



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

**Update prepared by
Climate Prediction Center / NCEP
October 1, 2007**



Outline

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



Overview

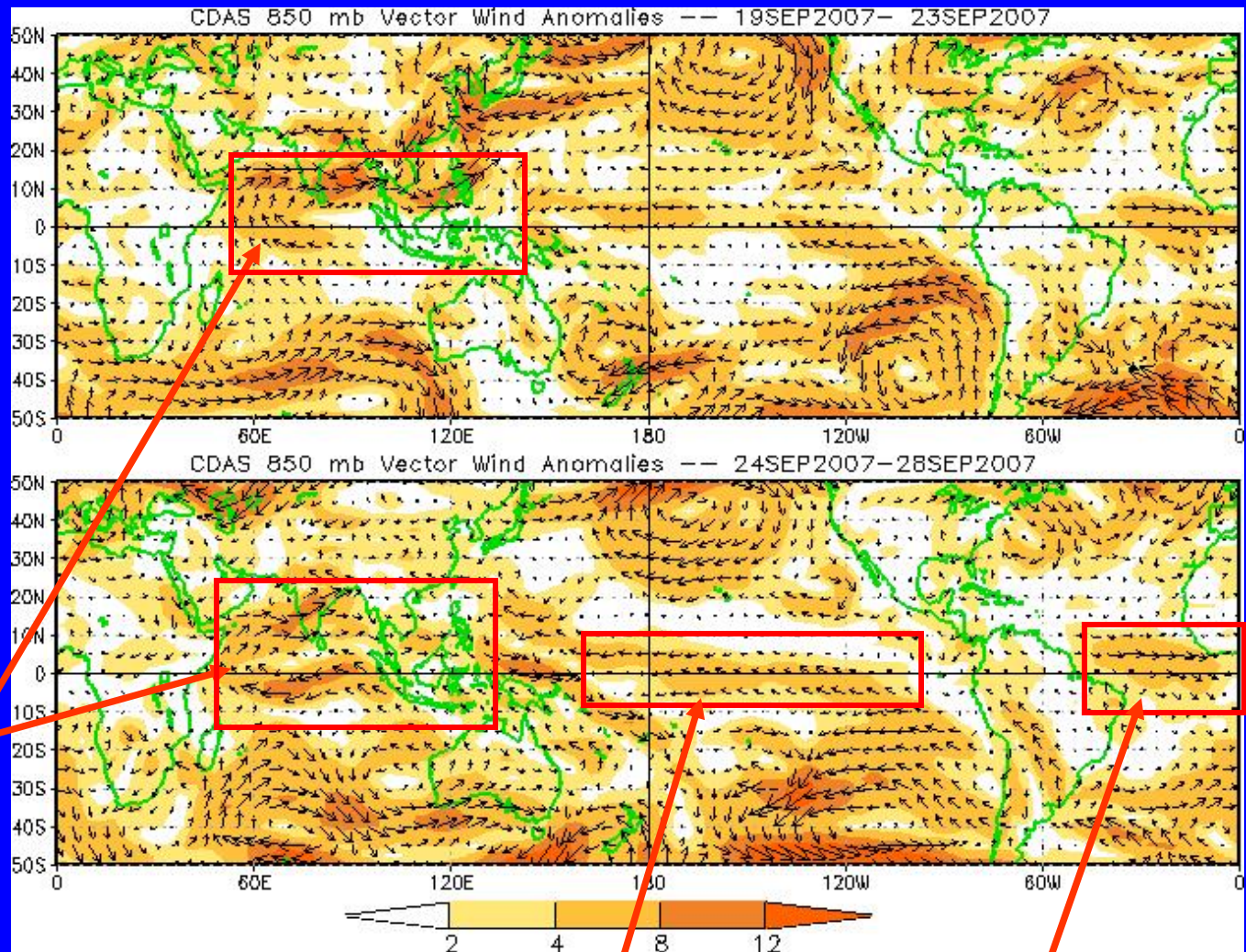
- **The latest observations continue to indicate an incoherent MJO.**
- **Tropical convection remained enhanced from a region stretching from India across Southeast Asia to the western Pacific Ocean – mainly north of the equator.**
- **Dry conditions have been evident across sections of the eastern Indian Ocean and western Maritime continent south of the equator.**
- **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 continues across the eastern hemisphere. Anomalies have increased across the eastern sections of the Indian Ocean.



