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

Update prepared by
Climate Prediction Center / NCEP
March 6, 2006

Outline

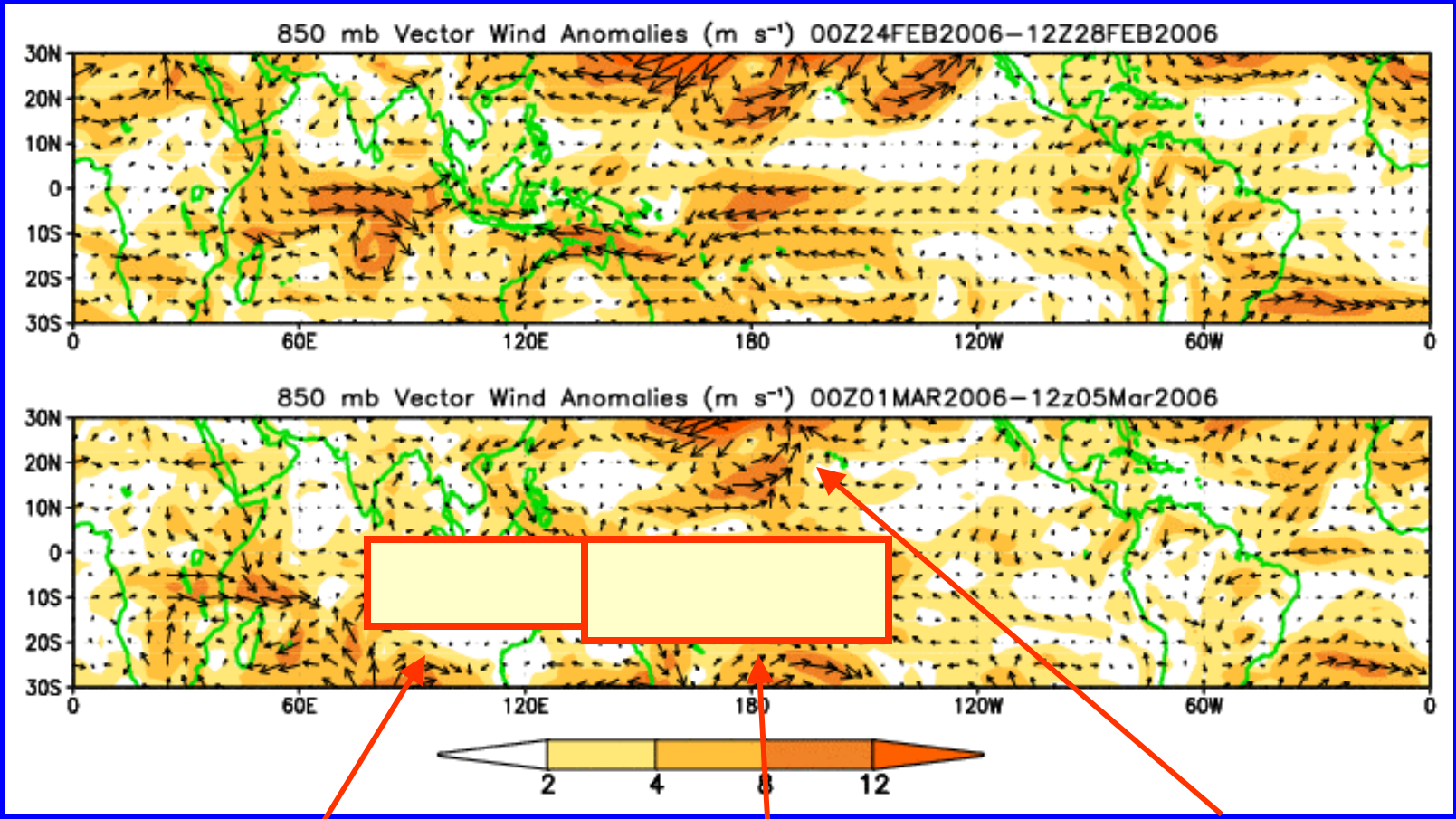
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- The latest observations indicate that a weak MJO exists and this signal is superimposed upon the underlying La Nina pattern.
- During the past week, convection intensified across Indonesia and parts of Australia. The easterly anomalies at the equator broadened east and west of the date line while low-level westerly anomalies persist along the equator in the central Indian Ocean. Rainfall remained enhanced in the central Pacific Ocean in the vicinity of Hawaii but was diminished over most of the equatorial Pacific east of the Maritime Continent. In addition, tropical systems developed east of Madagascar and the Philippines.
- Based on the latest observational evidence and forecasts, the MJO is expected to remain weak during the upcoming 1-2 week period.
- There exists several potential hazards/benefits across the global tropics during the upcoming period as conditions are expected to be dominated by La-Nina.
- During weeks 1 and 2, we expect enhanced rainfall for Indonesia, in the vicinity of Hawaii, and India (week 1 only) with diminished rainfall near the date line along the equator. An increased chance of tropical cyclogenesis in the southwest Indian Ocean and north of Australia exists through the period. Tropical Depression 01W may impact the Philippines, while tropical cyclone Diwa is expected to move away from Madagascar.
- Although not highlighted on the hazard maps, the threat exists for enhanced precipitation across the Pacific Northwest and for severe weather across sections of the central United States during week 1 as a well-developed trough positions itself across the western US. Also, tropical cyclogenesis is possible east of the Philippines during week 2.

