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

Update prepared by
Climate Prediction Center / NCEP
November 26, 2007

Outline

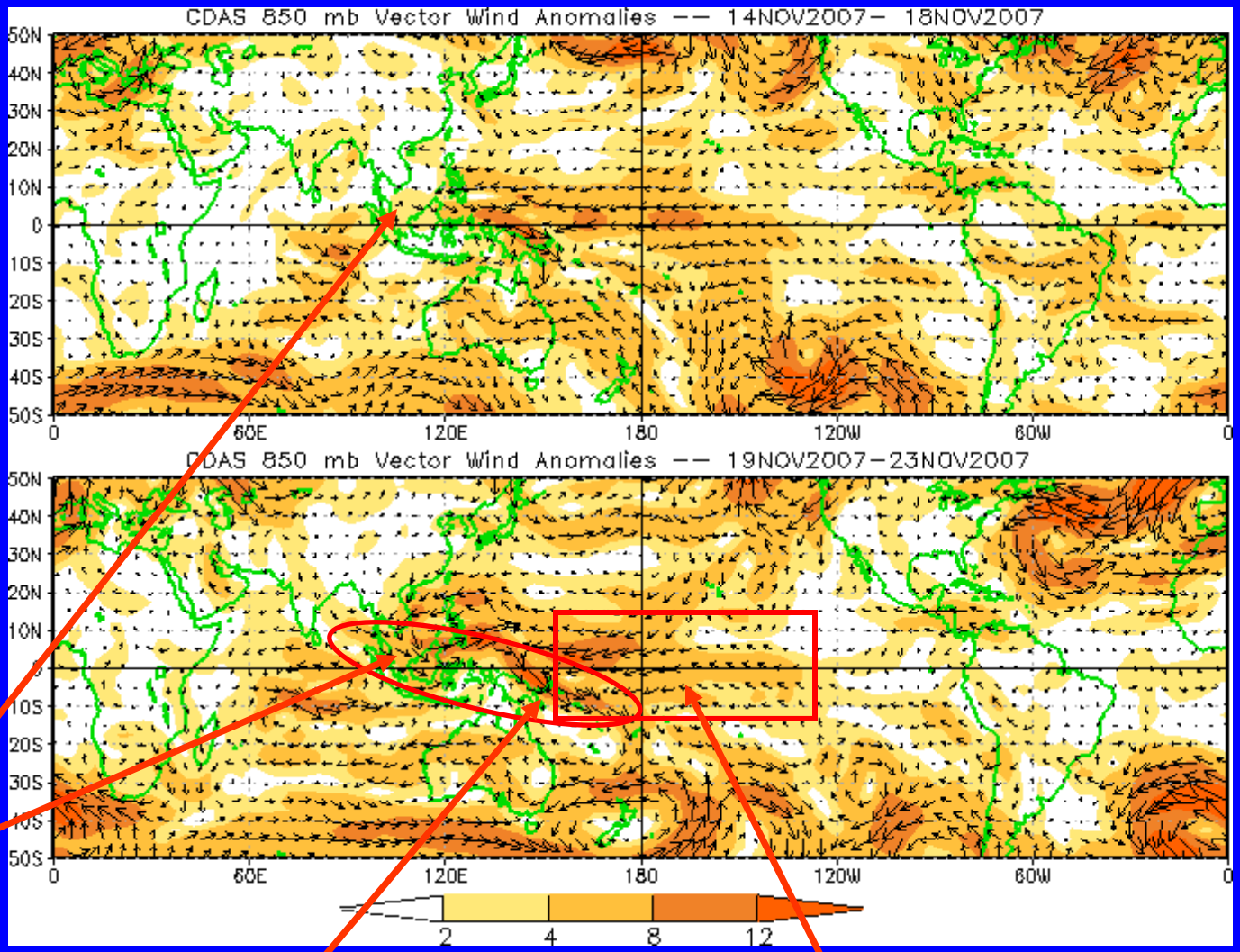
- Overview
- Recent Evolution and Current Conditions
- Madden-Julian Oscillation Forecast

Overview

- The MJO index has maintained its amplitude during the past week but has shown little eastward movement to date indicating continued weak MJO activity.
- The enhanced phase of the MJO remains in the western Pacific Ocean while dry conditions have developed across much of the eastern Indian Ocean and southern Maritime continent.
- The latest observations indicate enhanced convection generally remains stationary across the far western Pacific Ocean slightly east of that typical during La Nina conditions.
- Although some MJO forecast tools indicate an eastward shifting signal, the current lack of coherent eastward moving convection at MJO time scales indicates that other subseasonal variability most likely is responsible for this behavior.
- The MJO is expected to remain weak 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