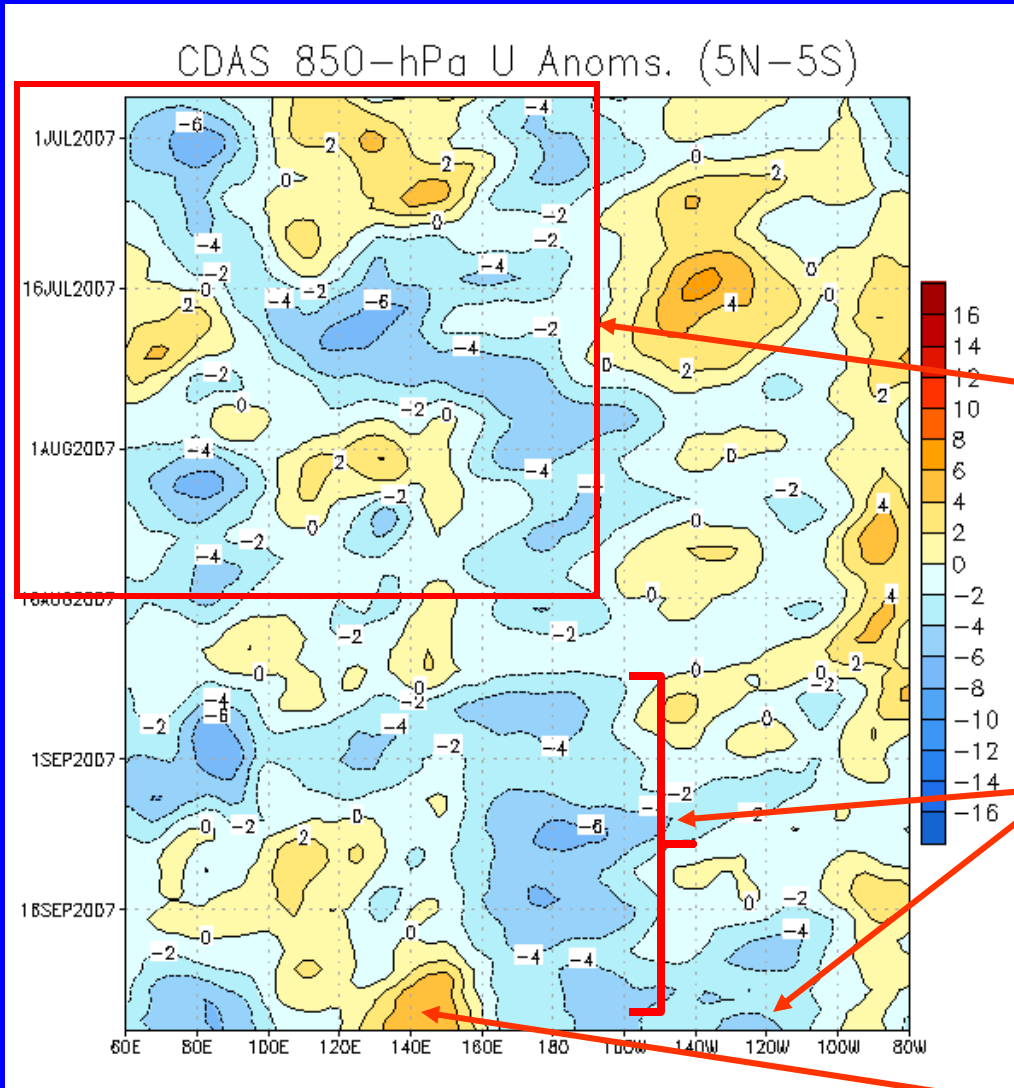
Easterly anomalies extend across much of the equatorial Pacific Ocean.

Weaker than average trade winds continue across the equatorial Atlantic Ocean.



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.

