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

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

Outline

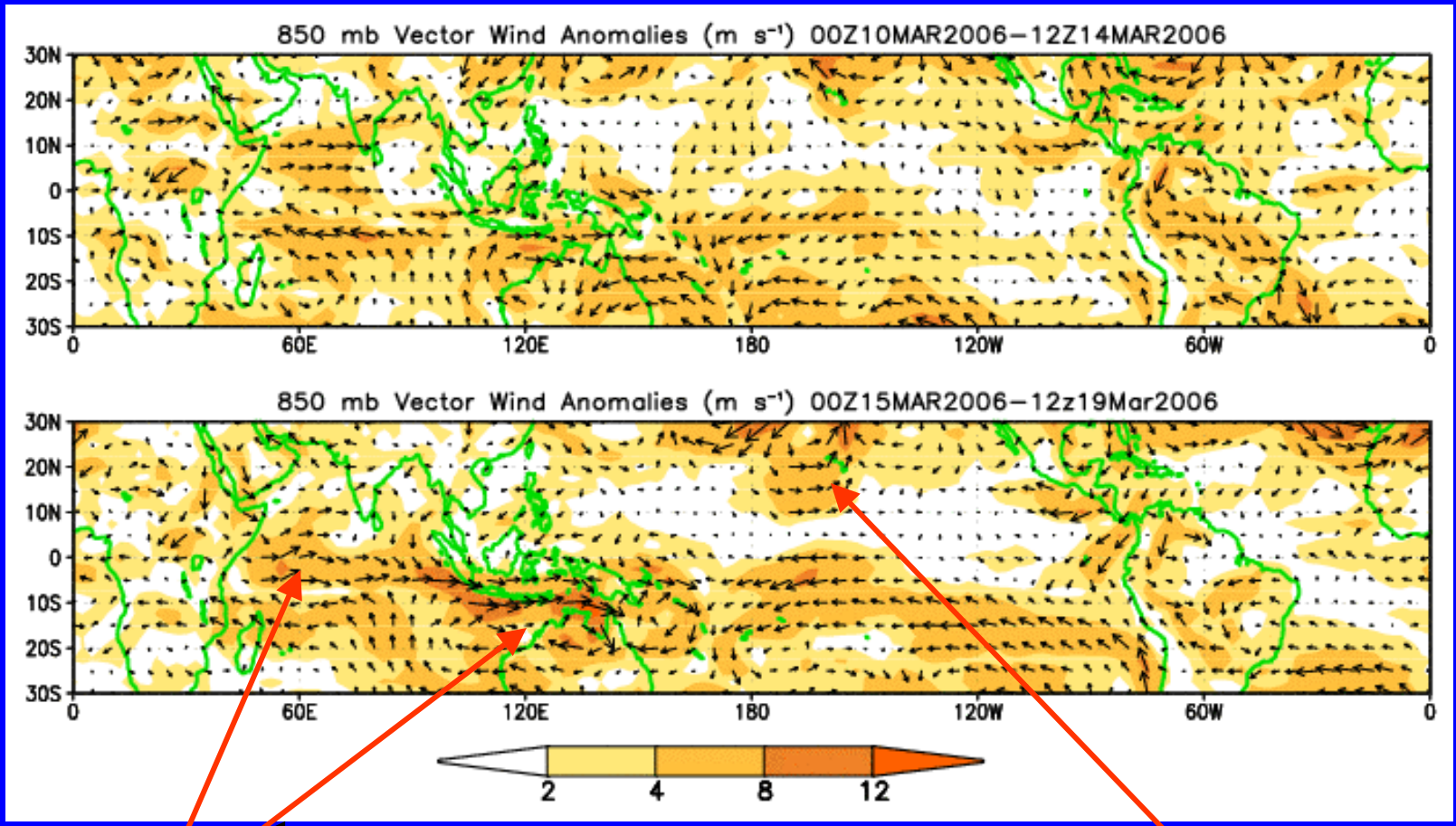
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- The latest observations indicate a very weak MJO signal with the continuation of La Nina conditions.
- Based on the latest observational evidence, the MJO is expected to remain weak during the upcoming 1-2 week period.
- Potential hazards/benefits across the global tropics during the upcoming period are consistent with the continuation of La Nina and include increased chances of above normal rainfall in proximity to Hawaii, sections of the Indian Ocean, Indonesia, and the western Pacific Ocean with drier than average conditions expected in the equatorial central Pacific Ocean.
- In addition, during both week 1 and 2, there is an increased likelihood of tropical cyclogenesis to the northwest of Australia as conditions are expected to become more favorable for tropical development. For week 1 only, there is also an increased chance of above average rainfall along sections of the California and Oregon coasts of the United States and tropical cyclone Wati will impact the Coral Sea in the western Pacific Ocean.