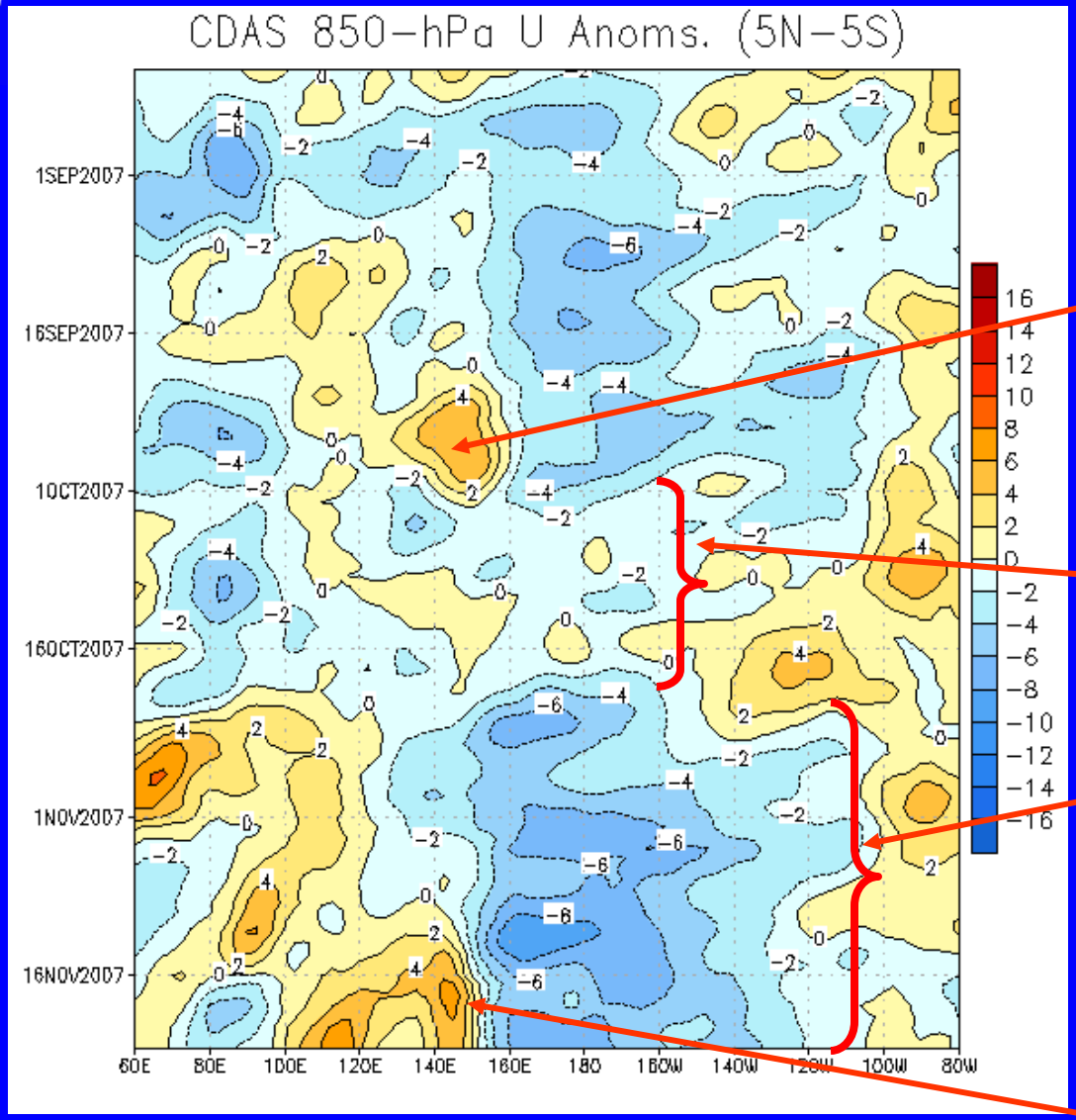


Westerly wind anomalies across the northern Maritime continent have increased during the past five days.

Anomalous cross-equatorial flow has strengthened over the far western Pacific Ocean / eastern Maritime Continent.

The easterlies across the equatorial western and central Pacific have remained above average.

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.