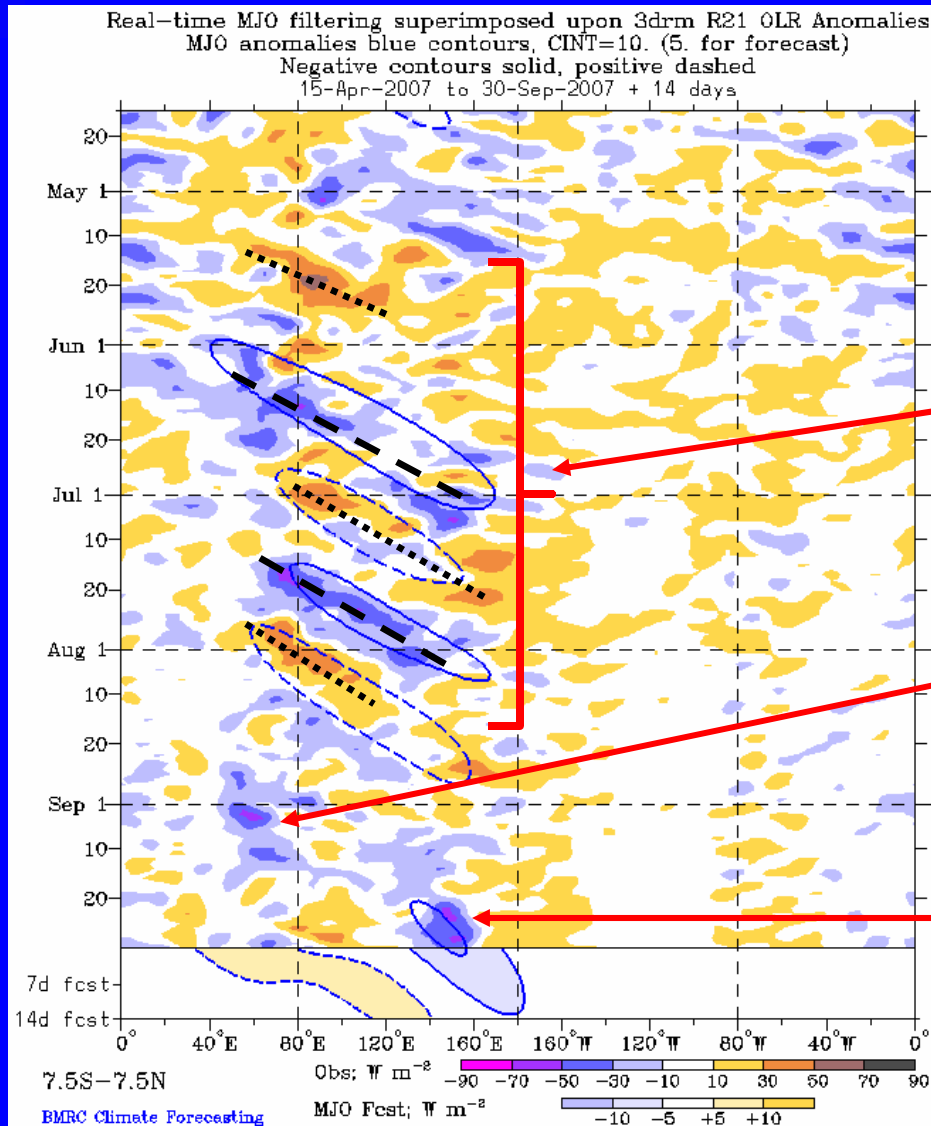
Coherent subseasonal variability, much of it related to the MJO, was observed from June into early August. Alternating periods of westerly and easterly anomalies propagated across the Maritime continent to the western Pacific Ocean.

Since late August, easterly anomalies have increased and become more stationary near the Date line. Most recently, easterly anomalies have extended eastwards.

Westerly anomalies have increased across the western Pacific and eastern Maritime continent in response to very active convection.



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)

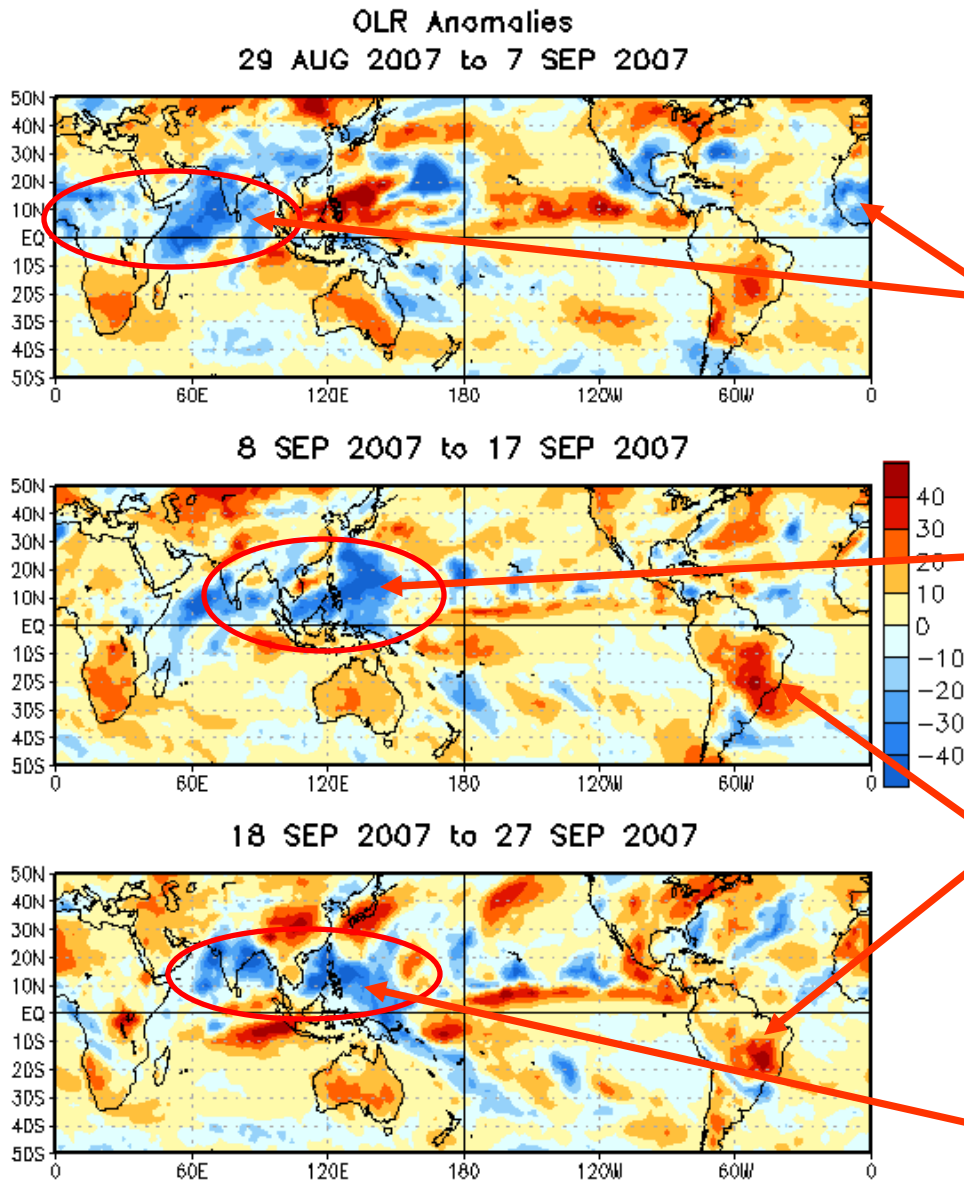
Beginning in mid May, weak-moderate MJO activity was observed as regions of suppressed and enhanced convection shifted eastward from the Indian Ocean into the far western Pacific.

