



# **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**



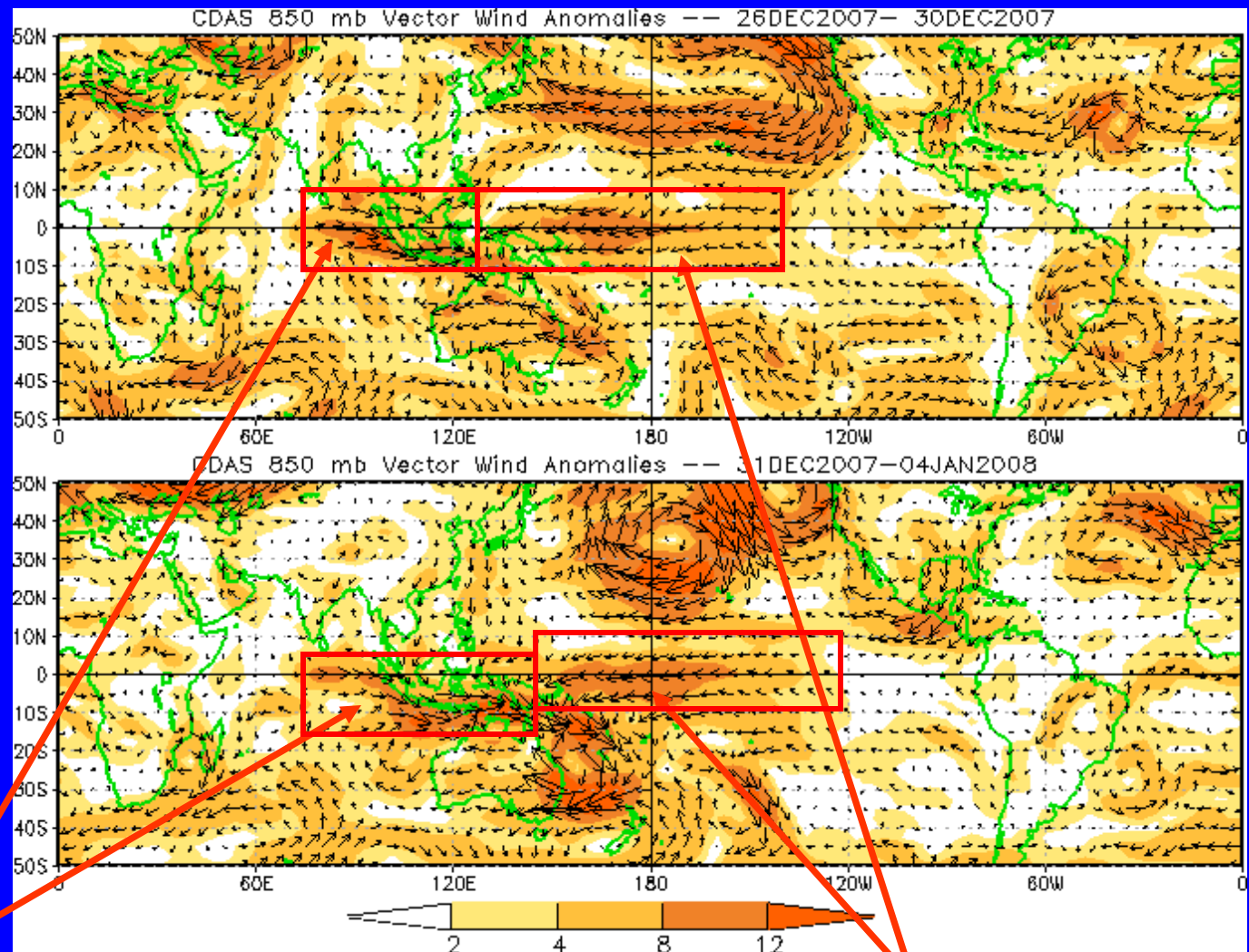
# Overview

- **A moderate-to-strong MJO is expected to continue to shift eastward.**
- **Currently the enhanced phase is centered across the western Pacific Ocean.**
- **Expected impacts during Week 1 include enhanced convection across the western and central Pacific Ocean (mainly south of the equator), suppressed convection in the Indian Ocean and western Maritime Continent, and an elevated risk of tropical cyclogenesis to the northeast of Australia.**
- **During Week 2, suppressed convection is anticipated across the Maritime Continent with enhanced convection for sections of southeastern Brazil and the southeast and Gulf of Guinea region of Africa.**



# 850-hPa Vector Wind Anomalies ( $\text{m s}^{-1}$ )

Note that shading denotes the magnitude of the anomalous wind vectors



Westerly anomalies continue south of the equator and stretch from the Indian Ocean across the Maritime continent to northeast of Australia.

