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

Update prepared by
Climate Prediction Center / NCEP
October 8, 2007

Outline

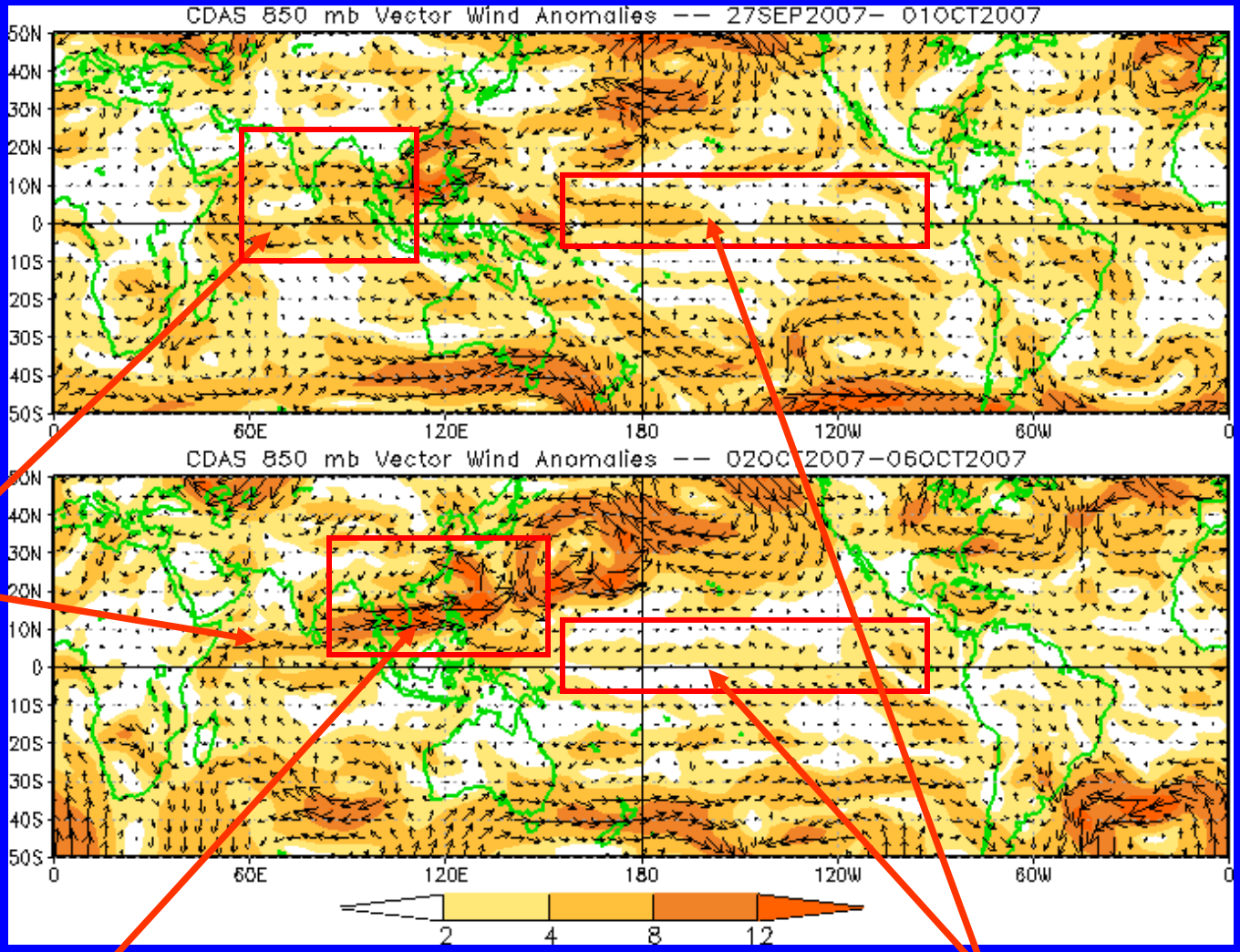
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- The latest observations continue to indicate an incoherent MJO.
- Enhanced tropical convection continues north of the equator in the eastern hemisphere much of it associated with tropical cyclone activity. In recent days, however, enhanced convection has returned to the equatorial Indian Ocean.
- Pronounced dry conditions have expanded to include much of the eastern Indian Ocean, Maritime continent, and much of the western Pacific.
- Based on the latest monitoring and forecast tools, weak MJO activity is expected during the next 1-2 weeks.