Convection increased markedly across sections of Africa and the Indian Ocean in early September.

Most recently enhanced convection has persisted across the western Pacific Ocean.



OLR Anomalies: Last 30 days



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

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

Enhanced convection was evident across much of Africa, the Arabian Sea, and the Indian Ocean during late August into early September.

A large change occurred across the western Pacific Ocean between late August and mid-September as dry conditions transitioned quickly to wet conditions.

A delayed onset of the South American monsoon has created very dry conditions across interior Brazil.

The ITCZ has been displaced northwards across the eastern Pacific Ocean during mid-late September while wet conditions shifted slightly northwards across the eastern hemisphere.

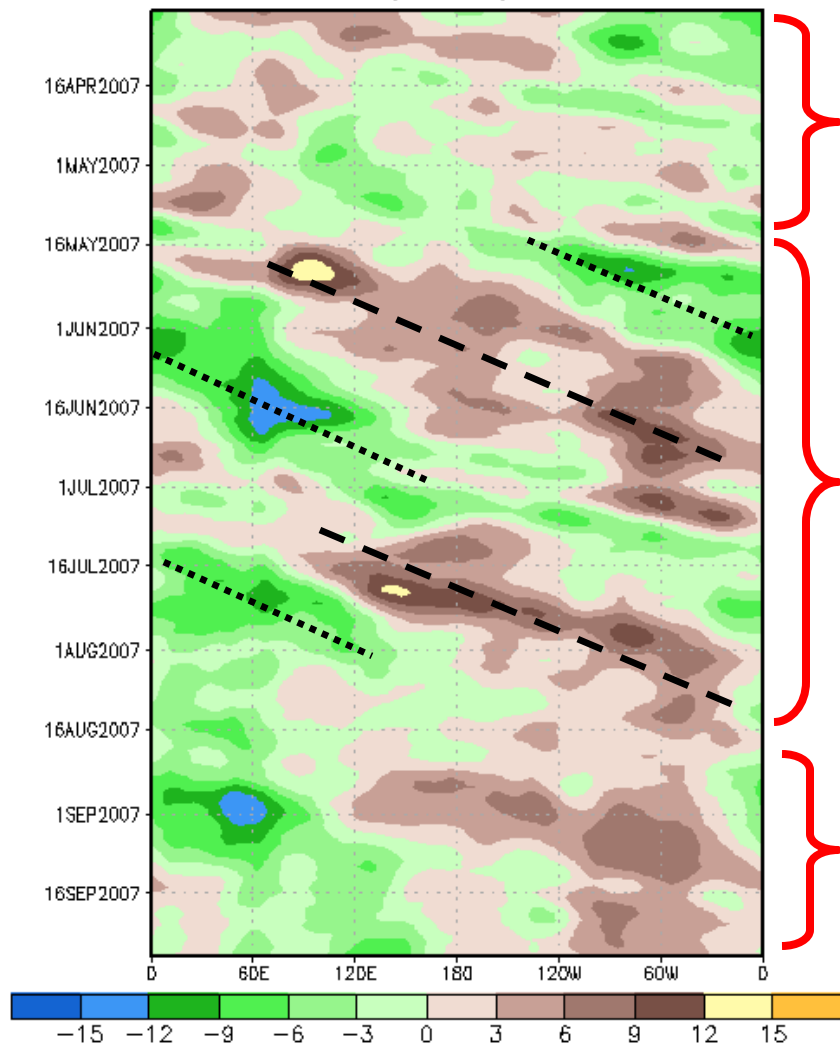


200-hPa Velocity Potential Anomalies (5°S-5°N)

