



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

**Update prepared by  
Climate Prediction Center / NCEP  
December 17, 2007**



# Outline

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



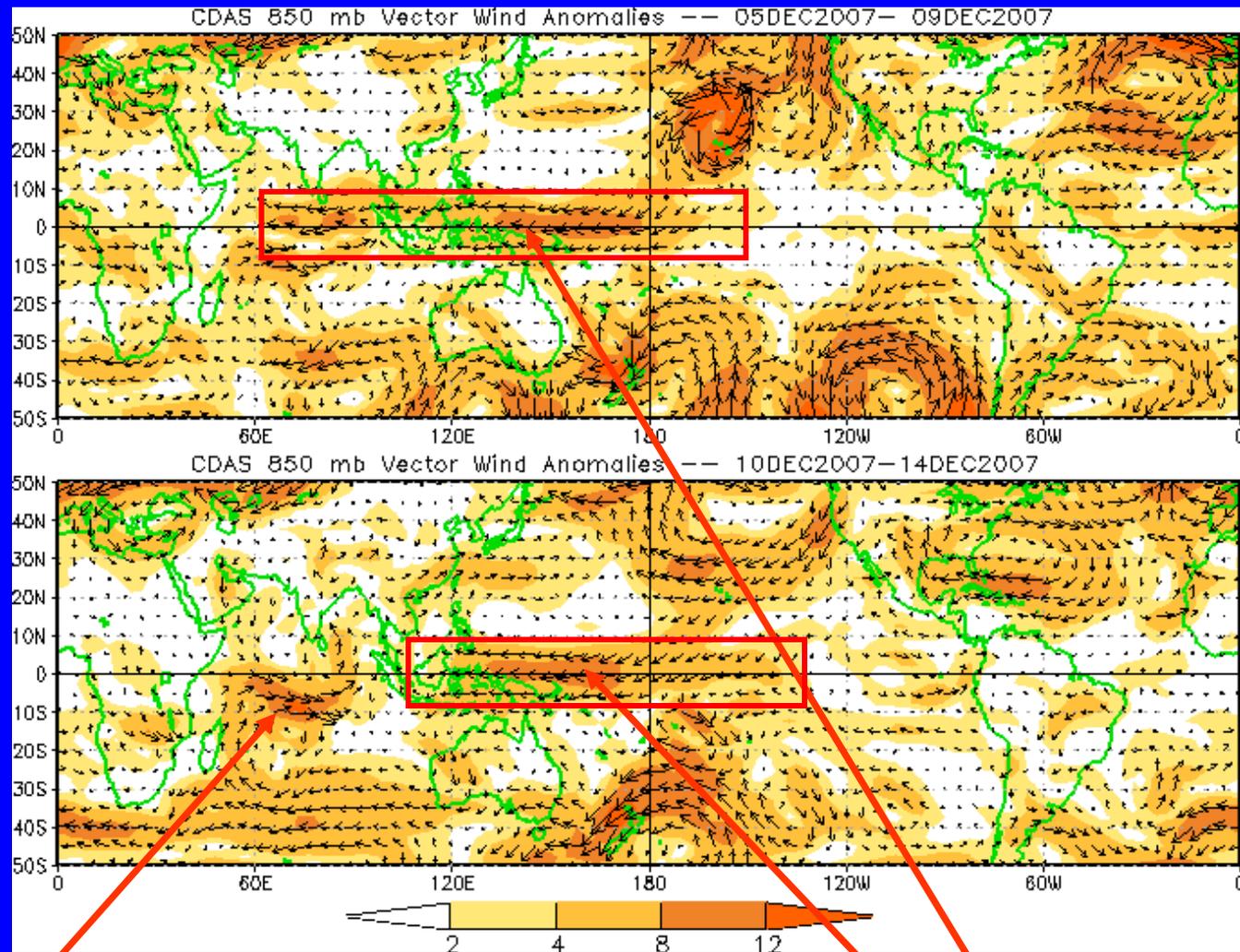
# Overview

- **Moderate to strong MJO activity continues, however, the eastward propagation has markedly slowed during the past week.**
- **The enhanced phase is centered in the Indian Ocean where convection has been very active. Dry conditions continued during the past week across much of the equatorial Pacific Ocean.**
- **Dynamical MJO forecast tools indicate renewed eastward propagation (at varying speeds) with the enhanced phase crossing into the Maritime continent during the period.**
- **Likely impacts associated with the MJO include wet conditions stretching from the eastern Indian Ocean across the Maritime continent during the period and an elevated risk of tropical cyclogenesis for the east-central Indian Ocean (week 1) and later the waters northwest of Australia (week 2).**