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

Note that shading denotes the magnitude of the anomalous wind vectors

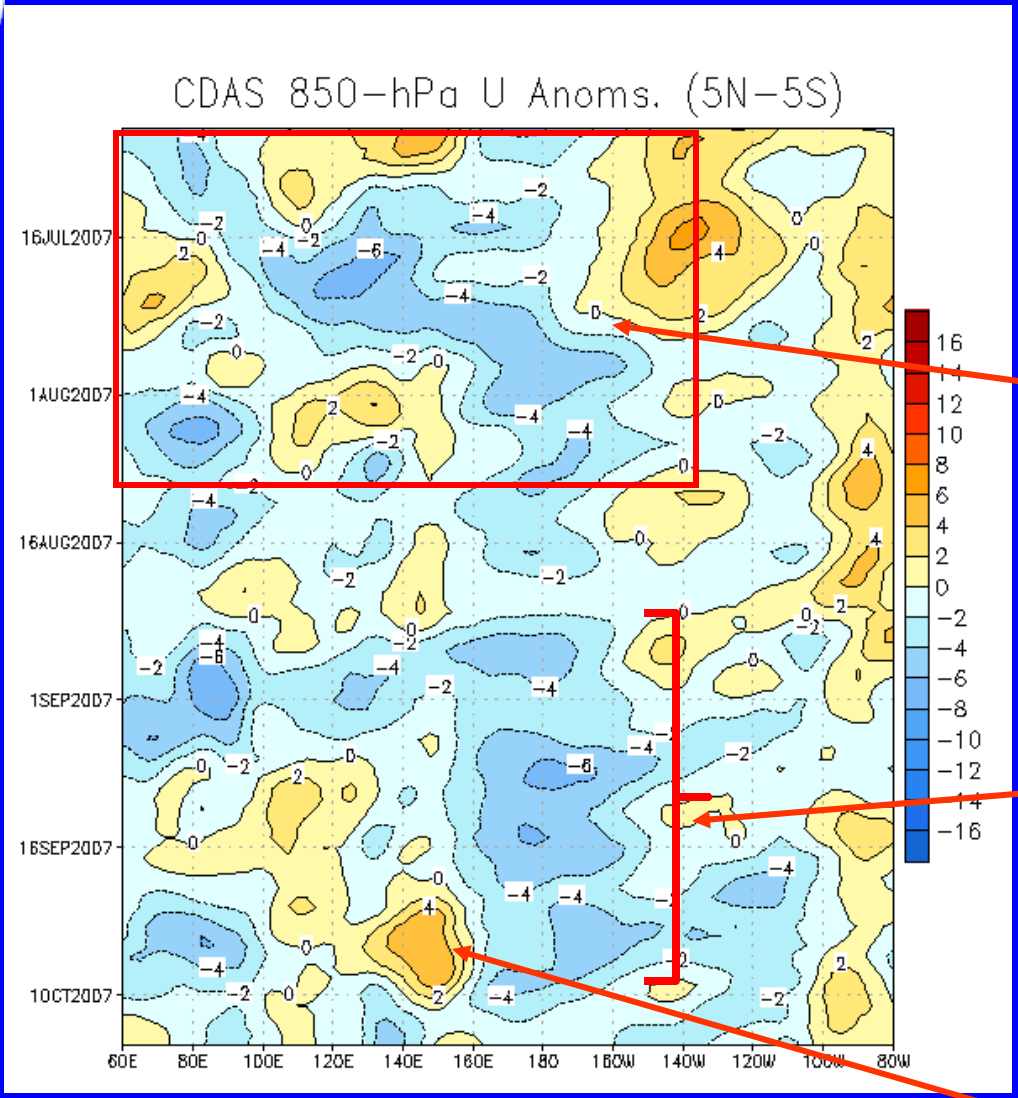


An enhanced monsoon circulation across the Indian Ocean and India has weakened.

Large westerly anomalies are mainly associated with tropical cyclone activity in the South China Sea and far western Pacific.

Easterly anomalies across the equatorial Pacific Ocean have lessened during the past five days.

