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

Update prepared by
Climate Prediction Center / NCEP
February 20, 2006

Outline

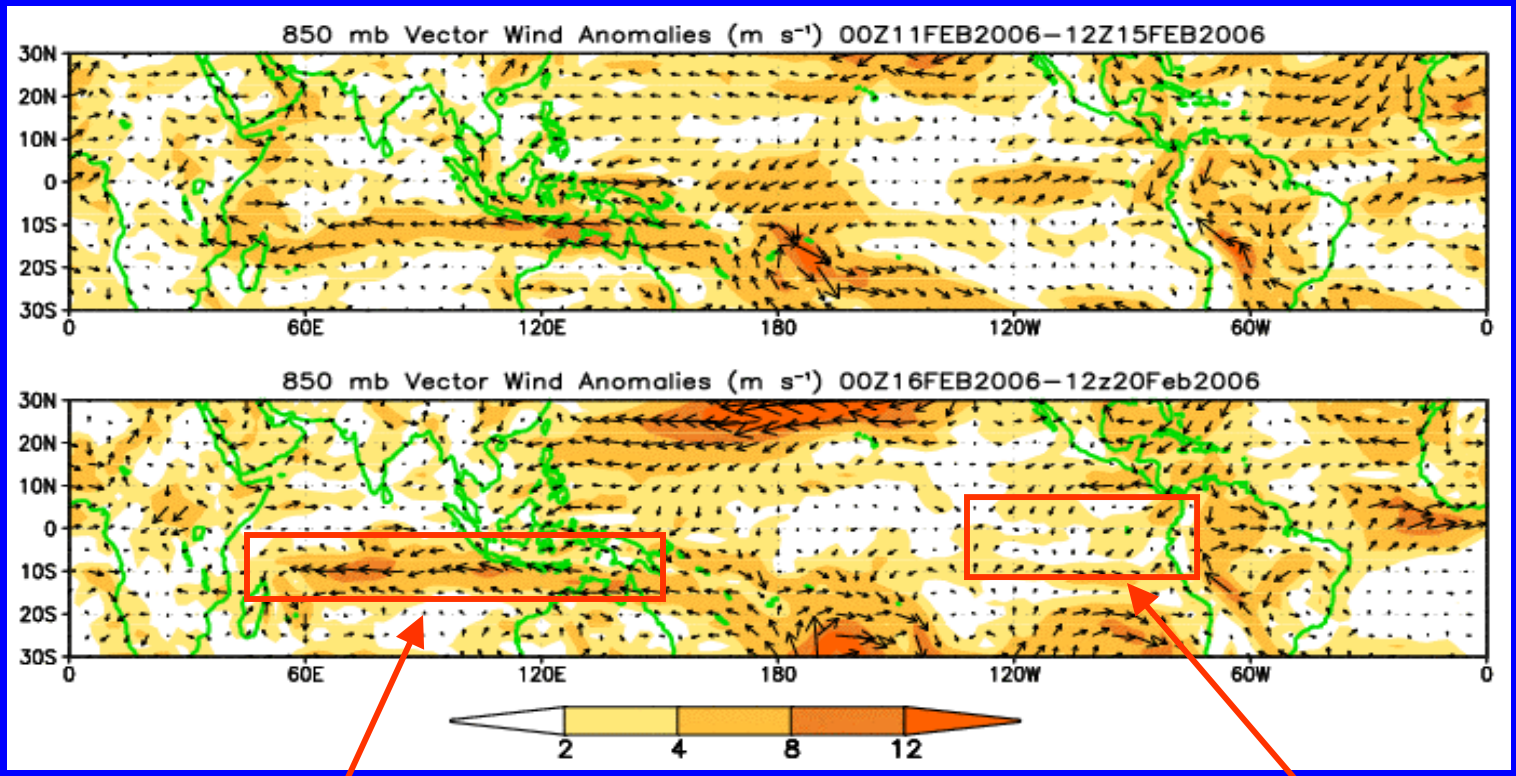
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- Current atmospheric conditions indicate a weak MJO signal superimposed upon the prevailing La Nina pattern.
- During the past week, convection has begun to redevelop across sections of Indonesia and the eastern Indian Ocean that have been drier than normal for the last few weeks. Low-level westerly anomalies across these regions, in part associated with an MJO, have ended and easterly anomalies have returned mainly south and along the equator. Rainfall was enhanced in the central Pacific Ocean near Hawaii as well as across sections of Africa. Tropical cyclogenesis occurred in the western Indian Ocean as well during the past week.
- The MJO is expected to continue to remain relatively weak during the upcoming 1-2 week period. It is, however, still anticipated to have influences across sections of the global tropics.
- Expected hazards/benefits across the global tropics during the upcoming 1-2 week period include an increased chance for above normal rainfall in the vicinity of Hawaii in the central Pacific Ocean associated with the expected continuation of upper-level cyclonic circulations typical during La Nina conditions. Increased chances for above average rainfall are expected for sections of southeast Africa stretching across the Indian Ocean along and south of the equator to Indonesia and into the western Pacific Ocean associated with the emergence of the enhanced phase of the MJO into the eastern hemisphere and the re-establishment of the pattern of convection expected during La Nina. There also exists increased chances of tropical cyclone development across sections of the southern Indian Ocean and in the Pacific Ocean (east of the Philippines, east of Australia) as conditions are again becoming favorable (enhanced convection, large scale upper-level divergence, and above average sea surface temperatures) for tropical development in these areas.
- Although not shown on the hazard maps, ensemble numerical weather forecast models are suggesting the threat of above average rainfall along the west coast of the United States during week 2. The uncertainty for this event, however, is high.

