Madden/Julian Oscillation: Recent Evolution, Current Status and Forecasts

Update prepared by
Climate Prediction Center / NCEP
April 23, 2007

Outline

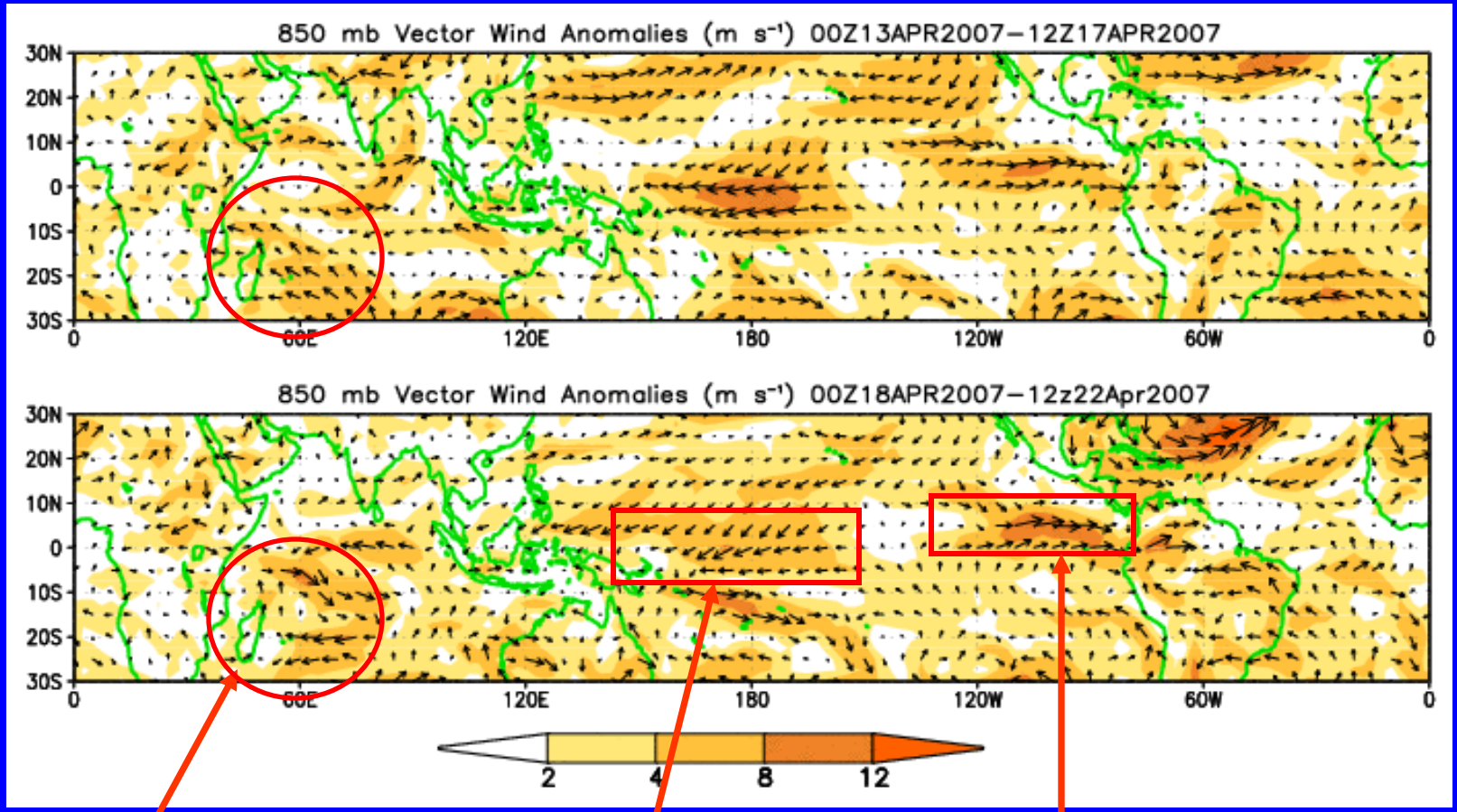
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- **The MJO remains incoherent.**
- **During week 1, wetter than average conditions are expected over the eastern tropical Pacific Ocean, sections of Central America and the Gulf of Guinea region of Africa.**
- **Also during week 1, there exists an increased chance for above-average rainfall across the Solomon Islands, Vanuatu and Fiji.**
- **An increased chance for above-average rainfall exists over the lower Bay of Bengal, Sri Lanka and the Nicobar Islands throughout the period. There is also the potential for tropical storm development during week 2 in this area.**

