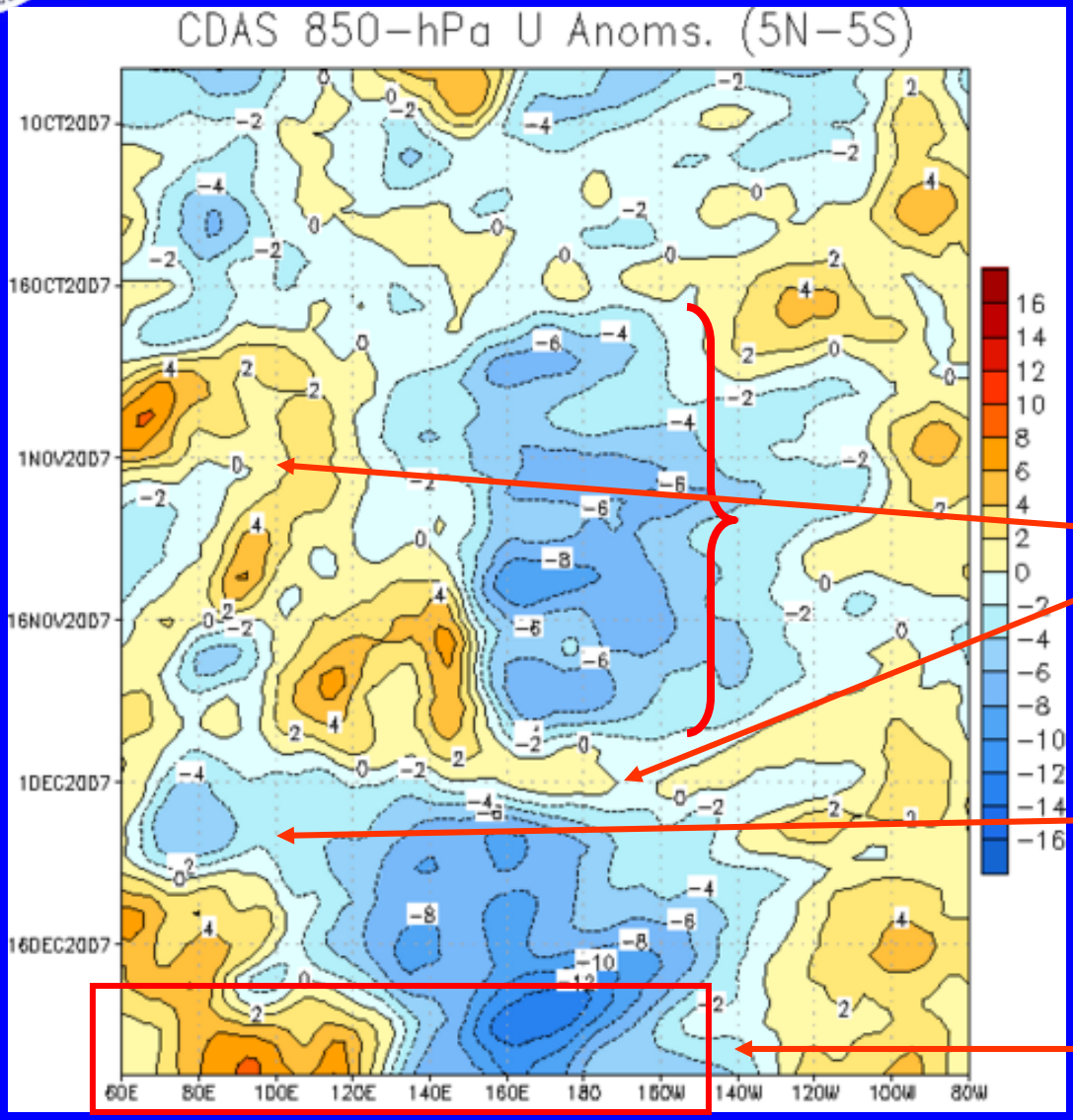
Note that shading denotes the magnitude of the anomalous wind vectors



Westerly anomalies have propagated eastward to include both the eastern Indian Ocean and the western Maritime continent.

Easterlies remain strong across the western Pacific Ocean but have weakened during the last five days. Only minor eastward movement is observed.

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.