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

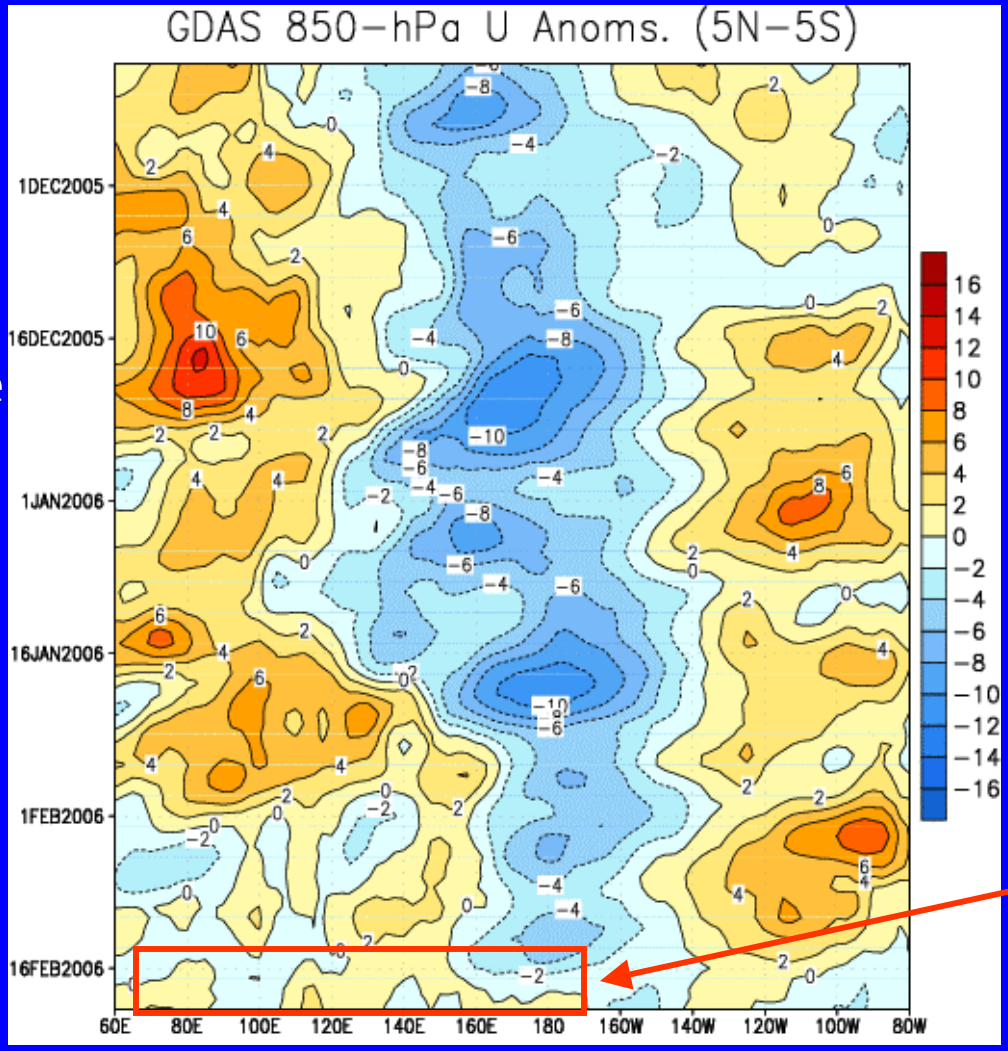
Note that shading denotes the magnitude of the anomalous wind vectors



Easterly anomalies increased over northern Australia and extended across the Indian Ocean into Madagascar and continental southern Africa

Westerly anomalies weakened in the eastern Pacific Ocean

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



Time

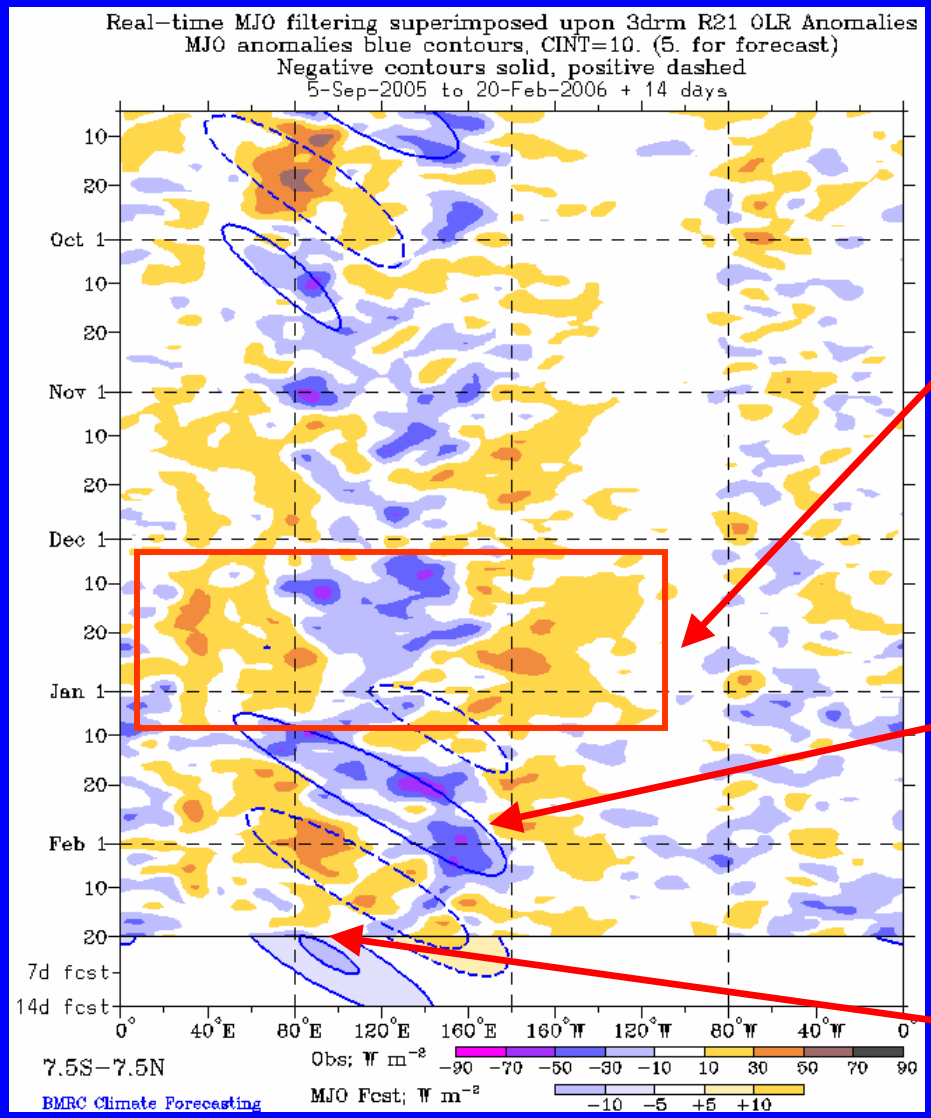
Longitude

Weaker-than-average easterlies or westerlies (orange/red shading).