Easterly anomalies continue across the western Pacific Ocean and have shifted slightly eastwards.



# 850-hPa Zonal Wind Anomalies ( $\text{m s}^{-1}$ )

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

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

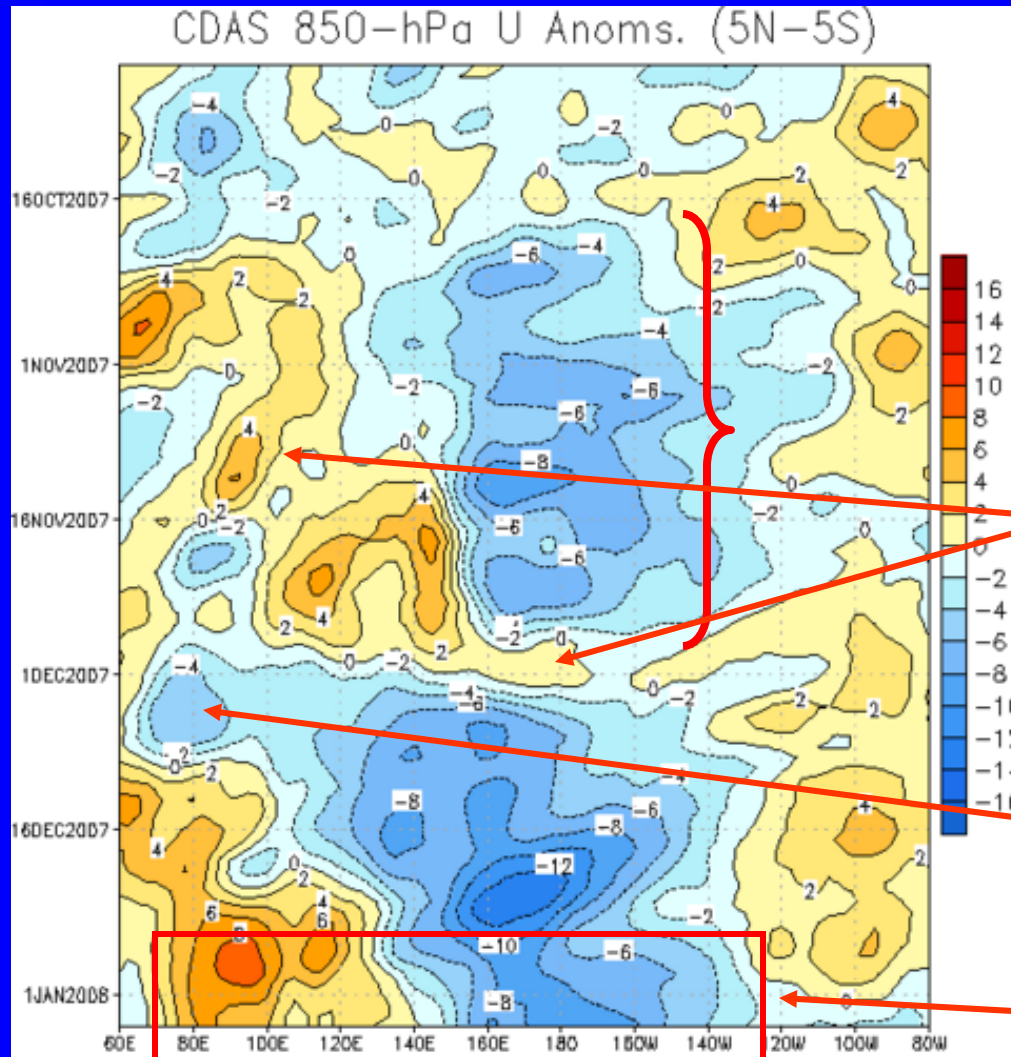
Strong easterlies were in place from mid-October through mid-November across much of the Pacific generally stretching from 150E to 150W.

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 couplet of westerly (easterly) anomalies stretches from the Indian Ocean to the Date Line.