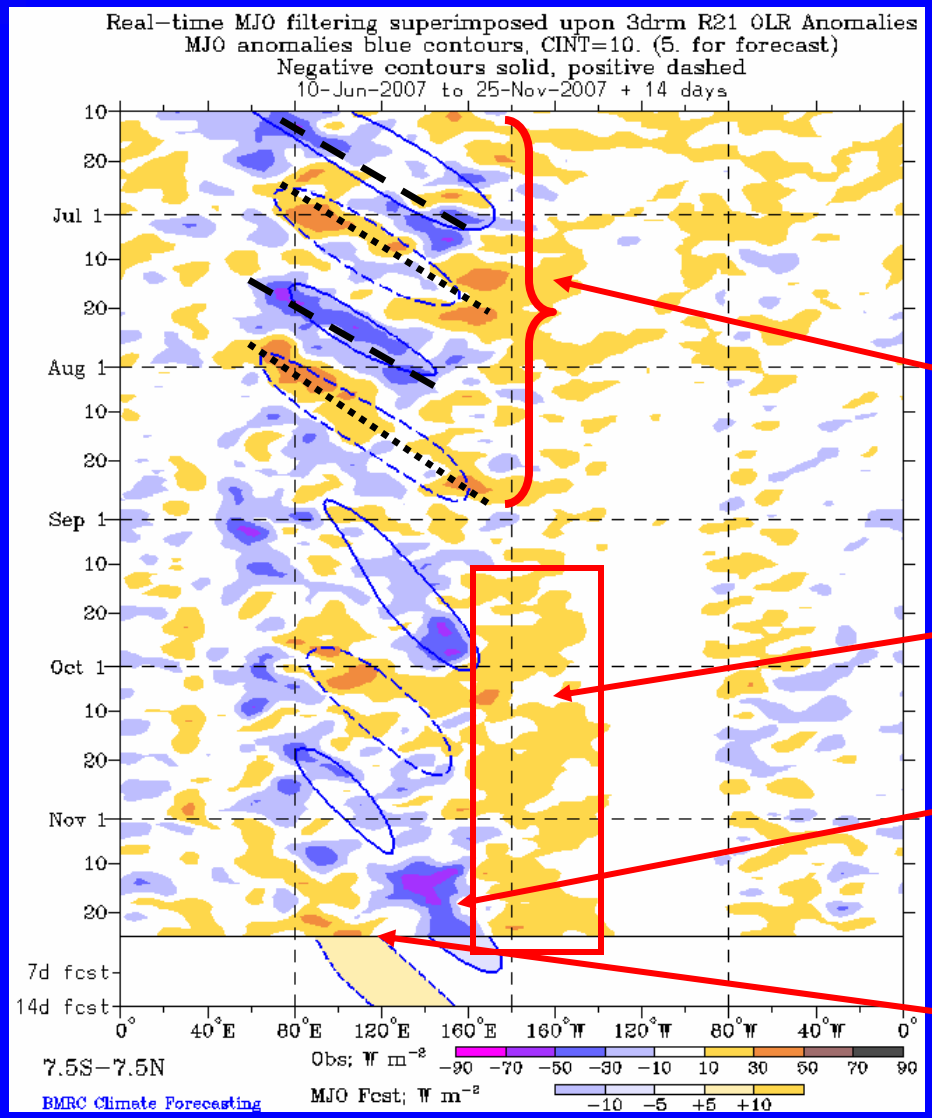
Westerly anomalies increased during late September across the western Pacific in response to very active convection and tropical cyclone activity.

The easterlies were near average during a part of mid-October.

Strong easterlies have been in place since mid-October across much of the Pacific generally beginning near 160 °E.

Strong anomalous westerlies have been evident across much of the Maritime continent and far western Pacific during the last 7-10 days.

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)

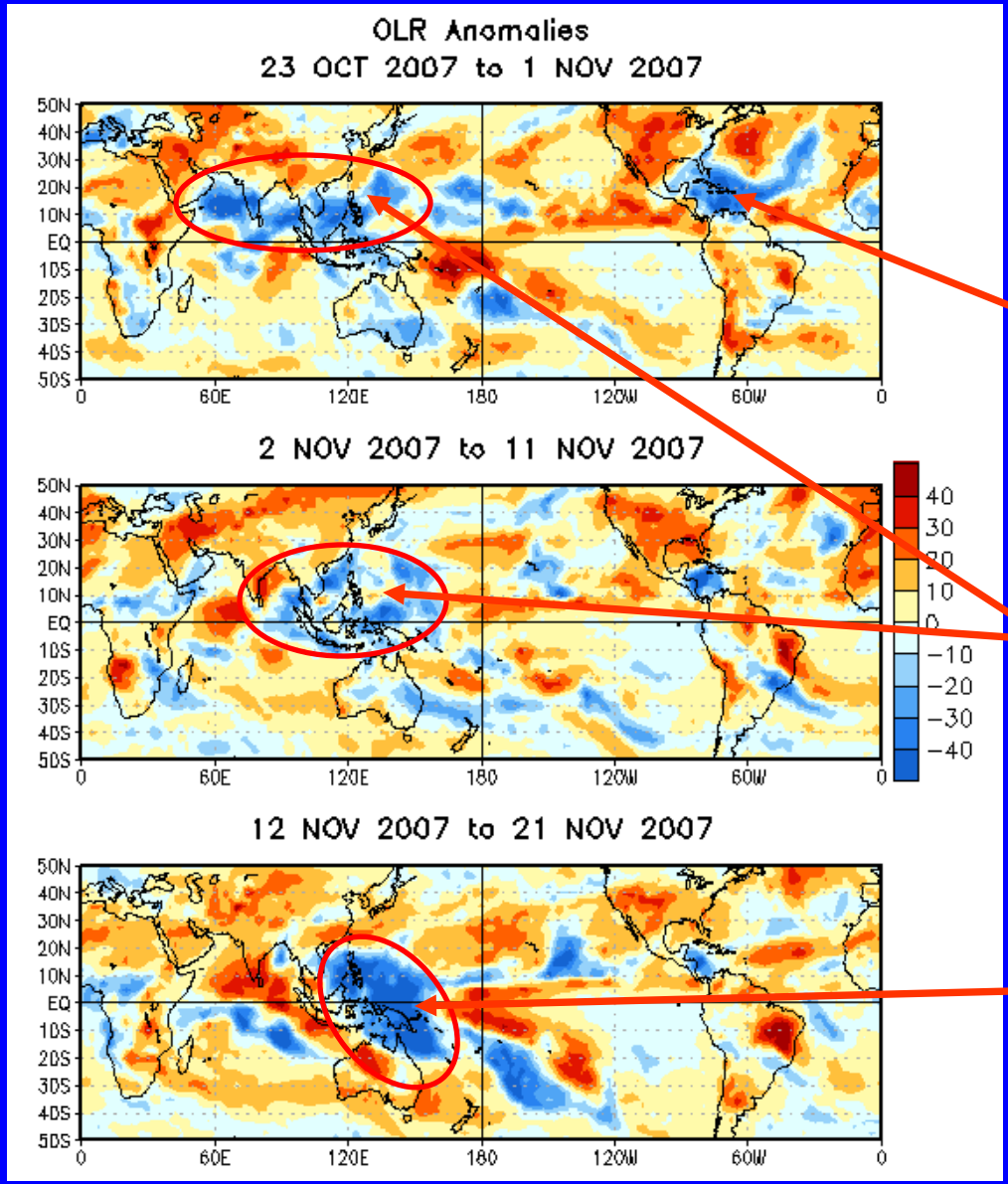
Beginning in mid May, weak-moderate MJO activity was observed as regions of suppressed and enhanced convection shifted eastward from the Indian Ocean into the far western Pacific.