Stronger-than-average easterlies (blue shading).

During the past week equatorial low-level winds have become near average across much of the Indian and Pacific Oceans

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



Time

Longitude

Drier-than-average conditions (/red shading)

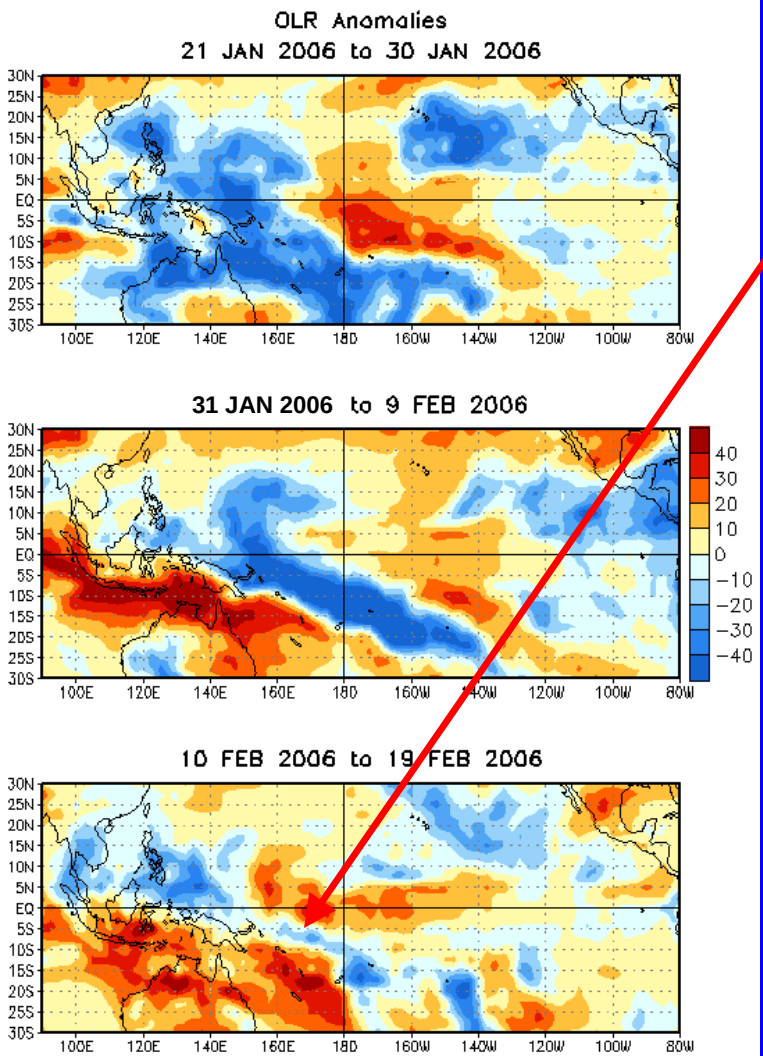
Wetter-than-average conditions (blue shading)

Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean during December

A couplet of suppressed and enhanced convection stretching from Indonesia into the western Pacific propagated east during mid-January through early February.

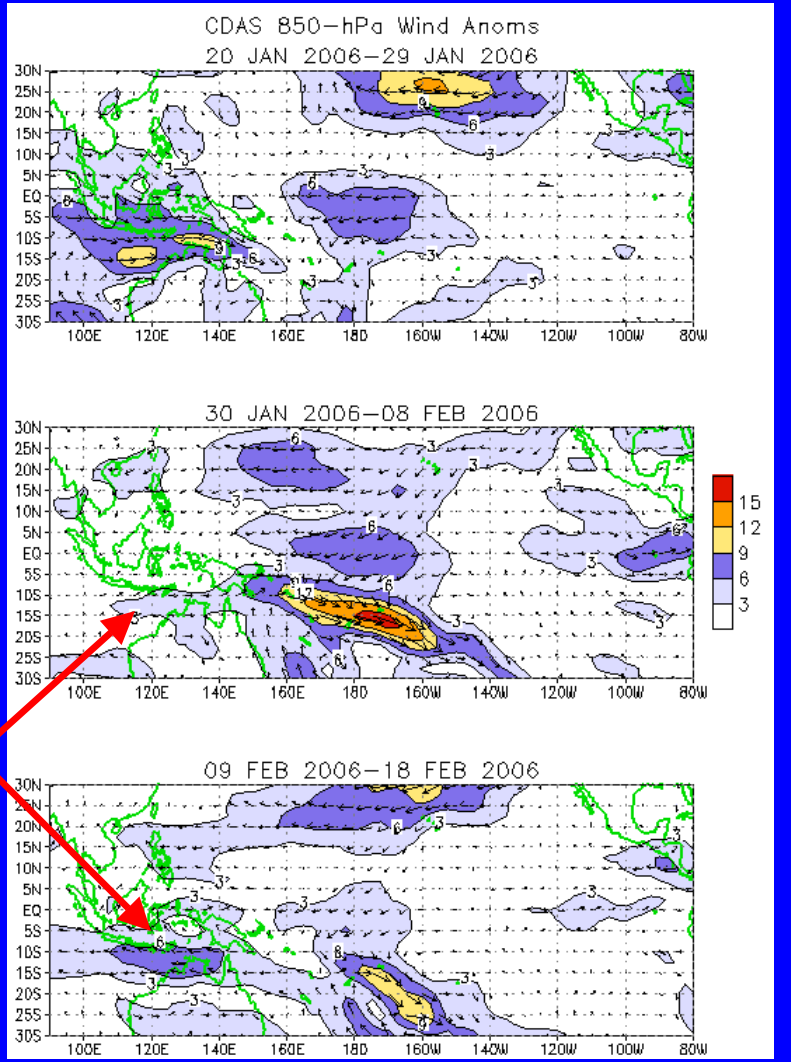
During the past week, convection has begun to redevelop in the Indian Ocean and Indonesia.