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

Note that shading denotes the magnitude of the anomalous wind vectors



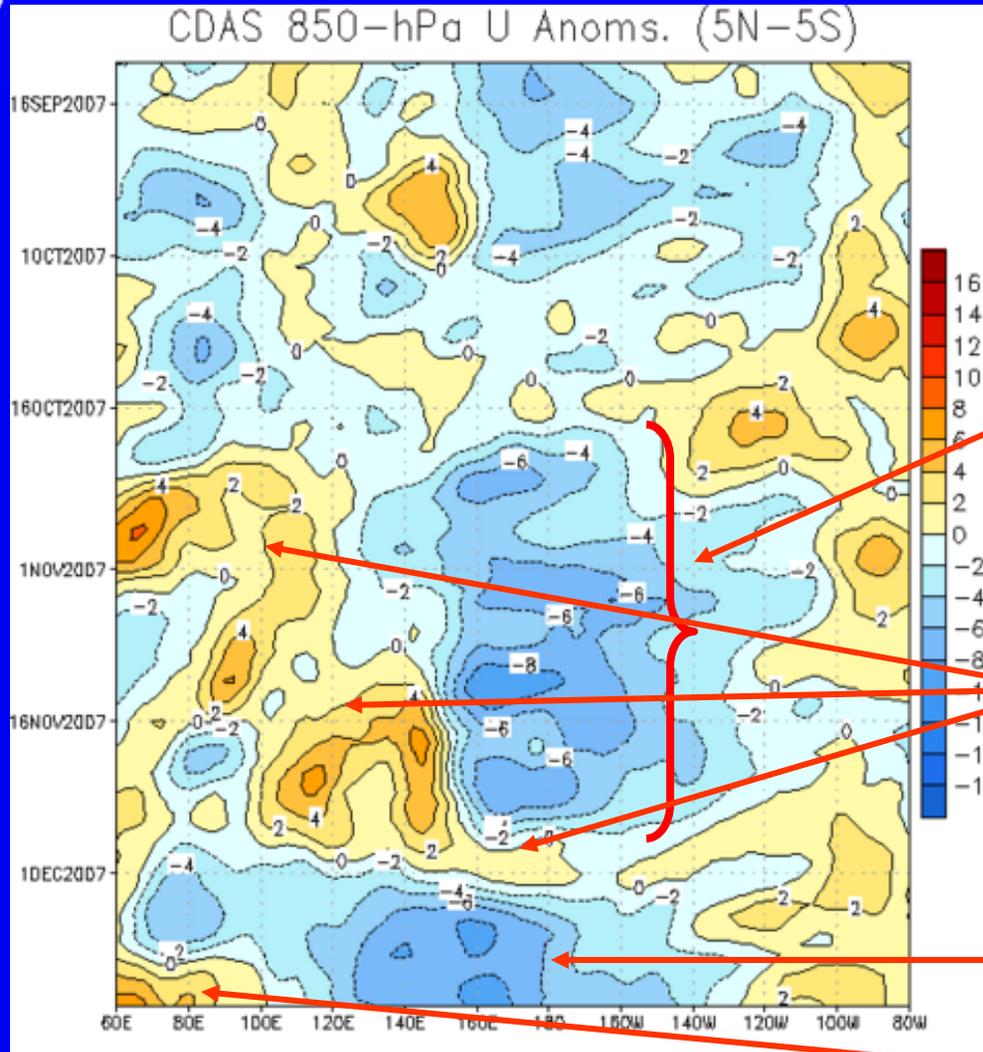
Easterly anomalies in the Indian Ocean have been replaced with westerly anomalies - mainly south of the equator.

Easterly anomalies have shifted east during the last five days and become focused across the western Pacific.



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

Time



Longitude

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

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

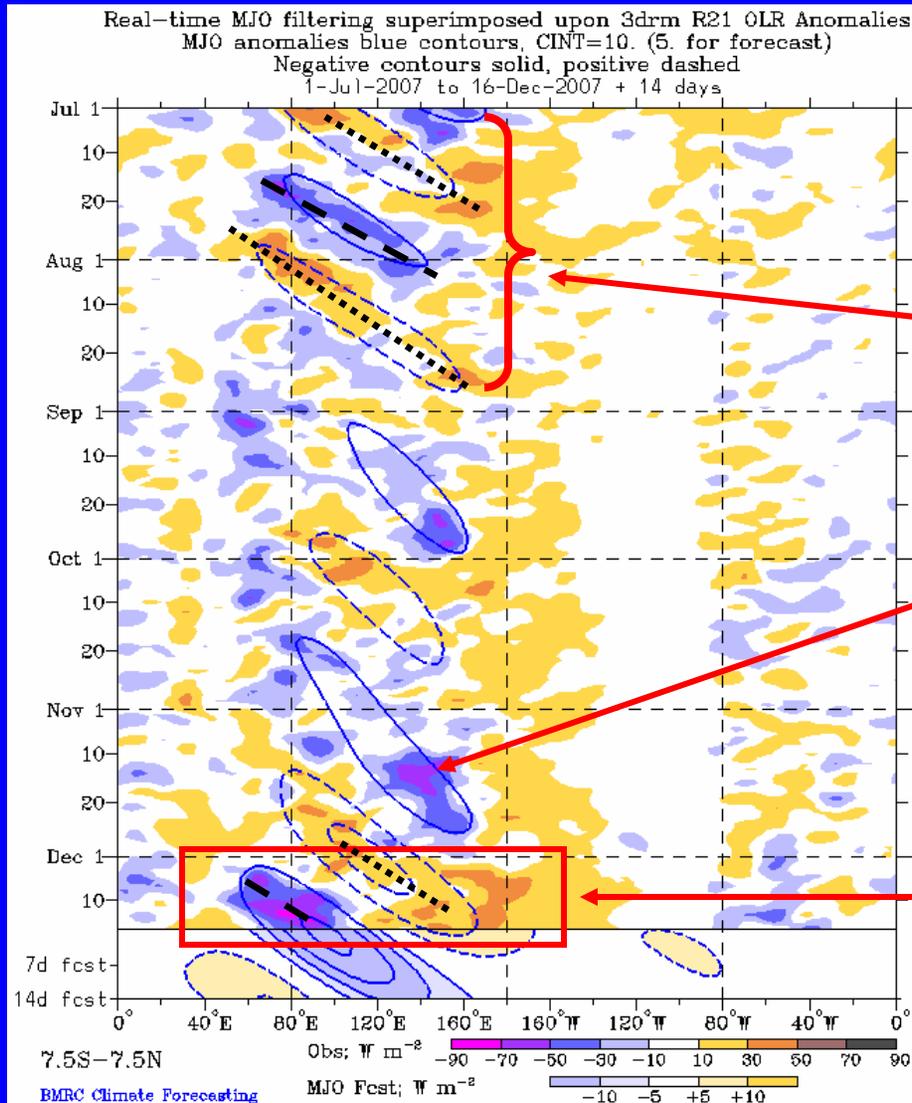
Strong easterlies were in place from mid-October through mid-November across much of the Pacific generally beginning near 160°E.