Persistent dry conditions have been evident near the Date Line since mid-September.

Recently, there has been a substantial enhancement of convection across the eastern Maritime continent and far western Pacific Ocean. There has been, however, only minor eastward movement.

Dry conditions have developed across the Indian Ocean and western Maritime continent during the past 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 late October, wet conditions were evident across the Caribbean Sea.

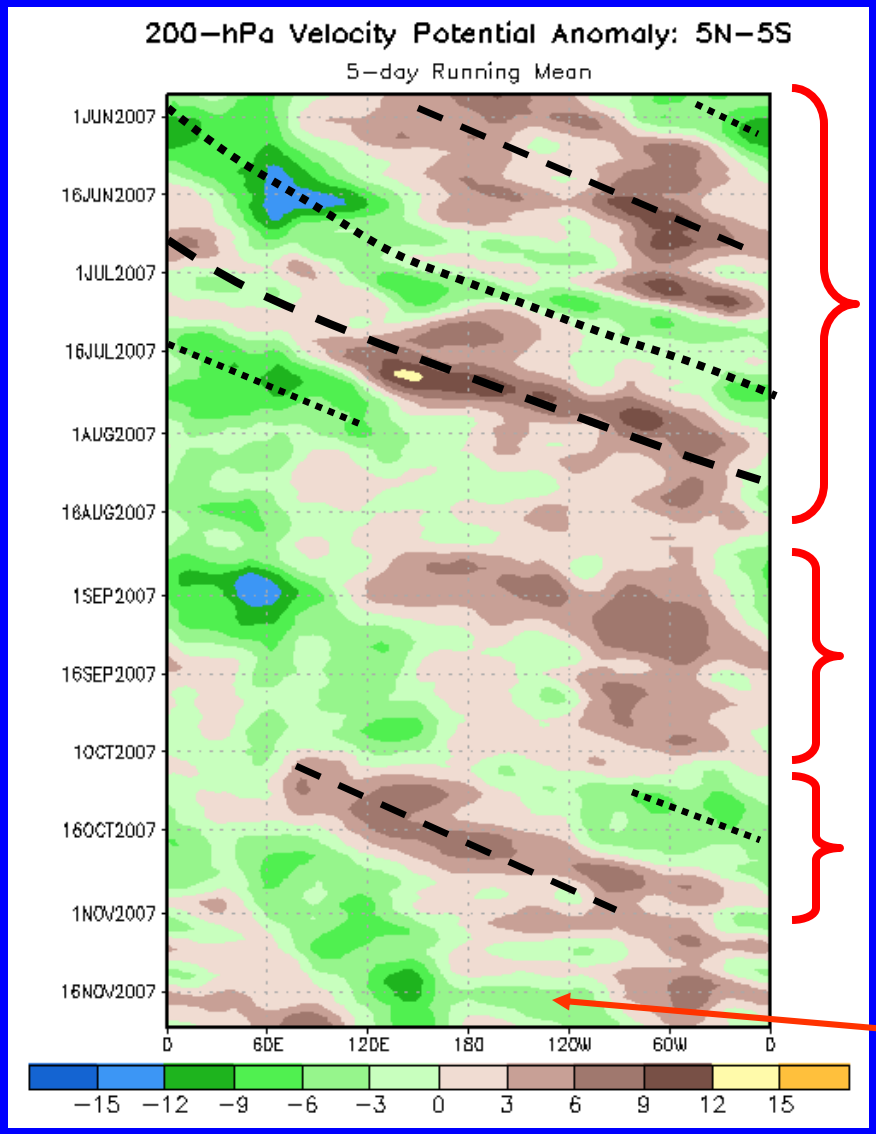
Enhanced convection prevailed across the Maritime continent during much of the period, remaining mostly north of the equator.