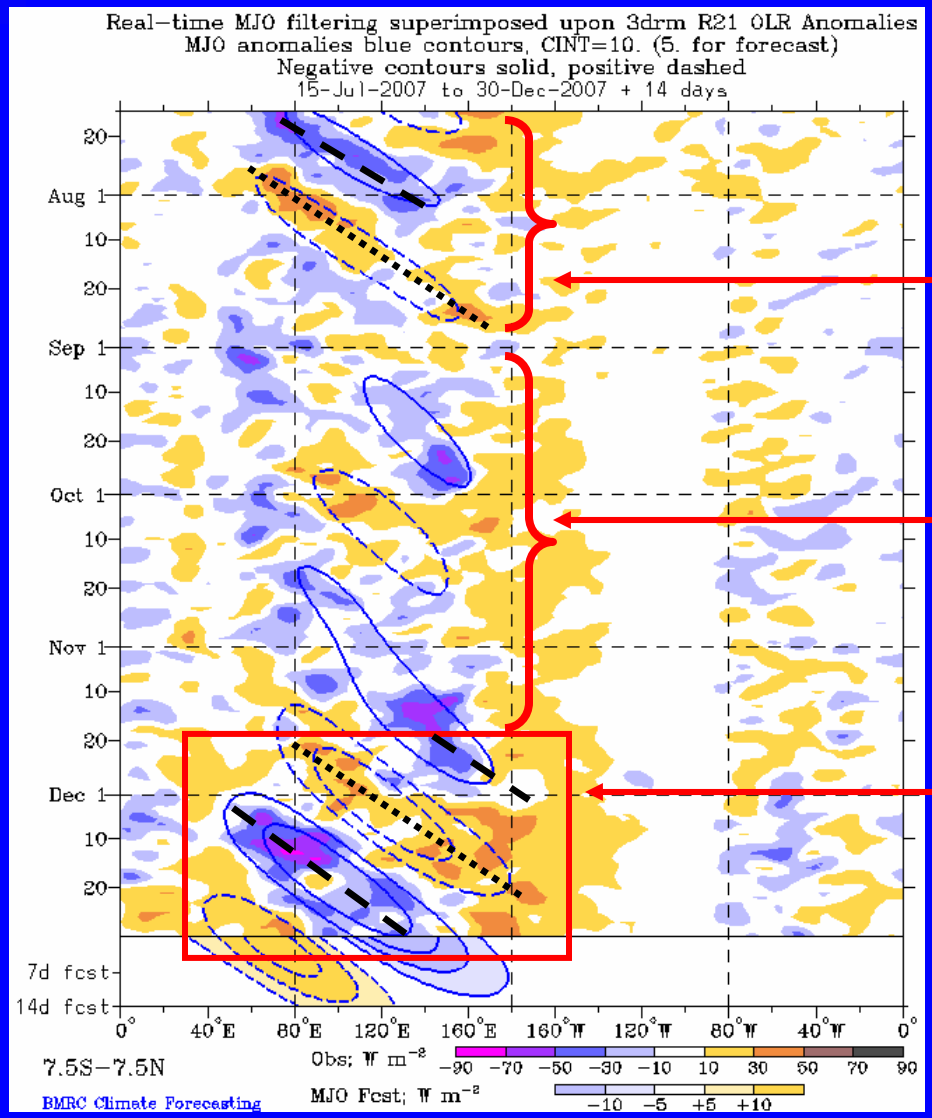
Strong easterlies were in place from mid-October through mid-November across much of the Pacific generally stretching from 150E to 150W.

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

During early December, easterly anomalies developed across the Indian Ocean and have shifted eastwards and were followed by westerly anomalies during mid-late December.

Westerly anomalies have propagated eastwards and a strong couplet of westerly (easterly) anomalies stretches from the Indian Ocean 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)