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

Note that shading denotes the magnitude of the anomalous wind vectors

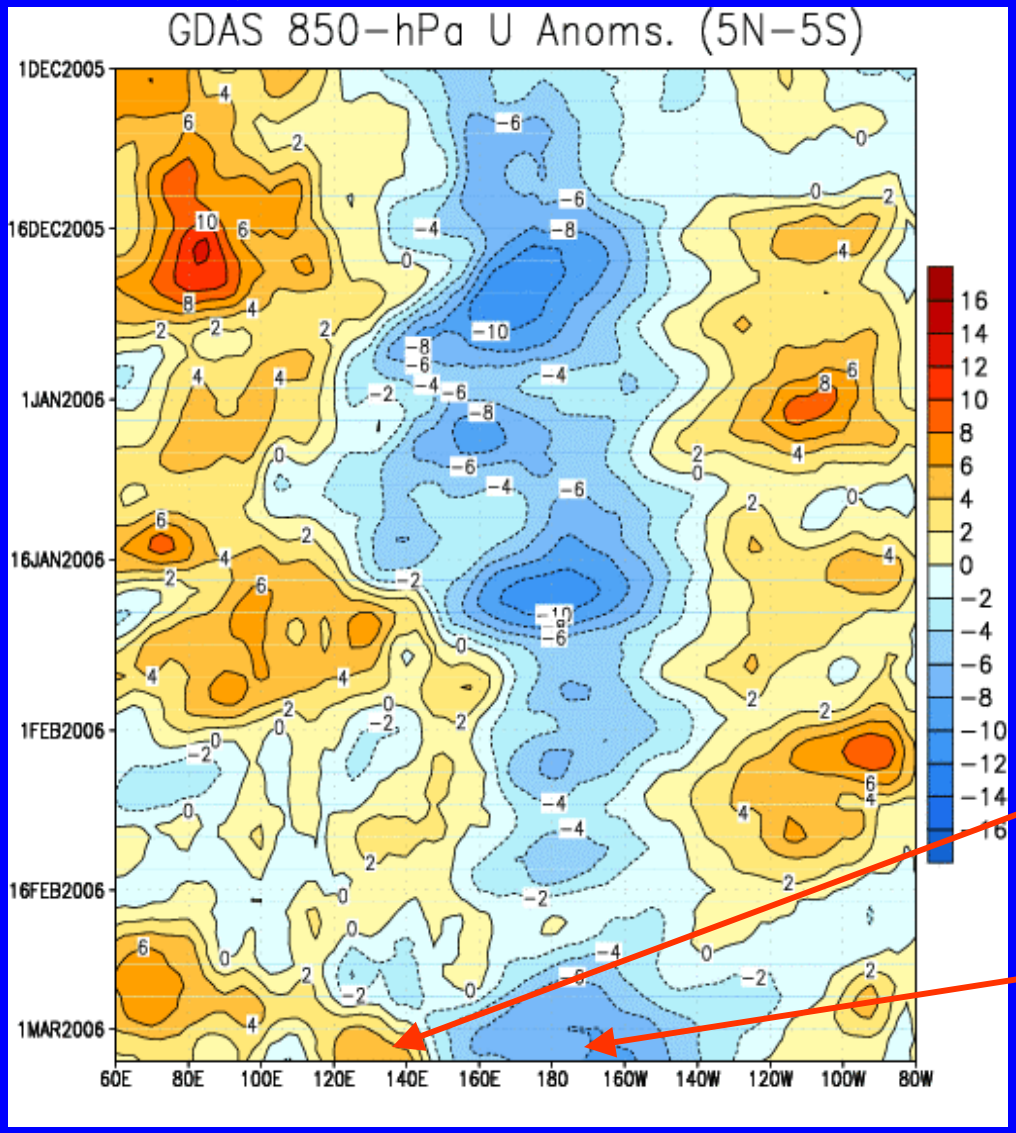


Westerlies are observed around Indonesia

Enhanced easterlies south of the equator

Couplet of cyclonic circulation evident near Hawaii

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



Time

Longitude

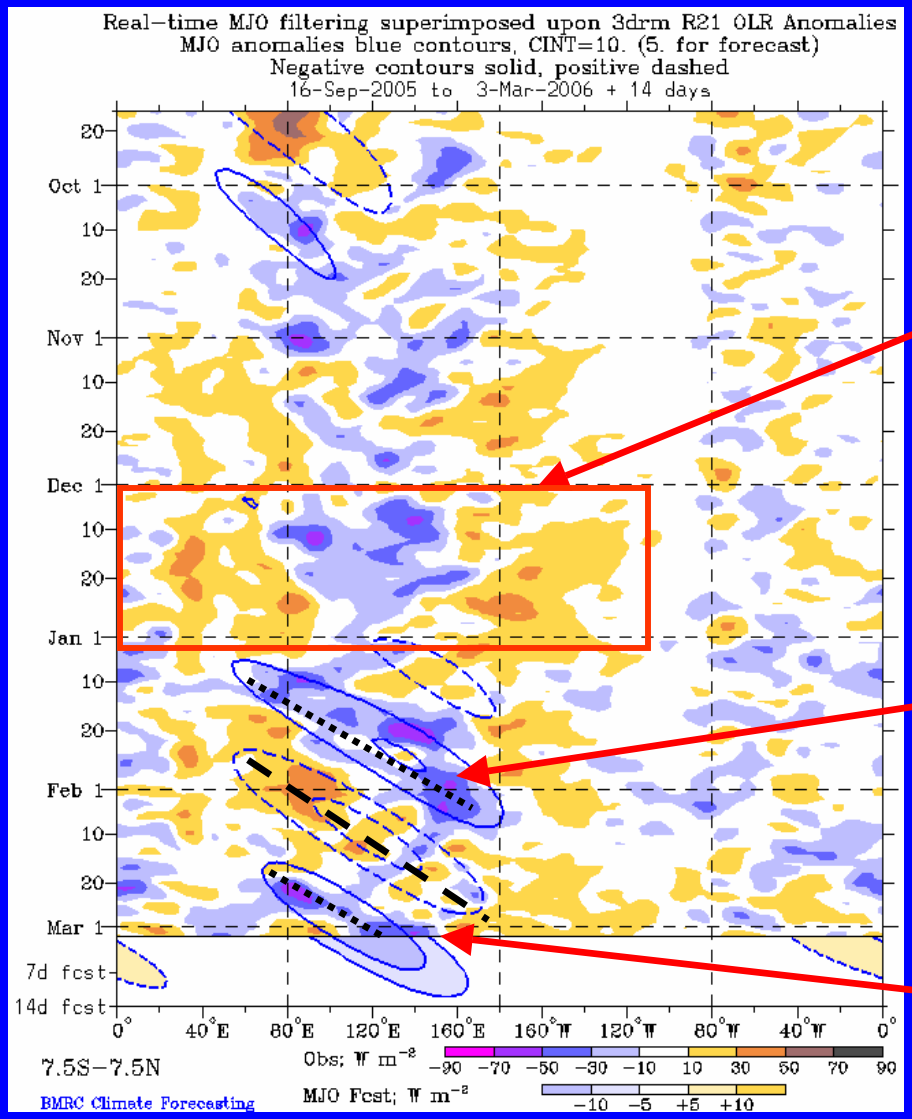
Weaker-than-average easterlies or westerlies (orange/red shading).