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

Note that shading denotes the magnitude of the anomalous wind vectors

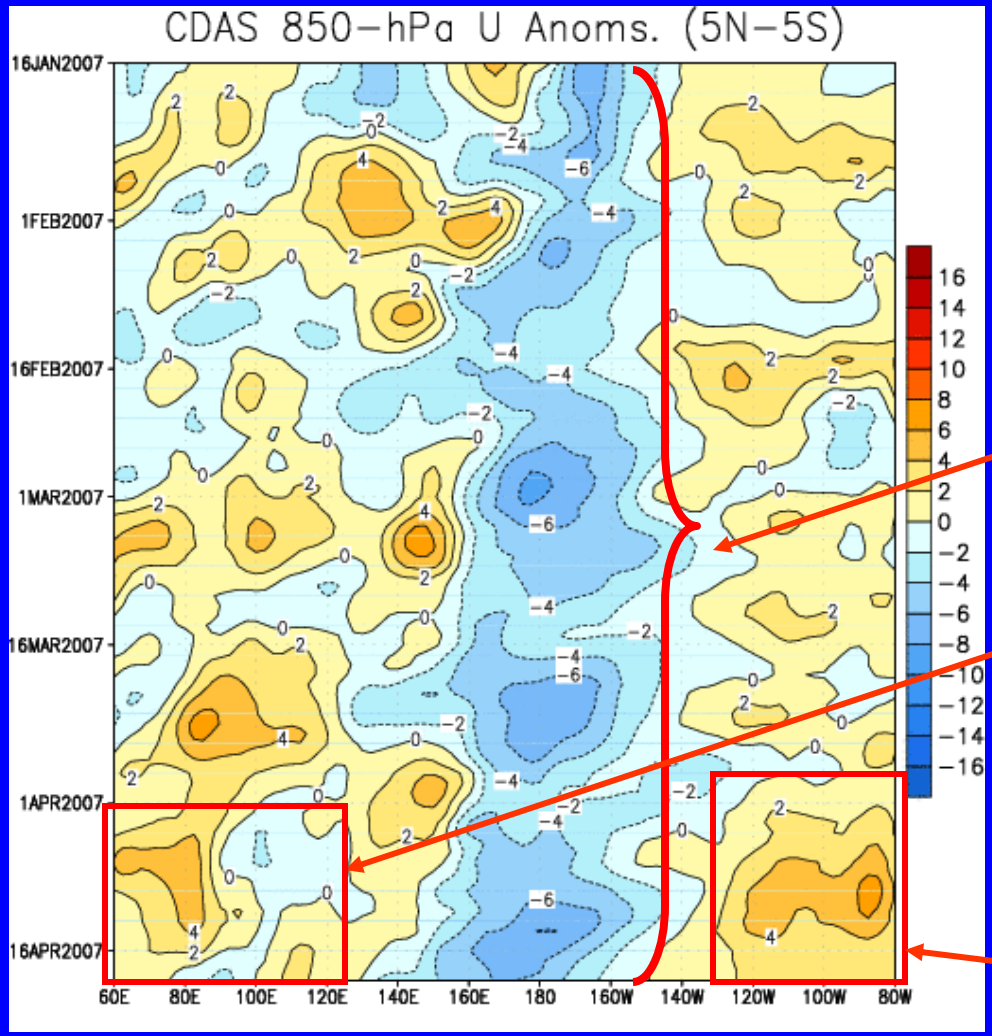


The enhanced southeasterly flow that helped to produce beneficial rains over Africa's Greater Horn has decreased.

Easterly anomalies have decreased in the western equatorial Pacific.

Westerly wind anomalies persisted over the eastern equatorial Pacific.

Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})



Time

Longitude

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

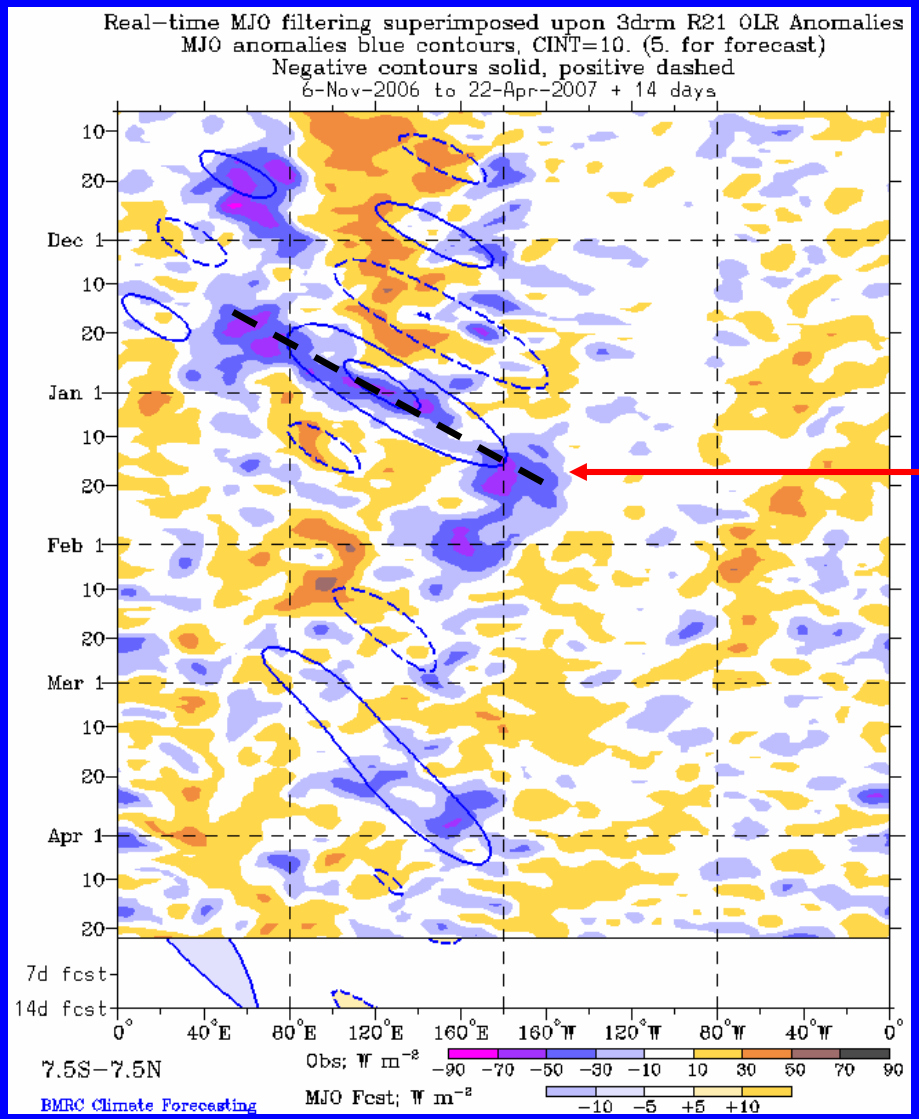
Easterly anomalies (blue shading) represent anomalous east-to-west flow.

Easterly anomalies have been persistent near the Date Line since the beginning of the year.

Westerly anomalies gradually decreased over the eastern equatorial Indian Ocean.

Westerly wind anomalies have persisted since the end of March over the equatorial Pacific east of 130°W.