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

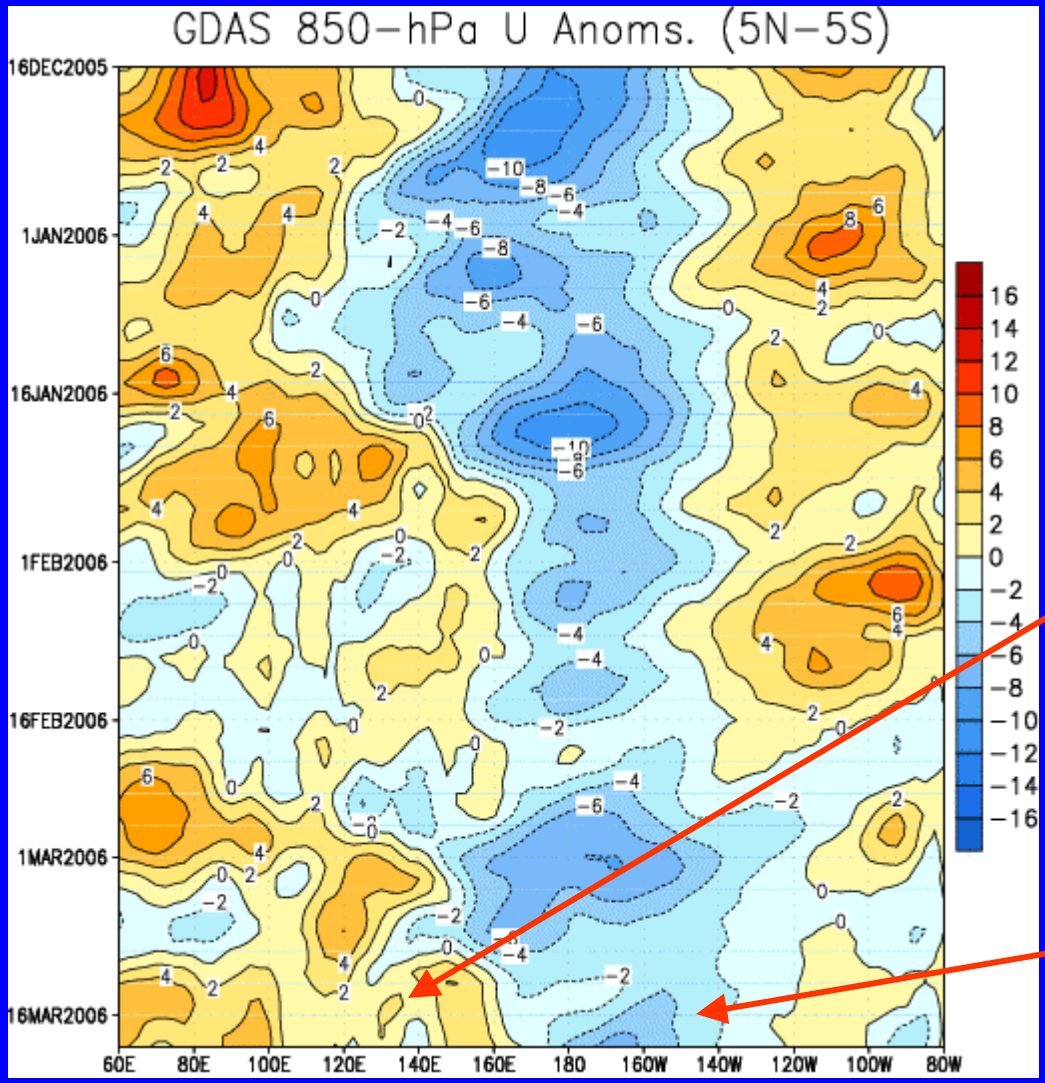
Note that shading denotes the magnitude of the anomalous wind vectors



Westerlies have strengthened in the equatorial Indian Ocean and extend across Indonesia and into the western Pacific Ocean south of the equator.

Cyclonic circulation evident near Hawaii.