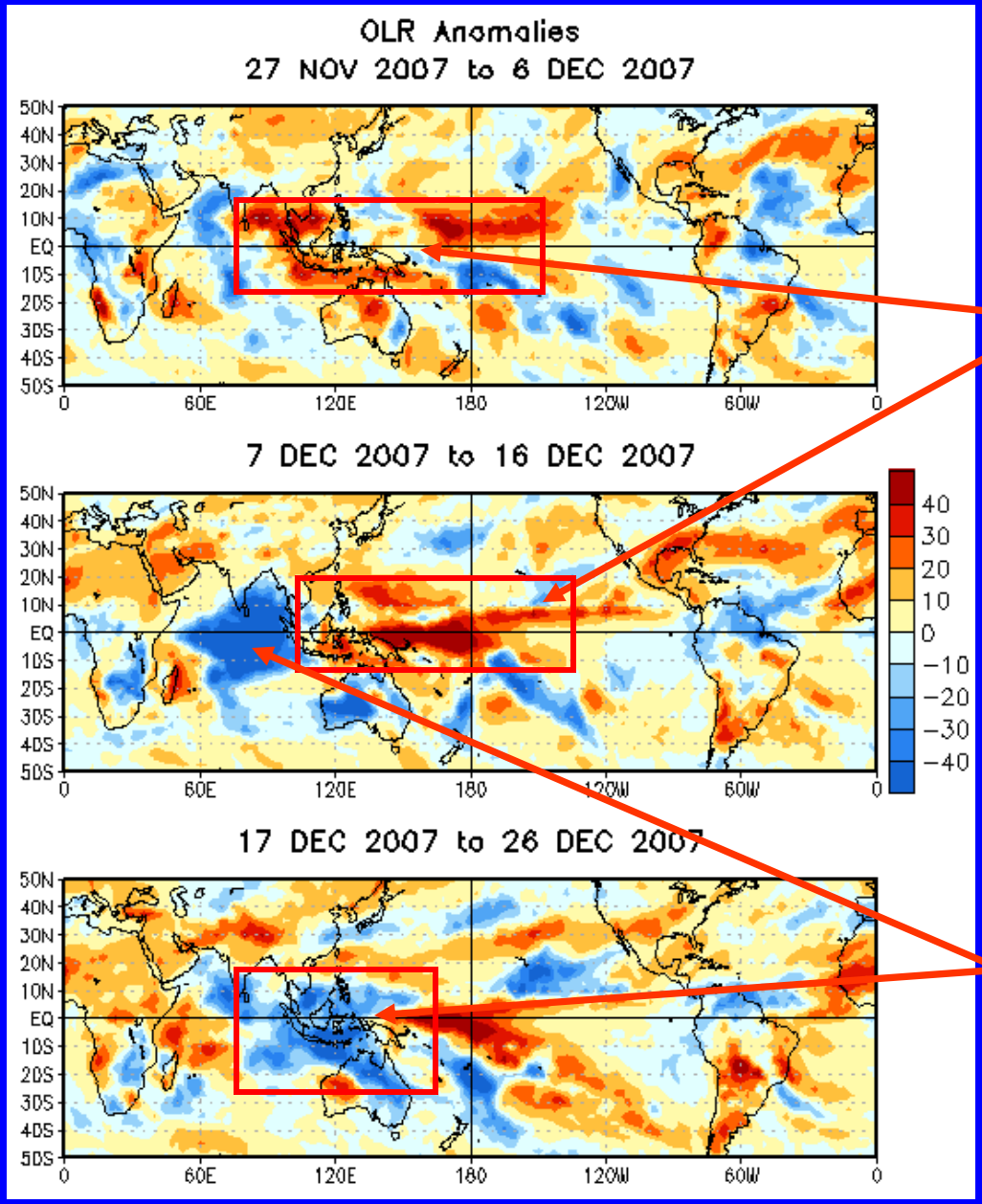
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

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 at moderate strength as enhanced convection has shifted eastward from the Indian Ocean to the Maritime continent and suppressed convection is now evident across Africa and portions of the Indian Ocean.