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



Time

Longitude

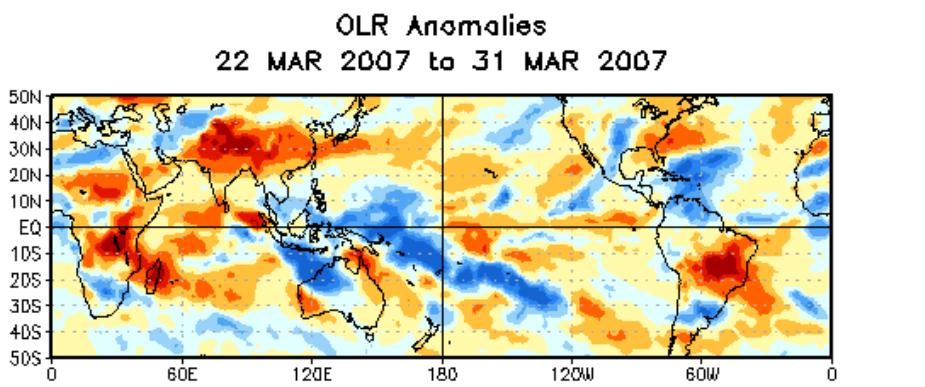
Drier-than-normal conditions, positive OLR anomalies (/red shading)

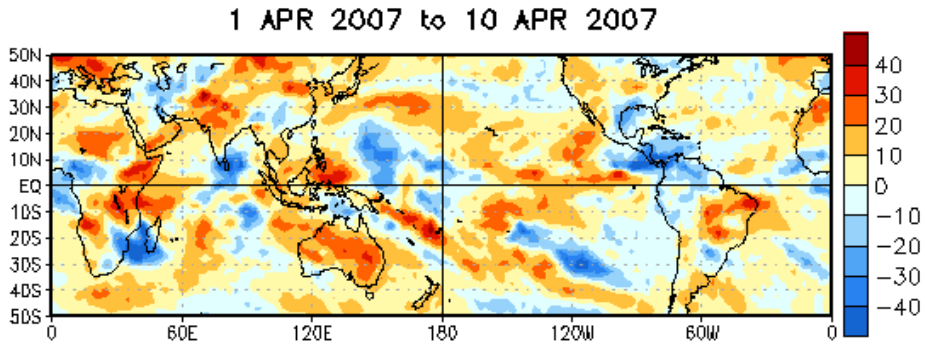
Wetter-than-normal conditions, negative OLR anomalies (blue shading)

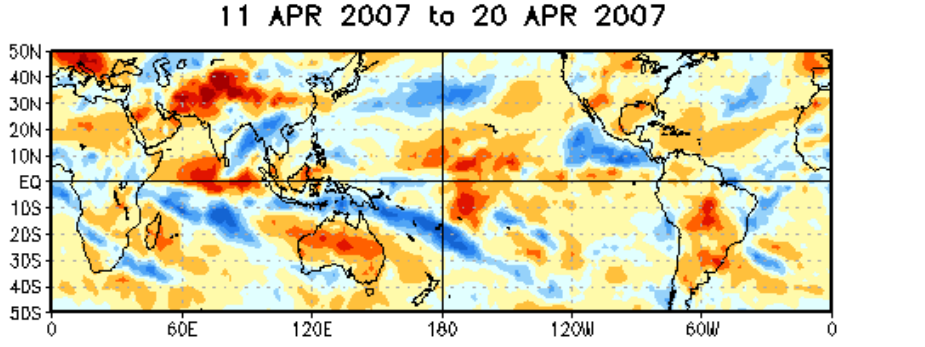
Enhanced convection, associated with the MJO in late December and January, shifted eastward from the Indian Ocean across the Maritime Continent and western Pacific.

Except for a few convective "flare ups", OLR anomalies were generally small across the Equatorial Belt during April.

Anomalous OLR: Last 30 days







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

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

During late March, convection was enhanced over the Maritime Continent and along the SPCZ, but was suppressed over much of central Africa and Brazil.

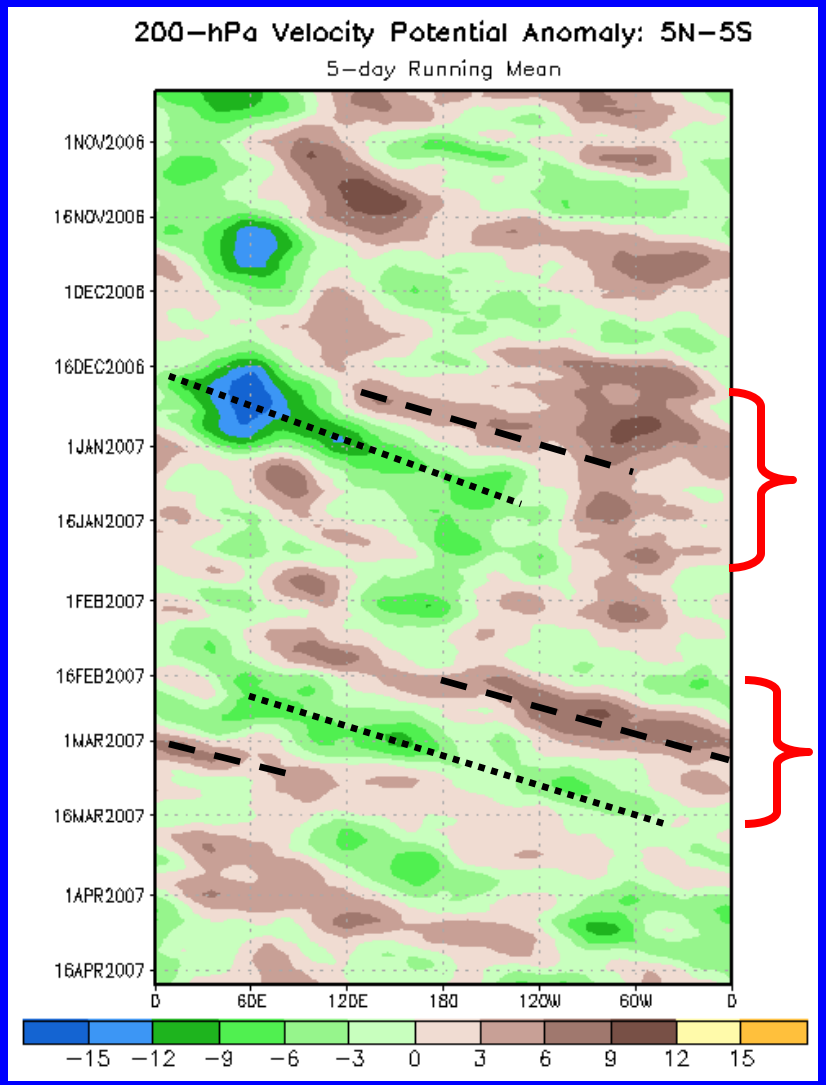
Convection decreased markedly across the Maritime Continent and along the SPCZ during early April.