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



Time

Longitude

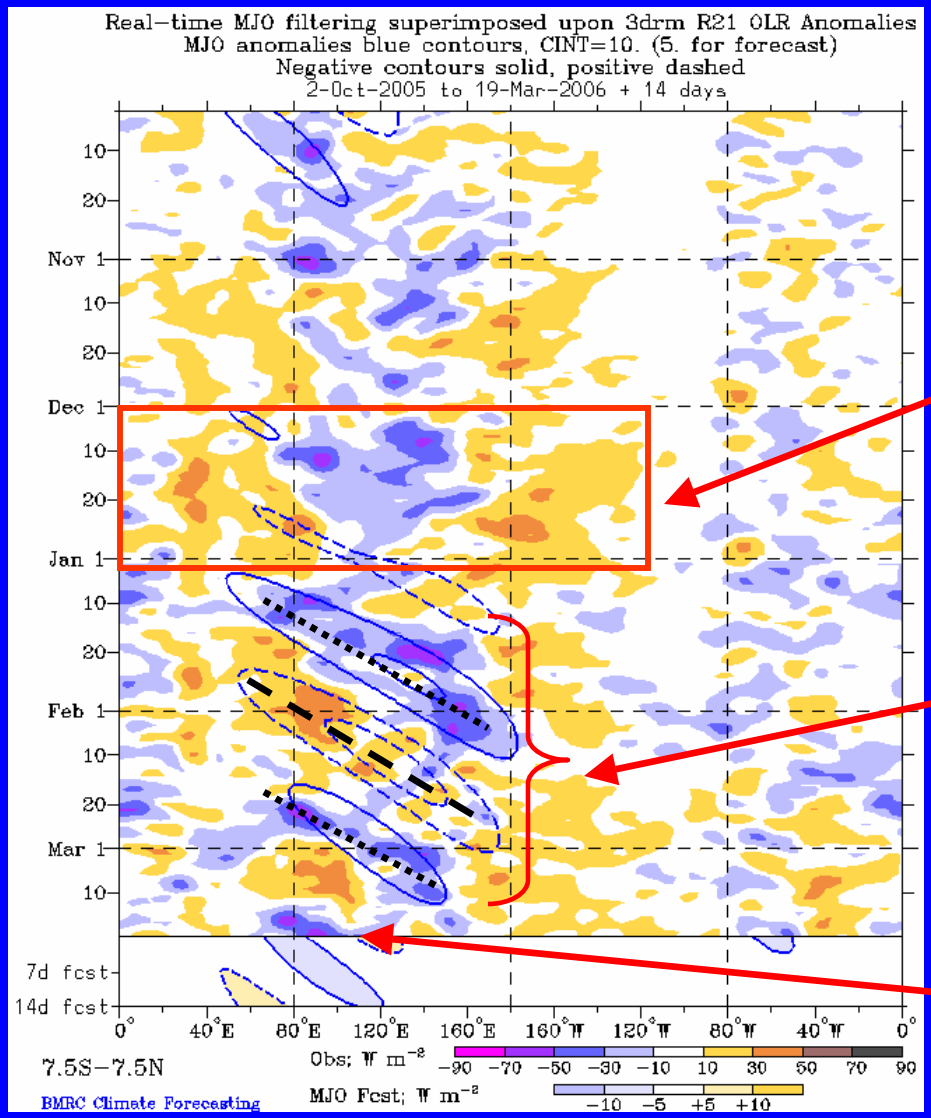
Weaker-than-average easterlies or westerlies (orange/red shading)

Stronger-than-average easterlies (blue shading)

Equatorial low-level westerly anomalies extend from the Indian Ocean over the Maritime Continent

Easterly anomalies remain near and east of the date line.

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



Time

Longitude

Drier-than-average conditions (/red shading)

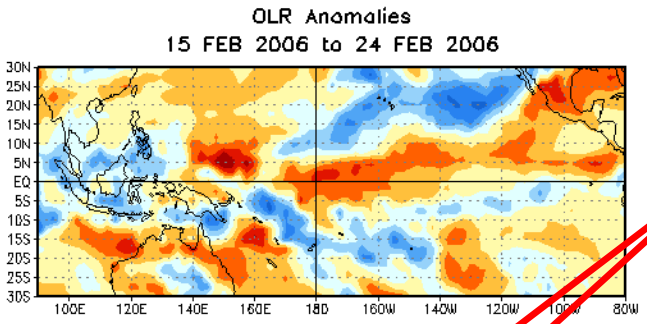
Wetter-than-average conditions (blue shading)

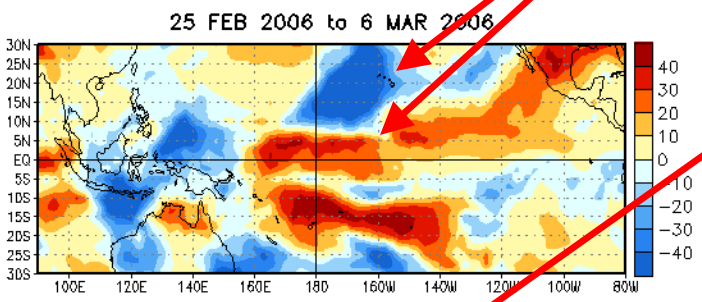
Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean during December