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



Time

Longitude

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

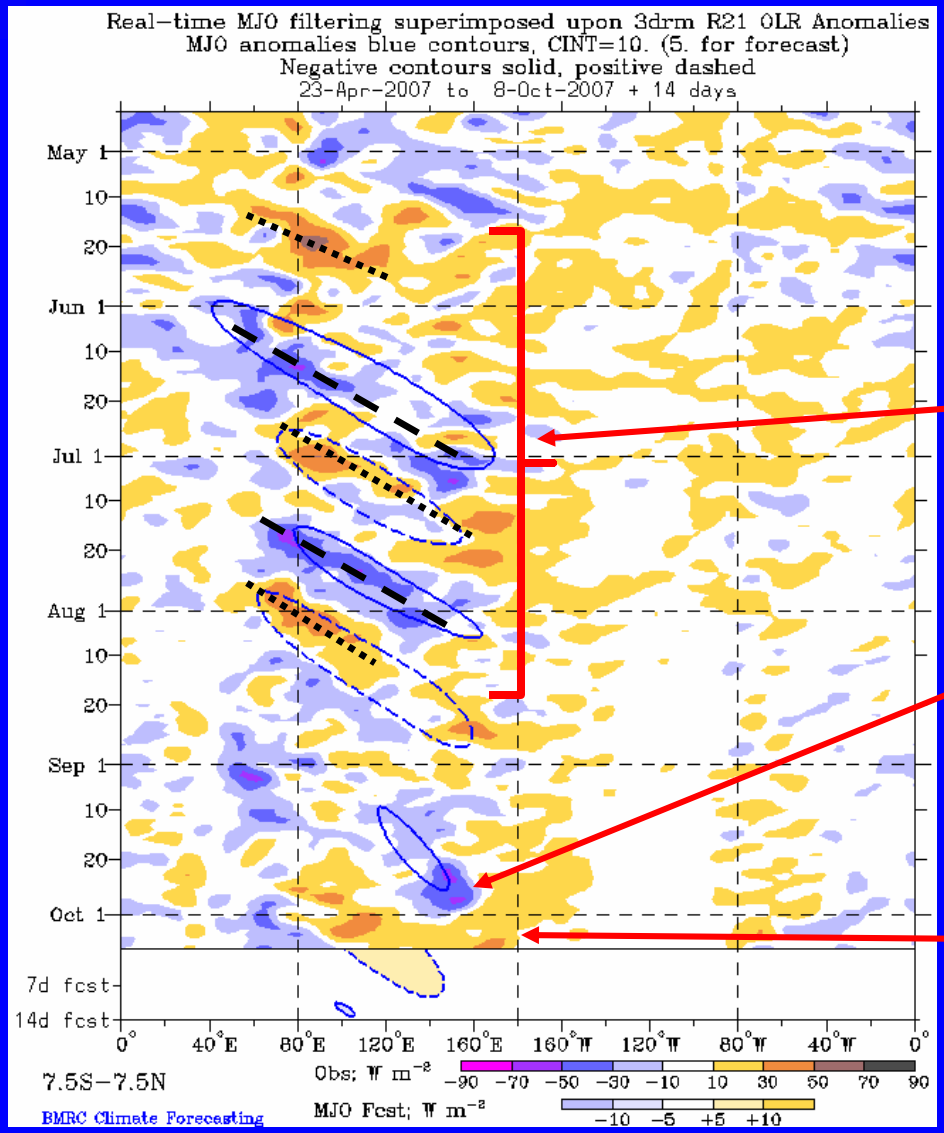
Easterly anomalies (blue shading) represent anomalous east-to-west flow.

Coherent subseasonal variability, much of it related to the MJO, was observed from June into early August. Alternating periods of westerly and easterly anomalies propagated across the Maritime continent to the western Pacific Ocean.

From late August to early October, the easterlies were strong and anchored near the Date line.

Westerly anomalies increased across the western Pacific during late September in response to very active convection and tropical cyclone activity.

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



Time

Longitude

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

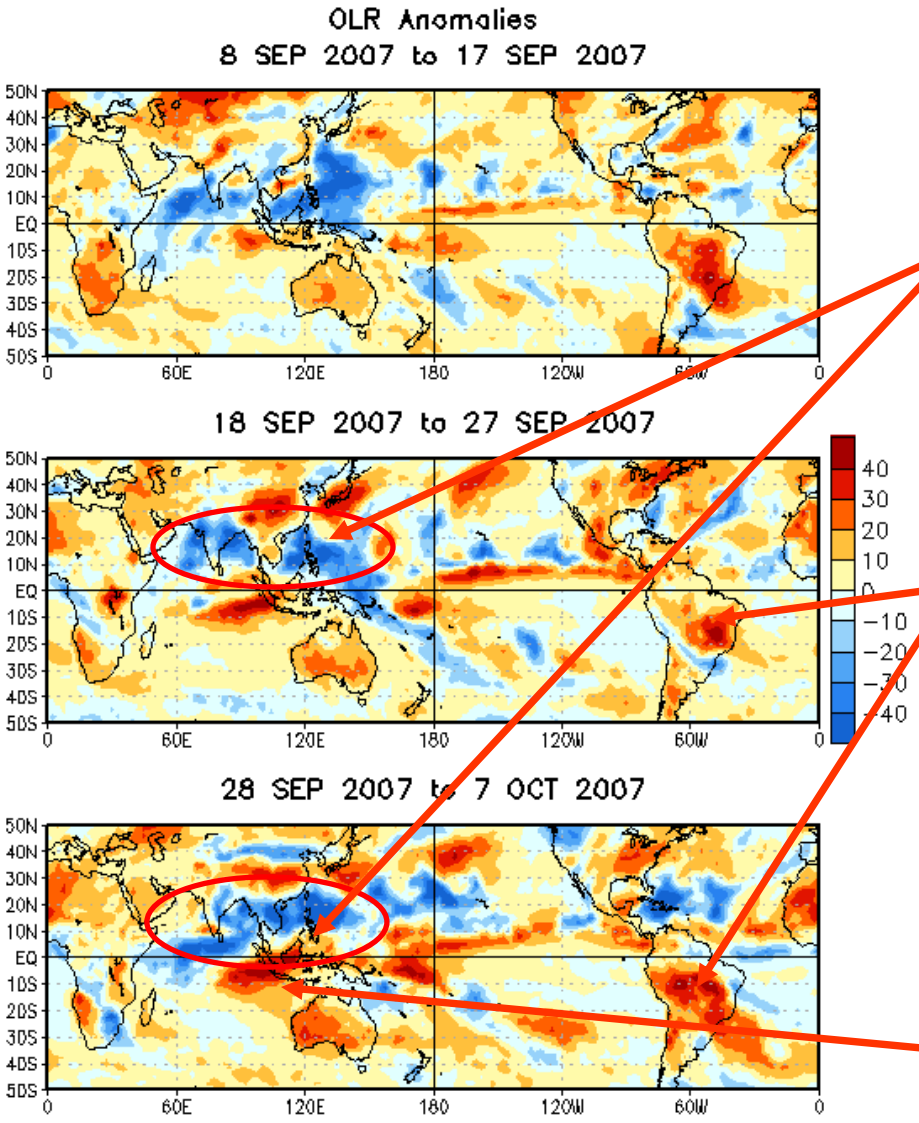
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