Stronger-than-average easterlies (blue shading).

Equatorial low-level westerly anomalies have expanded eastward into the western Pacific

During the past week, the area of easterly anomalies has intensified and expanded near the date line

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



Time

Longitude

Drier-than-average conditions (/red shading)

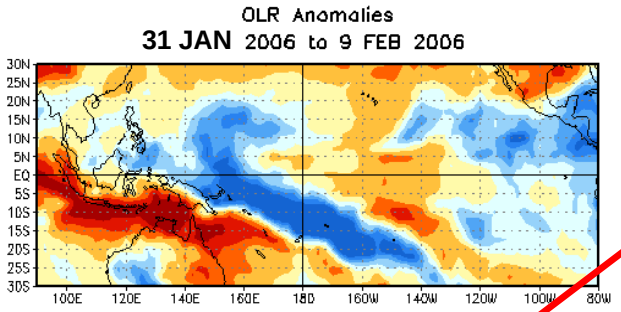
Wetter-than-average conditions (blue shading)

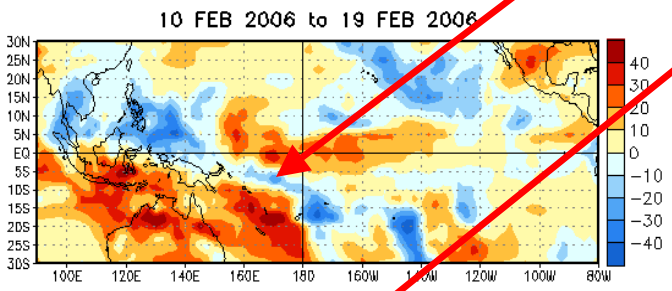
Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean during December

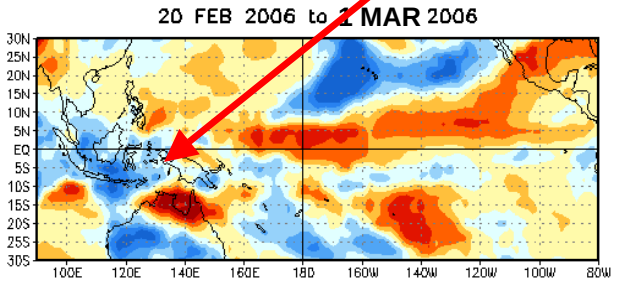
A couplet of suppressed and enhanced convection stretching from Indonesia into the western Pacific propagated east during mid-January through early February.

During the past week, enhanced convection is evident in Indonesia.

Anomalous OLR and 850-hPa Wind: Last 30 days

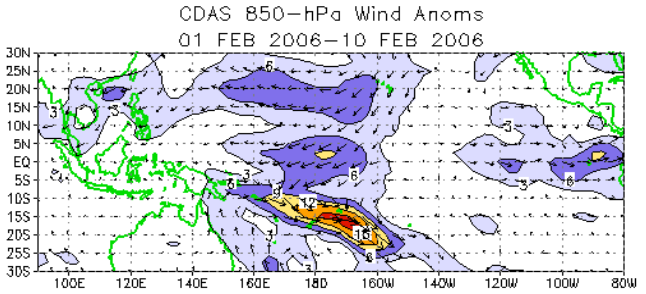


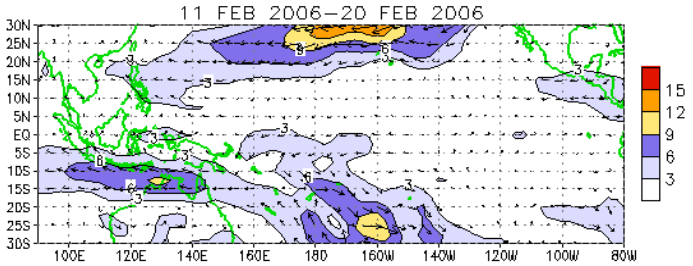


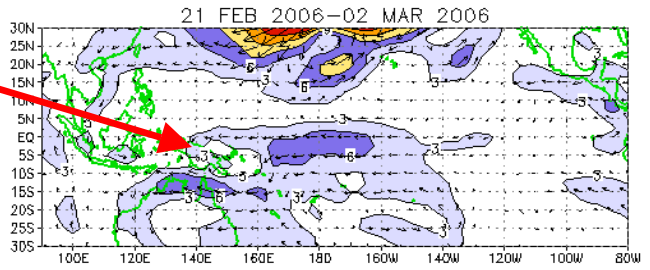


During the second 10 days, enhanced convection in the vicinity of the SPCZ weakened, but during the most recent 10 days, enhanced convection has gradually returned to Indonesia, southern Australia, and the western South Pacific.