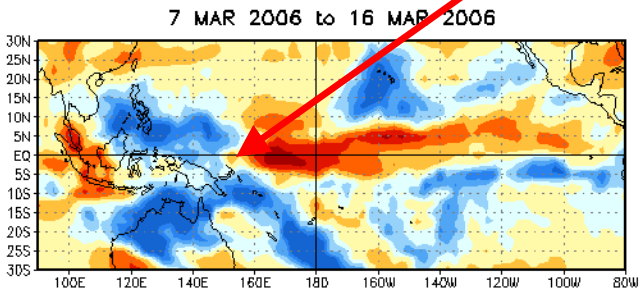
Eastward propagation of OLR anomalies was evident from mid-January through late February.

During the past week, enhanced convection is again evident in the Indian Ocean and across sections of Indonesia.

Anomalous OLR and 850-hPa Wind: Last 30 days

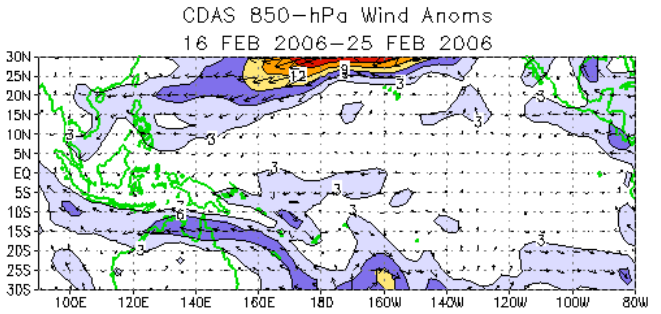


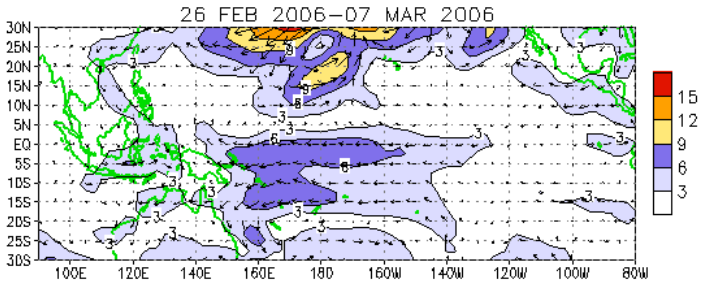


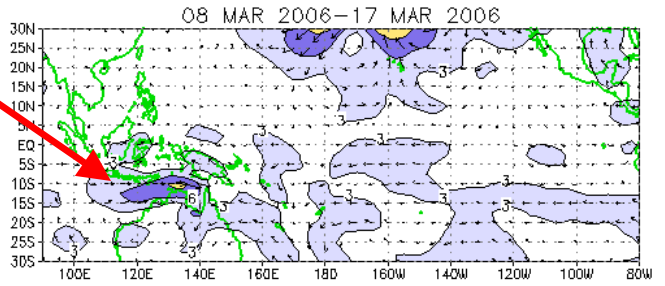


Enhanced convection in the vicinity of Hawaii is evident throughout the period as is suppressed convection in the equatorial central Pacific Ocean. Enhanced convection has increased near Indonesia and northern Australia by mid-March.