Beginning in late October, anomalous westerlies shifted eastward, first slowly, from the Indian Ocean to the Maritime continent and later quickly to the Date Line.

During early-mid December, easterly anomalies developed across the Indian Ocean and shifted eastwards. Westerly anomalies are once again evident in the Indian Ocean.



# 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)**

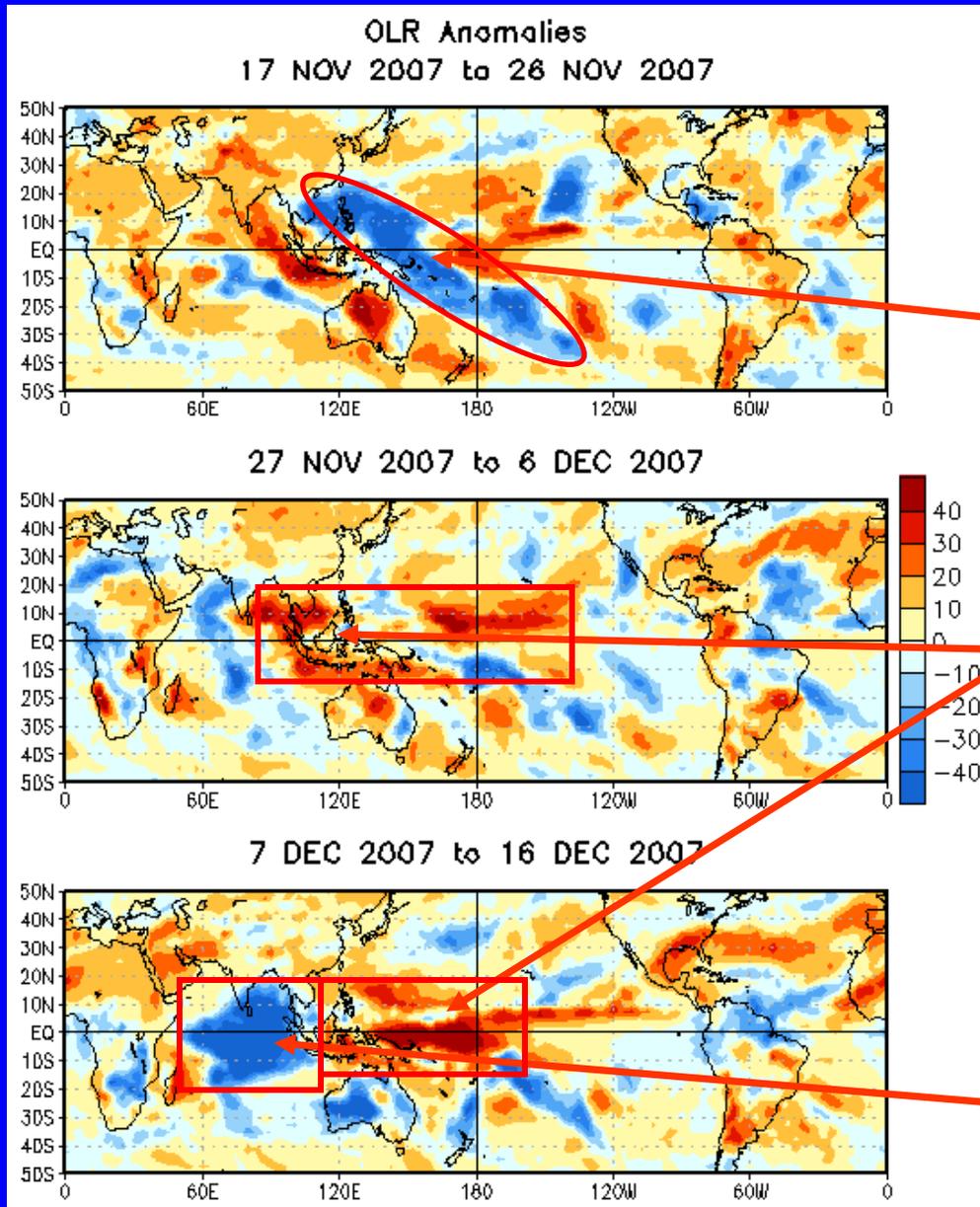
Beginning in mid May, weak-moderate MJO activity was observed as regions of suppressed and enhanced convection shifted eastward from the Indian Ocean into the far western Pacific.