Anomalous OLR and 850-hPa Wind: Last 30 days

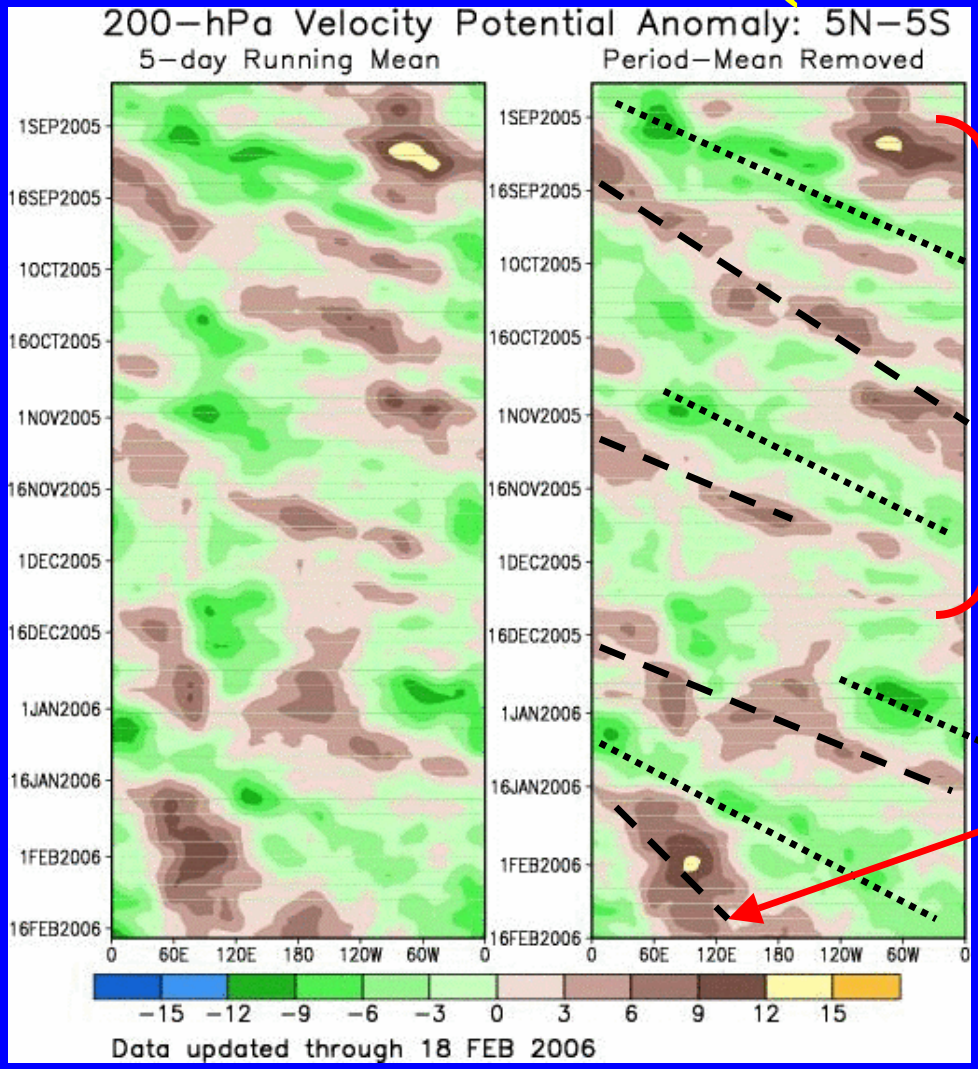


During the past 10 days, enhanced convection in the vicinity of the SPCZ has weakened and so has suppression across southern Indonesia and northern Australia. Also, enhanced convection is evident in the western Pacific north of the Equator.

During the past 10 days, strong westerly anomalies over Indonesia and northern Australia have weakened and have been replaced with easterly anomalies.



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



Time

Longitude

Positive anomalies (brown shading) indicate unfavorable conditions for precipitation.

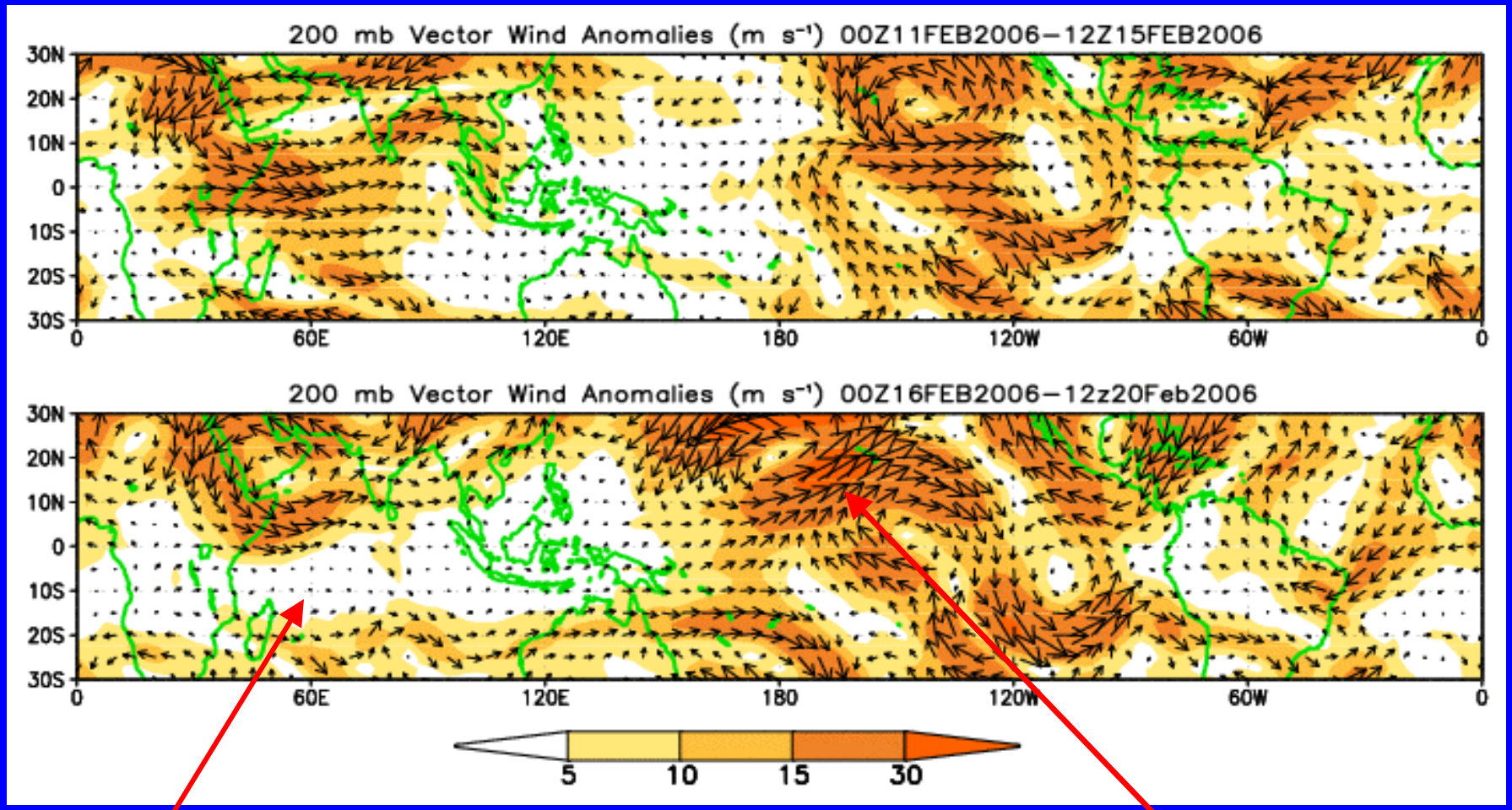
Negative anomalies (green shading) indicate favorable conditions for precipitation.