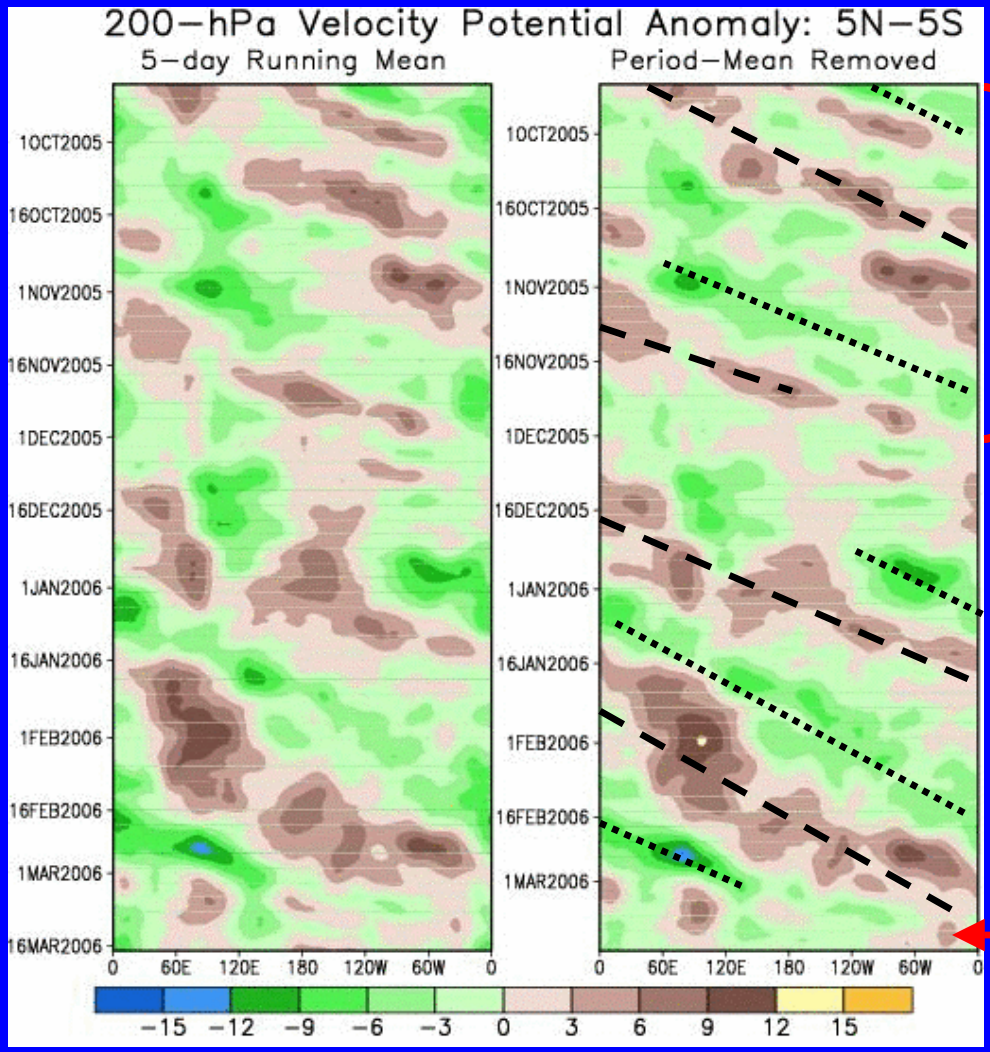
During the past 10 days, westerly anomalies are evident across southern Indonesia while easterly anomalies have weakened near the date line.







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



Time

Longitude

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

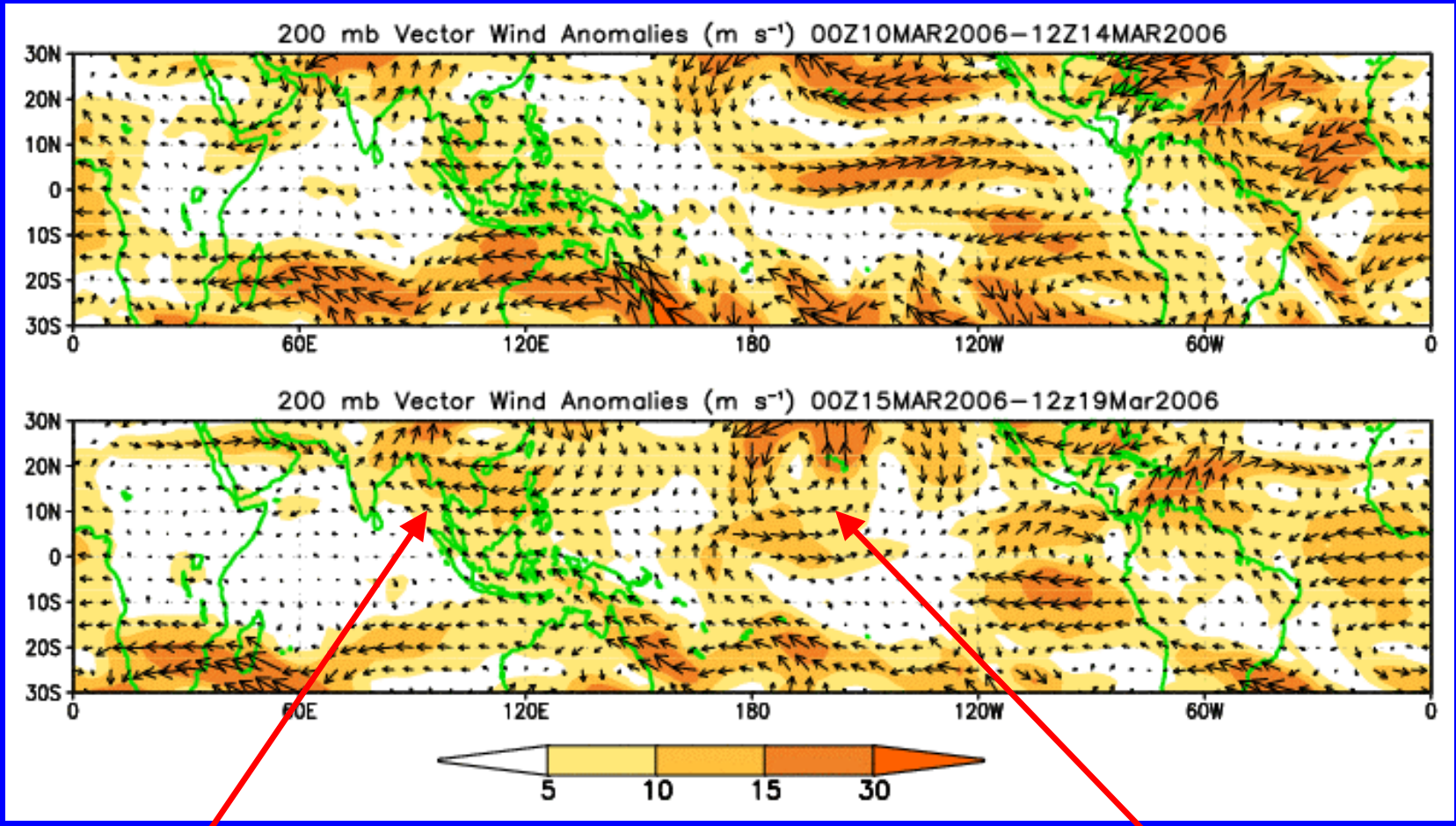
Negative anomalies (green shading) indicate favorable conditions for precipitation.