OLR Anomalies: Last 30 days



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

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

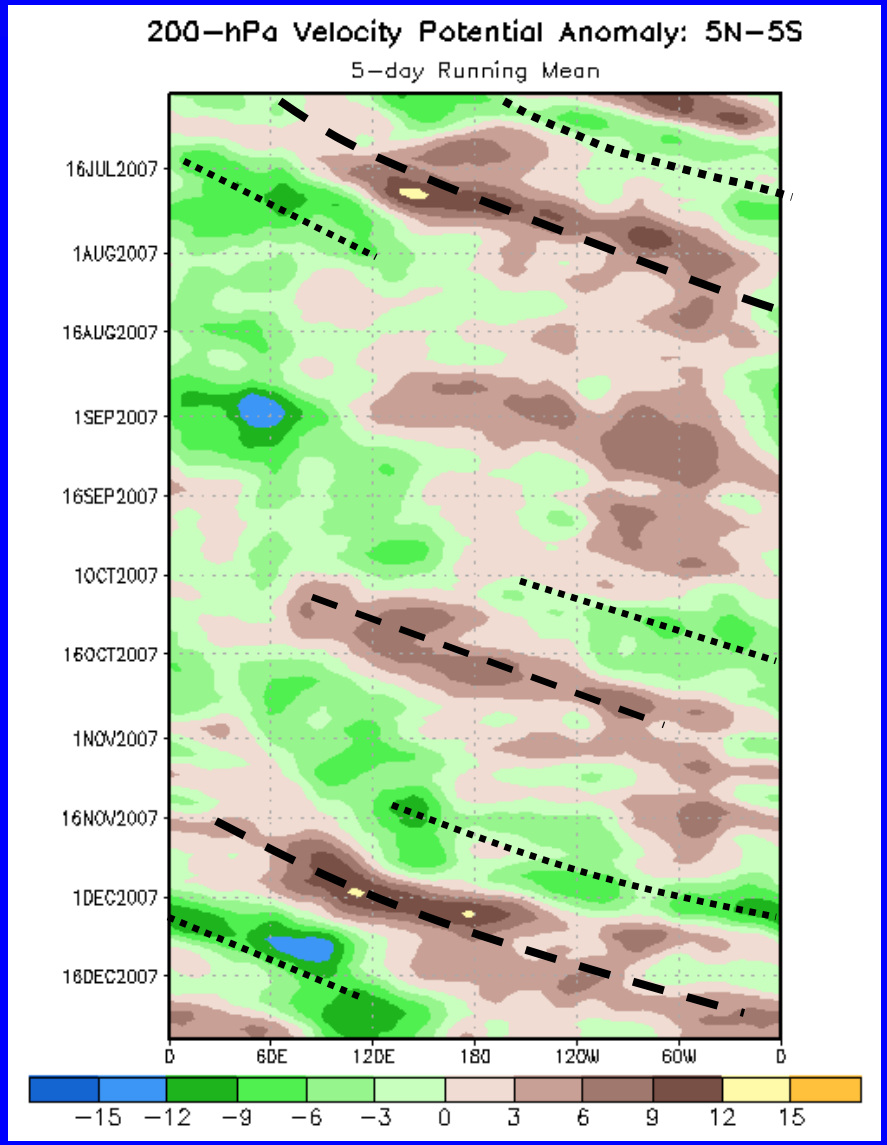
Mainly dry conditions prevailed across much of the Maritime continent, northern Australia, and the western Pacific Ocean from late November to mid December as the MJO phase shifted eastwards.

Wet conditions developed across the Indian Ocean in mid-December and shifted eastward to the Maritime continent by late December as the enhanced phase of the MJO shifted into this region.

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.



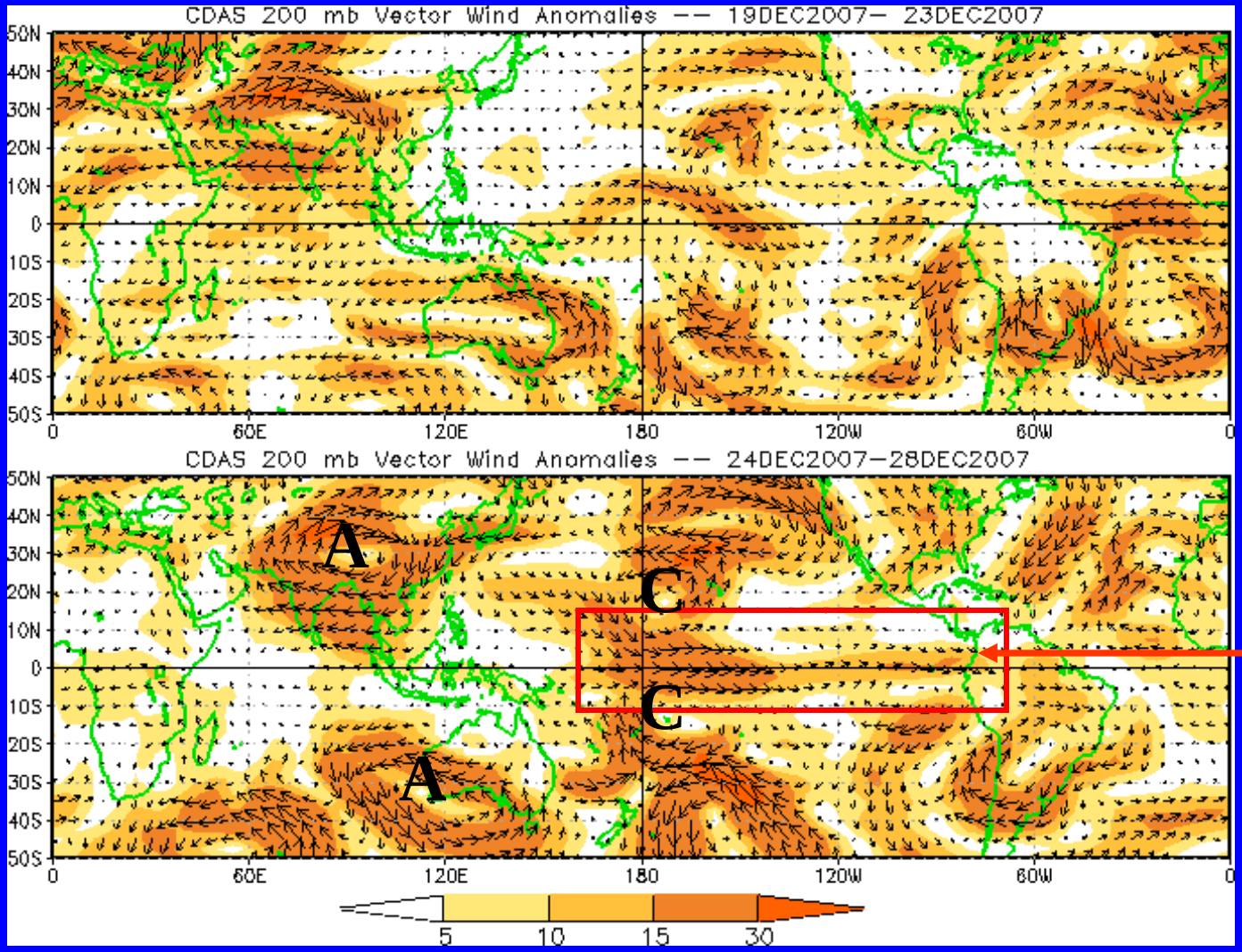
During July and early August, weak to moderate MJO activity was observed as velocity potential anomalies increased and propagated eastwards.