During mid April, convection increased over parts of East Africa. Also, the ITCZ over the eastern Pacific was displaced northward and was active.

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

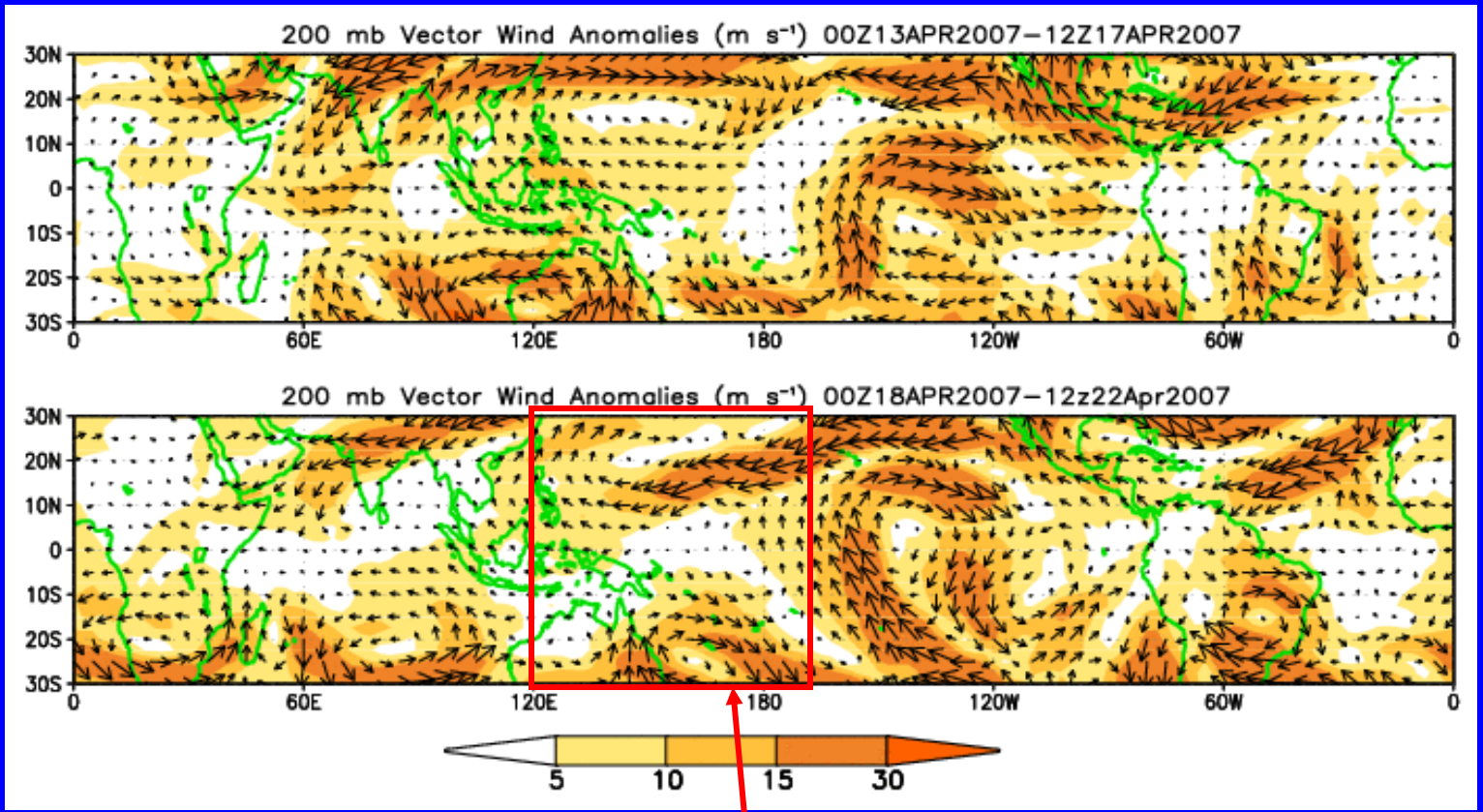
The MJO intensified in late December 2006, as negative OLR anomalies shifted eastward from the Maritime continent into the central tropical Pacific.

Weak to moderate MJO activity was observed during late February and early March as velocity potential anomalies shifted eastward.

The MJO has been weak or incoherent since mid-March.

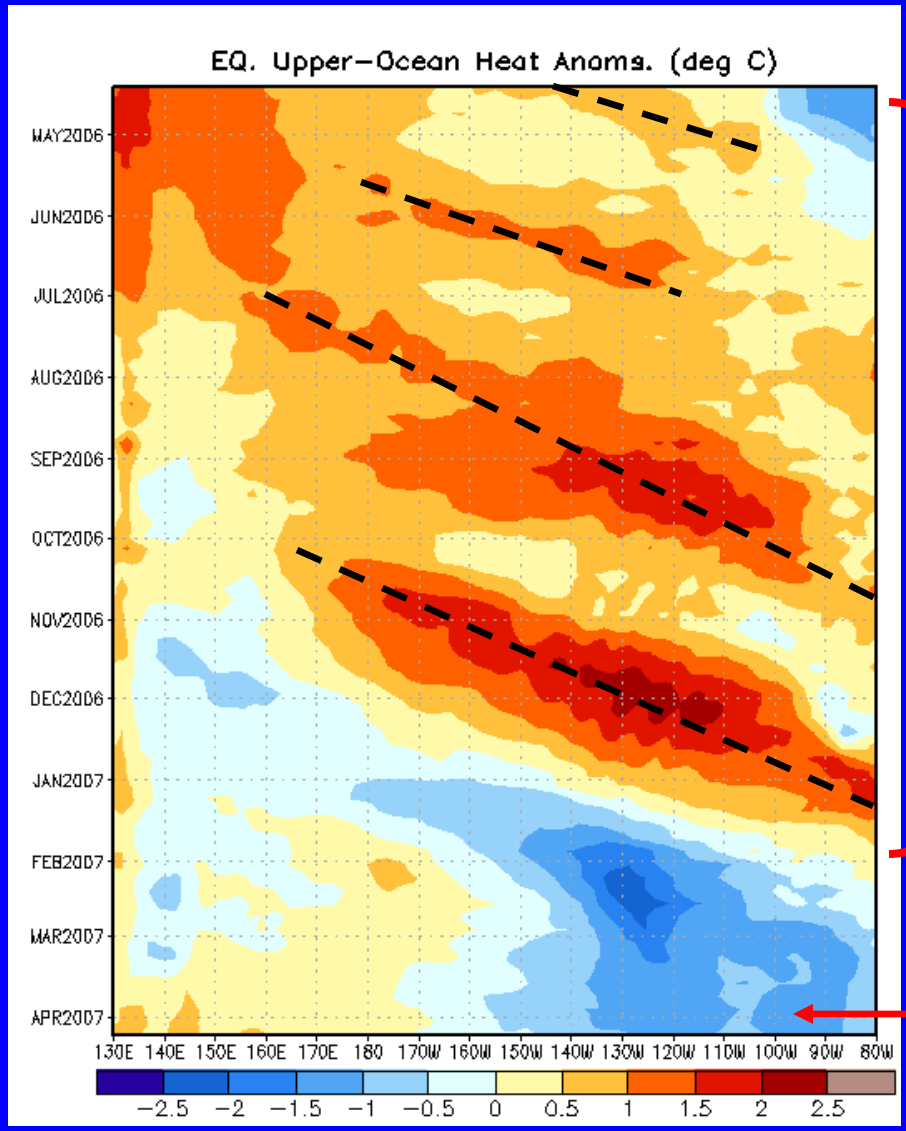
200-hPa Vector Winds and Anomalies ($m\ s^{-1}$)