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



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

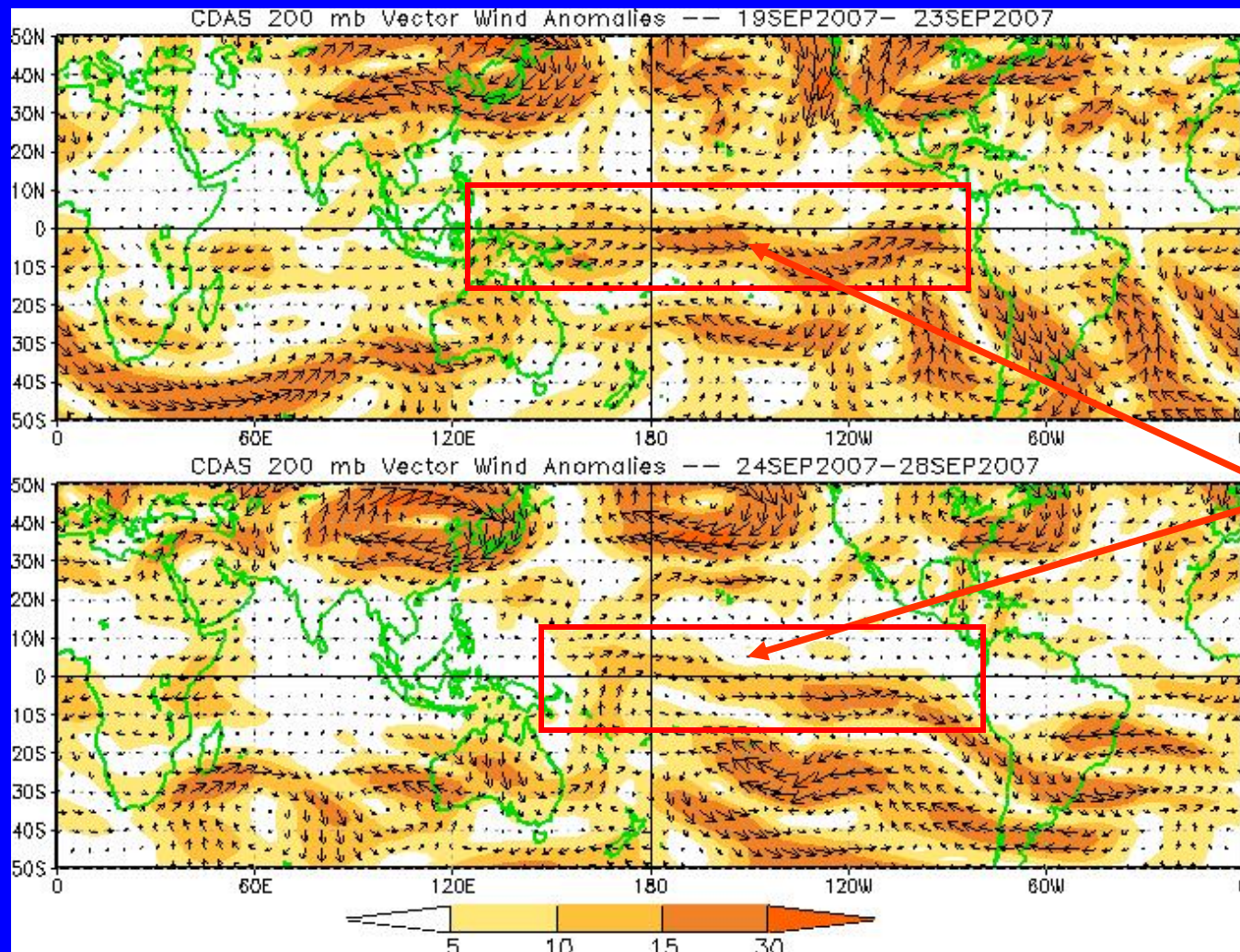
From mid-May into early August, weak to moderate MJO activity was observed as velocity potential anomalies increased and propagated eastwards.