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

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

The strongest and most coherent MJO activity since the summer period developed during the second half of November. In recent days, however, velocity potential anomalies have become more stationary in nature.

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

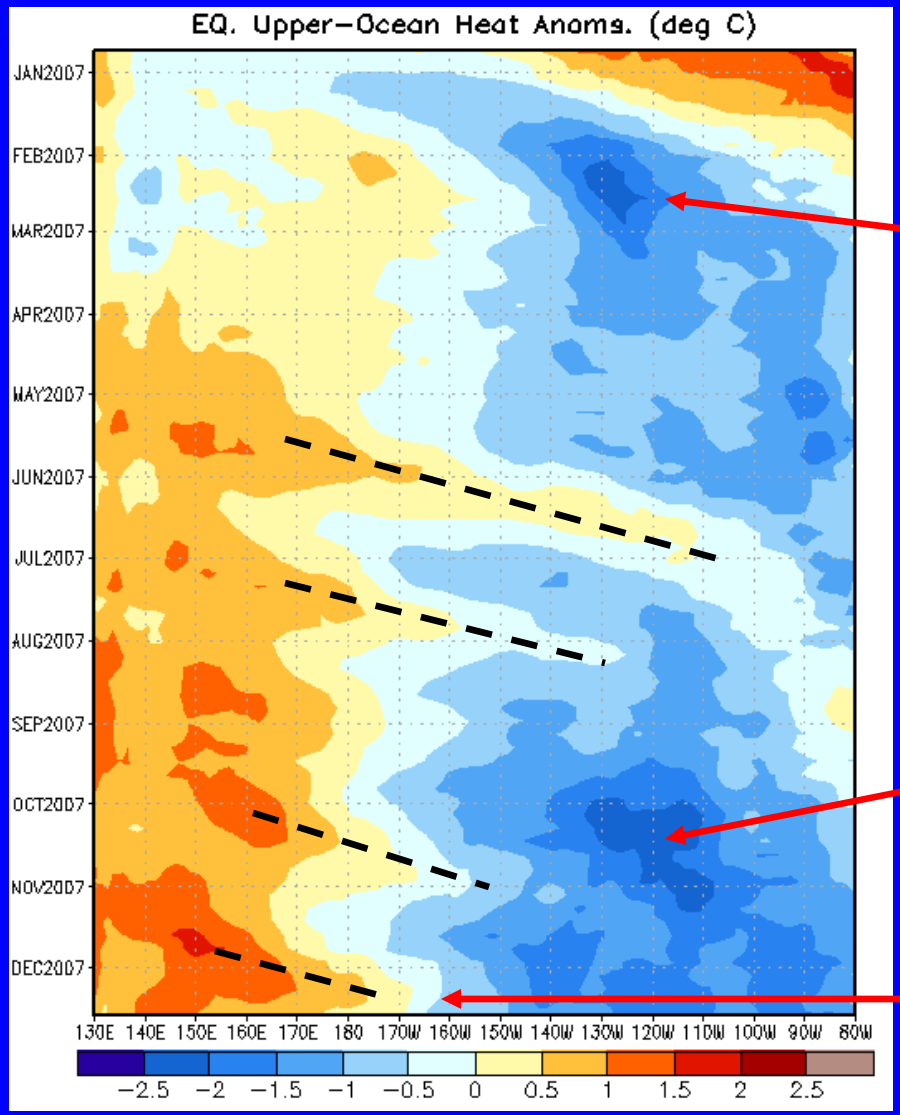


Note that shading denotes the magnitude of the anomalous wind vectors