Substantial enhanced convection developed across the eastern Maritime continent and far western Pacific Ocean during November but only shifted eastwards late in the month.

A couplet of strong enhanced and suppressed convection is clear during much of December. The area stretches from the Indian Ocean to the Date Line and has shown eastward movement during the period.



# OLR Anomalies: Last 30 days



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

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

**During mid-late November, enhanced convection stretched from the western Pacific Ocean to the South Pacific Convergence Zone (SPCZ) and began to shift eastwards as the MJO strengthened.**

**Mainly dry conditions prevailed across much of the Maritime continent and western Pacific Ocean during late November into early-mid December.**

**During early-mid December, very wet conditions again developed in the Indian Ocean as the MJO phase shifted eastwards.**

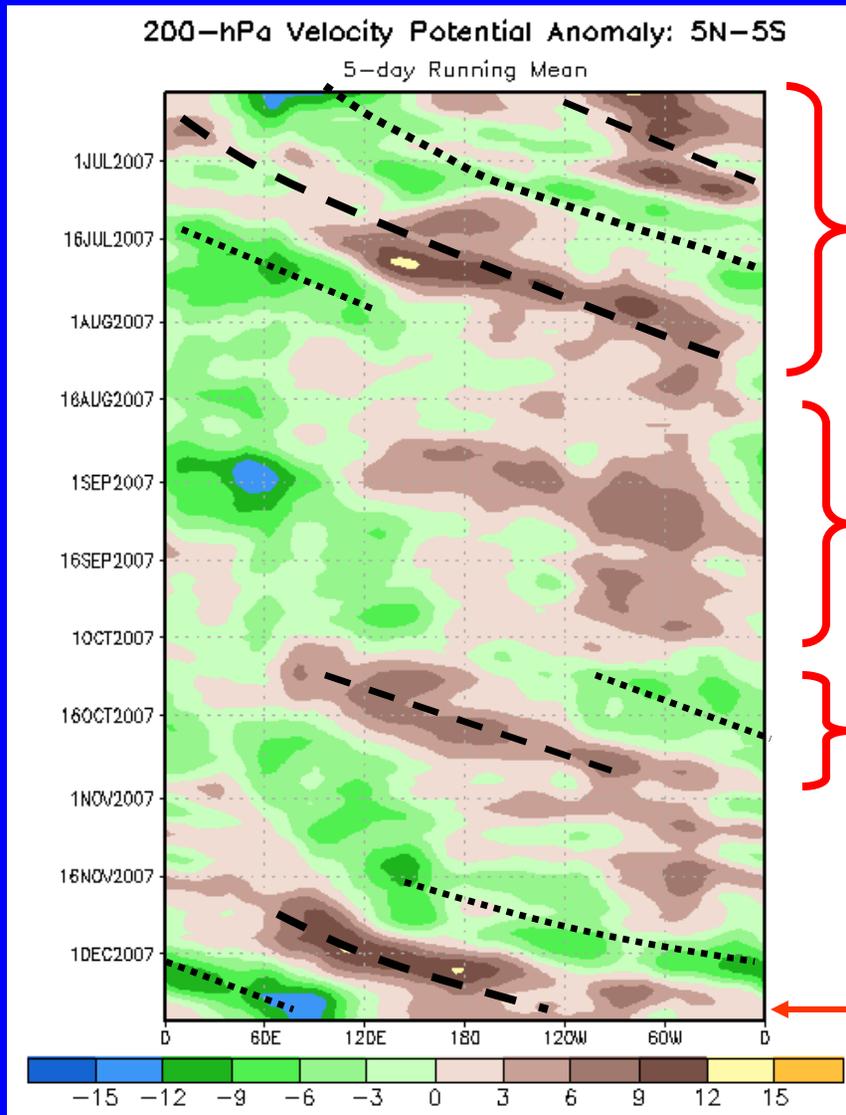


# 200-hPa Velocity Potential Anomalies (5°S-5°N)

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

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

Time



From mid-May into 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 and continues.