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

Longitude



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



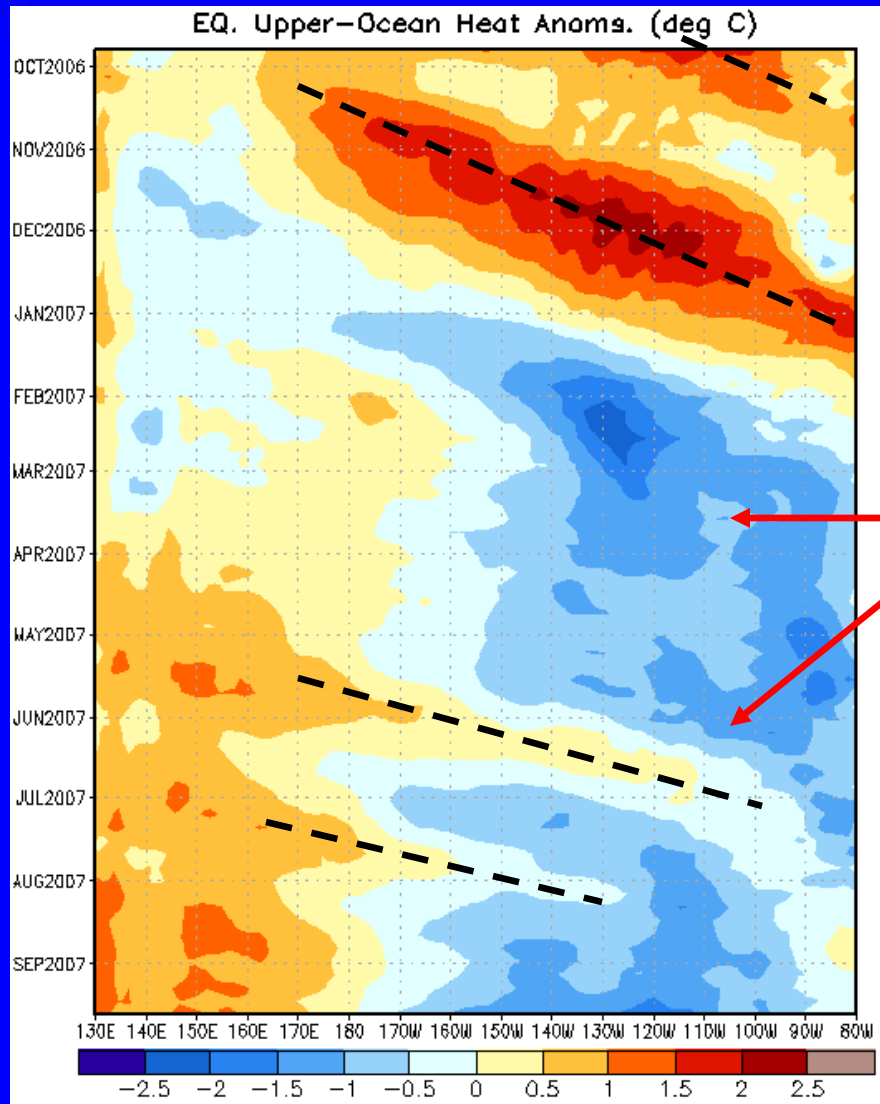
Note that shading denotes the magnitude of the anomalous wind vectors

Westerly anomalies along and near the equator continue across the Pacific Ocean.



Weekly Heat Content Evolution in the Equatorial Pacific

Time



Longitude

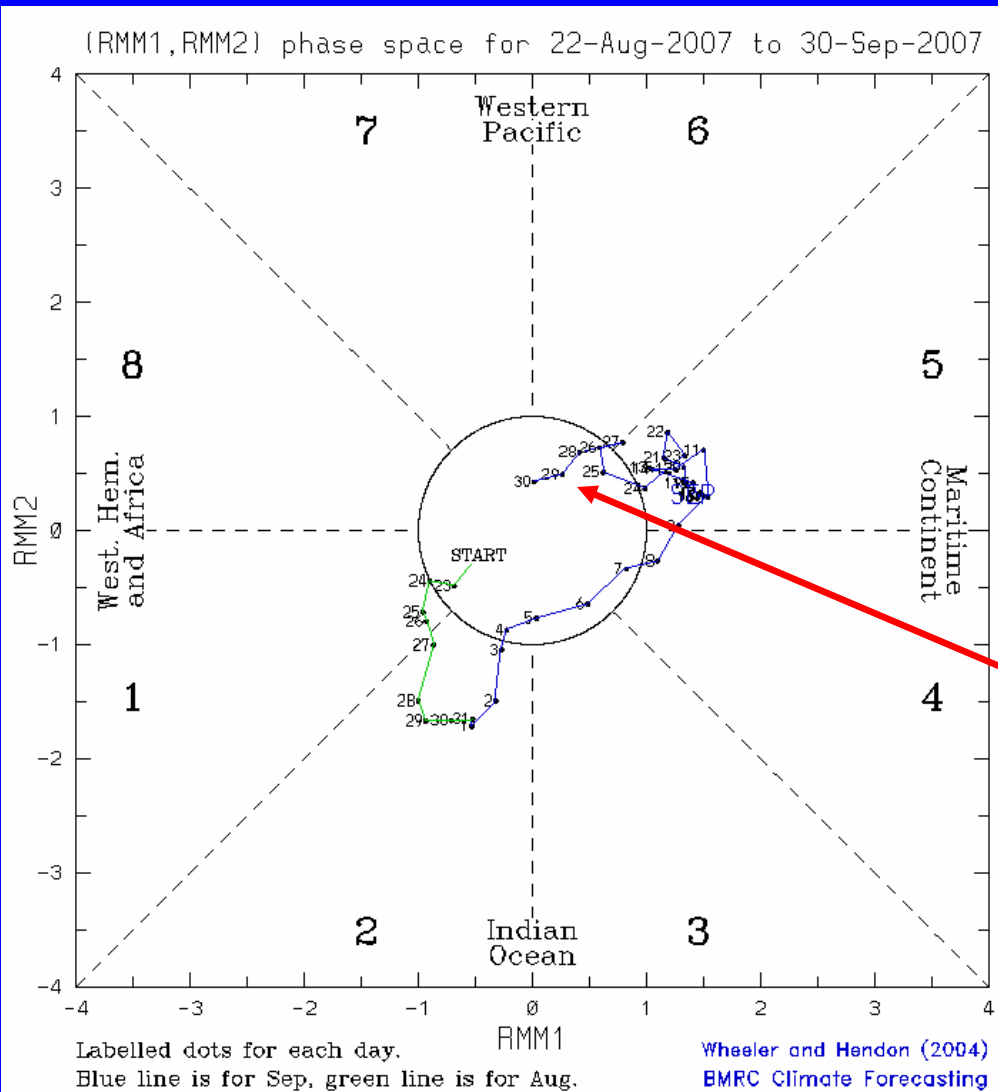
During late 2006, eastward-propagating Kelvin waves (warm phases indicated by dashed lines) caused considerable month-to-month variability in the upper-ocean heat content.