Note that shading denotes the magnitude of the anomalous wind vectors.



Anticyclonic anomalies emerged in the western Pacific.

Heat Content Evolution in the Eq. Pacific



Time

Longitude

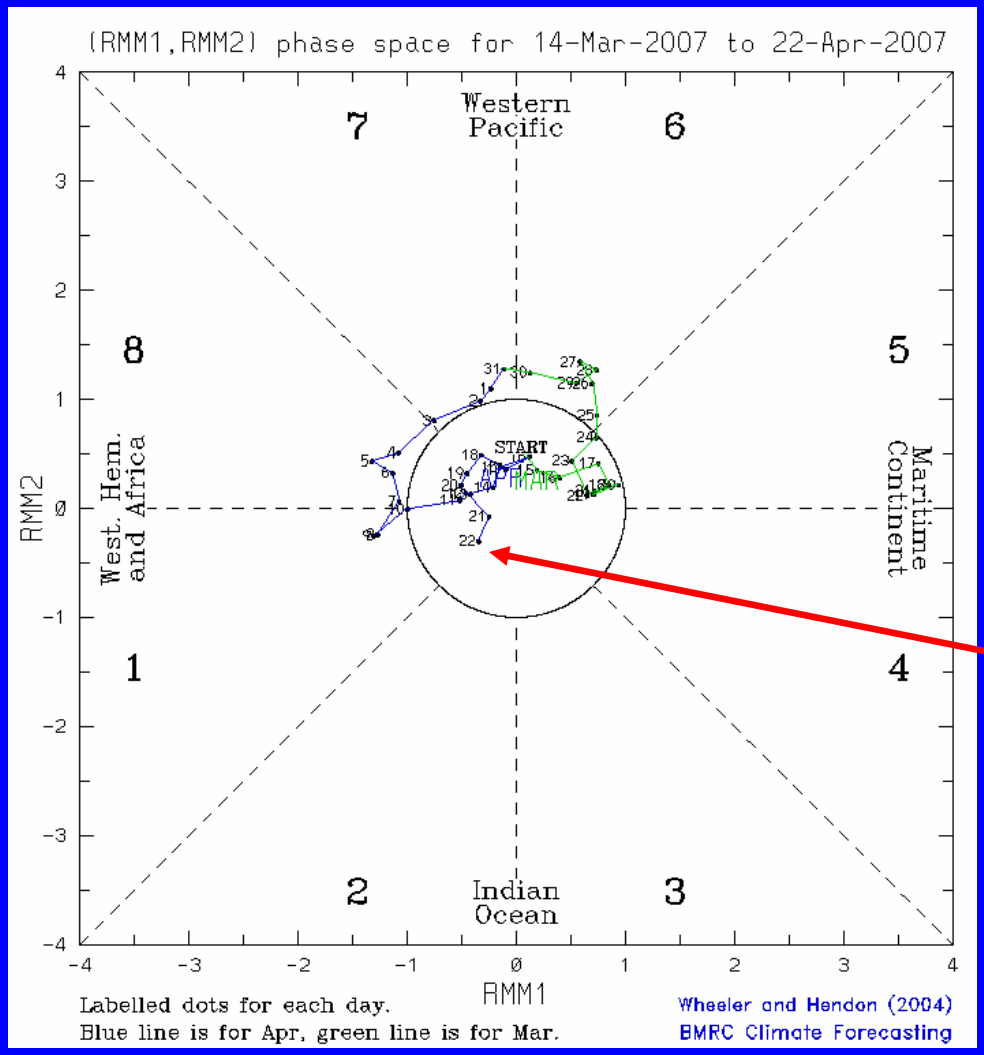
During this period eastward-propagating Kelvin waves (warm phases indicated by dashed lines) have caused considerable month-to-month variability in the upper-ocean heat content.

Since January, negative heat content anomalies are evident across the eastern equatorial Pacific. The negative temperature anomalies at depth have recently come to the surface, resulting in SST's of 1 to 2 °C below normal east of 120 °W.