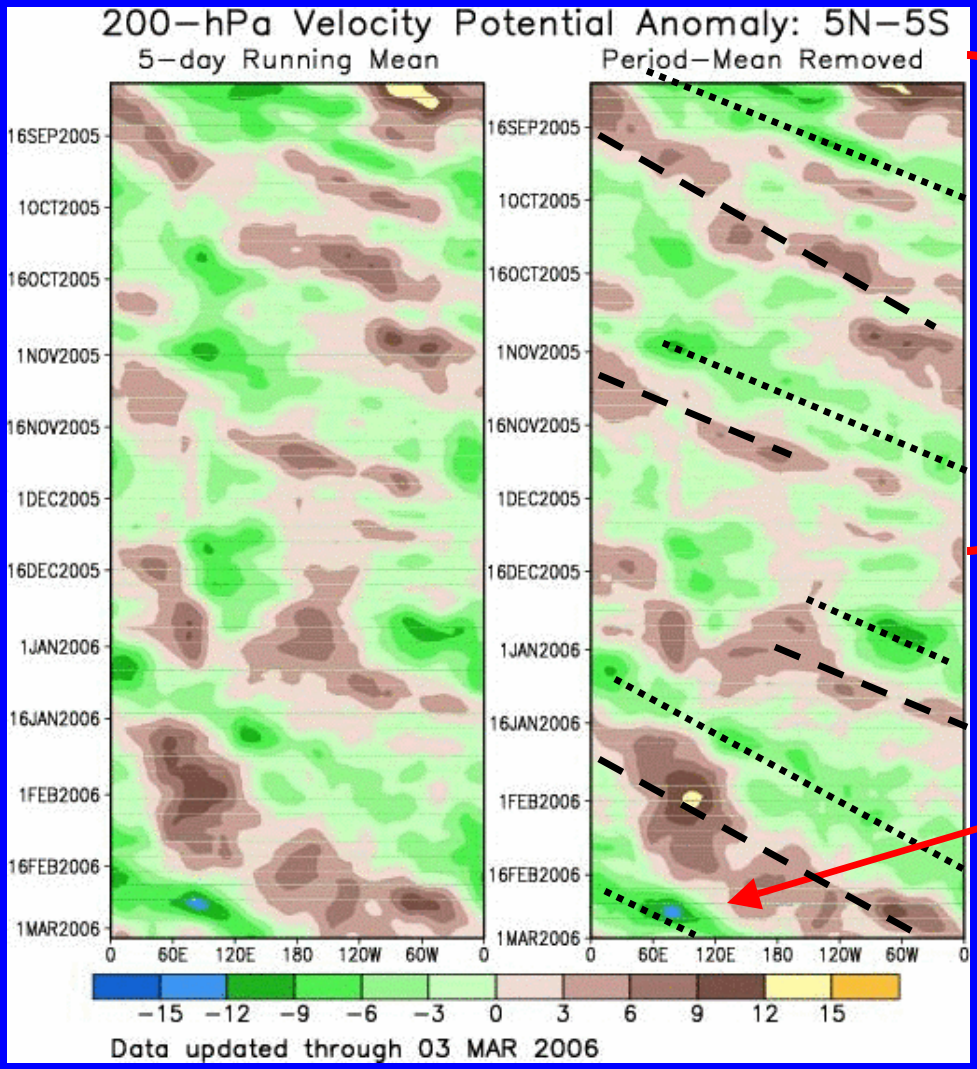
During the past 20 days, easterlies anomalies have strengthened over the equator near the date line.







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



Time

Longitude

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

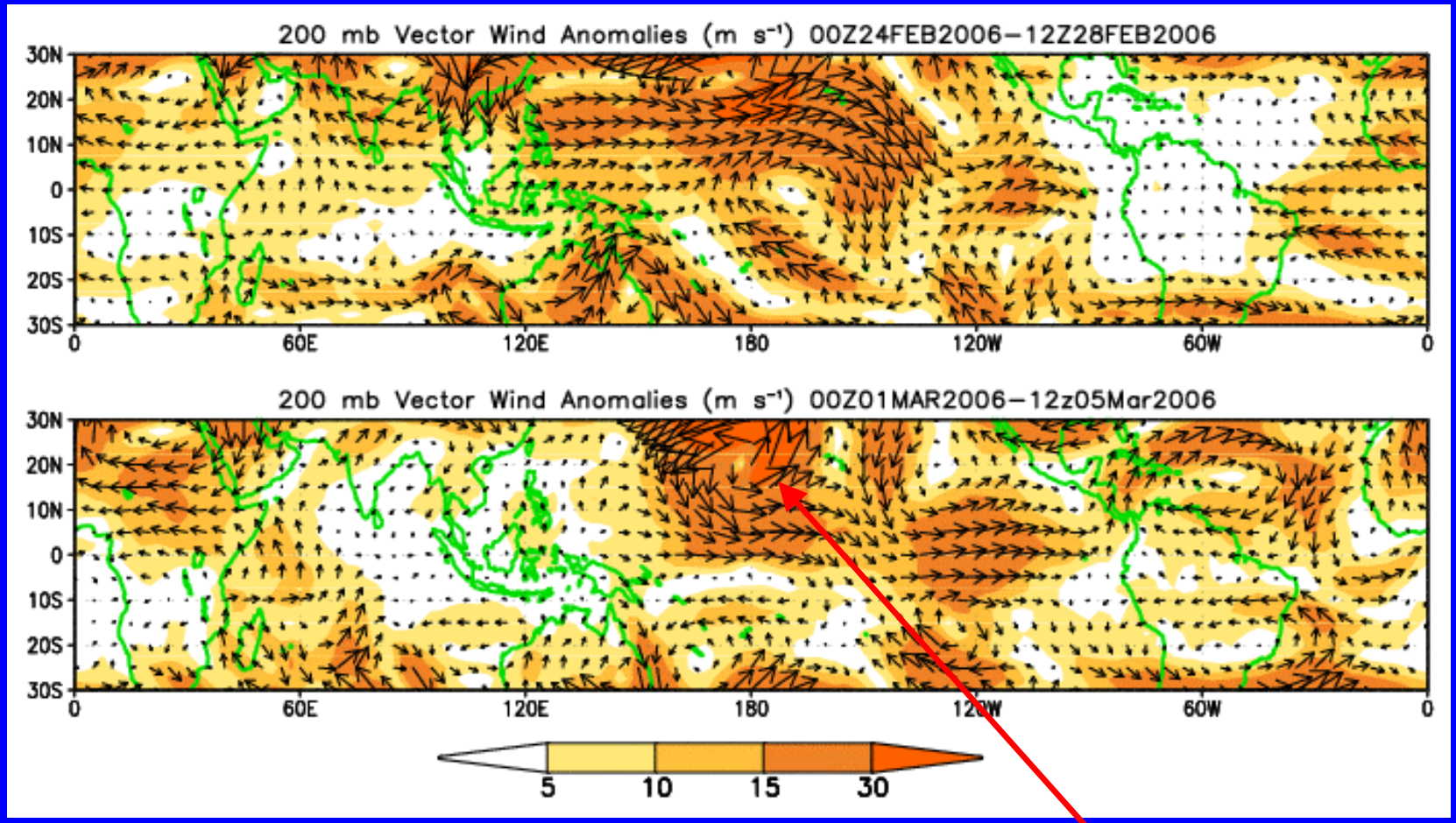
Negative anomalies (green shading) indicate favorable conditions for precipitation.