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

Weak Kelvin wave activity was observed from May to 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).

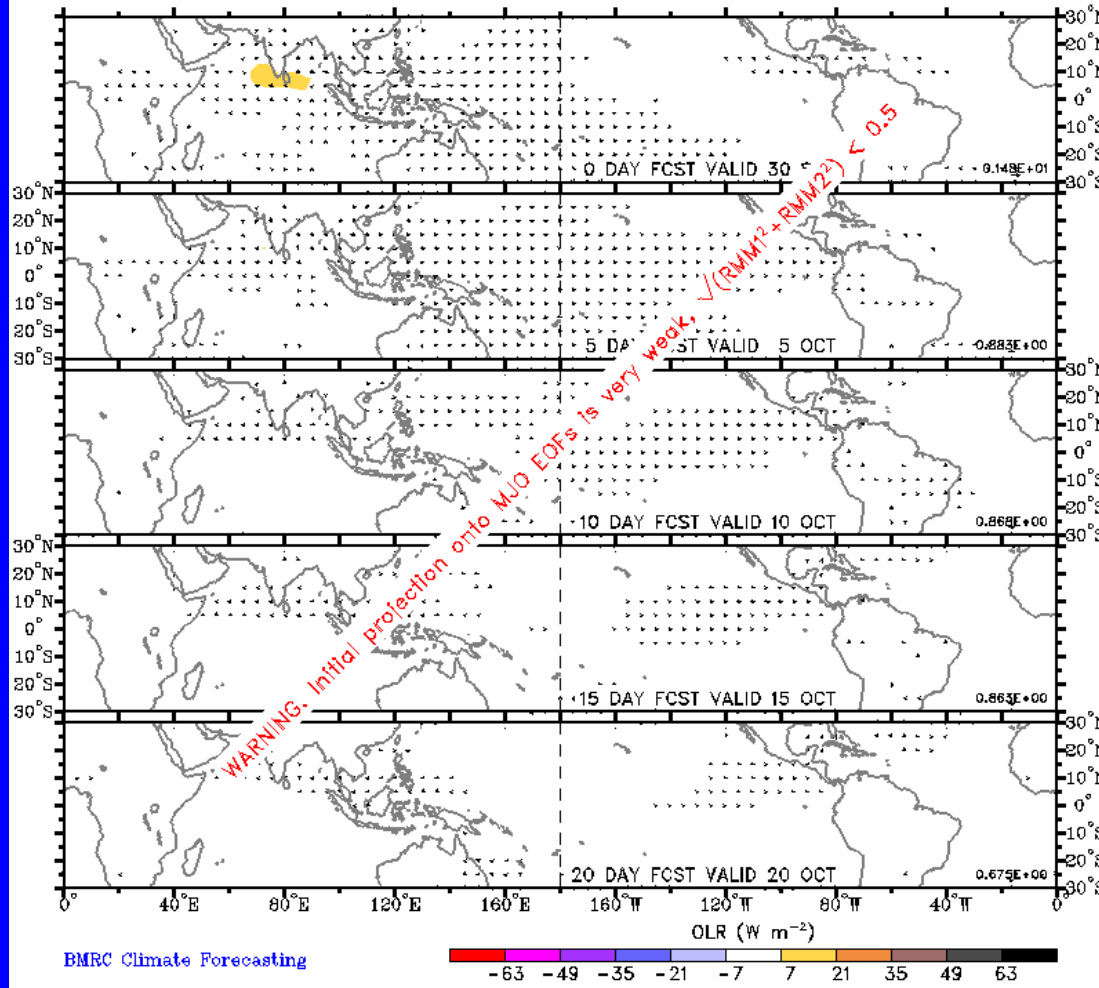
The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate different months.