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.

Convection increased markedly across sections of the western Pacific Ocean during late September.

Most recently suppressed convection has prevailed across much of equatorial region from the Indian Ocean to the Date Line.

OLR Anomalies: Last 30 days



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

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

During the second half of September, enhanced convection became widespread across much of South Asia and the western Pacific Ocean.

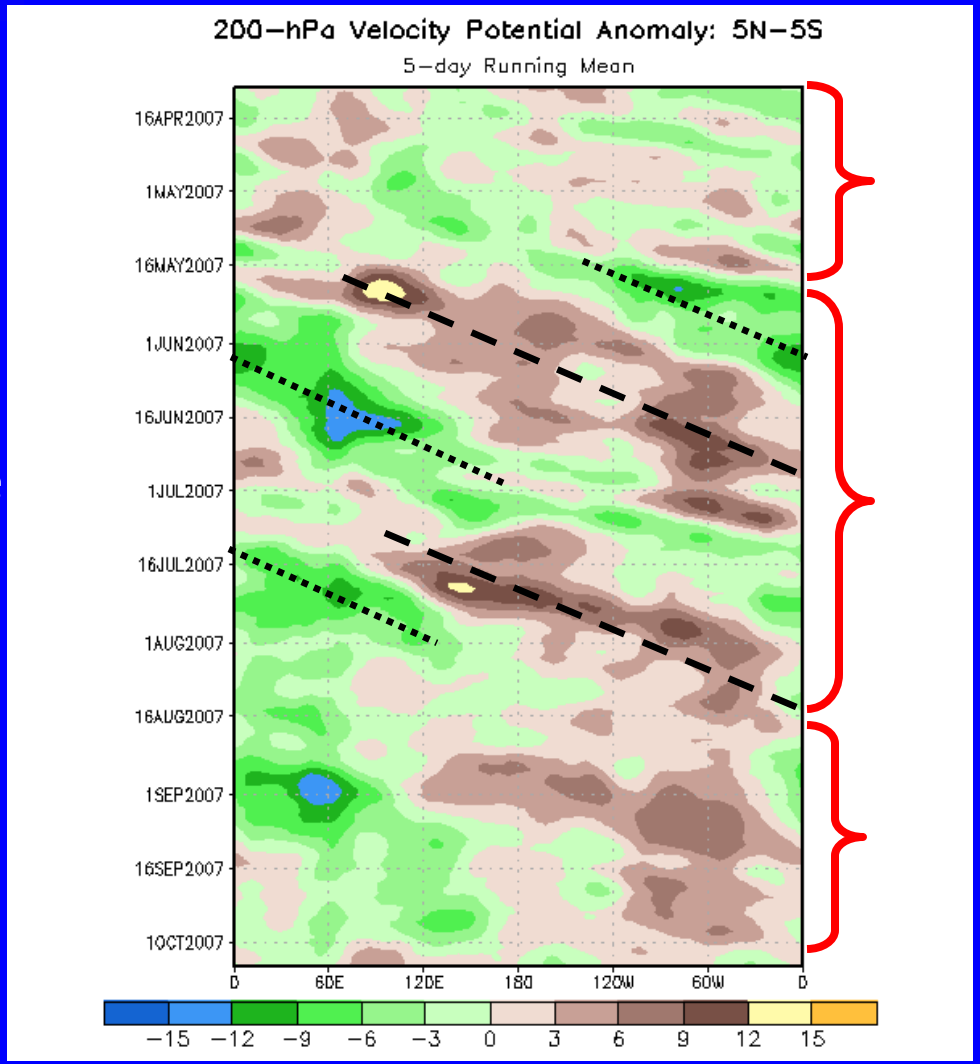
A delayed onset of the rainy season across South America has created very dry conditions across interior Brazil.