Weak to moderate MJO activity was observed at times during the period from August into November

During the past week, strong upper-level convergence evident across the central Indian Ocean and western Indonesia has relaxed.

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

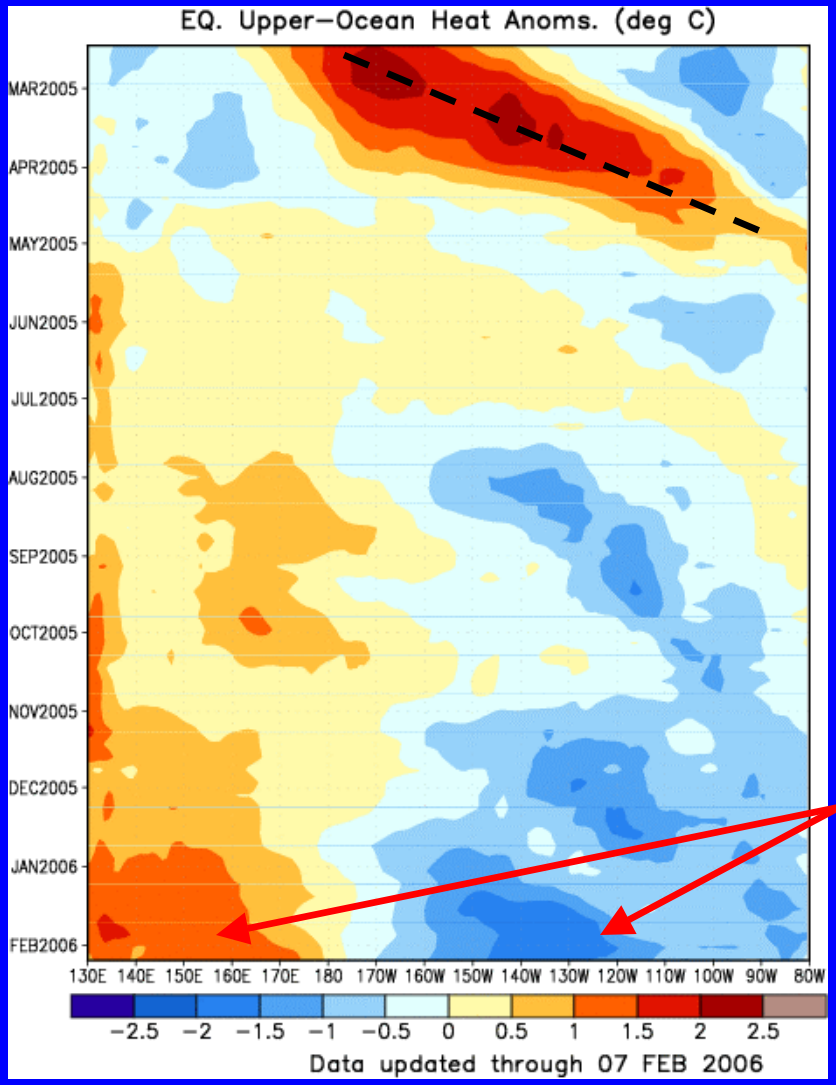
Note that shading denotes the magnitude of the anomalous wind vectors.



Upper-level tropospheric westerly anomalies across the southern Indian Ocean have lessened