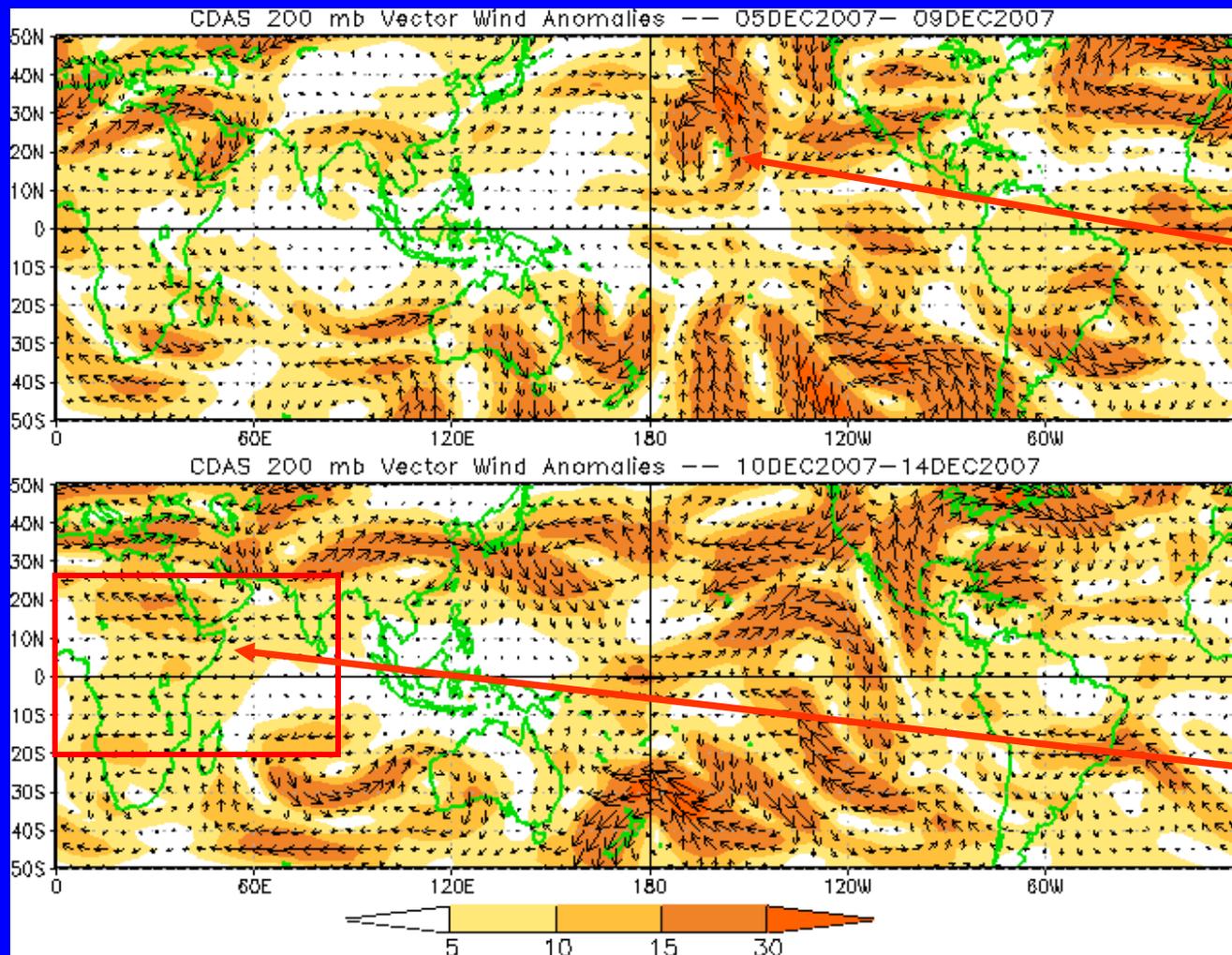


# 200-hPa Vector Wind Anomalies ( $\text{m s}^{-1}$ )

Note that shading denotes the magnitude of the anomalous wind vectors

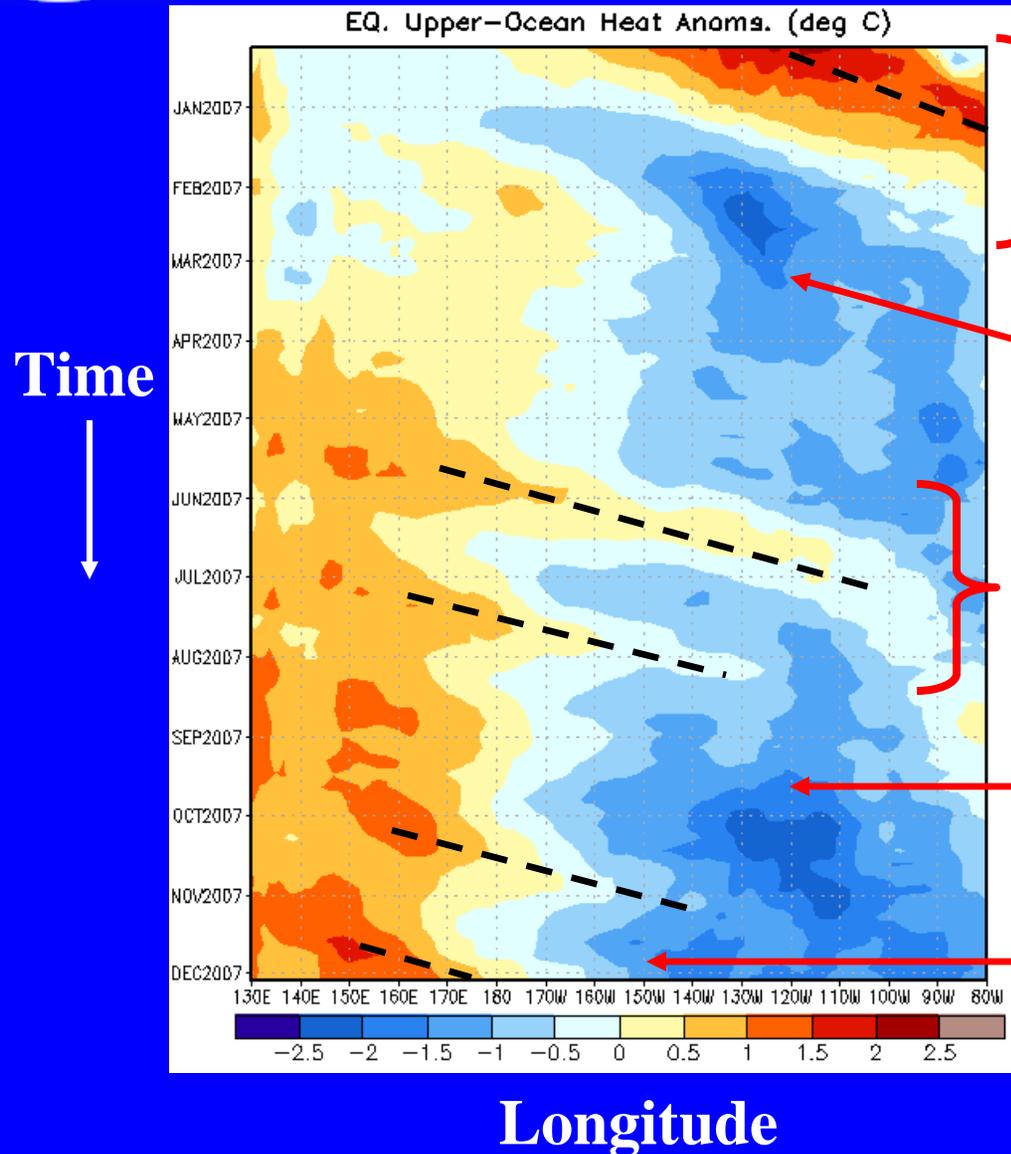
A strong cyclonic circulation was present near Hawaii during parts of early December.

Easterly anomalies have shifted eastward to the Atlantic Ocean and Africa during the last five days.





# Weekly Heat Content Evolution in the Equatorial Pacific



During late 2006, an eastward-propagating Kelvin wave (warm phase indicated by the dashed line) caused considerable positive anomalies in the upper-ocean heat content.

Beginning in February, negative heat content anomalies developed prevailed across the eastern equatorial Pacific.

Weak Kelvin wave activity was observed from May into August and affected the sub-surface temperature departures.

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

Most recently, negative heat content anomalies have decreased slightly near and just east of the Date Line in association with the most recent Kelvin wave.