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

During the past week, strong upper-level divergence evident across the central Indian Ocean and western Indonesia has shifted eastward.

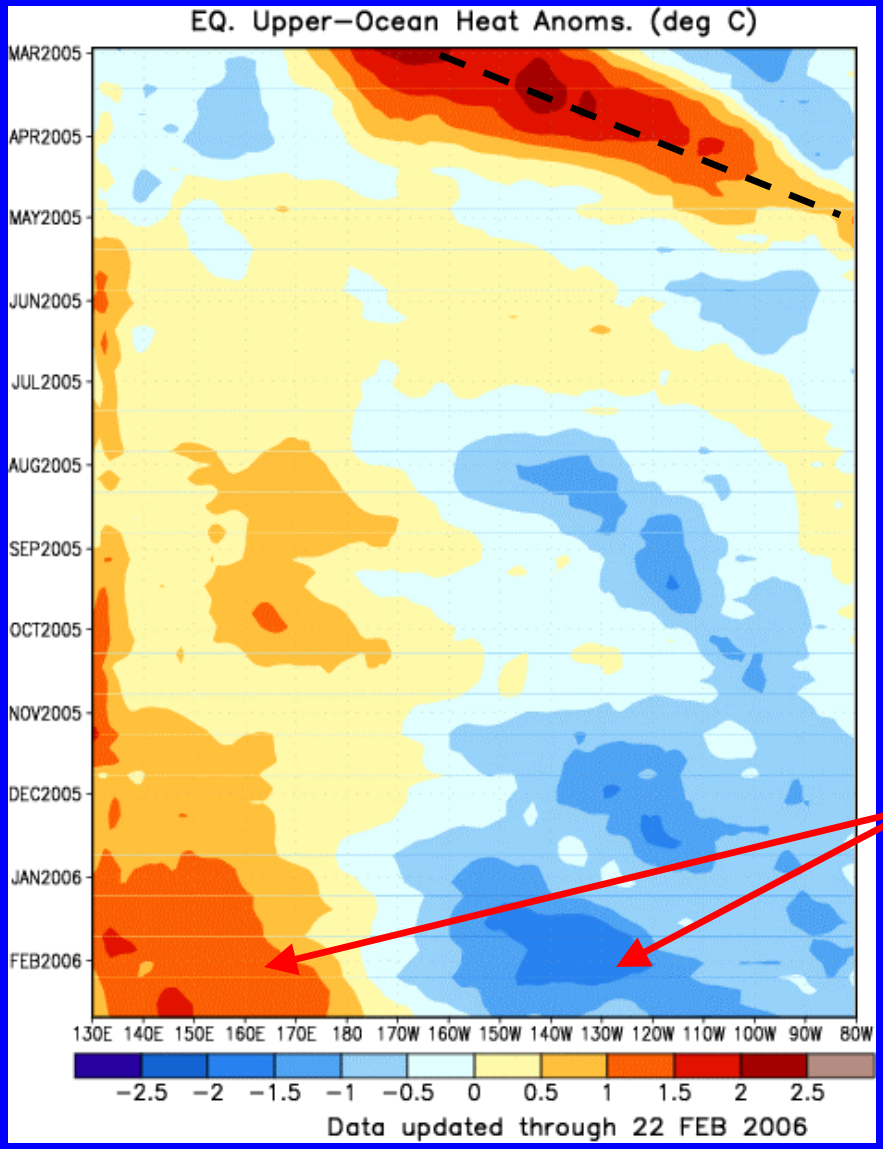
200-hPa Vector Winds and Anomalies (m s^{-1})

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



Upper-level cyclonic circulation north of the equator

Heat Content Evolution in the Eq. Pacific



Time

Longitude

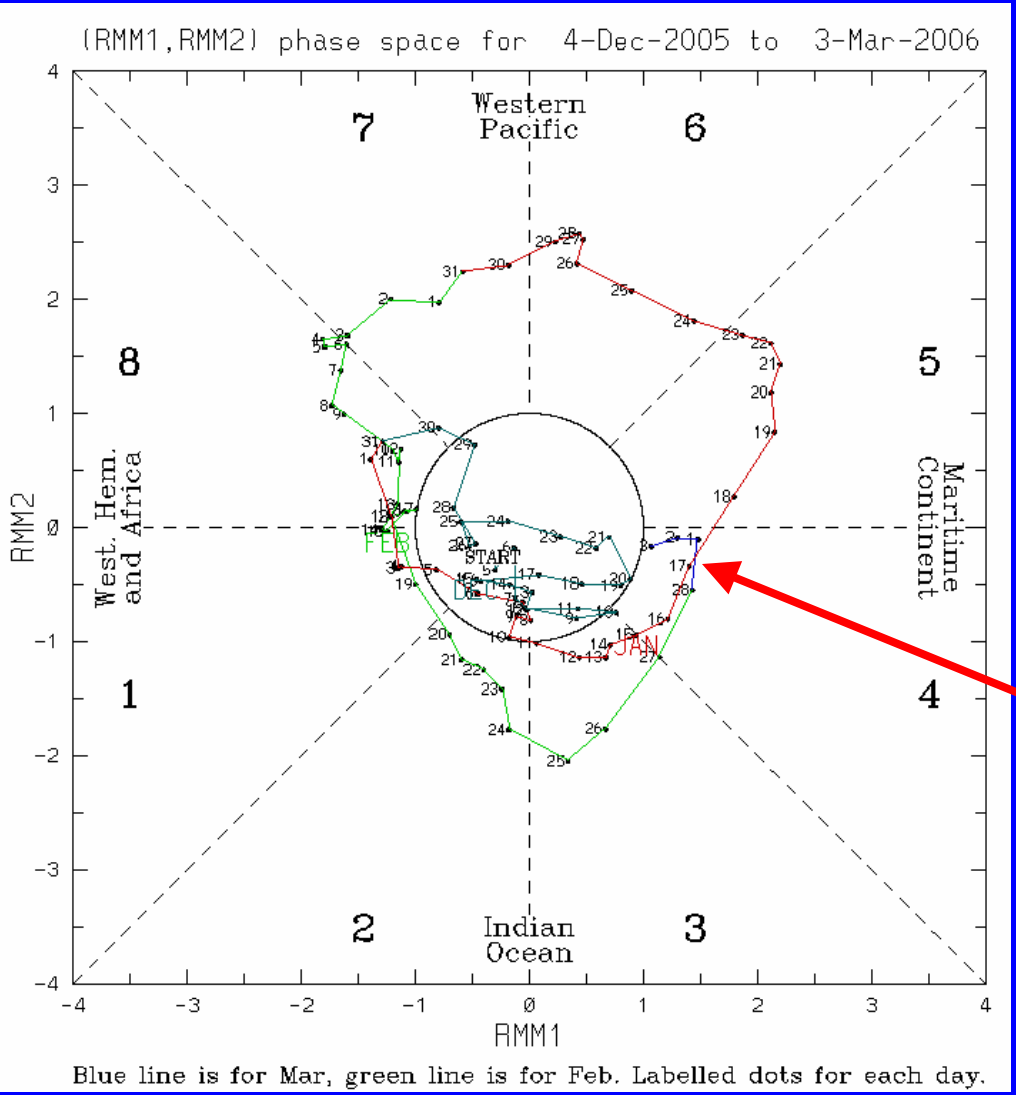
During February 2005, a strong Kelvin wave developed and continued to strengthen during March and reached the South American coast during early April