Upper-level cyclonic circulation west of Hawaii

Heat Content Evolution in the Eq. Pacific



Time

Longitude

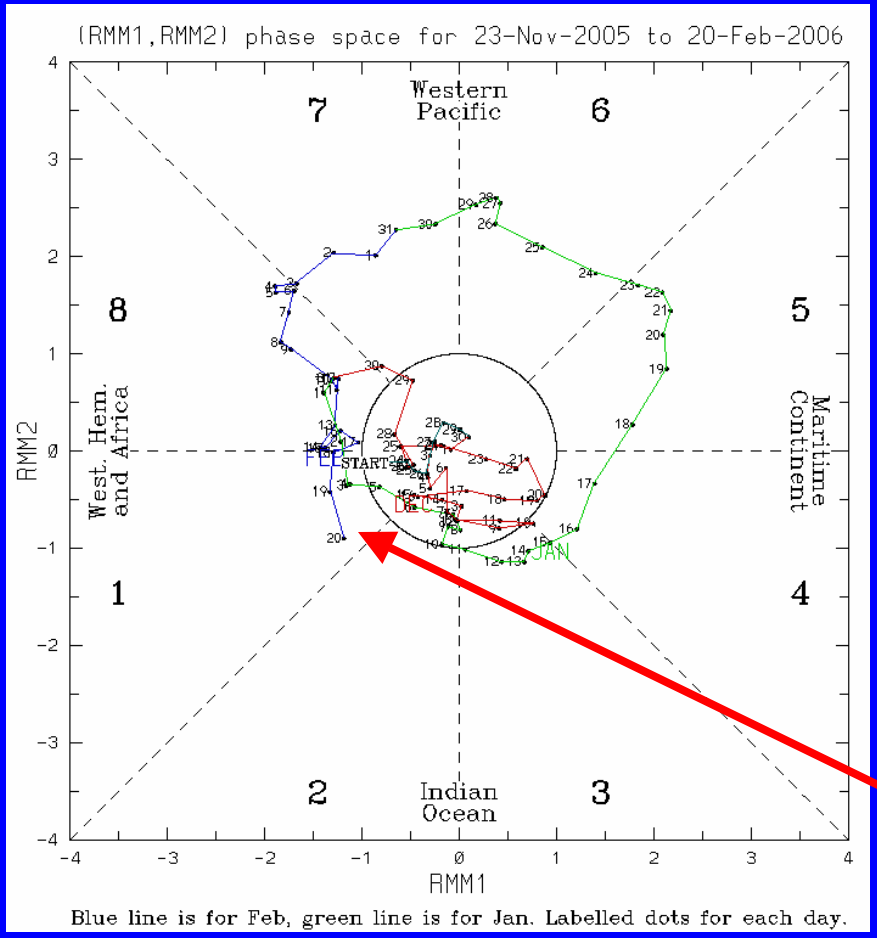
During February 2005, a strong Kelvin wave developed and continued to strengthen during March and reached the South American coast during early April

Heat content has been above average in the western Pacific since June while cooler water has been observed across the central and eastern Pacific.

MJO Index (Magnitude and Phase)

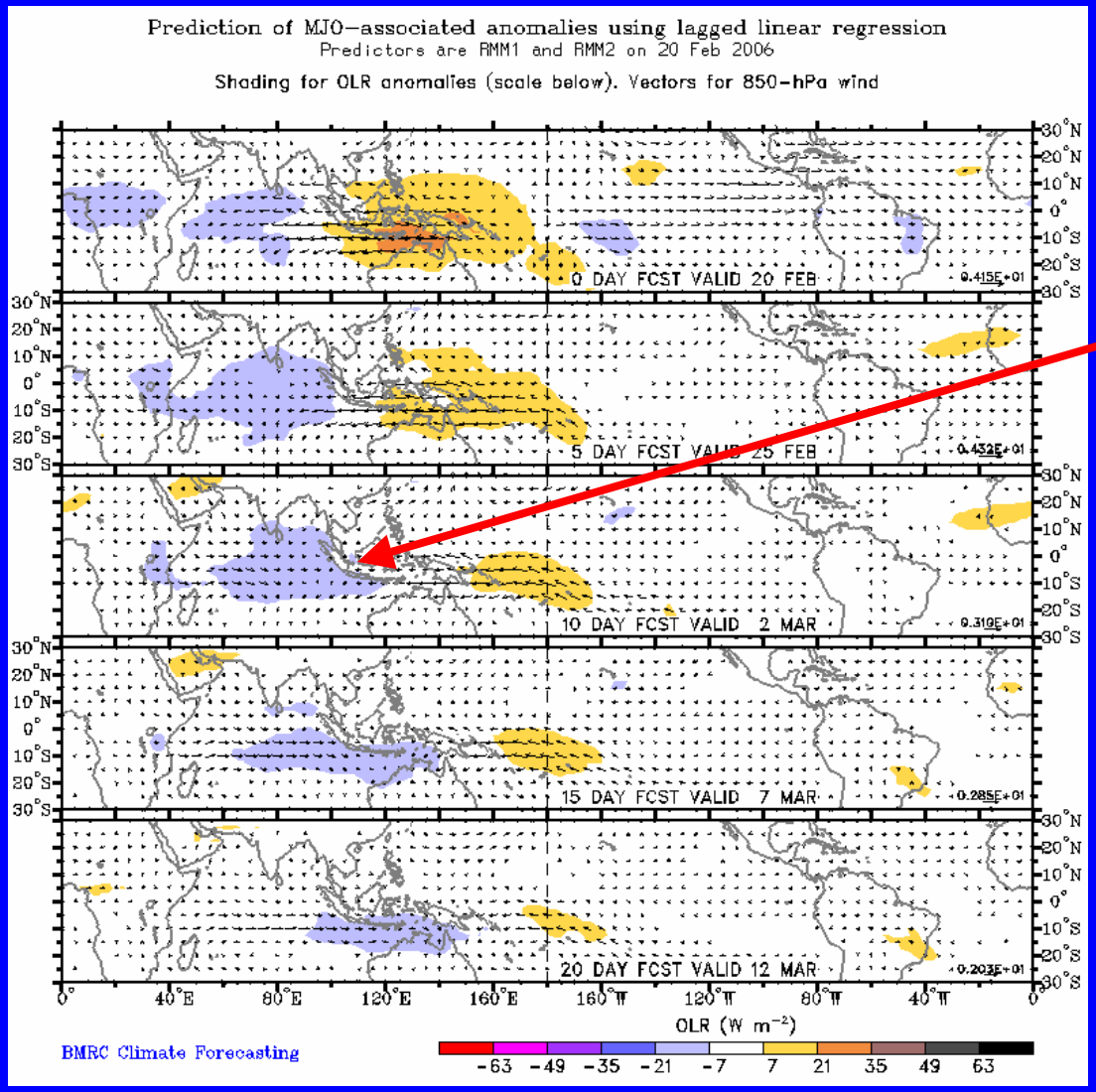
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.



