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

Update prepared by
Climate Prediction Center / NCEP
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Outline

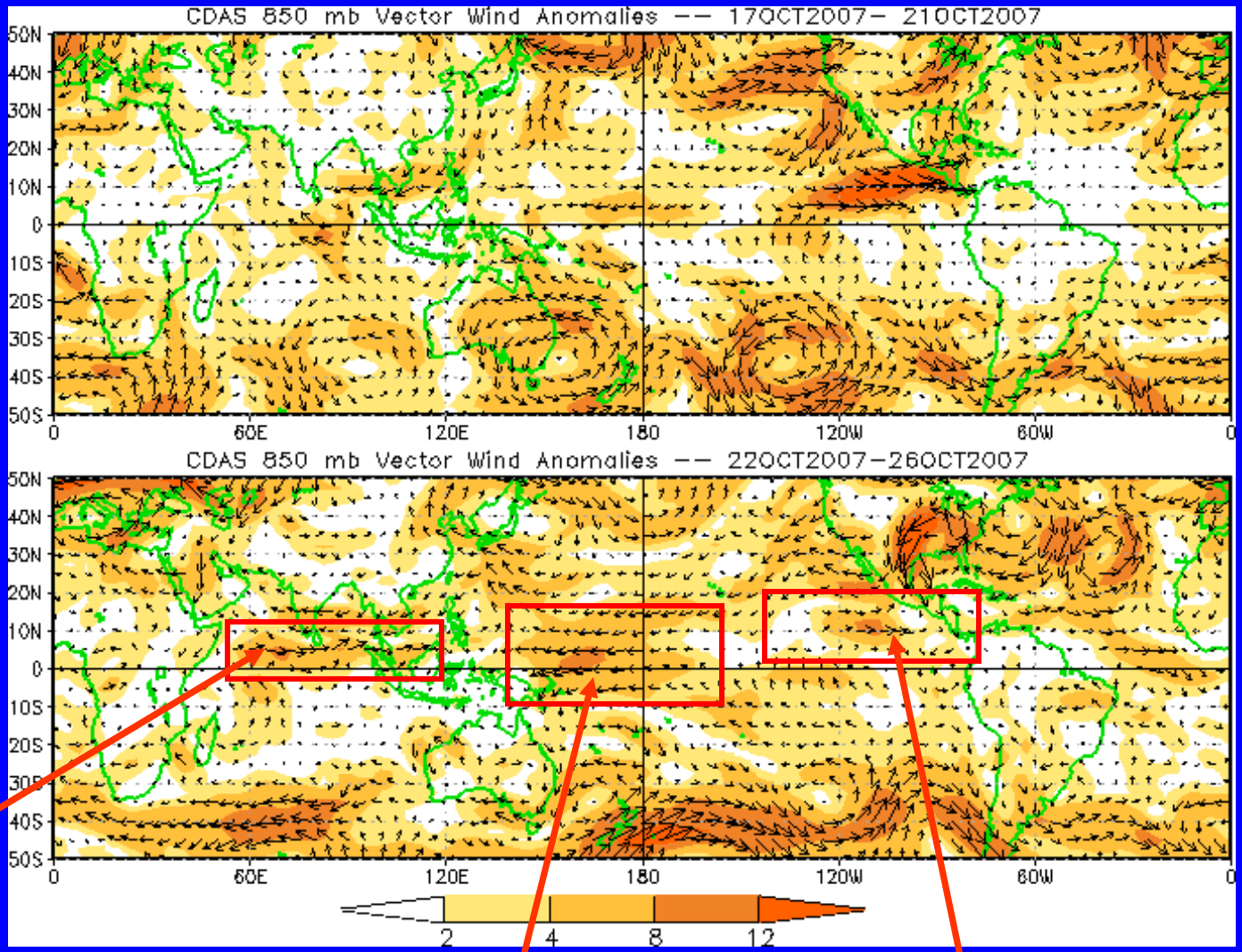
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- The MJO signal has strengthened in recent days but remains weak.
- The enhanced phase has shifted rapidly eastward from the western hemisphere to the Maritime continent during the past week.
- Enhanced convection has re-developed during the past couple of weeks across much of the eastern hemisphere mainly north of the equator consistent with La Nina conditions. The seasonal southward shift in convection, however, has been delayed.
- Over the next few weeks, there is the potential for a more coherent MJO to develop but at the current time this appears unlikely as La Nina conditions are expected to dominate.
- 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