In late September, dry conditions became evident across sections of the eastern Indian Ocean and Maritime continent as the seasonal shift southward in convection has been delayed to date.

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

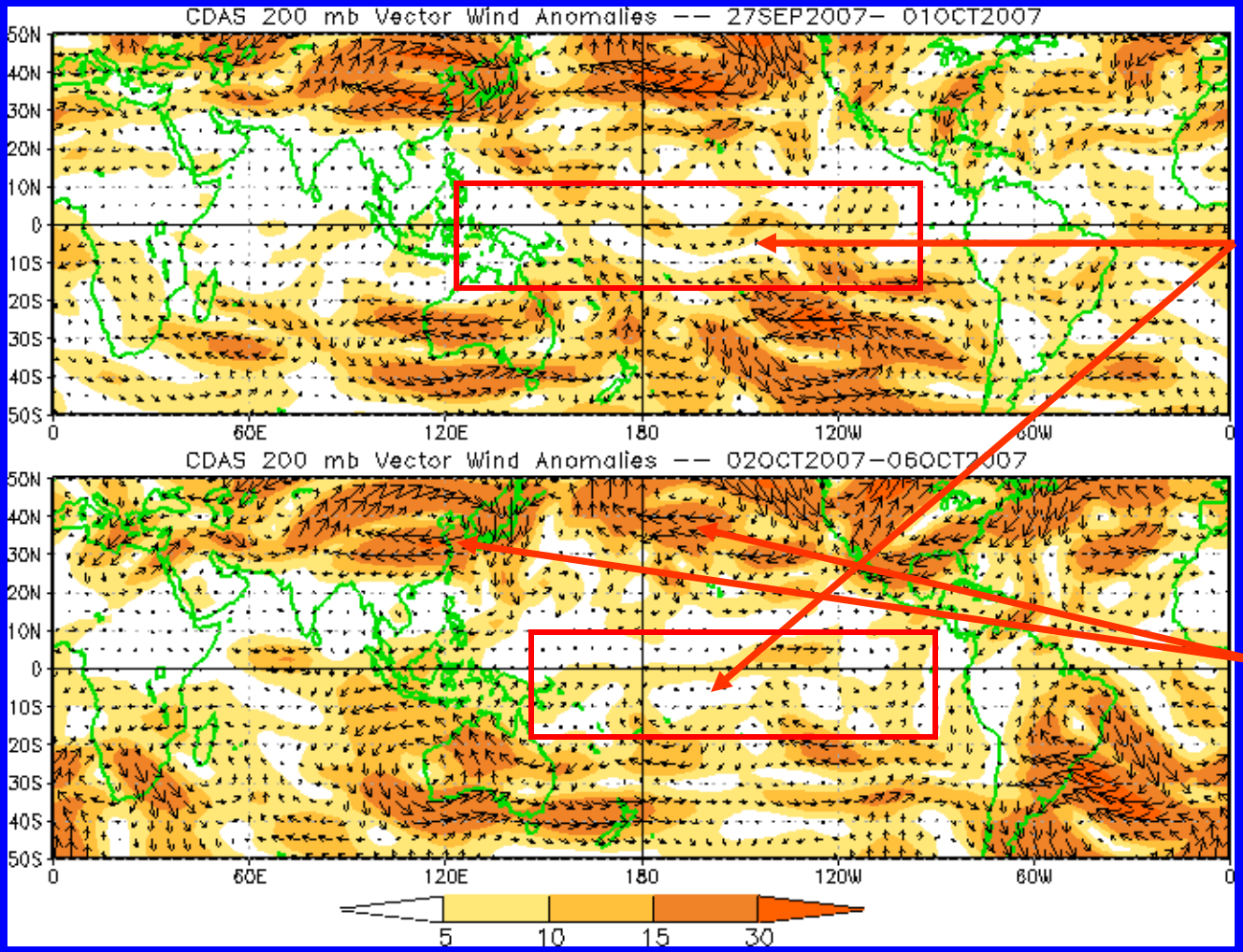
Longitude

The MJO was weak or incoherent from mid-March to mid-May.

From mid-May into early August, weak to moderate MJO activity was observed as velocity potential anomalies increased and propagated eastwards.