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)

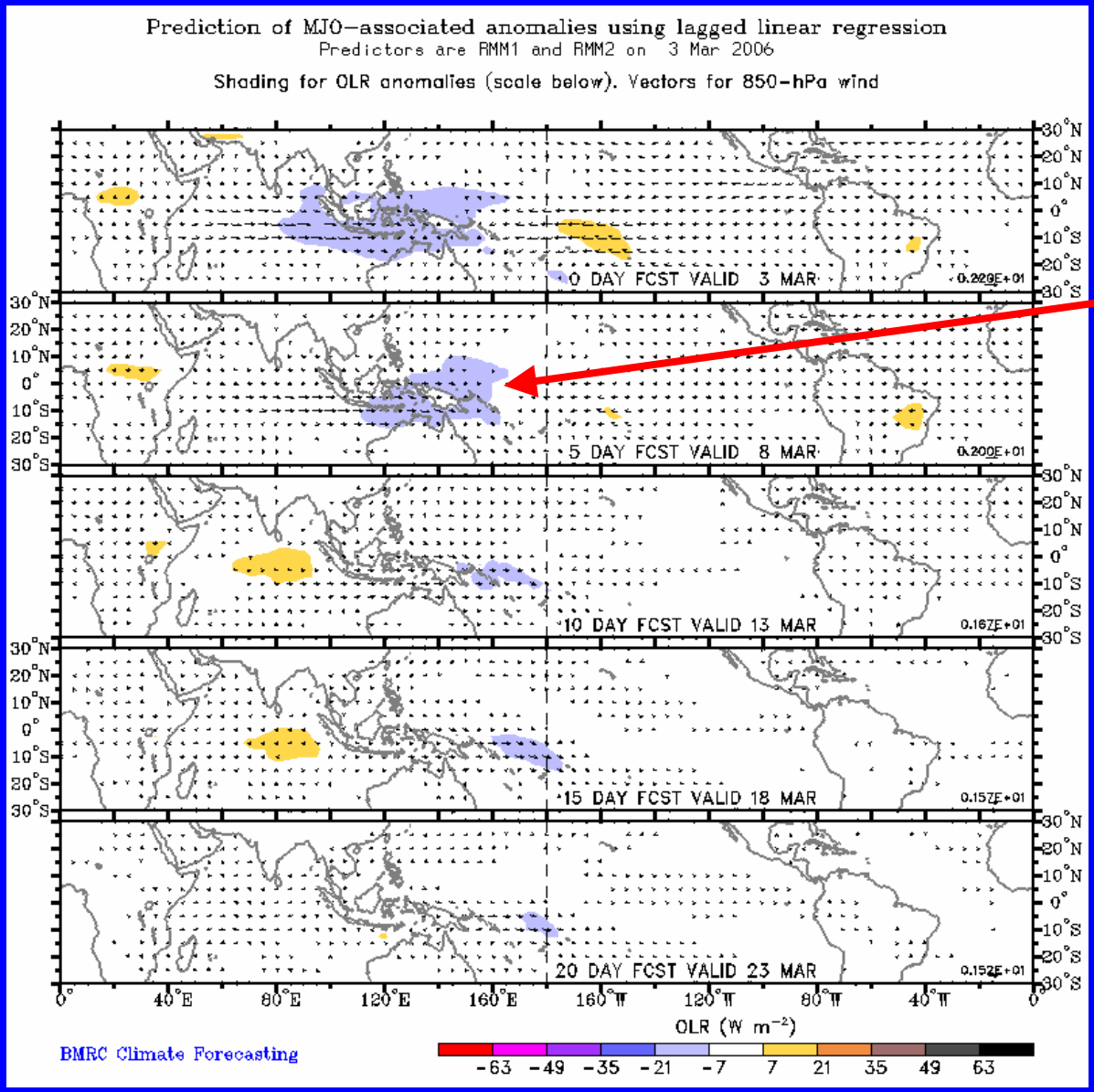
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.