Weak to moderate MJO activity was observed during the September-November and January-February time periods.

During the last few weeks, the MJO has become much less coherent.

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

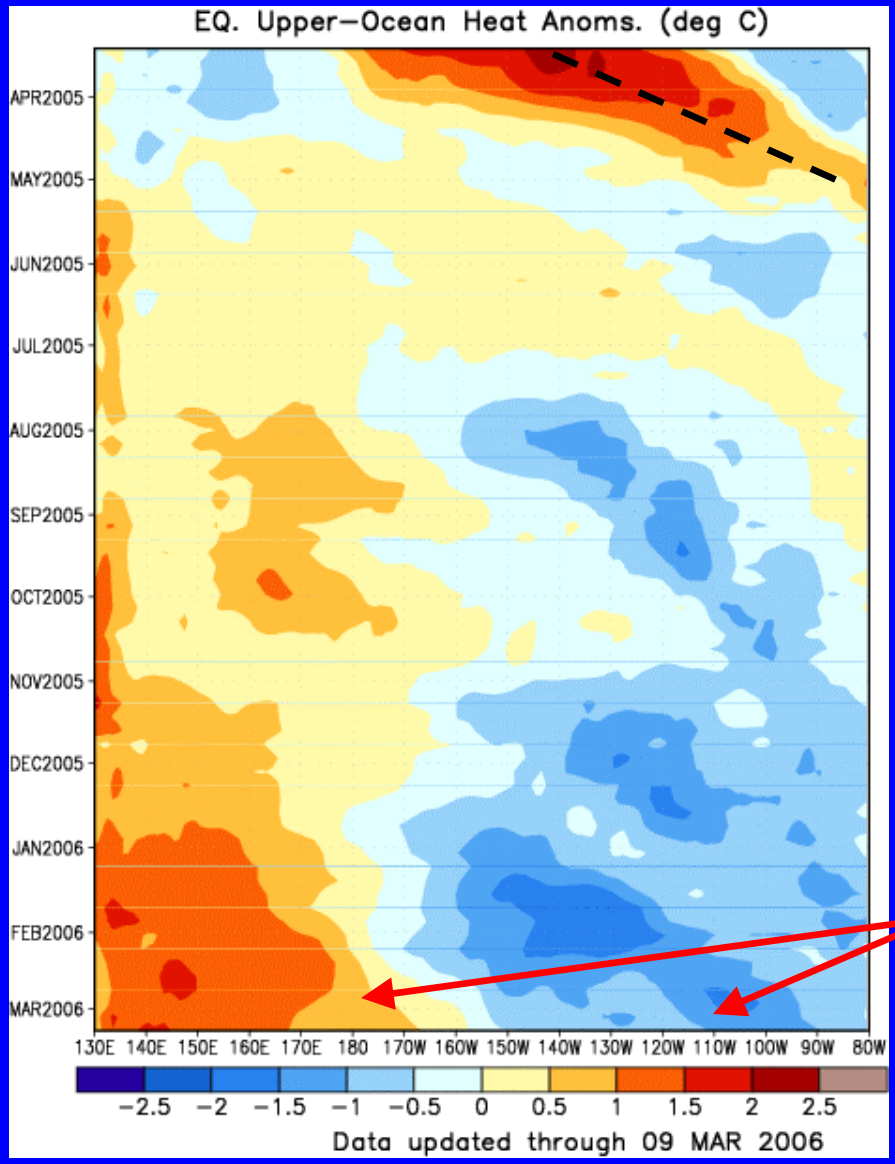
Note that shading denotes the magnitude of the anomalous wind vectors.