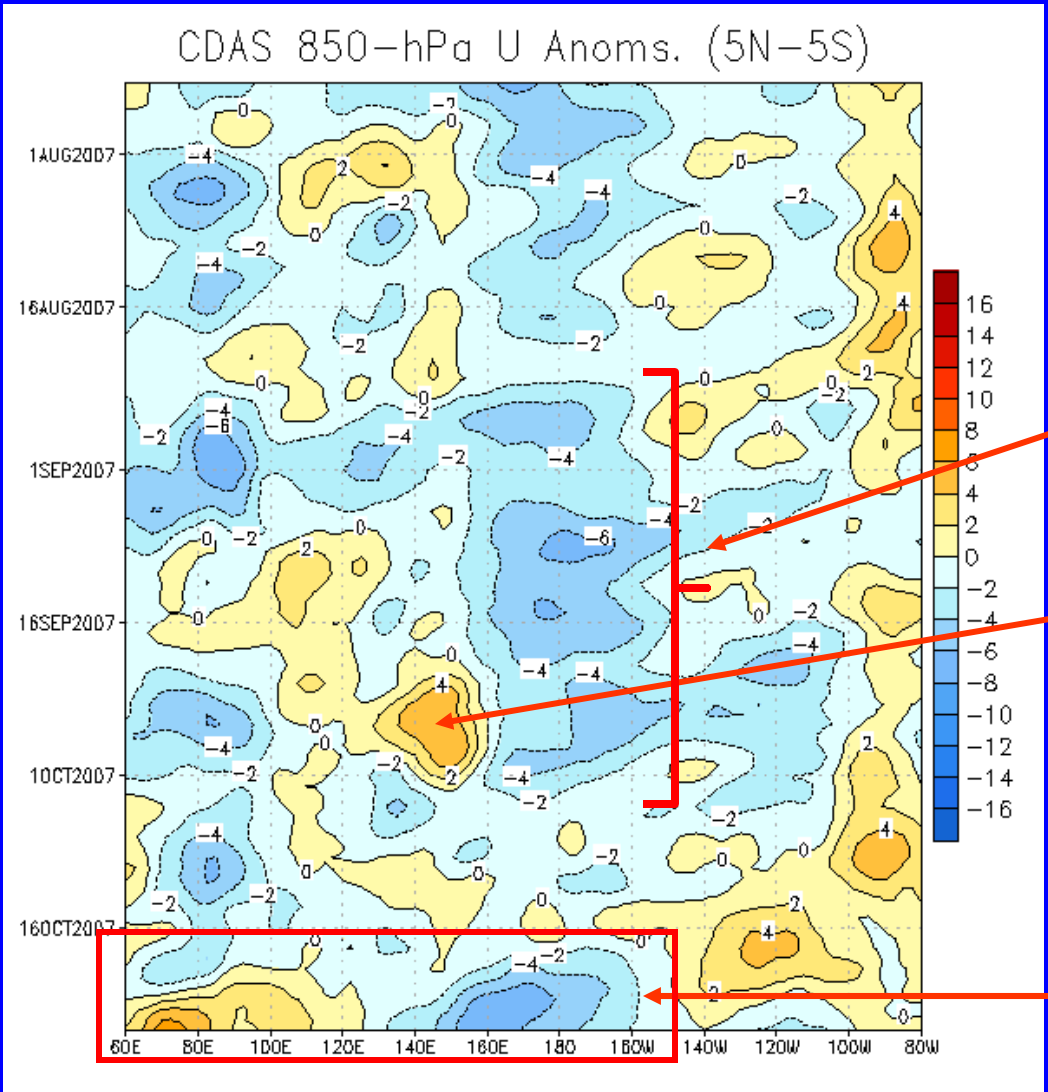


Westerly anomalies have developed just north of the equator in the Indian Ocean.

The easterlies have strengthened across the equatorial western Pacific Ocean.

Westerly anomalies have weakened across the far eastern Pacific Ocean 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.