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

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

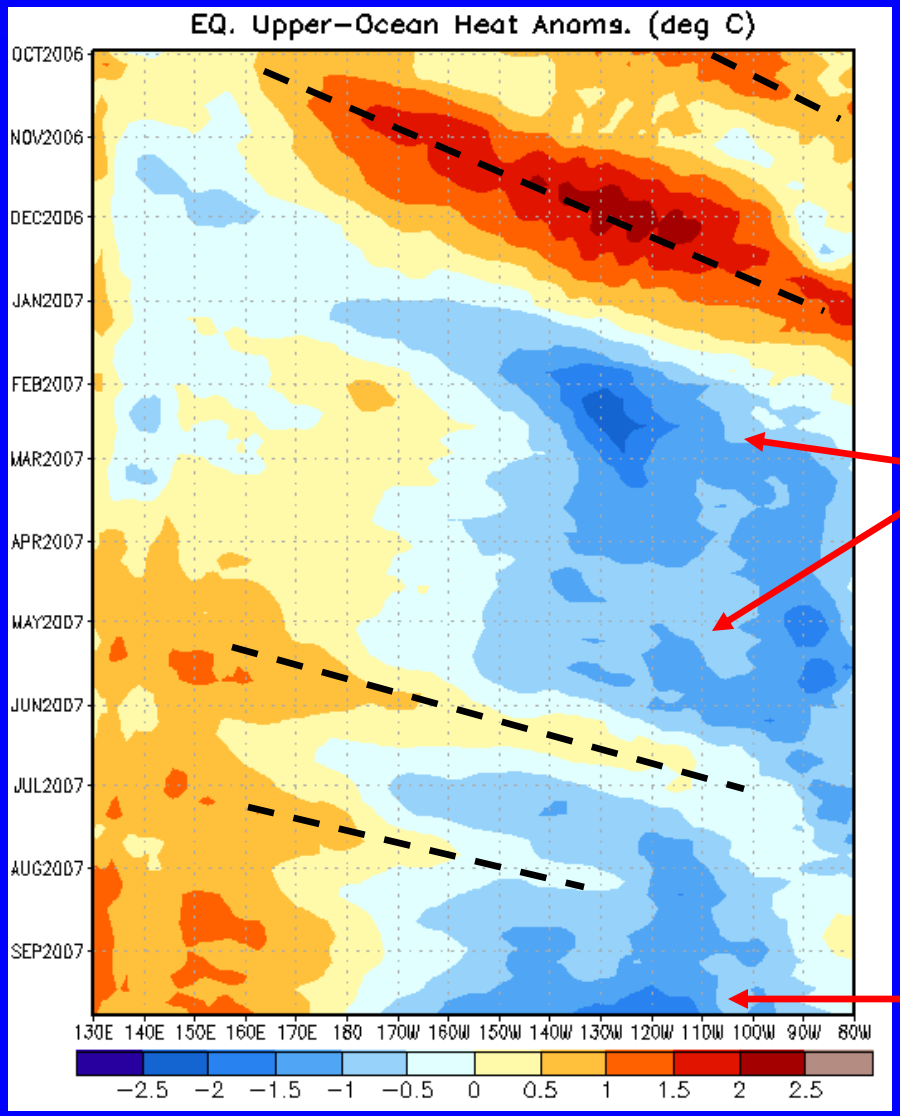


Note that shading denotes the magnitude of the anomalous wind vectors

Westerly anomalies along and near the equator have remained small.

Anomalous anticyclones persist across the northern hemisphere mid-latitudes.

Weekly Heat Content Evolution in the Equatorial Pacific



Time

Longitude

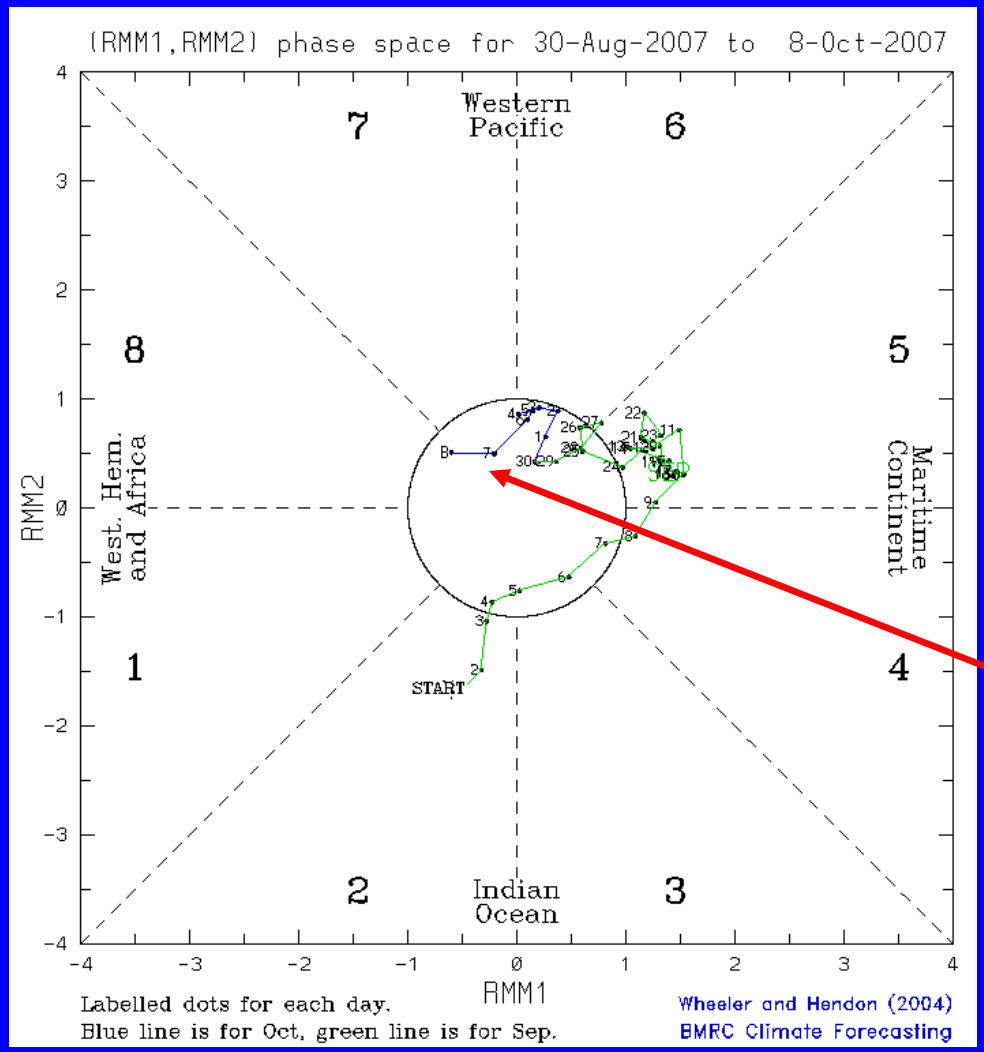
During late 2006, eastward-propagating Kelvin waves (warm phases indicated by dashed lines) caused considerable month-to-month variability in the upper-ocean heat content.