Anticyclonic (A) and cyclonic (C) circulations are evident during the last five days. These features are consistent with an MJO event in its current phase.

Westerly anomalies are clear across the equatorial Pacific Ocean.

Weekly Heat Content Evolution in the Equatorial Pacific



Time

Longitude

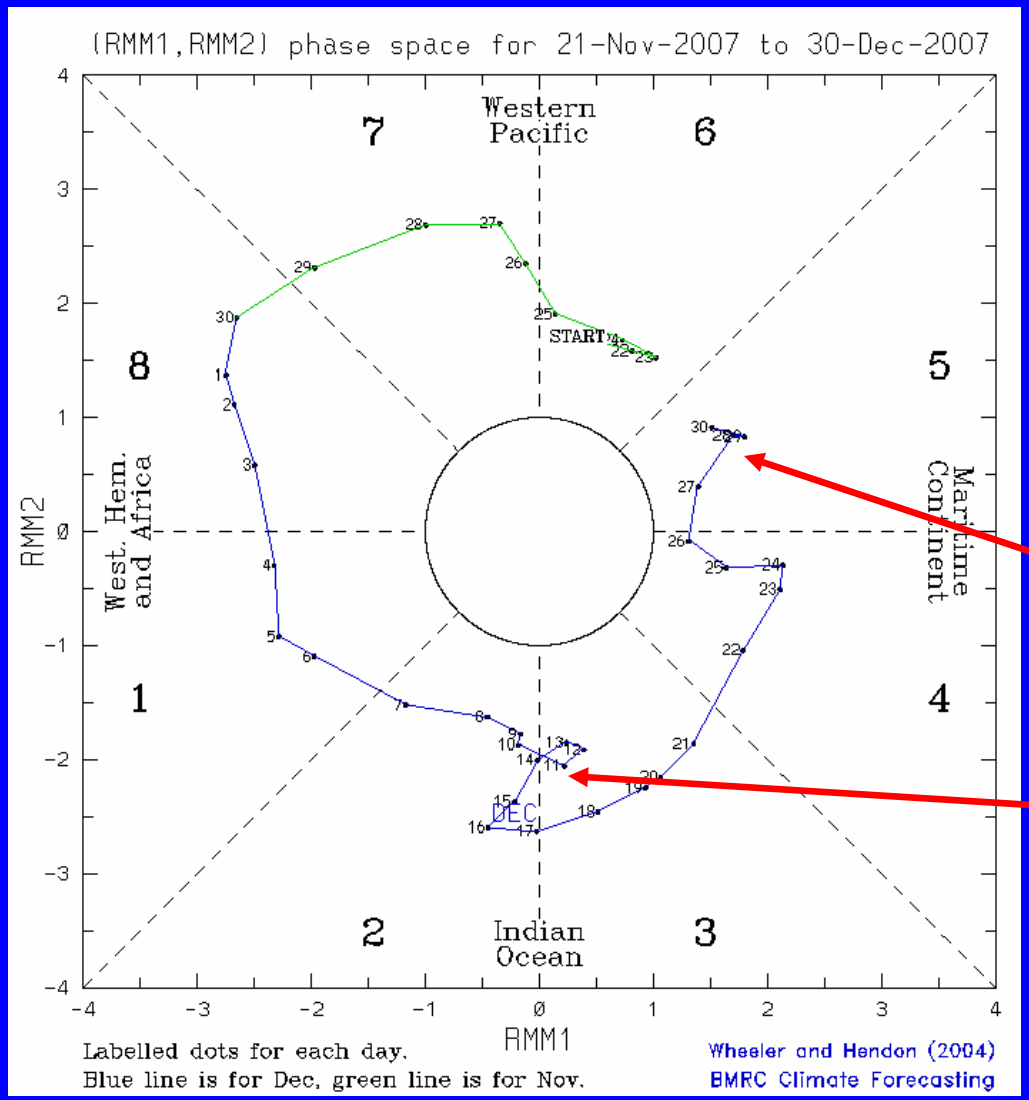
Beginning in February, negative heat content anomalies developed across the eastern equatorial Pacific and continued until June 2007.