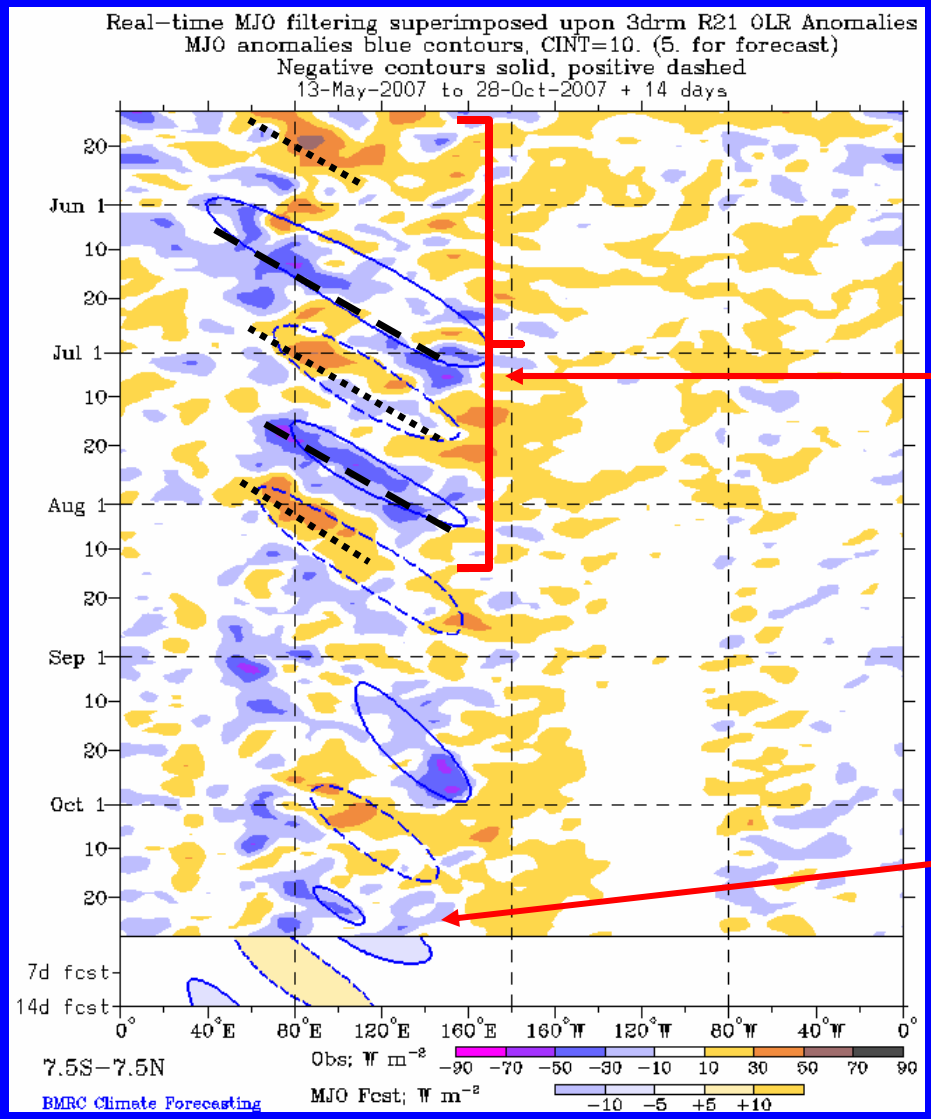
Easterly anomalies (blue shading) represent anomalous east-to-west flow.

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.

Recently, a strong couplet of anomalous wind has developed across the eastern hemisphere. Large westerly (easterly) anomalies are evident across the Indian Ocean (western Pacific) during the last week.

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



Time

Longitude

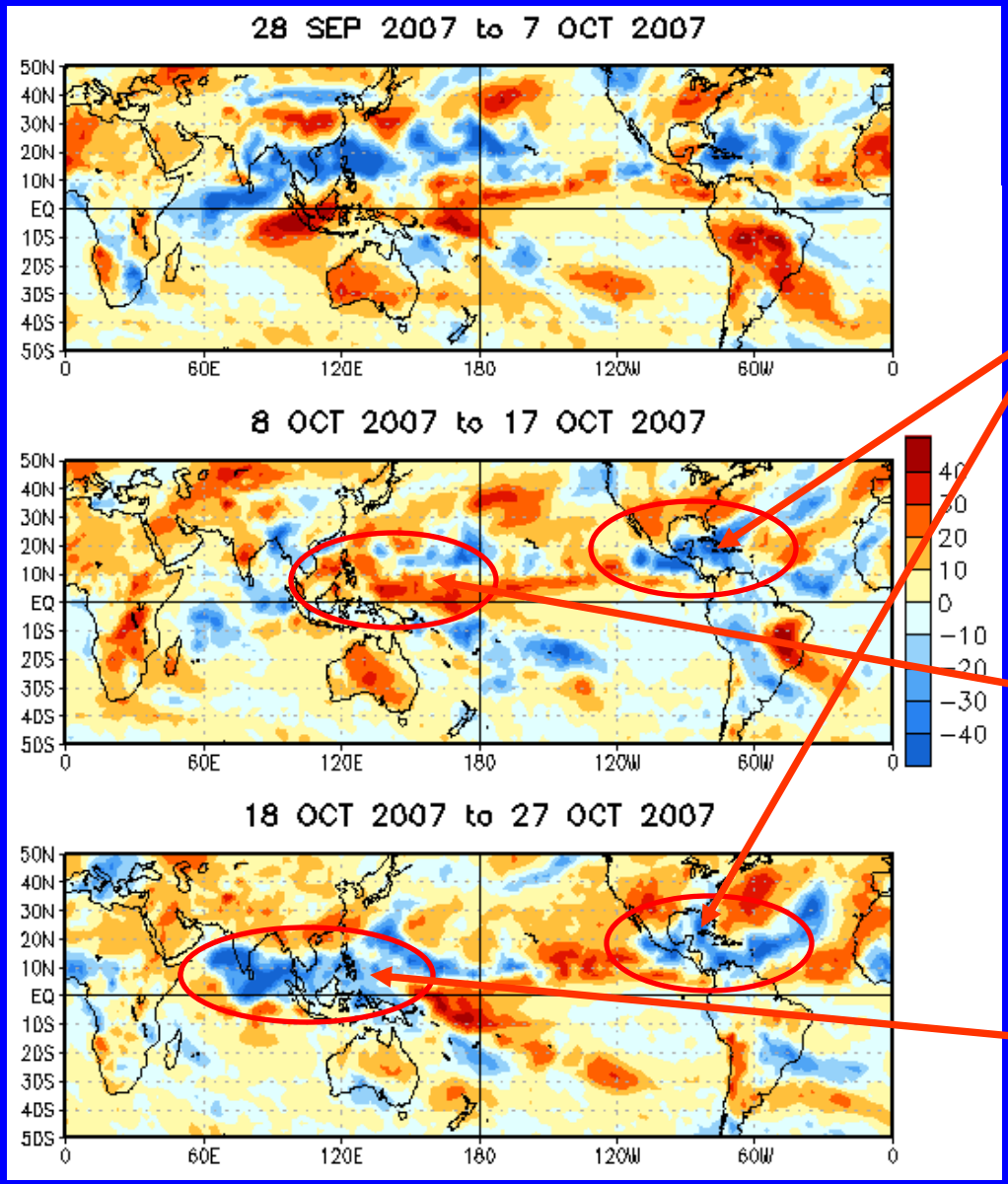
Drier-than-normal conditions, positive OLR anomalies (yellow/orange shading)