In mid November the area of enhanced convection strengthened, shifted south and eastward, and now includes the eastern Maritime continent and the far western Pacific Ocean.

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

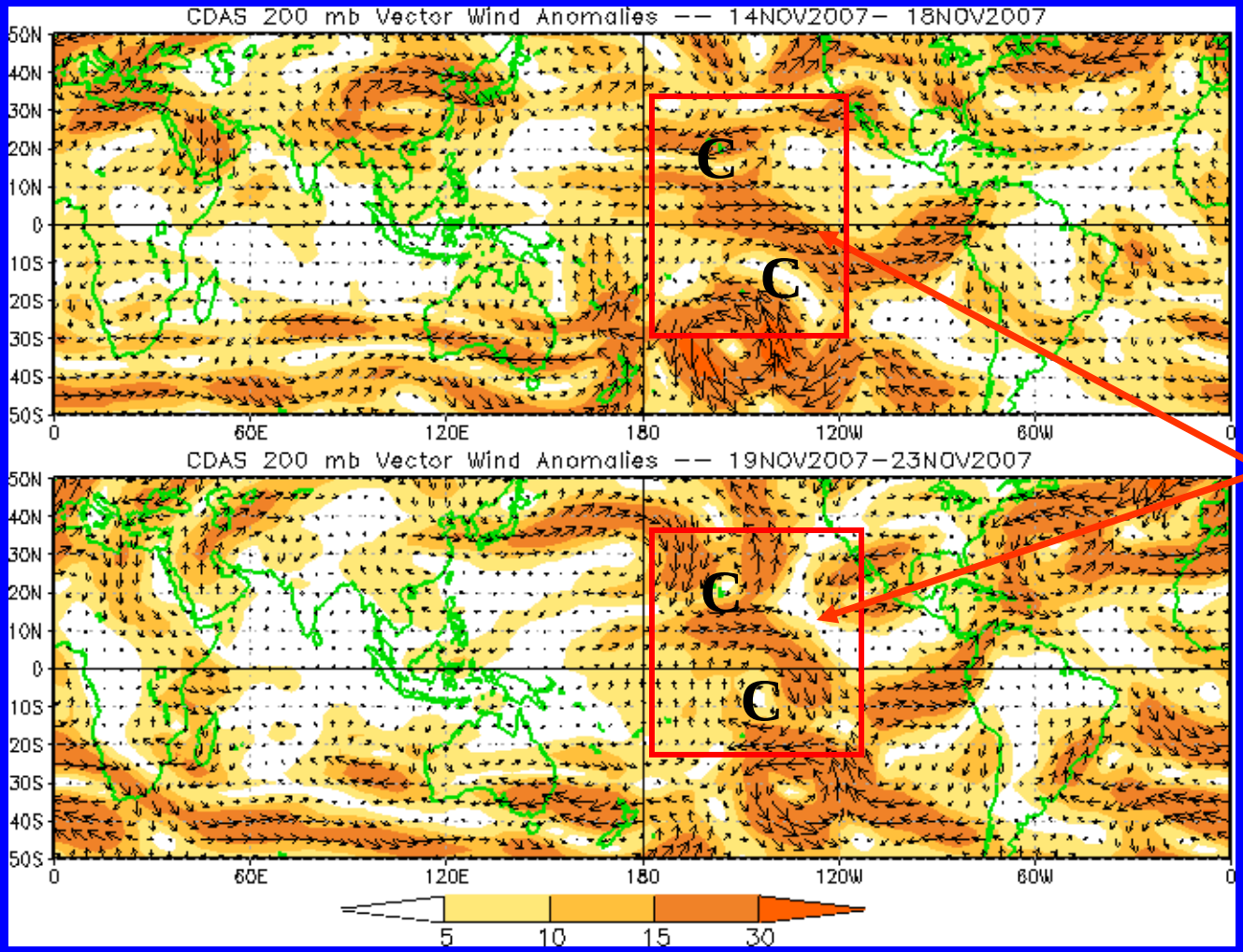
From mid-May into early August, weak to moderate MJO activity was observed as velocity potential anomalies increased and propagated eastwards.

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

The MJO strengthened during October with fast eastward propagation.

Recently, the strongest signal has become more stationary, but a faster eastward moving signal is also apparent.