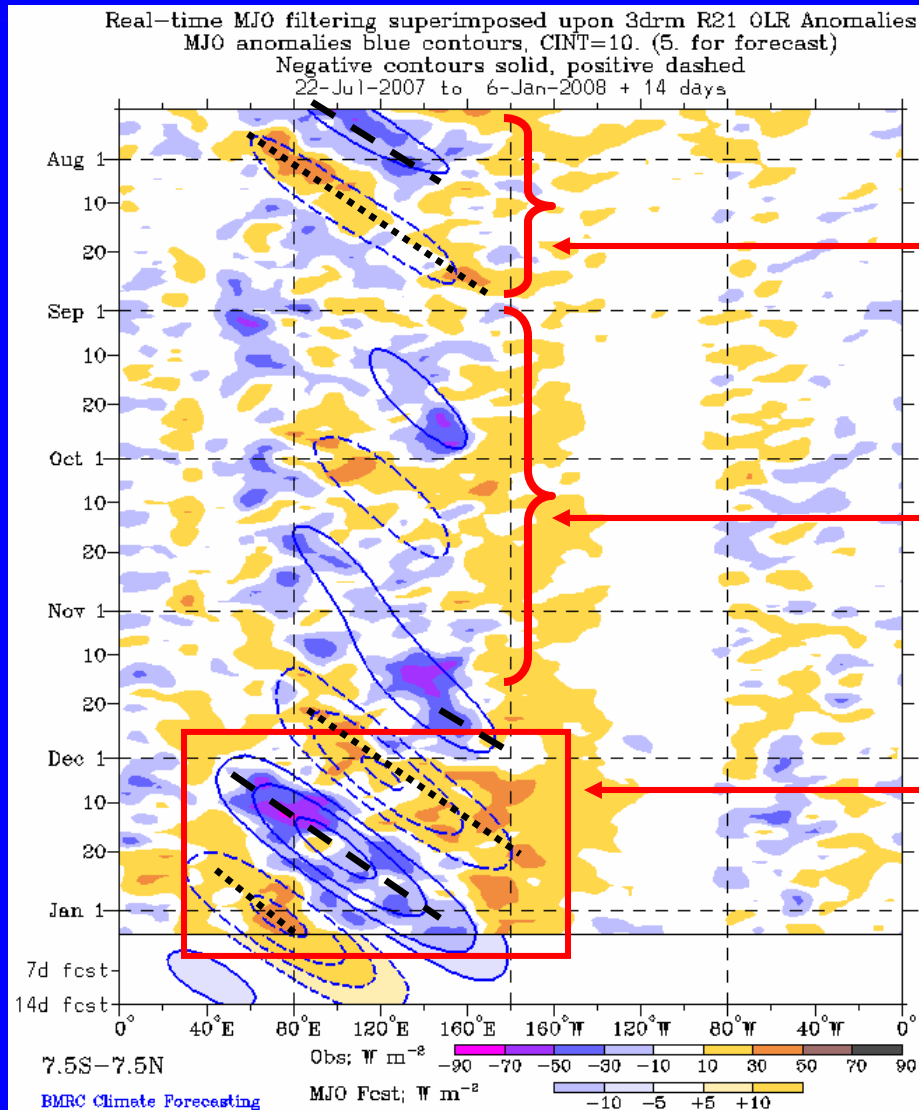
Time



Longitude



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



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

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

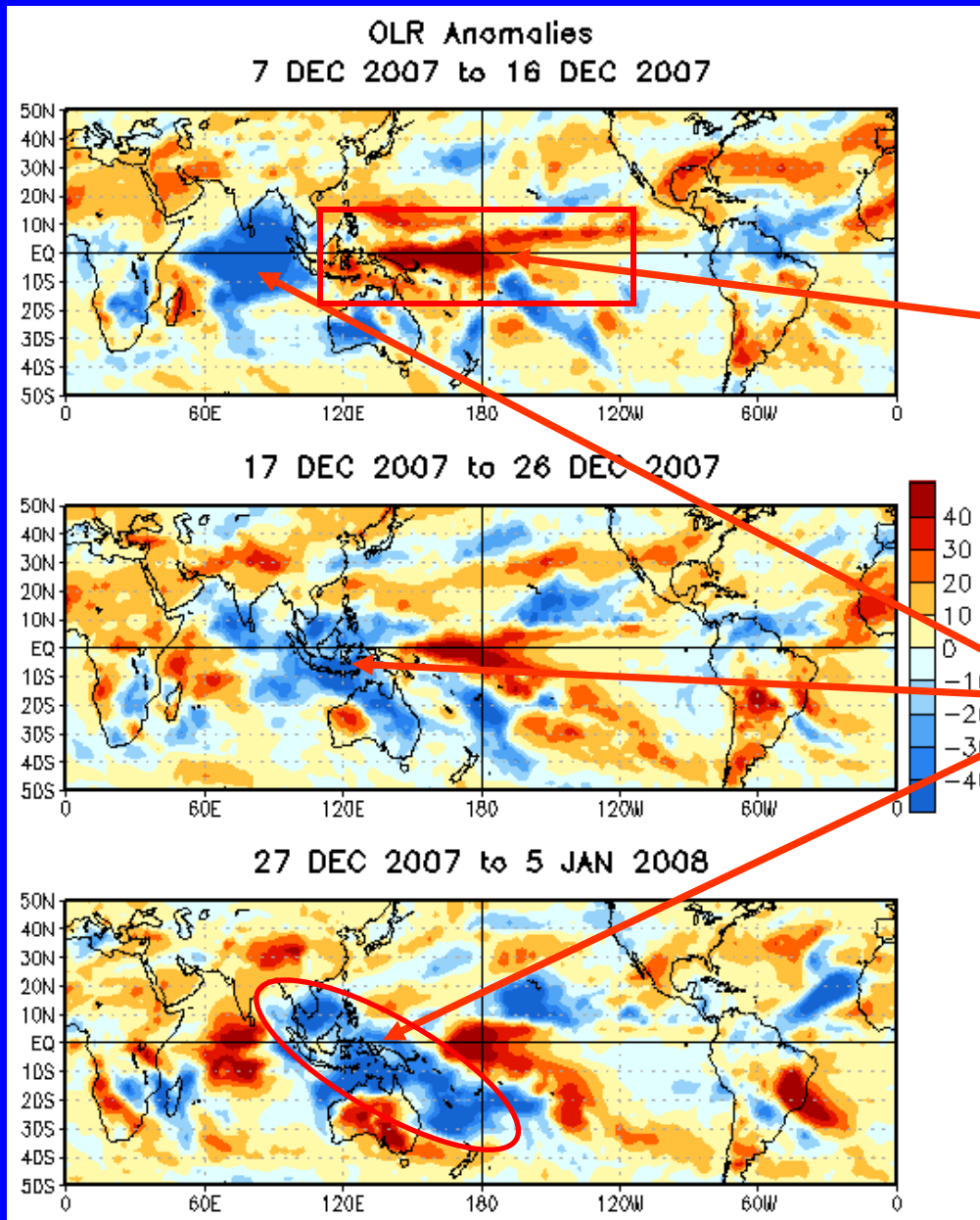
**Weak-moderate MJO activity was observed during July and August as regions of suppressed and enhanced convection shifted eastward.**