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.

Recently, wet conditions have become more prevalent across the Indian Ocean and Maritime Continent during the last ten days.

OLR Anomalies: Last 30 days



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

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

During much of October, wet conditions have been evident across the eastern Pacific, Central America, and the Caribbean Sea.

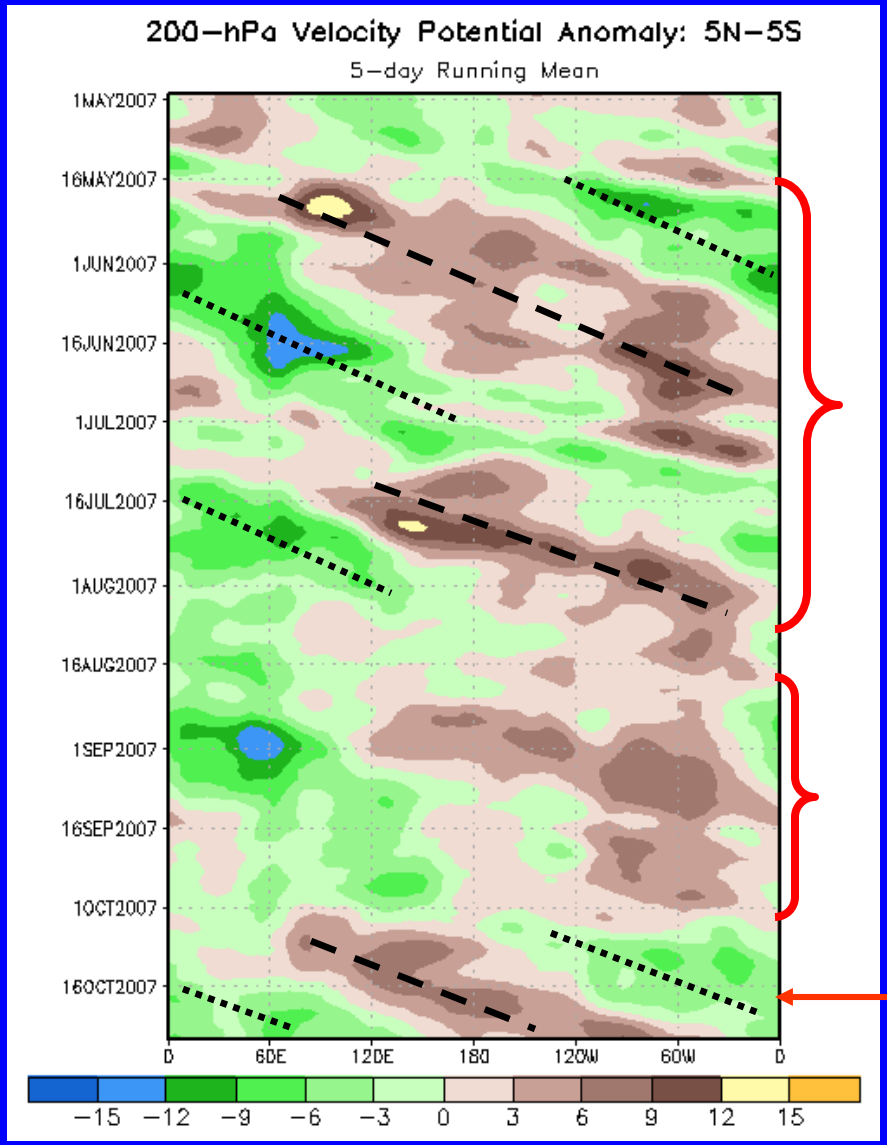
Dry conditions prevailed during mid-October across the western Pacific Ocean.

Convection more typical during La Nina has returned to much of the eastern hemisphere including southern India and the Philippines.