After remaining nearly stationary for a few weeks, the MJO index shifted eastwards during the past week. The amplitude, however, remains small.



Statistical MJO OLR Forecast

Prediction of MJO-associated anomalies using lagged linear regression
Predictors are RMM1 and RMM2 on 30 Sep 2007
Shading for OLR anomalies (scale below). Vectors for 850-hPa wind

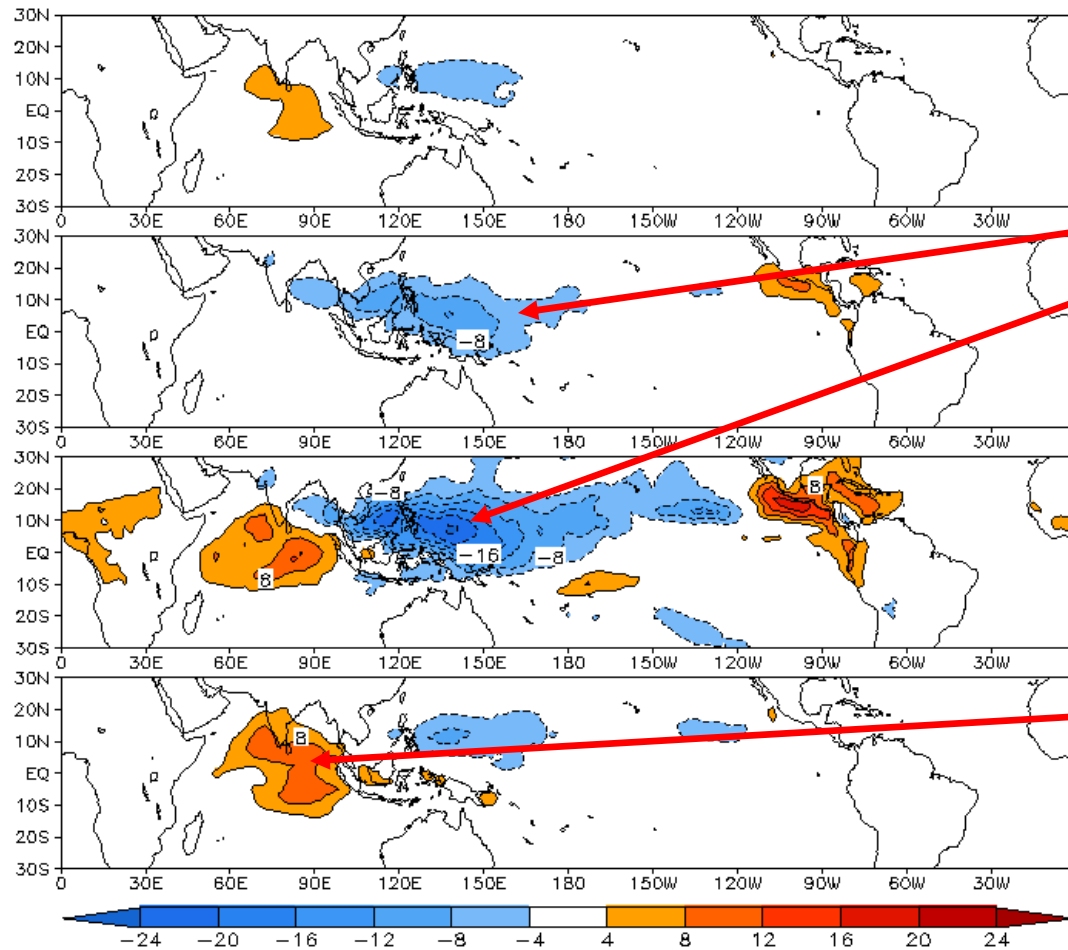


The statistical method forecasts very weak MJO activity during the upcoming ten day period.



GFS MJO OLR Forecast

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 30 Sep 2007
OLR



Initial Date
(30 Sep 2007)

Days 1-5 Ave
Forecast

Days 6-10 Ave
Forecast

Days 11-15 Ave
Forecast

The GFS indicates wet conditions mainly across the western Pacific Ocean with the greatest anomalies during the second five days.

Dry conditions are expected to prevail in the Indian ocean during week 2.