**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 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 and the western Pacific Ocean during early-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 mid-late December as the MJO progressed.

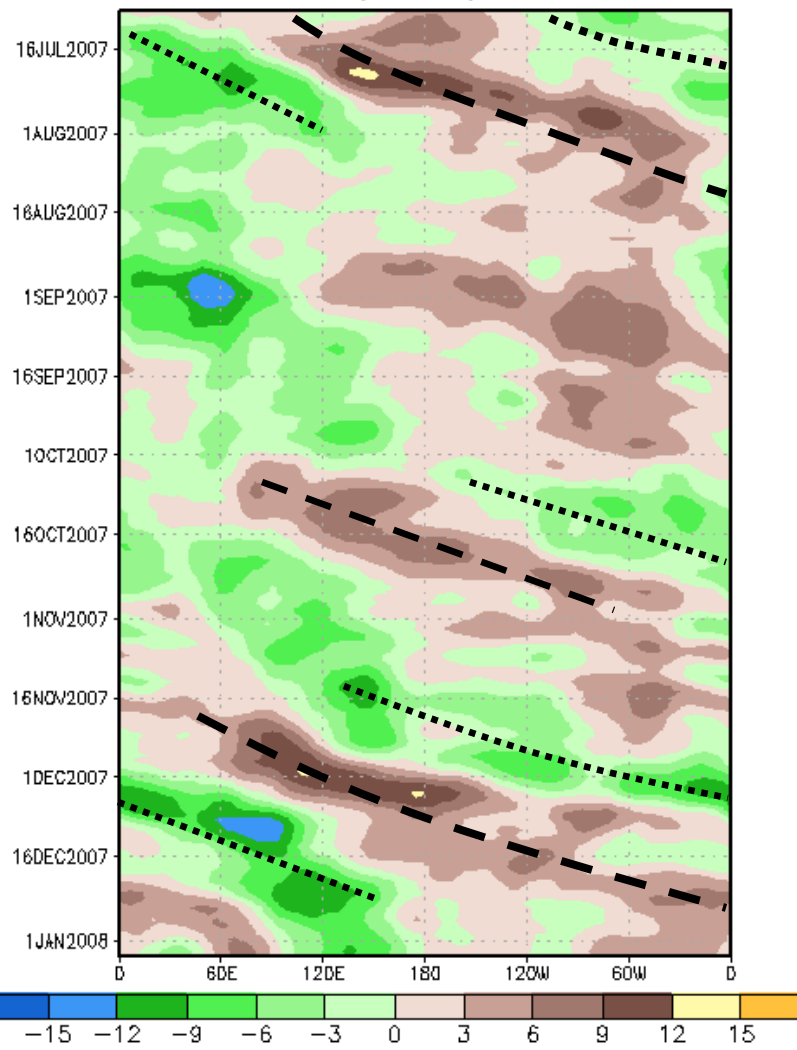


# 200-hPa Velocity Potential Anomalies (5°S-5°N)

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

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

200-hPa Velocity Potential Anomaly: 5N-5S  
5-day Running Mean



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 late December, the coherent MJO degraded slightly.