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

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

Most recently, below average heat content anomalies have increased across much of the central and eastern Pacific Ocean.

MJO Index



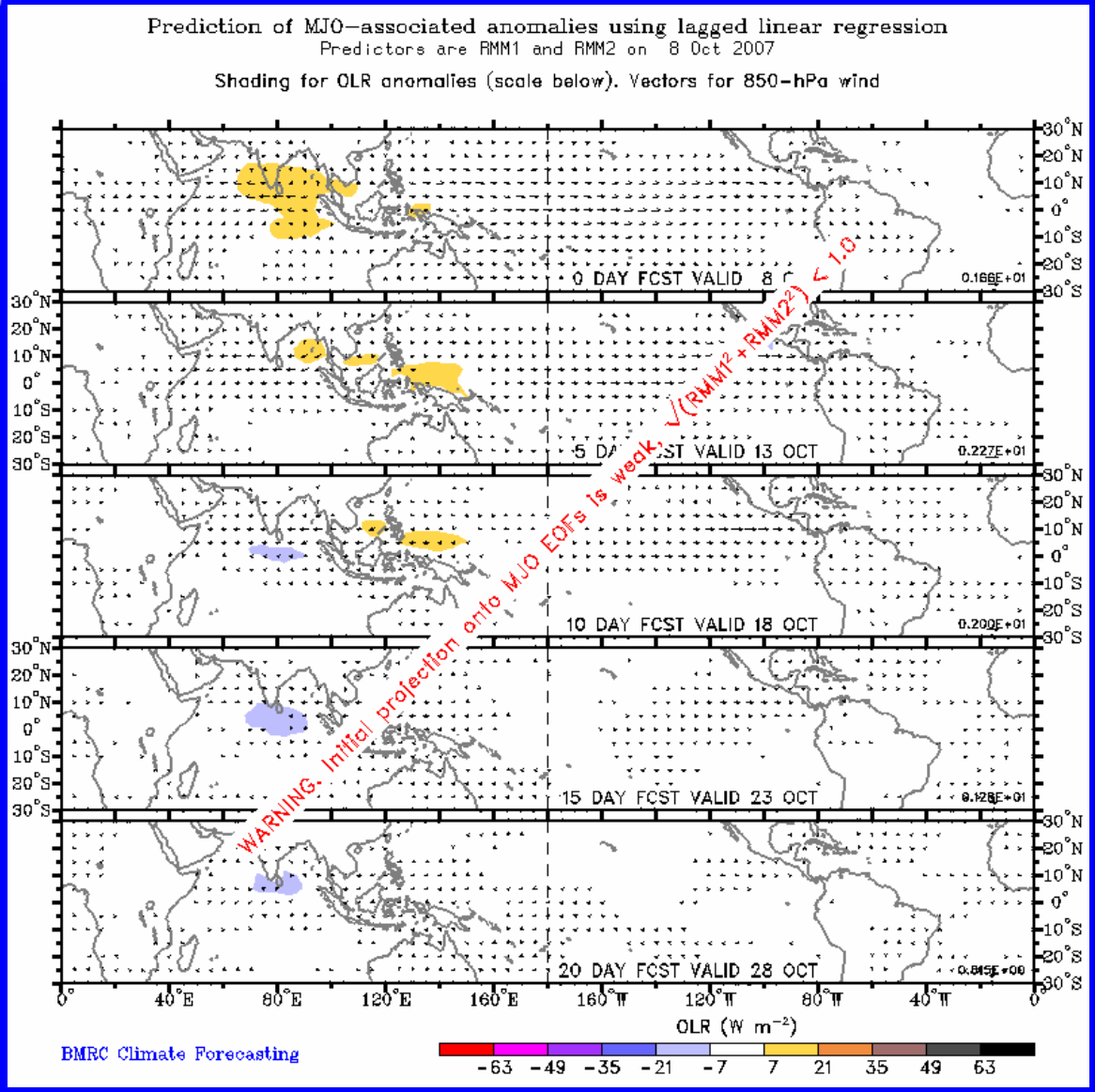
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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 has shown only a gradual and minor shift eastward since mid-September. The amplitude has remained generally small.