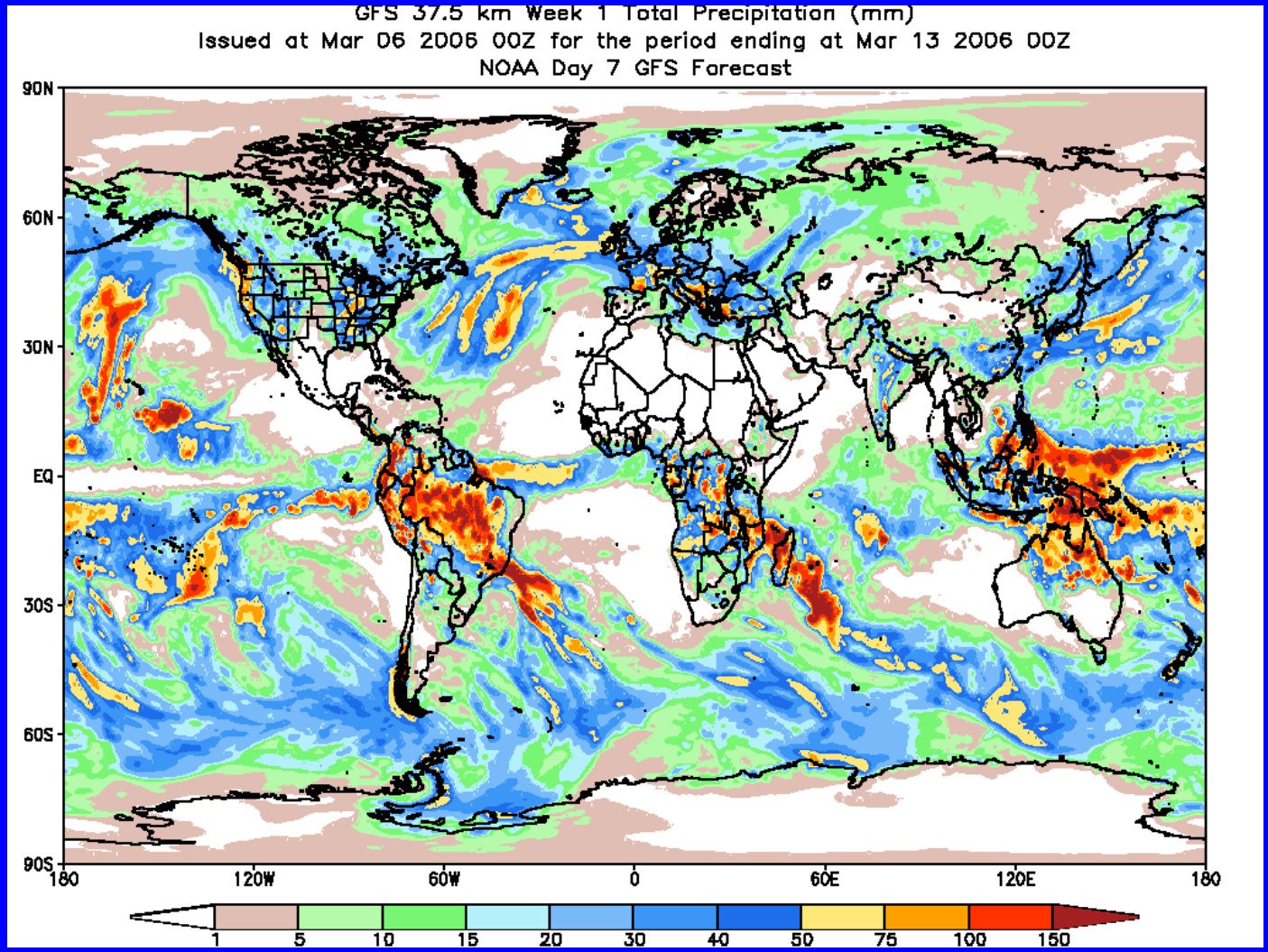
The MJO signal continues with the enhanced phase in the Maritime Continent during the past week. The signal has weakened during the last few days.

Statistical OLR MJO Forecast



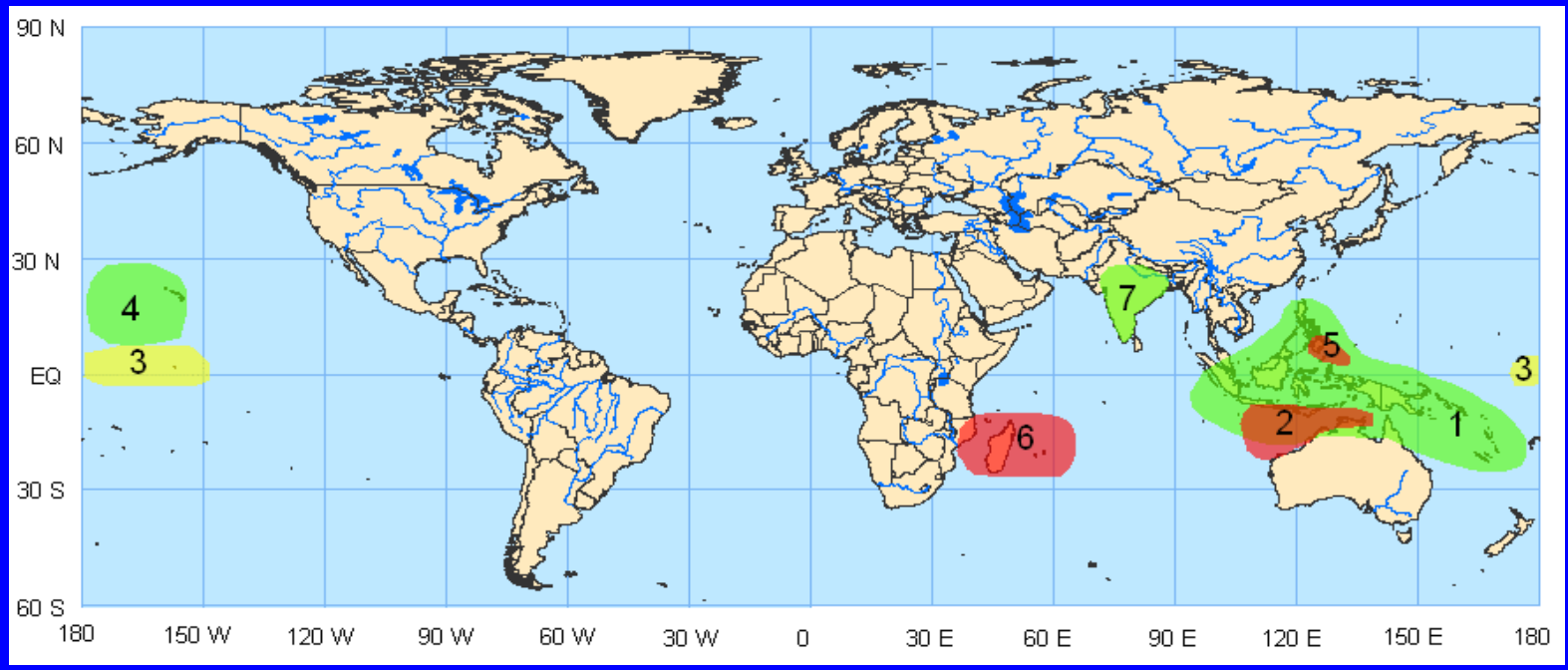
A statistical MJO forecast indicates a weak signal of enhanced convection (blue shades) slowly shifting east