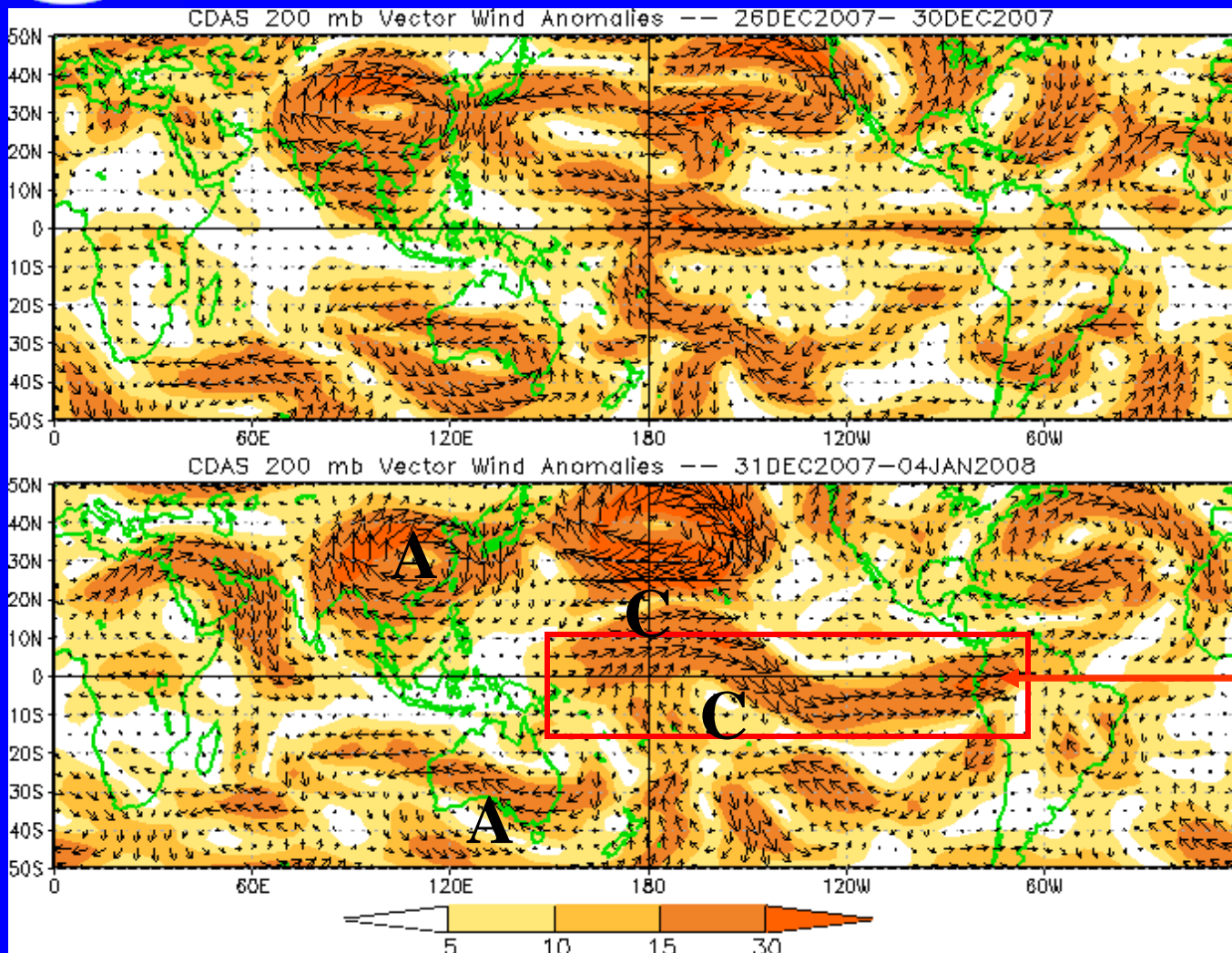
Longitude





# 200-hPa Vector Wind Anomalies ( $\text{m s}^{-1}$ )

Note that shading denotes the magnitude of the anomalous wind vectors



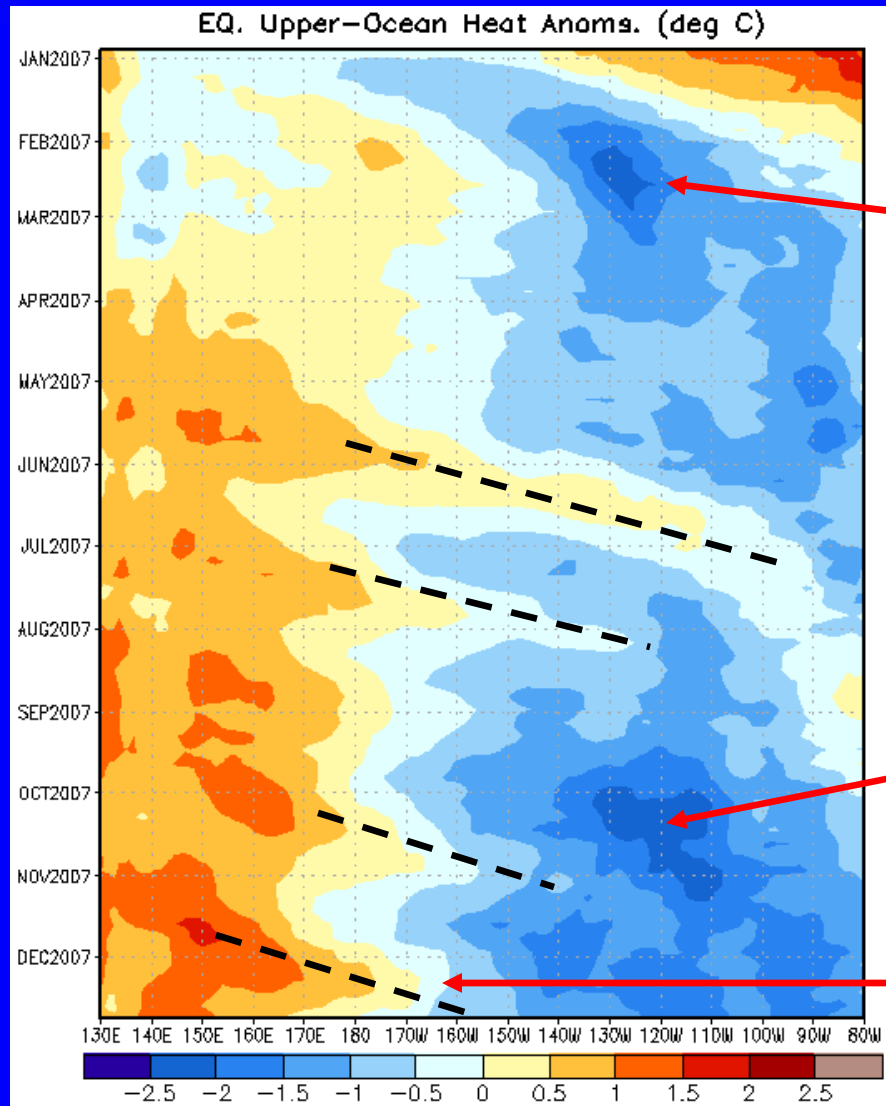
Anticyclonic (A) and cyclonic (C) circulations are evident during the last ten