Weak Kelvin wave activity was observed from May into August and affected the sub-surface temperature departures and resulted in slightly positive anomalies during June.

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

Most recently, a stronger downwelling Kelvin wave is indicated with positive sub-surface temperature departures extending to 170W.

MJO Index



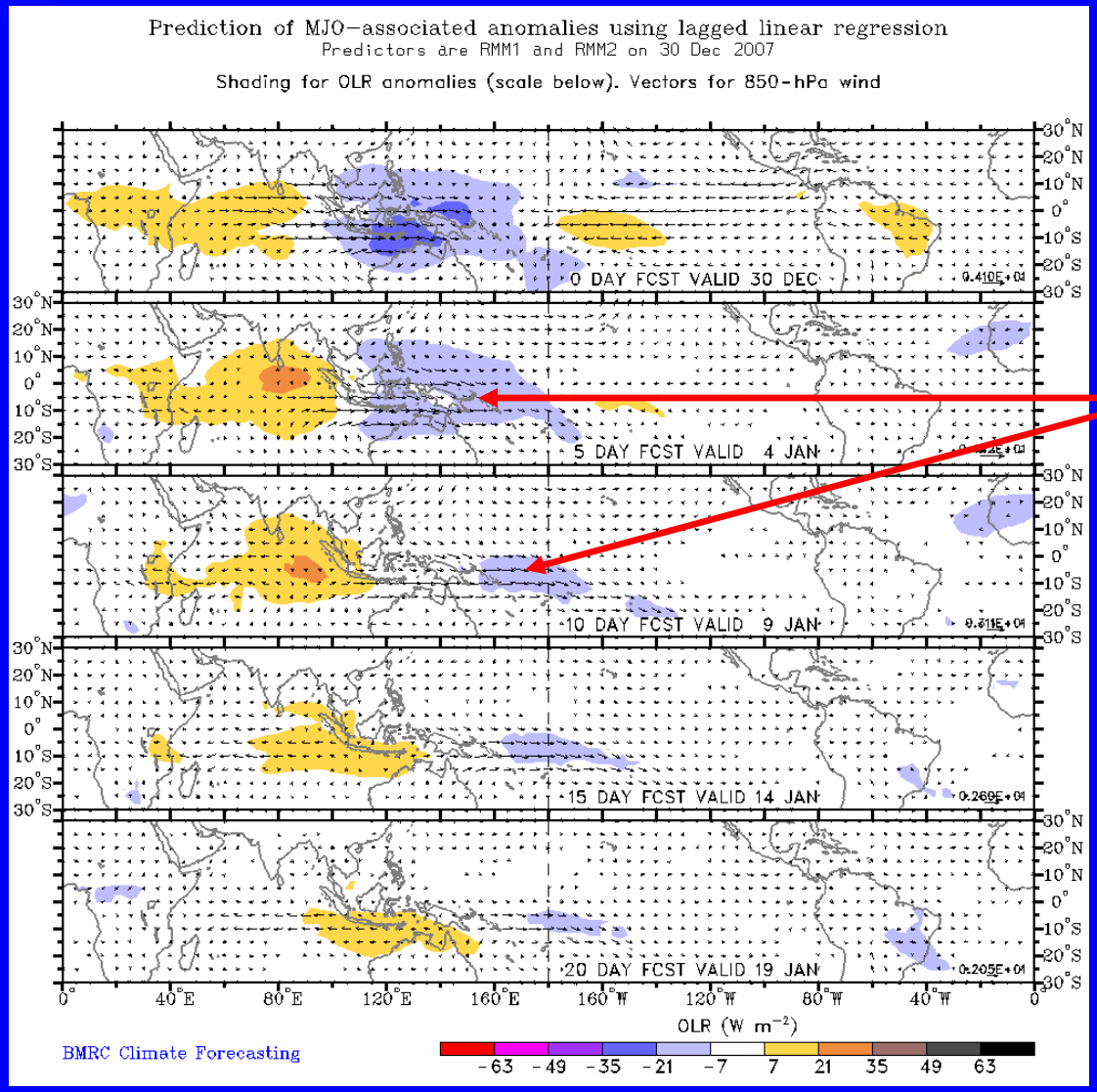
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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 eastern Maritime continent. In recent days, eastward propagation has decreased but a moderate amplitude remains.