MJO Index (Magnitude and Phase)

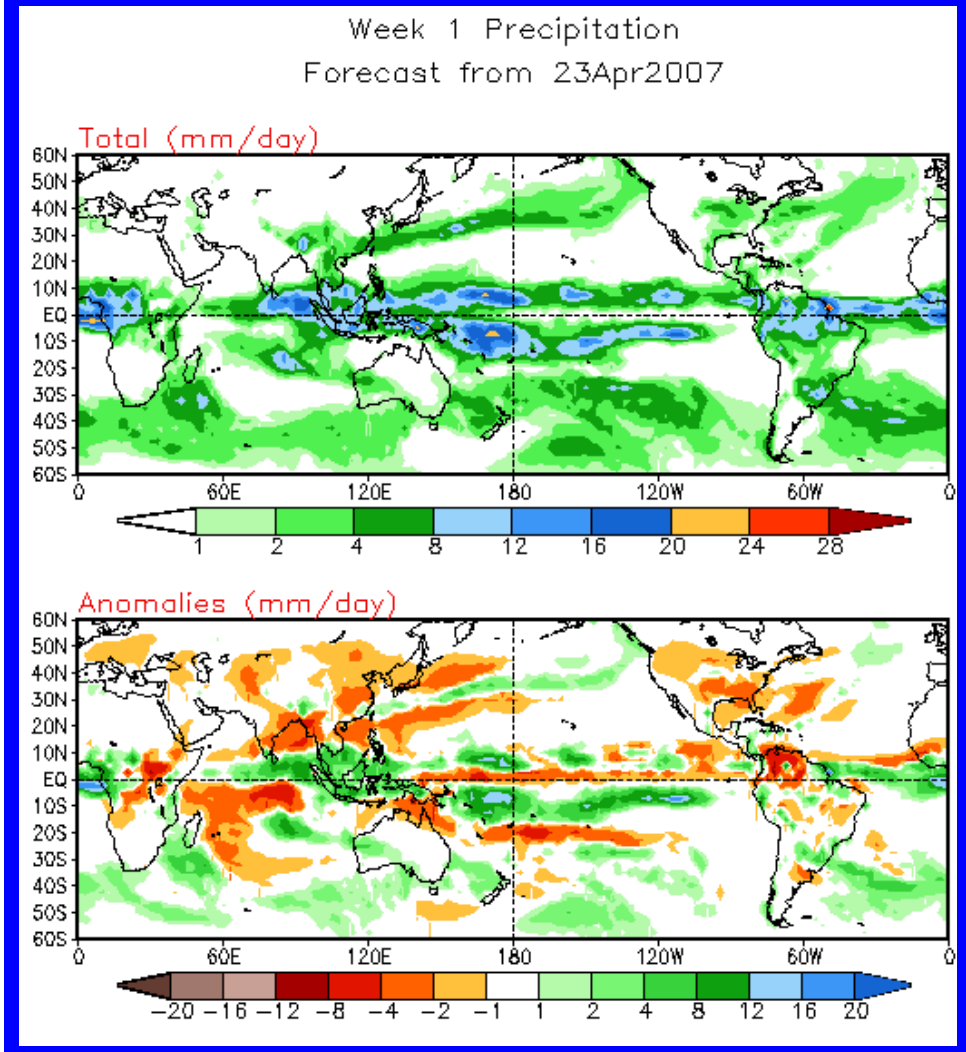
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850-hPa zonal wind, 200- hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

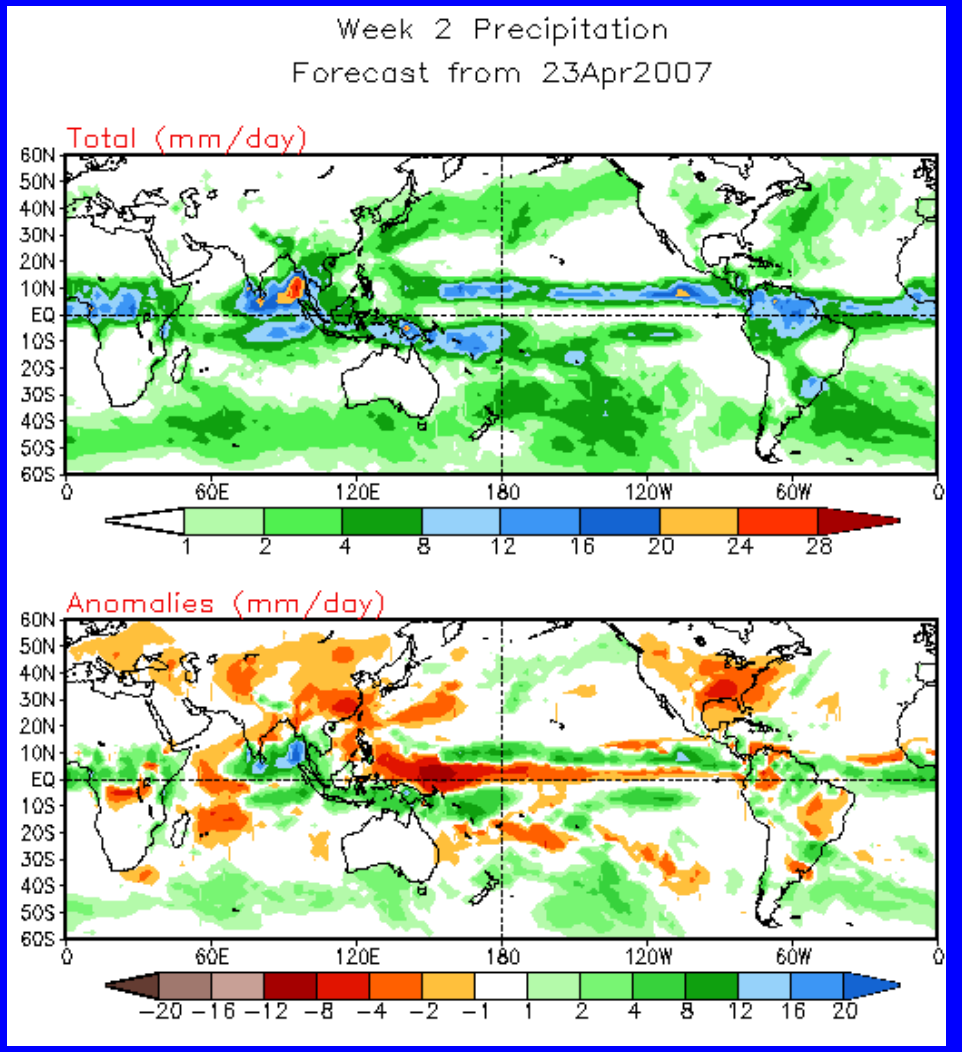
The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate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