days. These features are consistent with an MJO event in its current phase.

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.

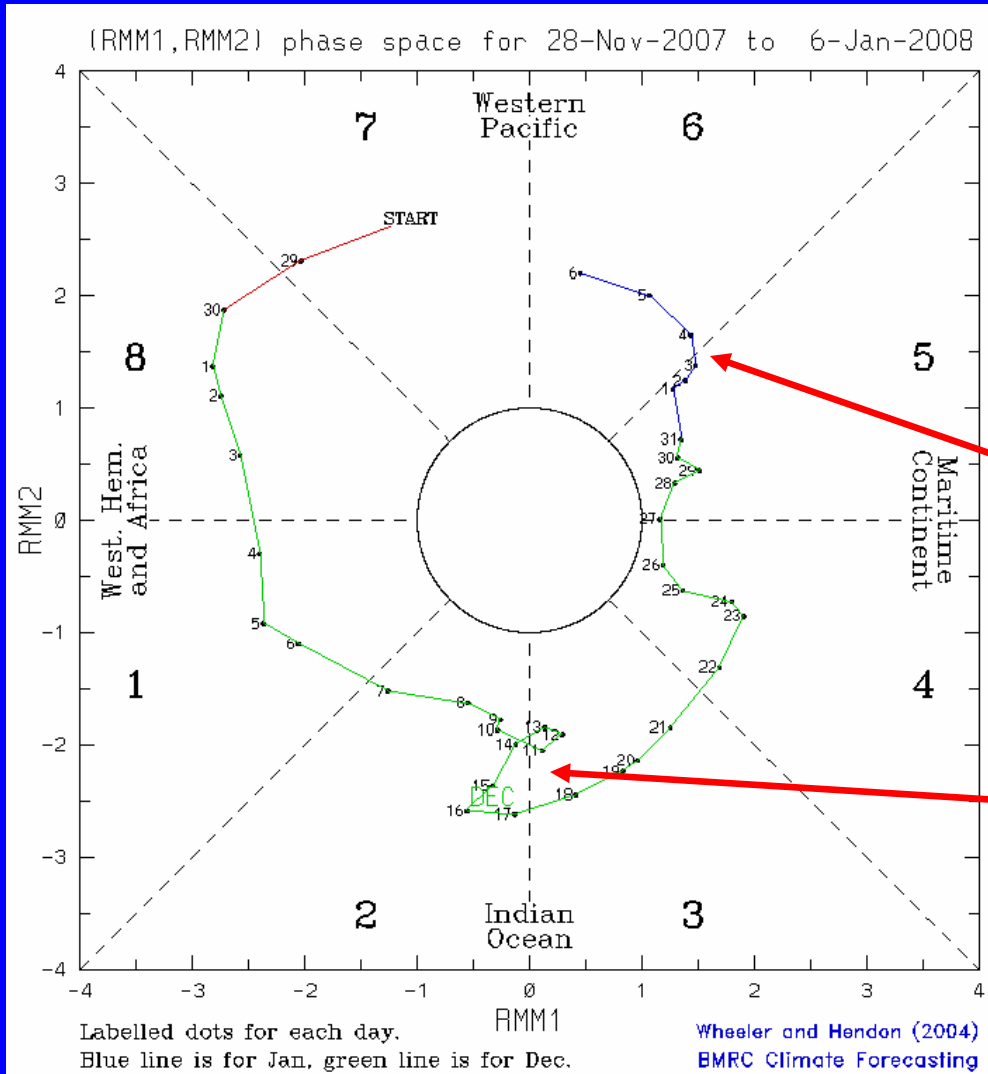
Most recently, a stronger downwelling Kelvin wave is indicated with positive sub-surface temperature departures extending to 170W.