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

Statistical MJO OLR Forecast

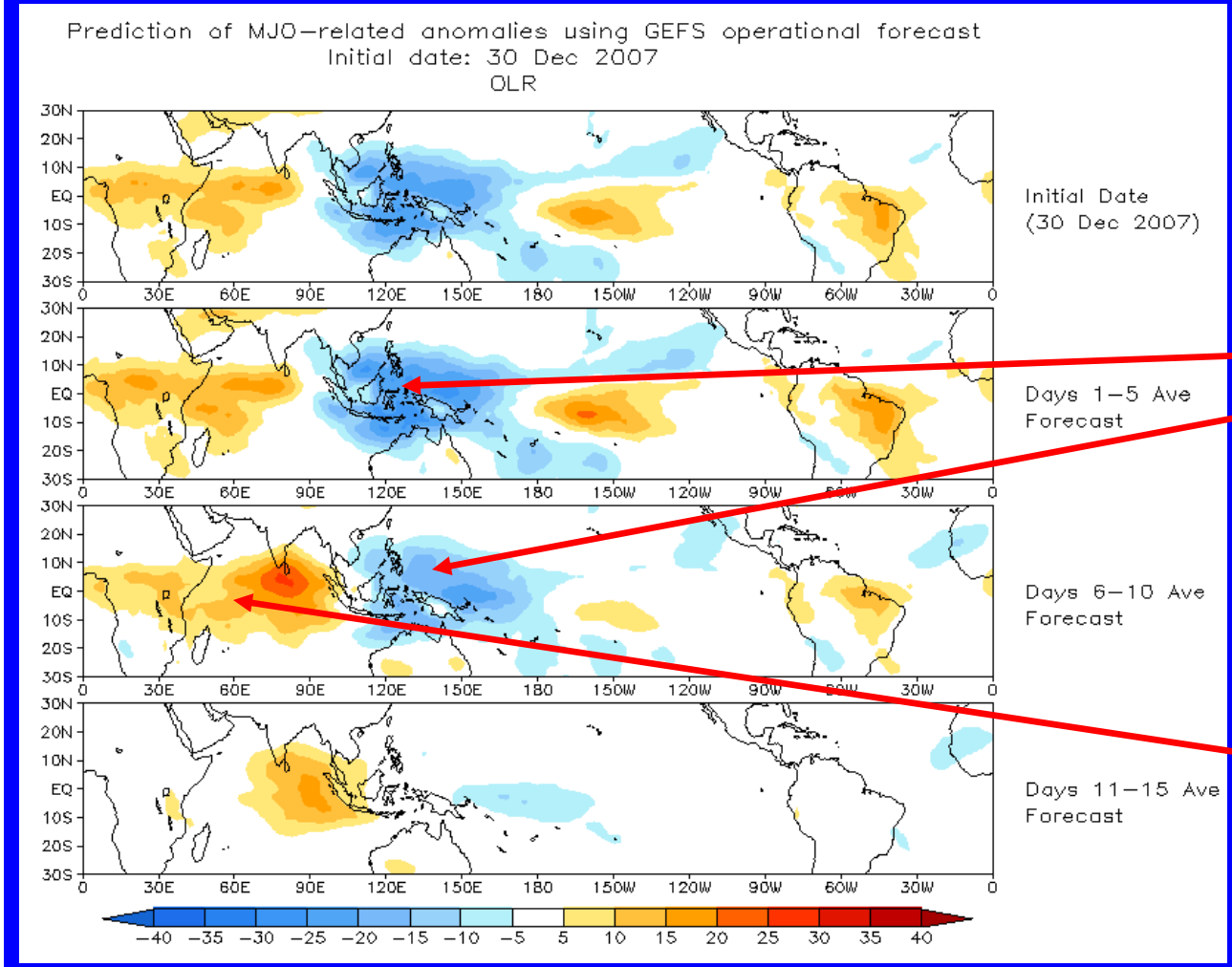


The statistical MJO forecast indicates moderate MJO activity during the upcoming 1-2 week period.

Wet conditions are forecast to shift across the Maritime continent into the western Pacific Ocean during the period.

Dry conditions are forecast for sections Africa and the Indian Ocean.

Experimental GFS MJO OLR Forecast



The GFS forecasts a moderate a MJO signal with minor eastward propagation during the period – mainly during week 2.

Wet conditions are expected for the Maritime continent throughout much of the period with enhanced convection shifting slowly into the western Pacific Ocean by the end of week 2.

Suppressed convection is forecast for Africa and the Indian Ocean.