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

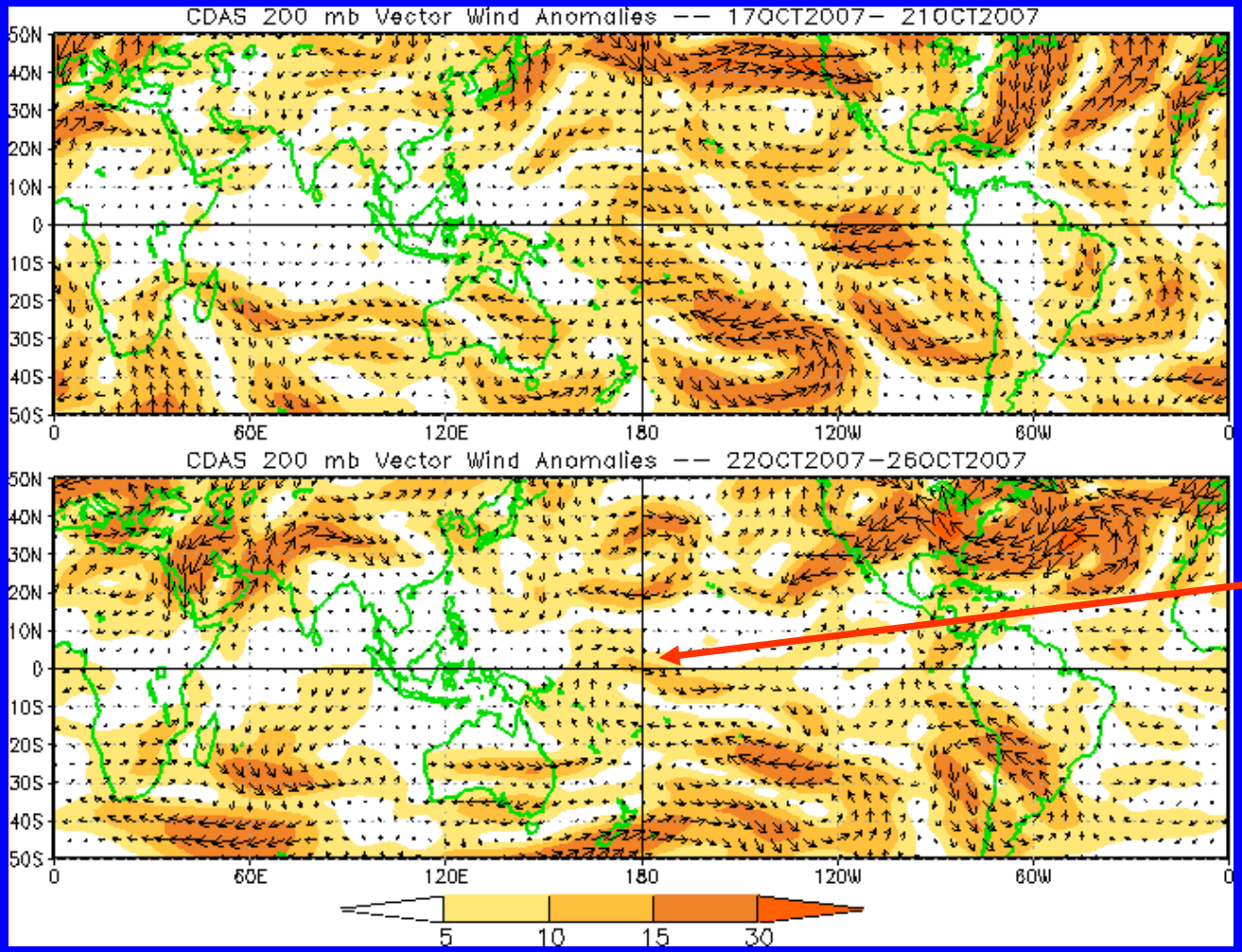
Longitude

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.

Since the beginning of October, a substantial change has occurred globally in the sign of the velocity potential anomalies. Eastward movement is evident indicating weak MJO activity.