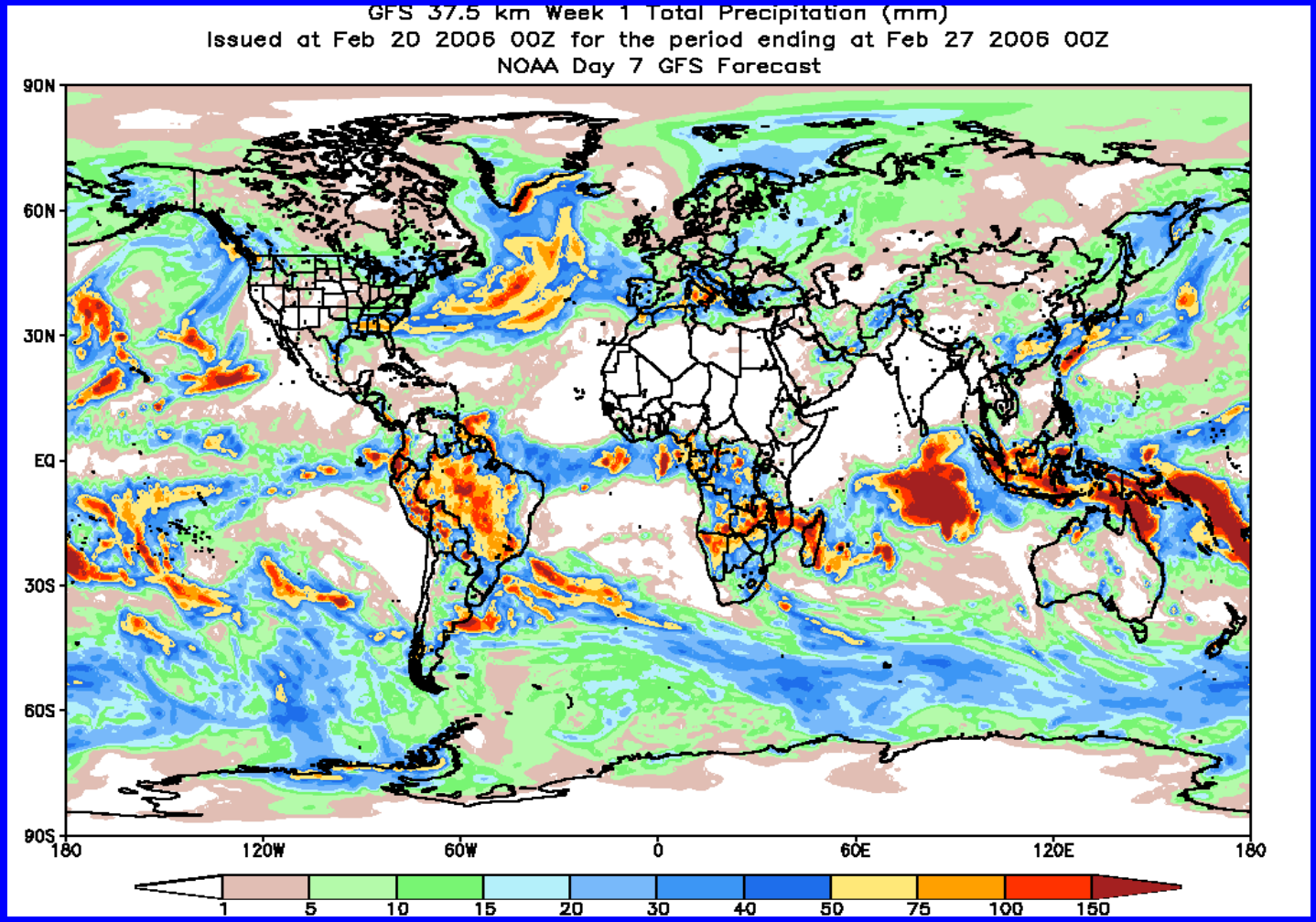
The MJO index indicates a weak but evident MJO signal with the enhanced phase located in the western hemisphere mainly near Africa.

Statistical OLR MJO Forecast



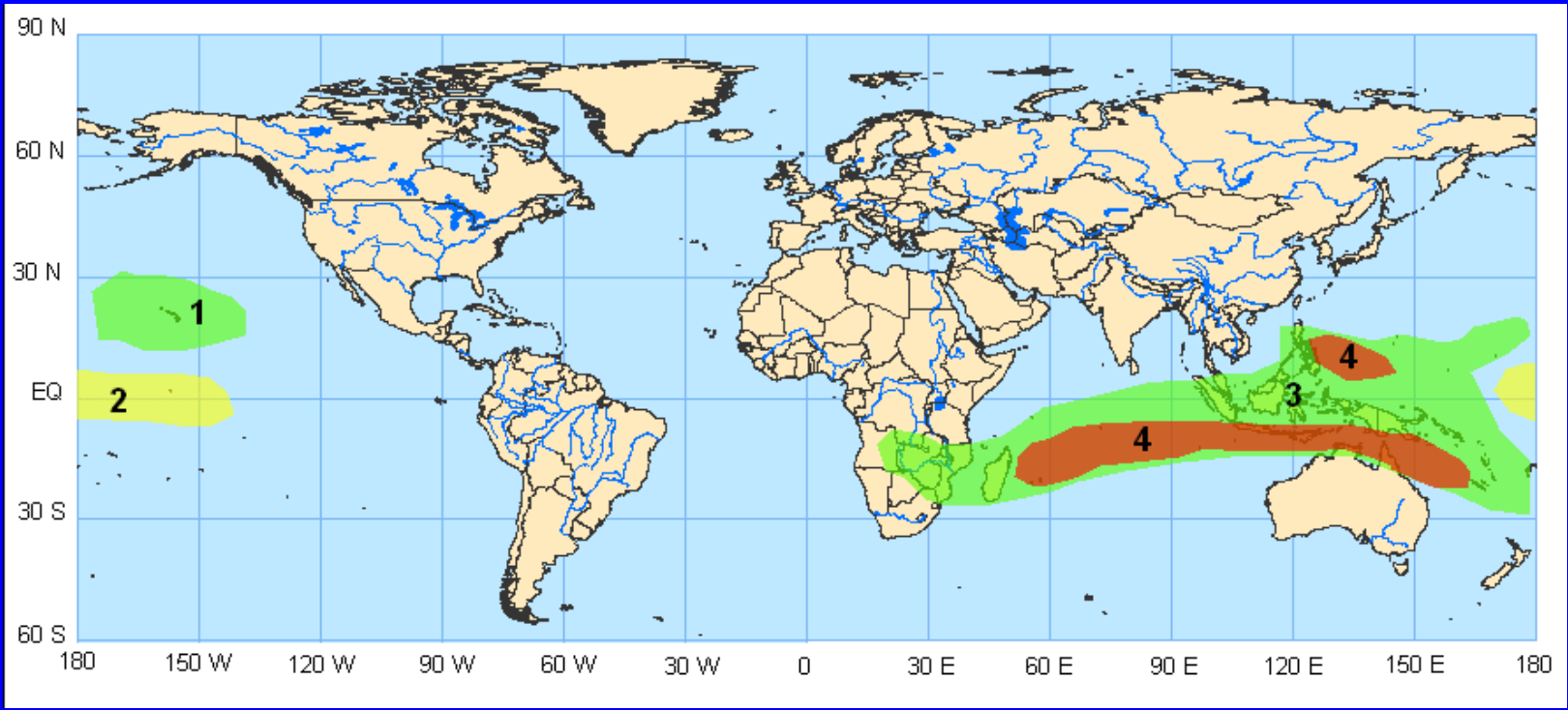
A statistical MJO forecast indicates enhanced convection (blue shades) slowly shifting east from central Africa to Indonesia during the period.