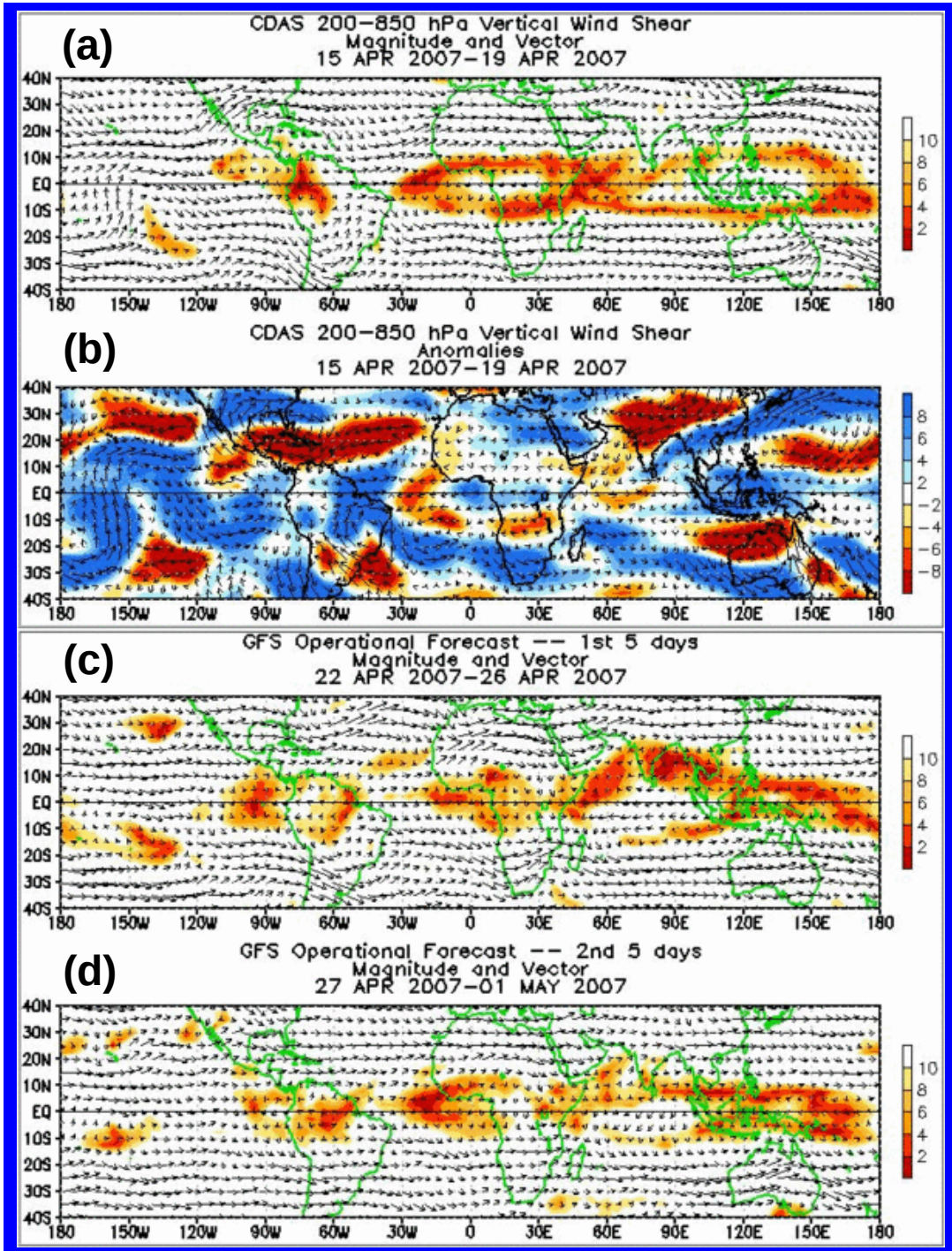


The MJO index indicates that the MJO signal is incoherent.

Experimental Bias-Corrected GFS Precipitation







200 – 850 hPa Vertical Wind Shear

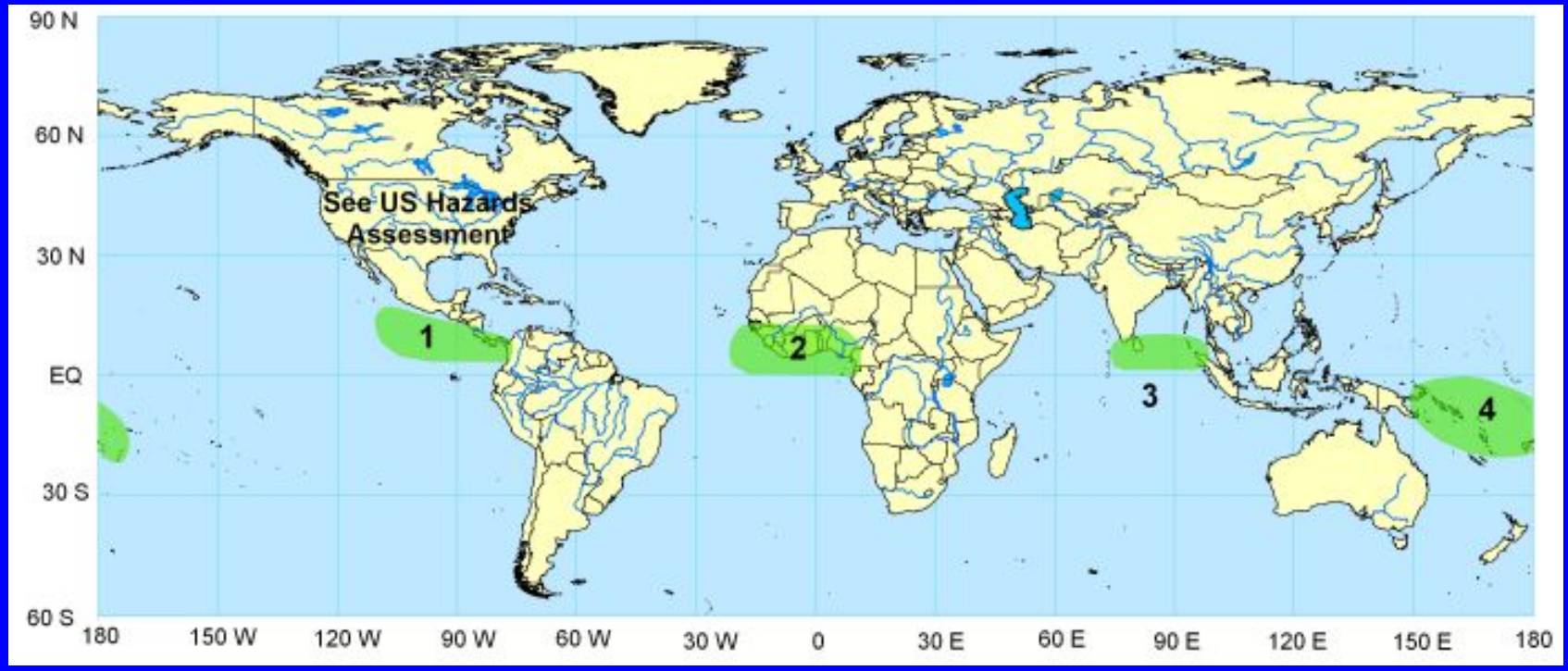
All plots: Shading denotes magnitude of vectors