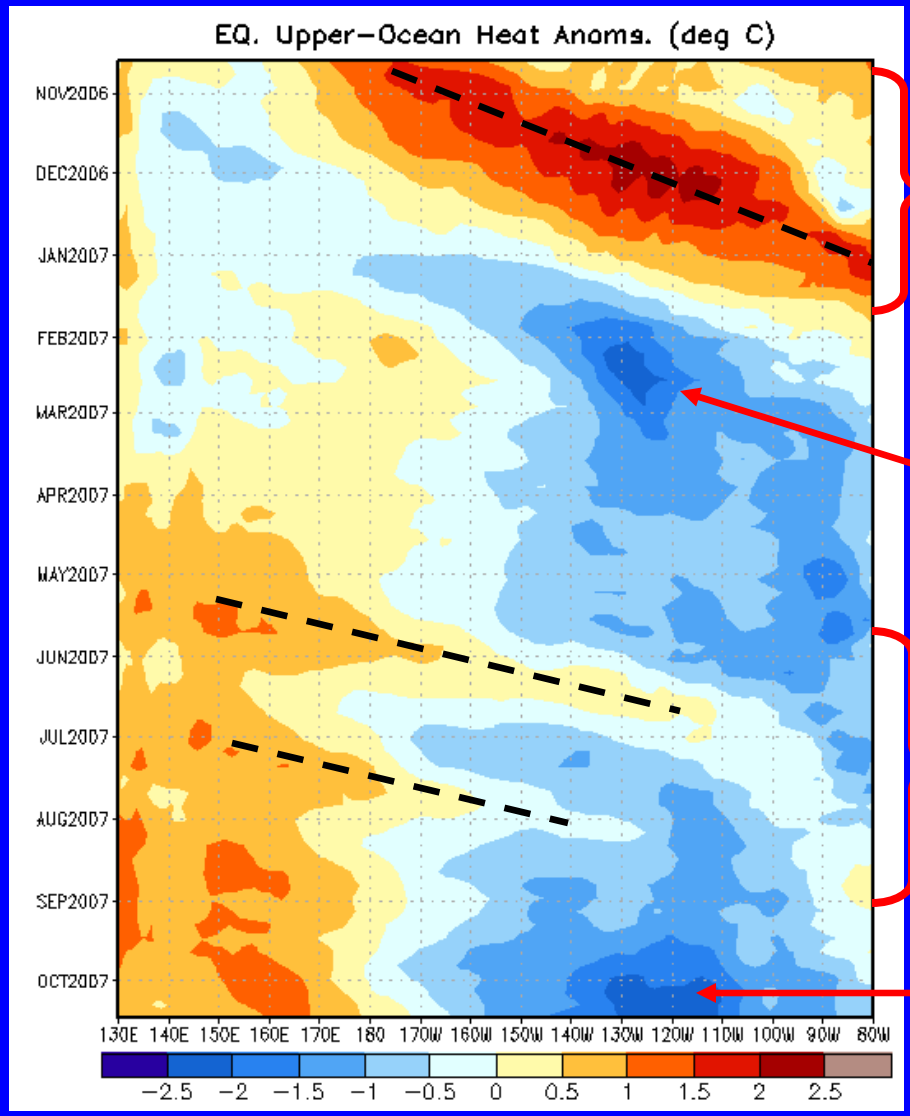
200-hPa Vector Wind Anomalies (m s^{-1})



Note that shading denotes the magnitude of the anomalous wind vectors

Westerly anomalies continue across the equatorial western Pacific Ocean near the Date Line.

Weekly Heat Content Evolution in the Equatorial Pacific



Time

Longitude

During late 2006, an eastward-propagating Kelvin wave (warm phase indicated by the dashed line) 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.

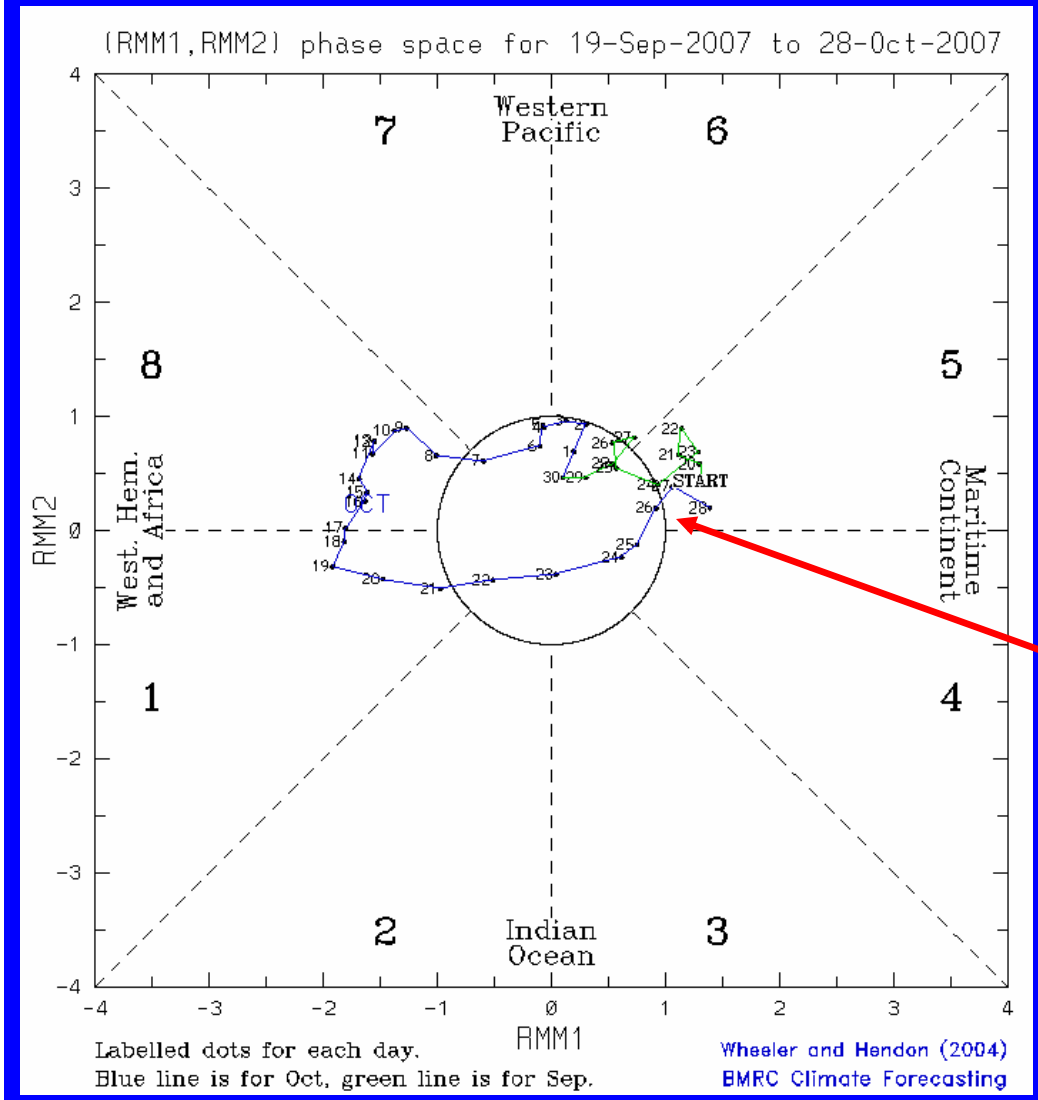
Weak Kelvin wave activity was observed from May into August and affected the sub-surface temperature departures.