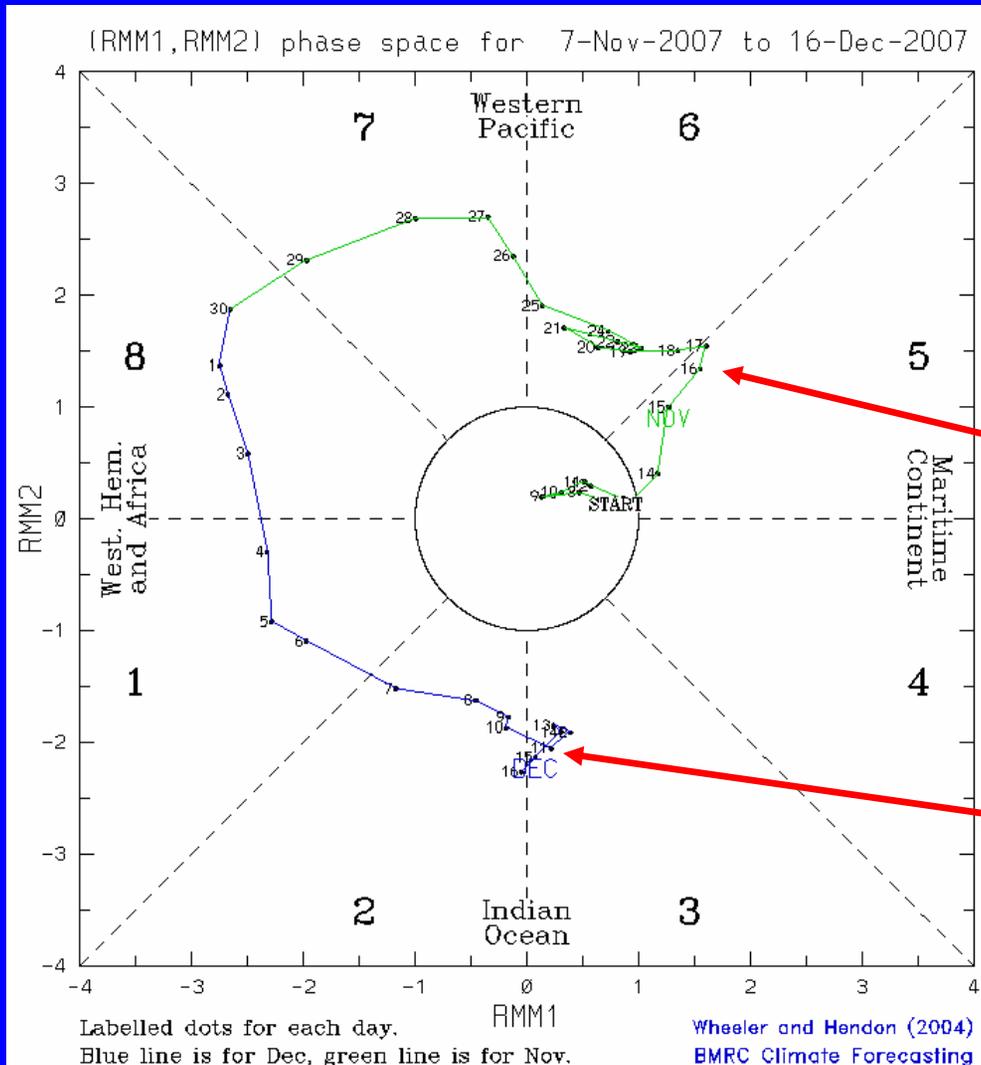
# MJO Index

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.

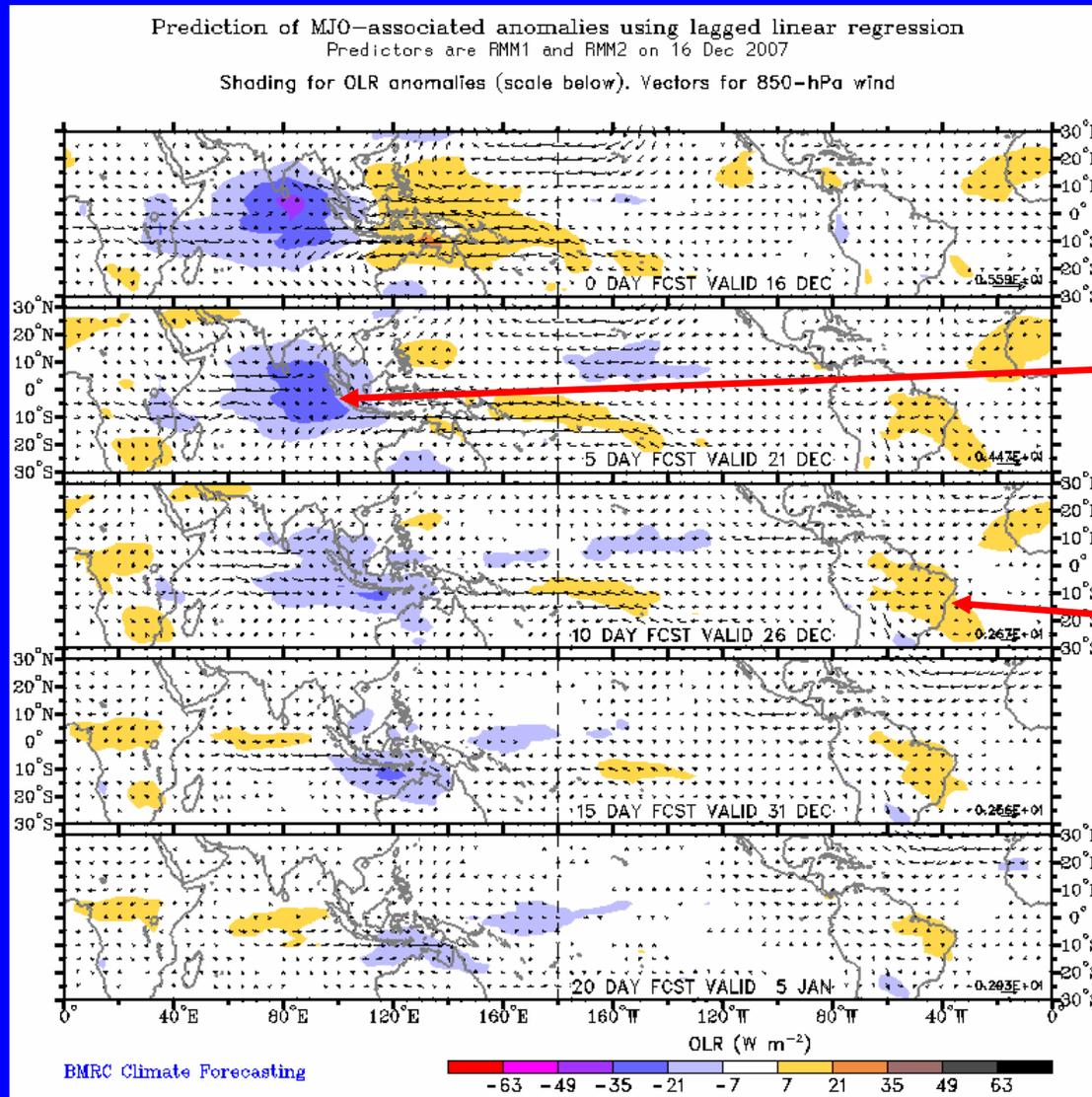
The MJO index increased in amplitude during mid-late November and has propagated rapidly eastward.