Upper-level anti-cyclonic circulation north of the equator over Southeast Asia

Cyclonic circulation near Hawaii continues

Heat Content Evolution in the Eq. Pacific



Time

Longitude

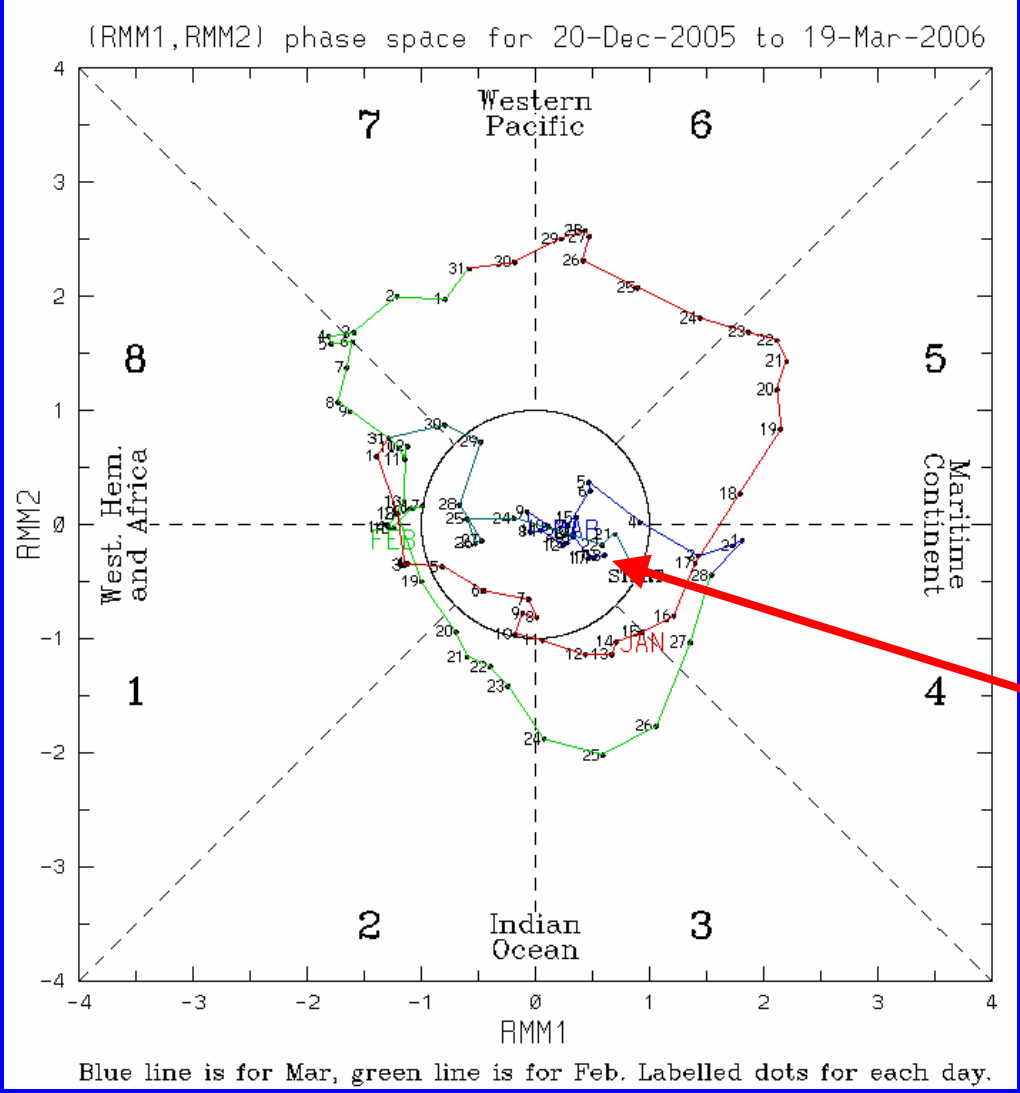
During February 2005, a strong Kelvin wave developed and continued to strengthen during March and reached the South American coast during early April.