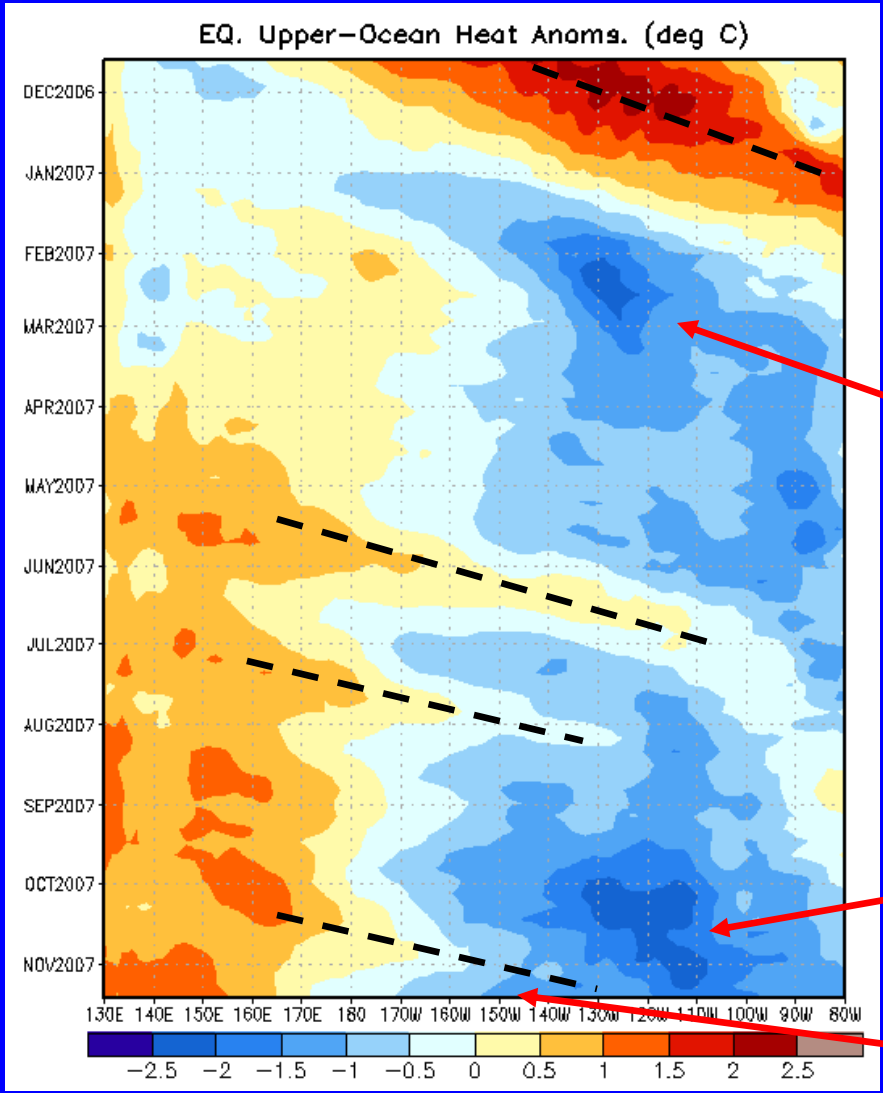
200-hPa Vector Wind Anomalies (m s^{-1})



Note that shading denotes the magnitude of the anomalous wind vectors

Equatorial upper-level westerly wind anomalies and anomalous cyclones, typical during La Nina, are evident across the central Pacific Ocean. during the last ten days.

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.

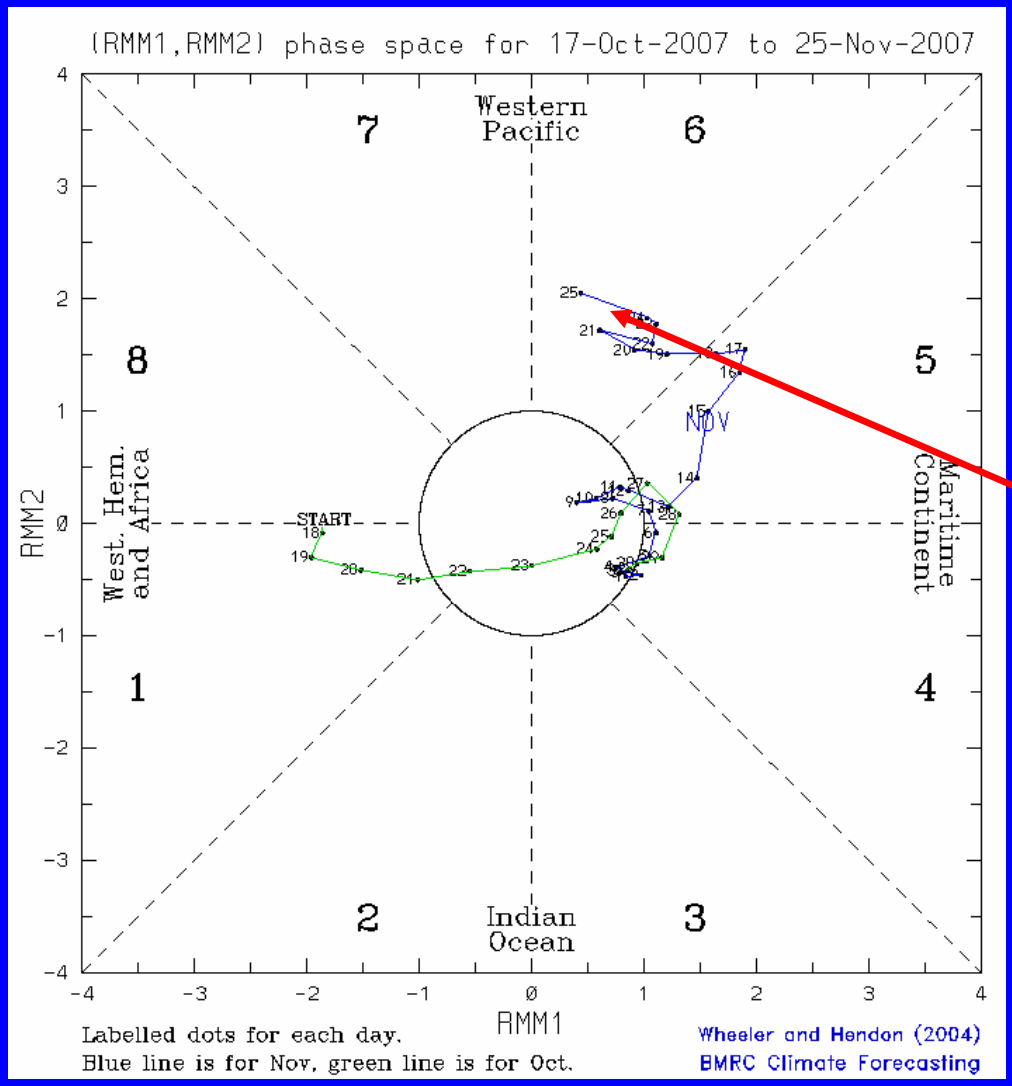
During October, negative heat content anomalies increased across the eastern Pacific Ocean, but weakened slightly in the central and east-central Pacific in association with a weak Kelvin wave.