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

MJO Index

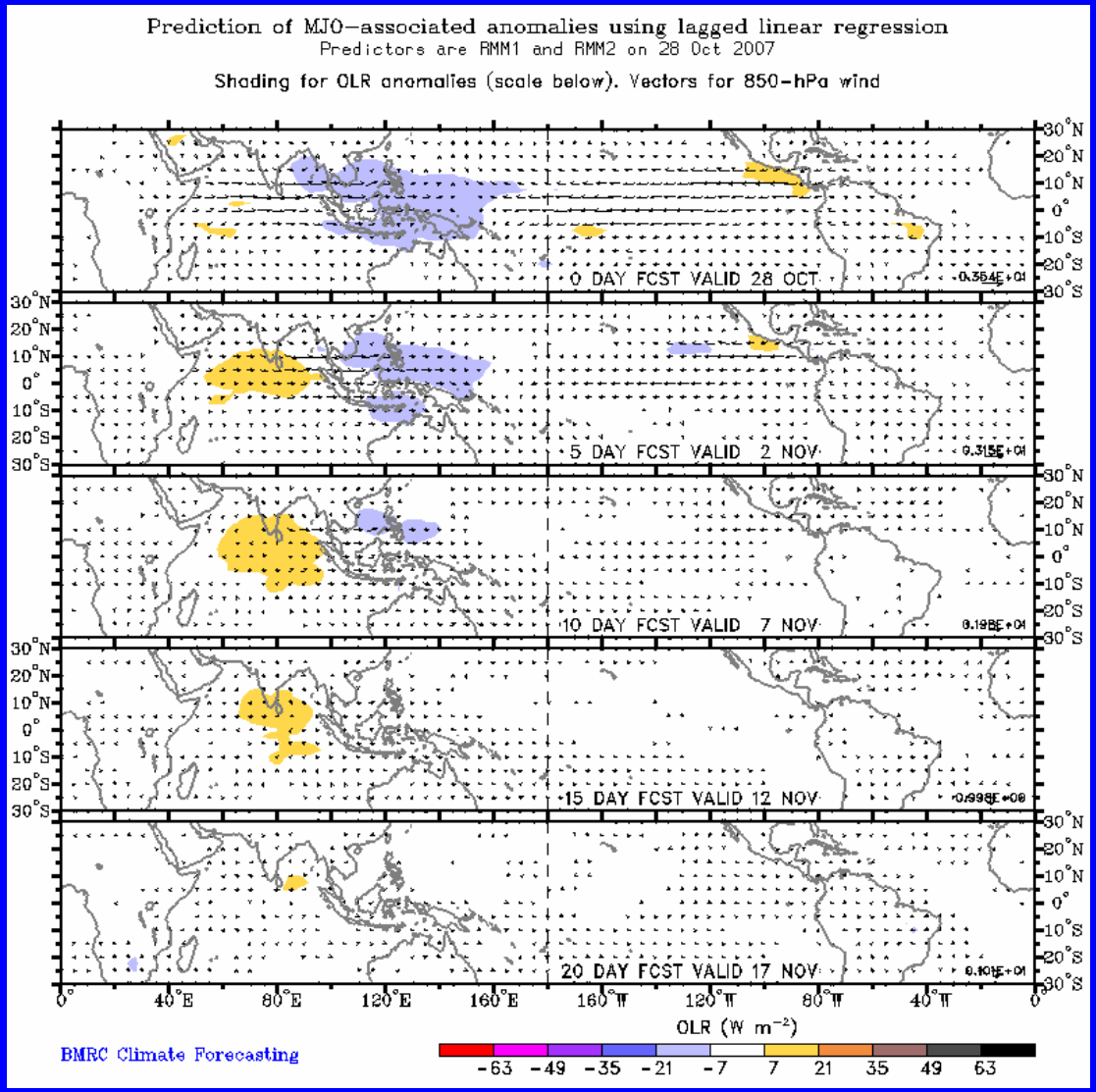
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.