# 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.

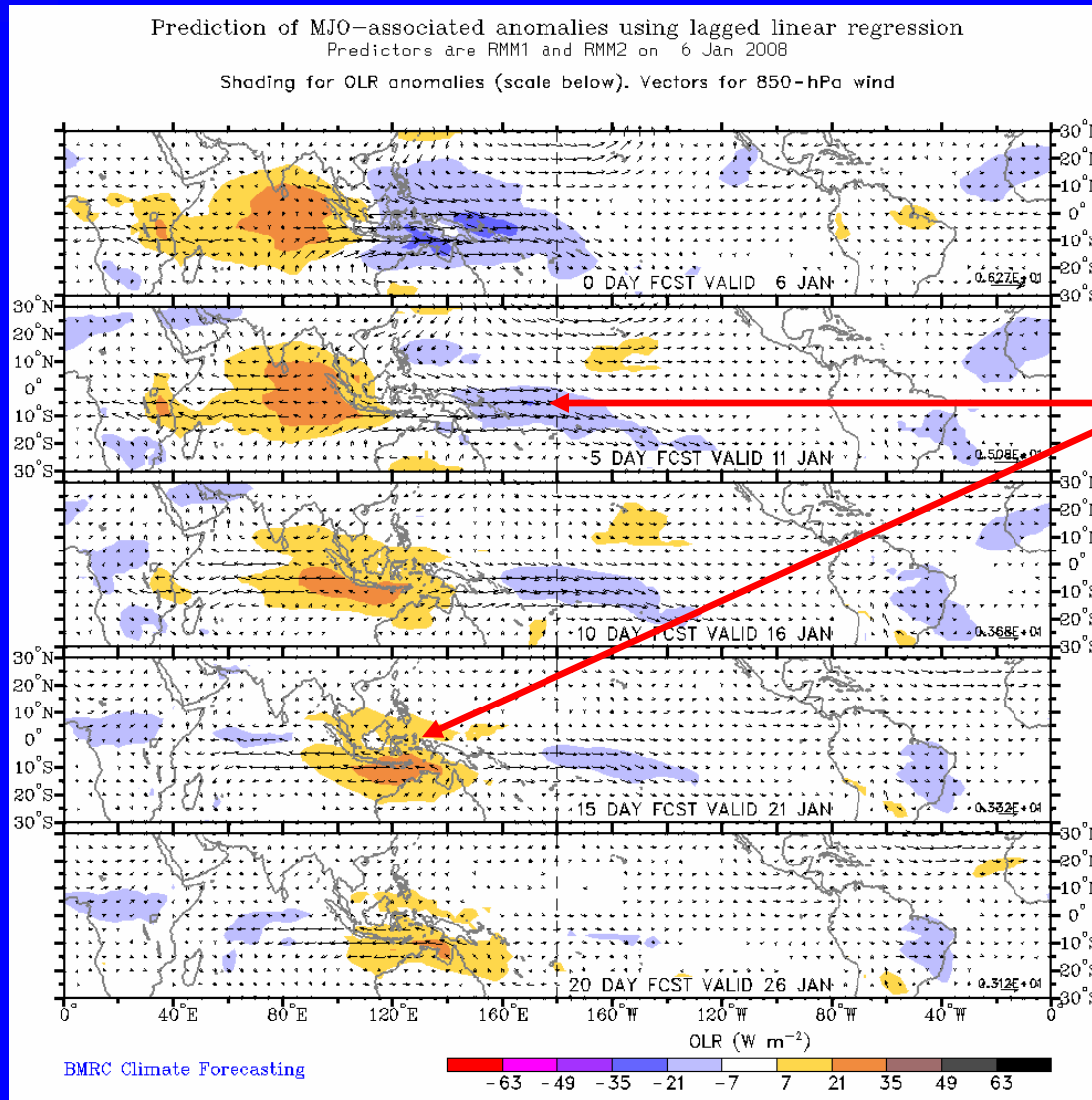


The enhanced phase of the MJO is now centered across the western Pacific Ocean and in recent days a faster eastward propagation is evident with a moderate amplitude.

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



# Statistical MJO OLR Forecast



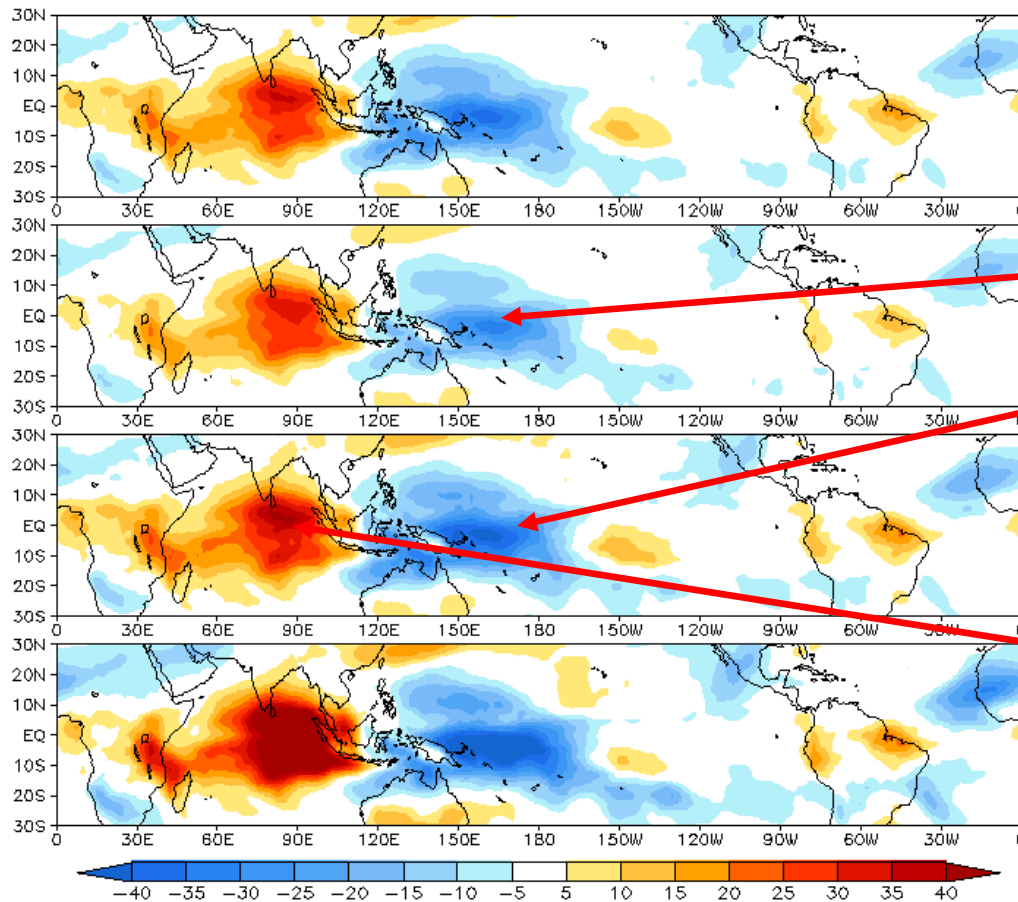
The statistical MJO forecast indicates moderate – strong MJO activity during the upcoming 1-2 week period.

Wet conditions are forecast for the western Pacific Ocean during week 1 with dry conditions shifting eastward to the Maritime continent from the Indian Ocean during the period.



# Experimental GFS MJO OLR Forecast

Prediction of MJO-related anomalies using GEFS operational forecast  
Initial date: 06 Jan 2008  
OLR



The GFS forecasts a moderate-strong MJO signal but little 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.