Plots (a),(c),(d): low shear (red), high shear (yellow/white)

Plot (b): Shear greater than average (blue) Shear less than average (yellow/red)

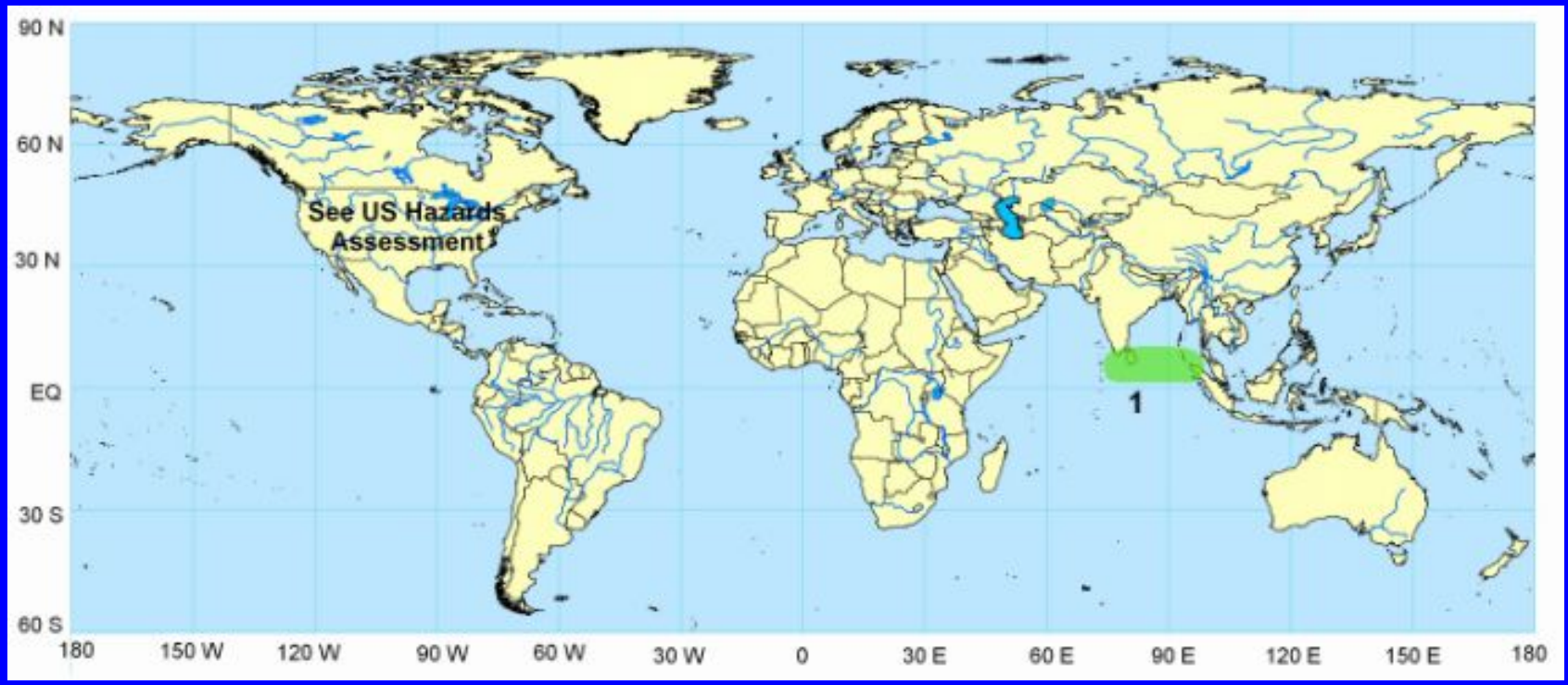
The GFS forecast indicates low shear over the Arabian Sea, Bay of Bengal and western tropical Pacific during the next 10 days.

Potential Benefits/Hazards – Week 1
Valid: 24 - 30 April 2007



1. An increased chance for above-average rainfall for Central America and the eastern tropical Pacific.
2. An increased chance for above-average rainfall over the Gulf of Guinea region of Africa.
3. An increased chance for above-average rainfall across the lower Bay of Bengal, Sri Lanka and the Nicobar Islands.
4. An increased chance for above-average rainfall over the Solomon Islands, Vanuatu and Fiji.

Potential Benefits/Hazards – Week 2
Valid: 1 – 7 May 2007



1. **An increased chance for above-average rainfall across the lower Bay of Bengal, Sri Lanka and the Nicobar Islands. The potential also exists for tropical cyclone development in this region.**

Summary

- **The MJO remains incoherent.**
- **During week 1, wetter than average conditions are expected over the eastern tropical Pacific Ocean, sections of Central America and the Gulf of Guinea region of Africa.**
- **Also during week 1, there exists an increased chance for above-average rainfall across the Solomon Islands, Vanuatu and Fiji.**
- **An increased chance for above-average rainfall exists over the lower Bay of Bengal, Sri Lanka and the Nicobar Islands throughout the period. There is also the potential for tropical storm development during week 2 in this area.**