Most recently, negative heat content anomalies have strengthened.

MJO Index

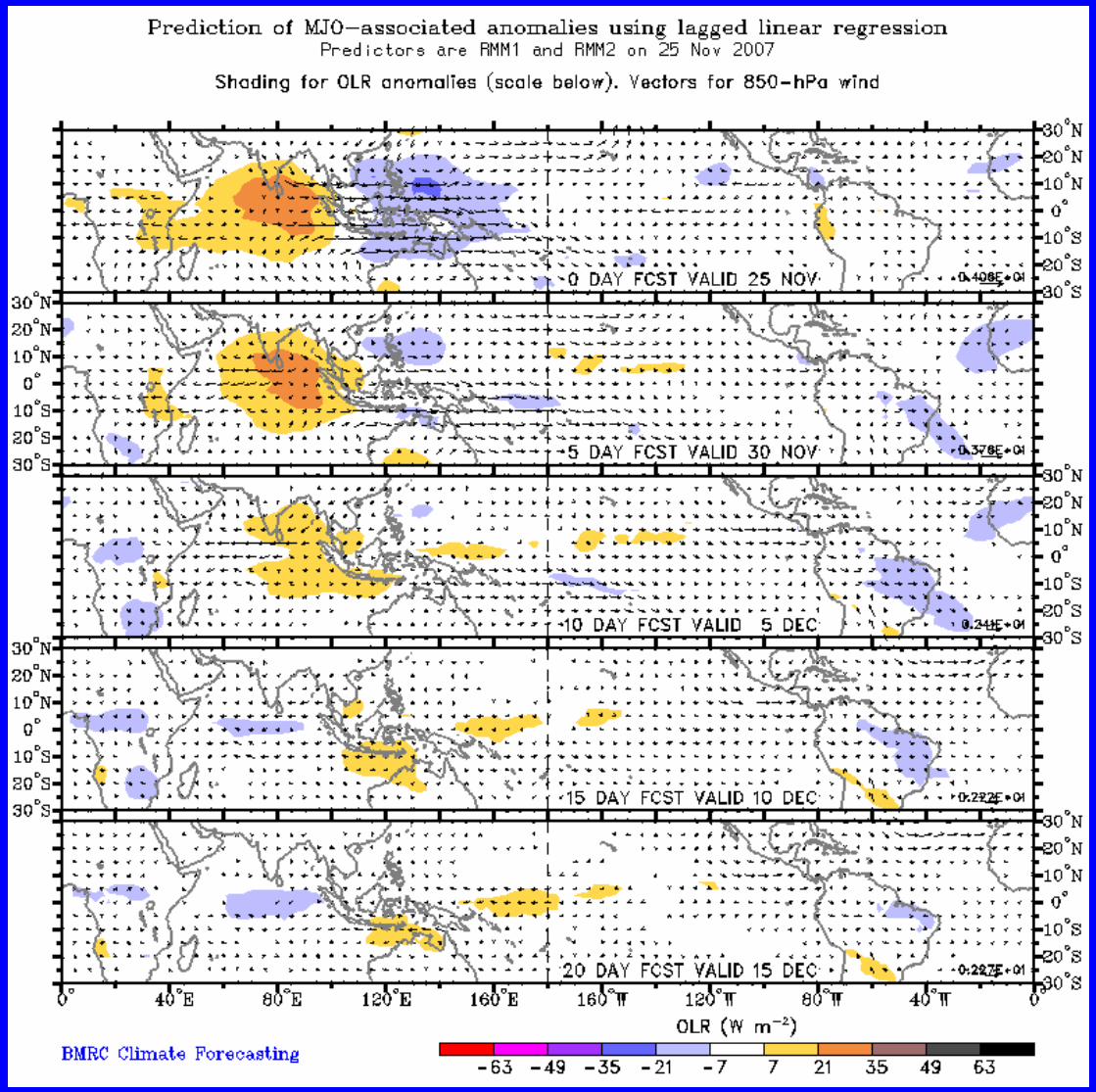
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa and 200-hPa zonal wind and outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.