Global Forecast System (GFS) Precipitation Forecast



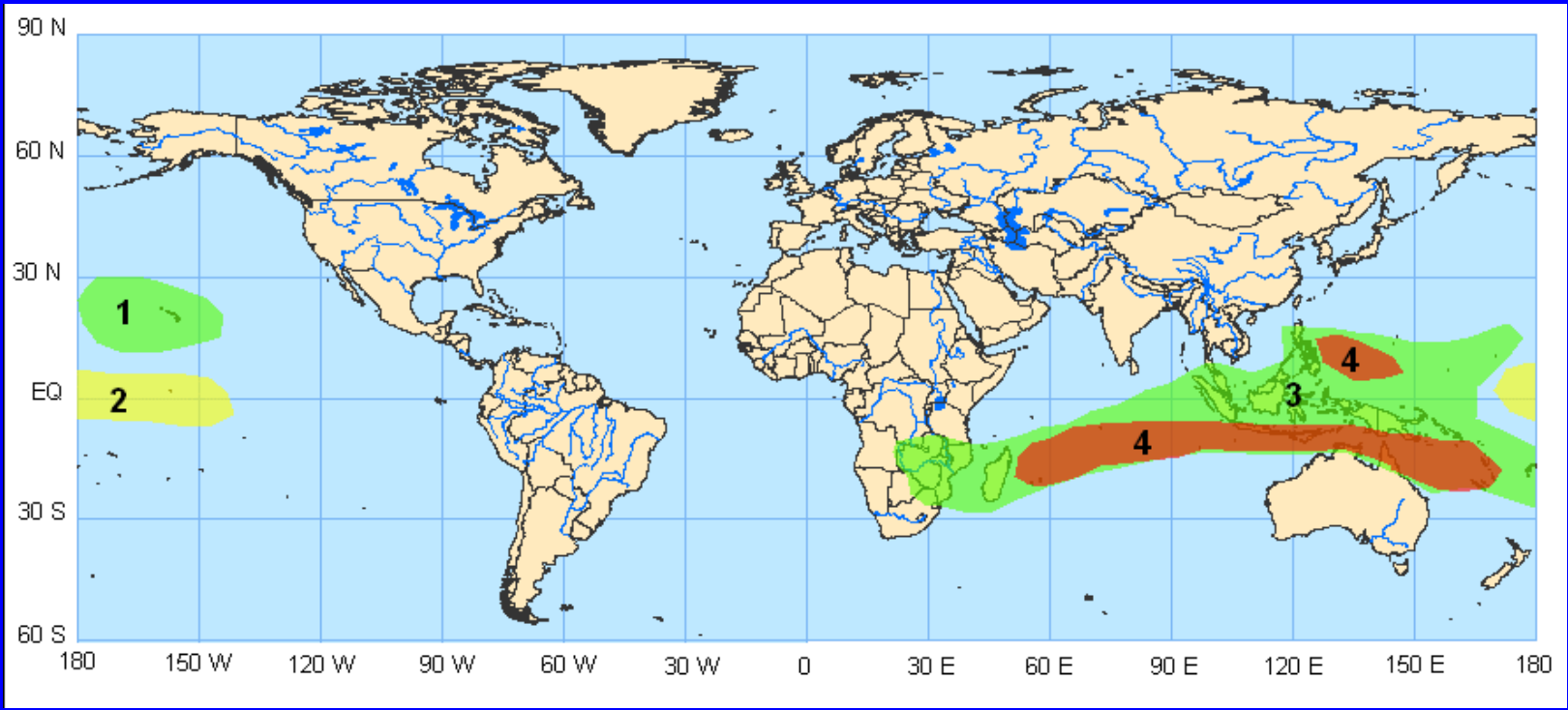
The GFS indicates plentiful rainfall over the eastern Indian Ocean, Indonesia and sections of the western Pacific mainly across Polynesia, as well as sections of north-central Brazil, and southern Africa.

Potential Benefits/Hazards – Week 1
Valid February 21 – February 27, 2006



1. An increased chance for above normal rainfall in the north central Pacific due to cyclonic circulations common with La Nina conditions.
2. An increased chance for below normal rainfall in the central equatorial Pacific Ocean due to cool sea surface temperatures.
3. An increased chance for above normal rainfall from southeast Africa across the Indian Ocean into Indonesia due to a combination of the enhanced phase of the MJO and the re-establishment of convection typical during La Nina conditions.
4. Increased chances for tropical cyclogenesis in the Indian Ocean south of the equator and in the western Pacific Ocean east of the Philippines and east of Australia due the return of favorable atmospheric conditions (enhanced convection, large scale upper-level divergence, and low-level wind anomalies) and above average sea surface temperatures.

Potential Benefits/Hazards – Week 2
Valid February 28-March 6, 2006



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