Taken together, they indicate incoherent MJO activity.

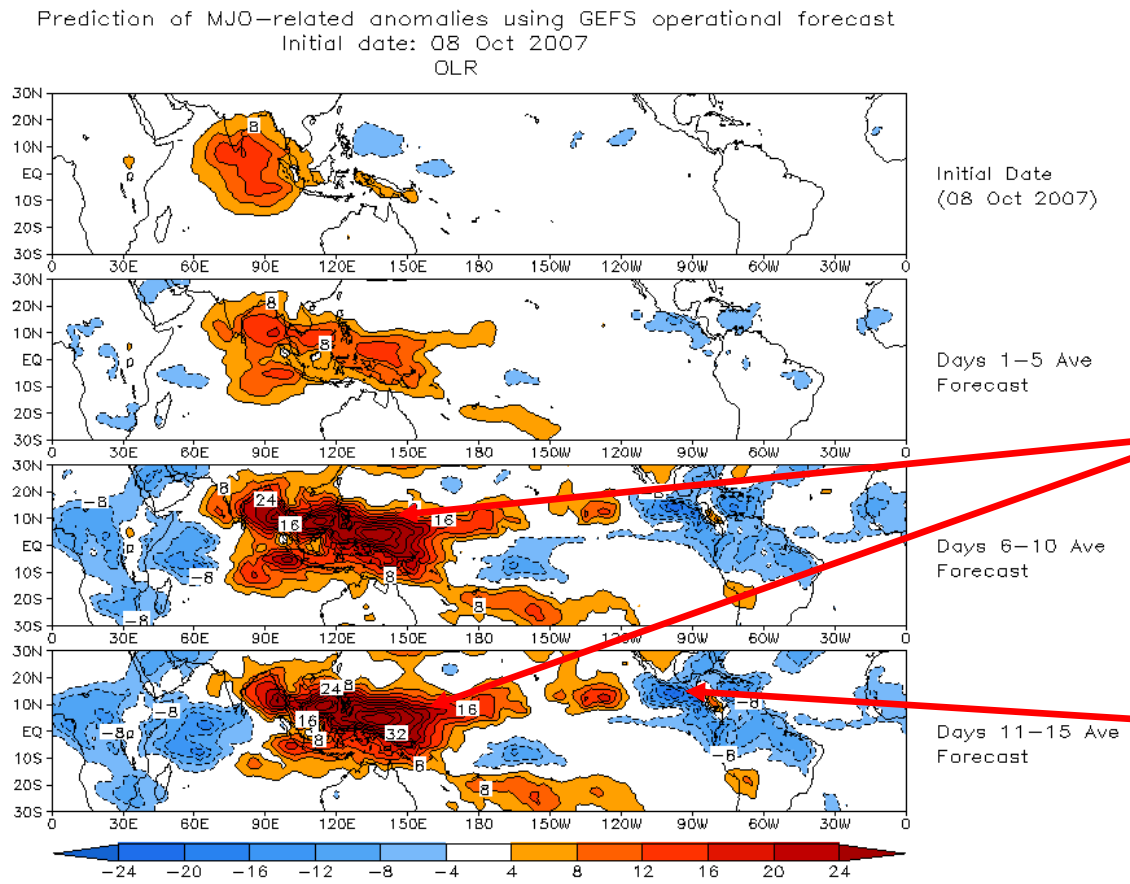
Statistical MJO OLR Forecast



The statistical method forecasts generally weak MJO activity during the upcoming ten day period.

Dry conditions are expected across mainly the Maritime Continent and the far western Pacific.

Experimental GFS MJO OLR Forecast



The GFS forecasts a more robust MJO signal during the period especially during week 2 with the enhanced phase across the western hemisphere.

Dry conditions are expected throughout the period across the Maritime continent and west Pacific.

Wet conditions are anticipated across sections of the eastern Pacific Ocean and Caribbean Sea throughout much of the period.