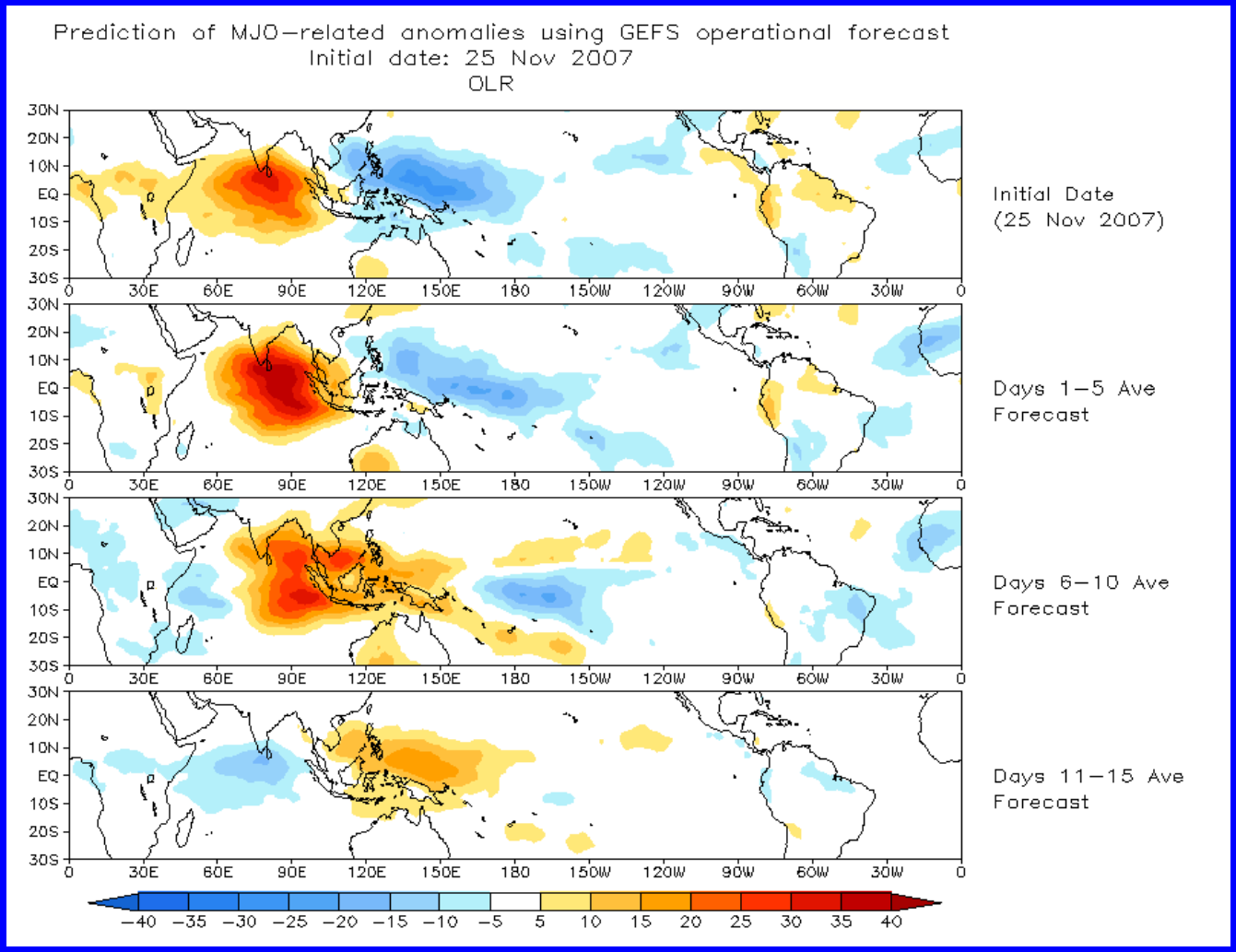
The MJO index has increased in amplitude during mid-late November. In recent days, the index has once again regained eastward movement.

Statistical MJO OLR Forecast



A statistical MJO forecast indicates weak-moderate MJO activity with dry conditions expected over the Indian Ocean early during the period and over the Maritime continent by week 2.

Experimental GFS MJO OLR Forecast



The GFS forecasts a moderate-to-strong MJO for the coming two weeks with enhanced convection over the western and central Pacific Ocean and dry conditions in the Indian Ocean and later the Maritime Continent.