During recent days, the eastward movement has slowed with the enhanced phase now centered in the Indian Ocean.





# Statistical MJO OLR Forecast



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

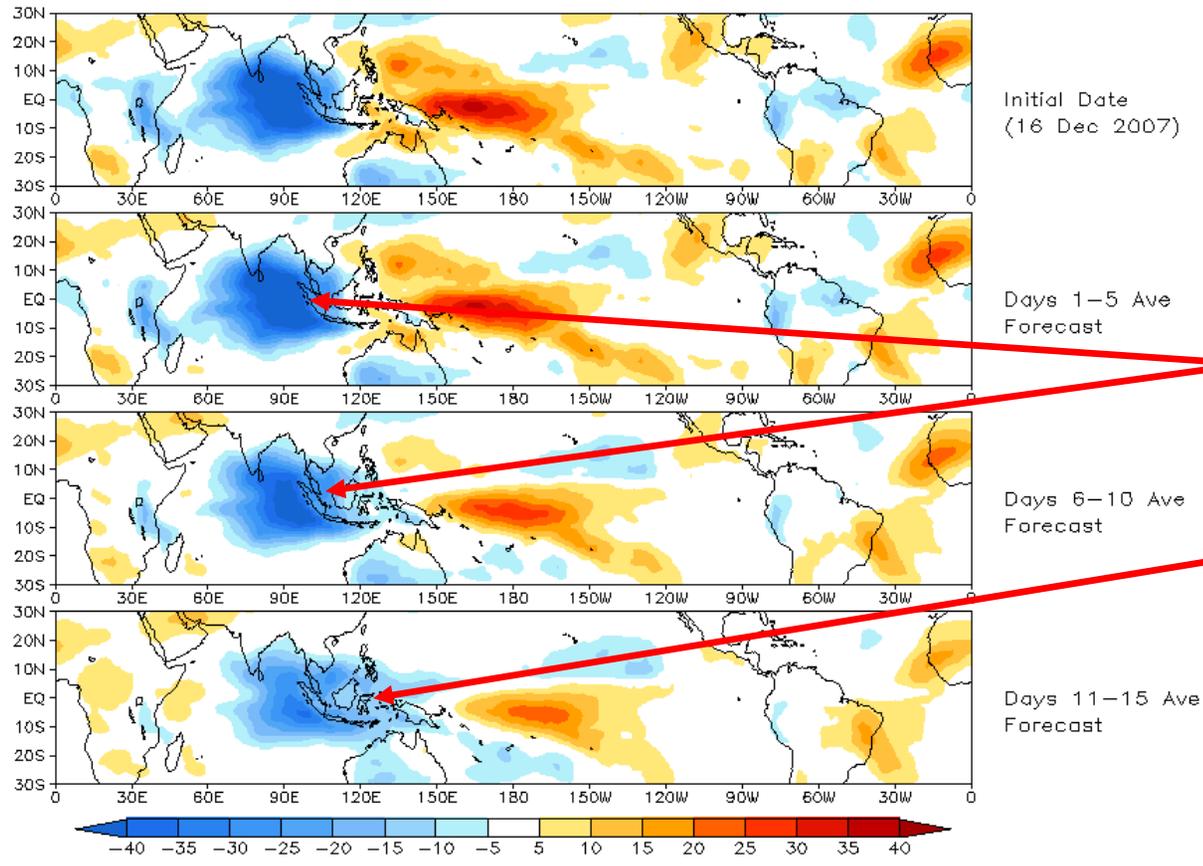
Wet conditions are forecast for the eastern Indian Ocean and Maritime continent during the period.

Dry conditions are expected across sections of South America and Africa.



# Experimental GFS MJO OLR Forecast

Prediction of MJO-related anomalies using GEFS operational forecast  
Initial date: 16 Dec 2007  
OLR



The GFS forecasts a moderate-strong MJO signal but little eastward propagation during the next 1-2 weeks.

Wet conditions are expected for the Indian Ocean and western Maritime continent throughout much of the period.

Only later in week 2 does enhanced convection shift slightly eastward.

Suppressed convection is forecast for the western Pacific Ocean during much of the period.