Global Forecast System (GFS) Precipitation Forecast



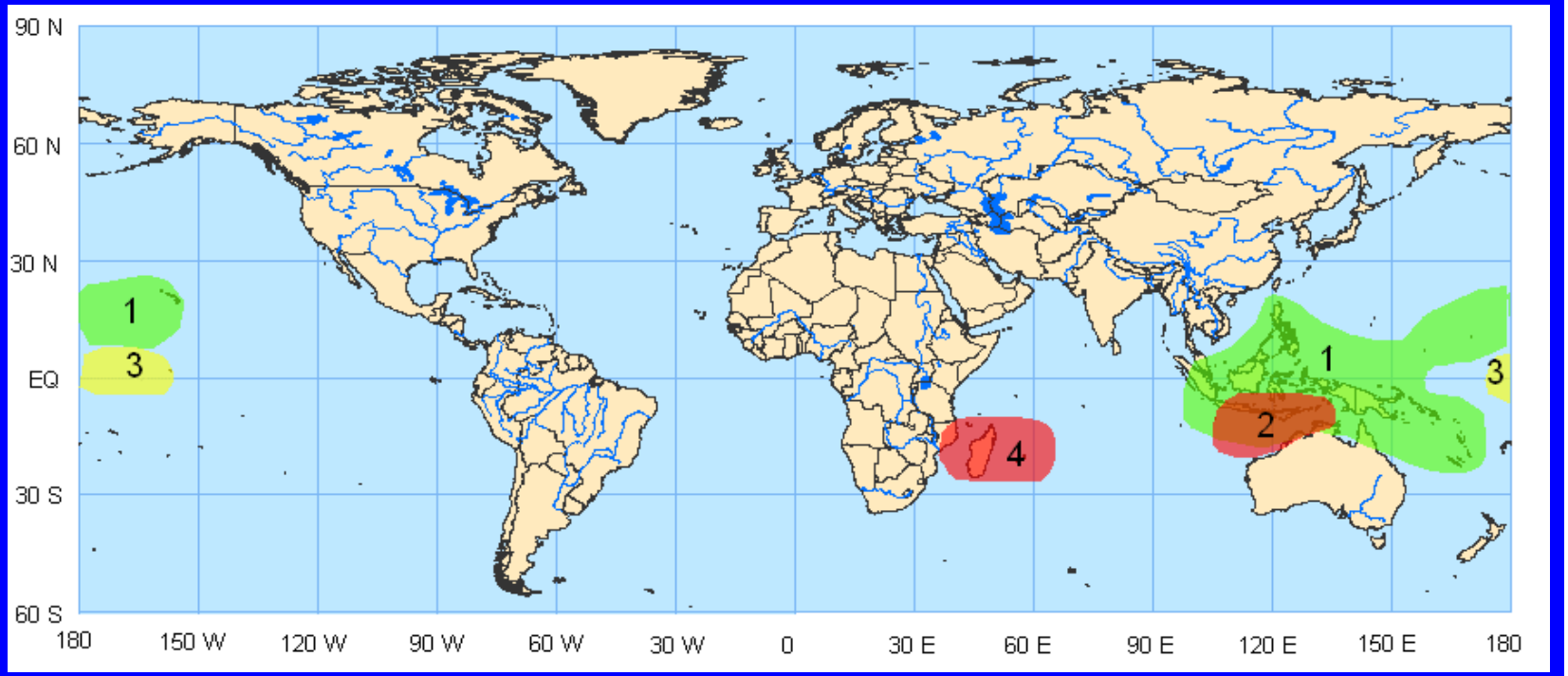
The GFS indicates plentiful rainfall over the eastern half of southern Africa, the western Indian Ocean, Indonesia and sections of the western Pacific and Indonesia.

Potential Benefits/Hazards – Week 1
Valid March 6, 2006-March 13th



1. An increased chance for above normal rainfall across Indonesia into sections of the western Pacific Ocean due to the re-establishment of convection typical during La Nina
2. Increased chances for tropical cyclogenesis north of Australia due to the return of favorable atmospheric conditions (enhanced convection, large scale upper-level divergence, and westerly low-level wind anomalies) and above average sea surface temperatures
3. An increased chance for below average rainfall due to cool sea surface temperatures
4. An increased chance for above normal rainfall in the north central Pacific due to cyclonic circulations common during La Nina
5. Tropical system may impact the Philippines
6. Increased chances for tropical cyclogenesis near Madagascar
7. Increased chances for above normal rainfall in India

Potential Benefits/Hazards – Week 2
Valid March 14-March 20, 2006



1. An increased chance for above normal rainfall from the eastern Indian Ocean across Indonesia into sections of the western Pacific Ocean due to the re-establishment of convection typical during La Nina
2. Increased chances for tropical cyclogenesis north of Australia due to the return of favorable atmospheric conditions (enhanced convection, large scale upper-level divergence, and westerly low-level wind anomalies) and above average sea surface temperatures
3. An increased chance for below average rainfall due to cool sea surface temperatures
4. Increased chance for tropical cyclogenesis in the southern Indian Ocean near Madagascar

Summary

- The latest observations indicate that a weak MJO exists and this signal is superimposed upon the underlying La Nina pattern.
- During the past week, convection intensified across Indonesia and parts of Australia. The easterly anomalies at the equator broadened east and west of the date line while low-level westerly anomalies persist along the equator in the central Indian Ocean. Rainfall remained enhanced in the central Pacific Ocean in the vicinity of Hawaii but was diminished over most of the equatorial Pacific east of the Maritime Continent. In addition, tropical systems developed east of Madagascar and the Philippines.
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