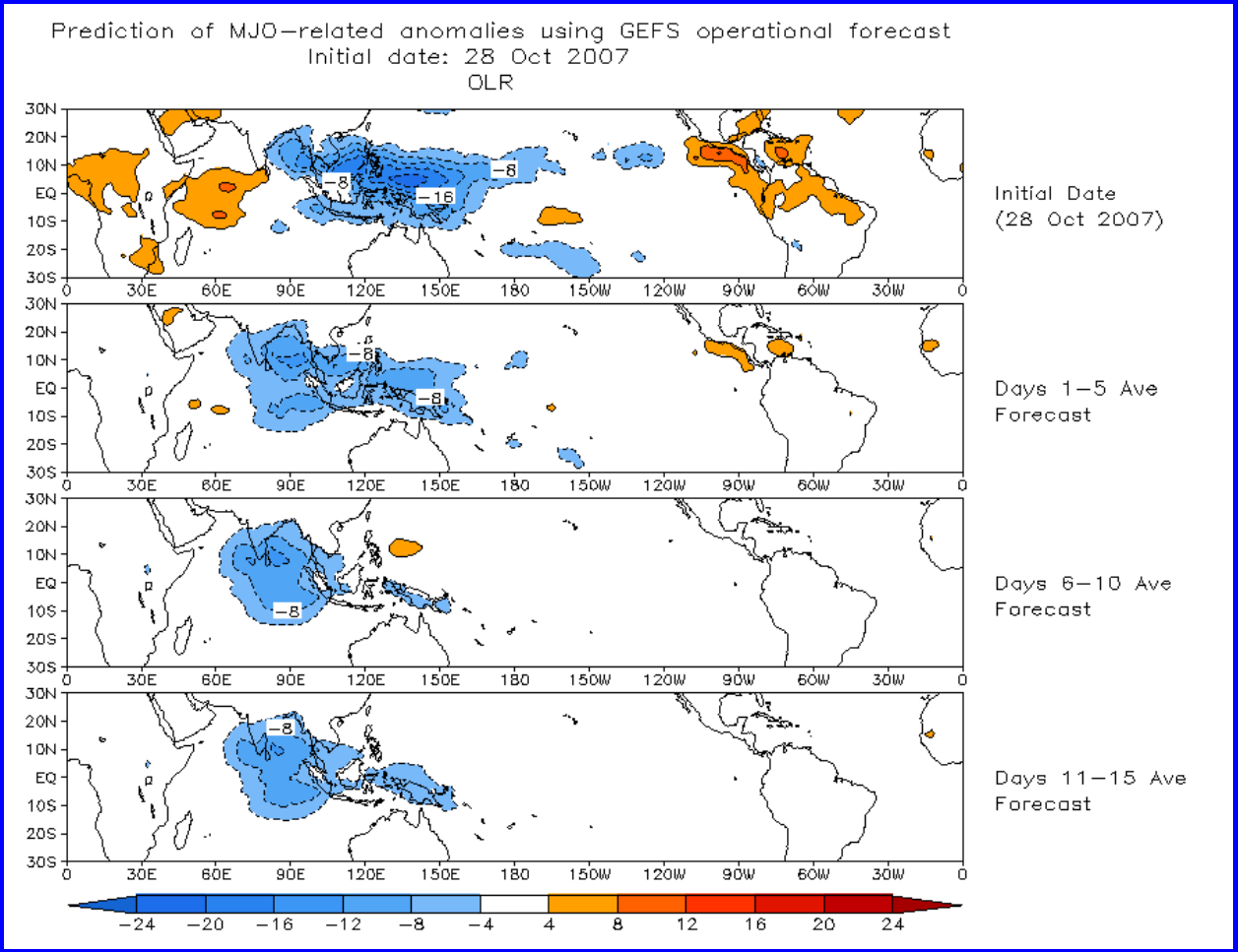
The MJO signal has increased in strength during recent days after a rapid eastward movement from the western hemisphere to the Maritime continent.

Statistical MJO OLR Forecast



A statistical MJO forecast indicates weak MJO activity during the next two weeks with enhanced convection expected across the western Pacific Ocean and dry conditions developing in the Indian Ocean.

Experimental GFS MJO OLR Forecast



The GFS forecasts a weakening MJO signal with enhanced convection persisting over the Maritime Continent during the period.