Heat content has been above average in the western Pacific since June while cooler water has been observed across the central and eastern Pacific. Warmer water in the western Pacific has expanded slightly east during late February and early March.

MJO Index (Magnitude and Phase)

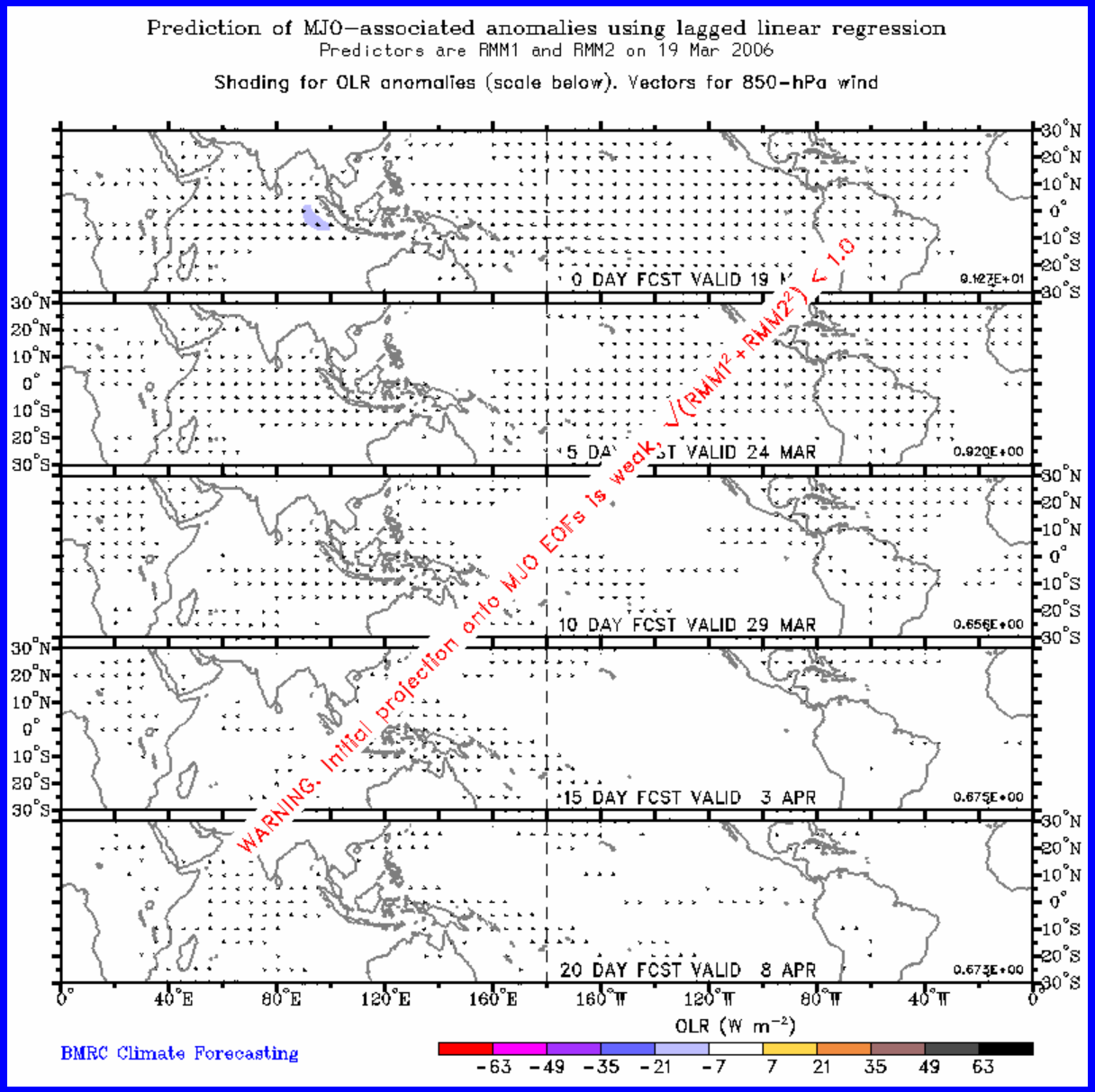
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.



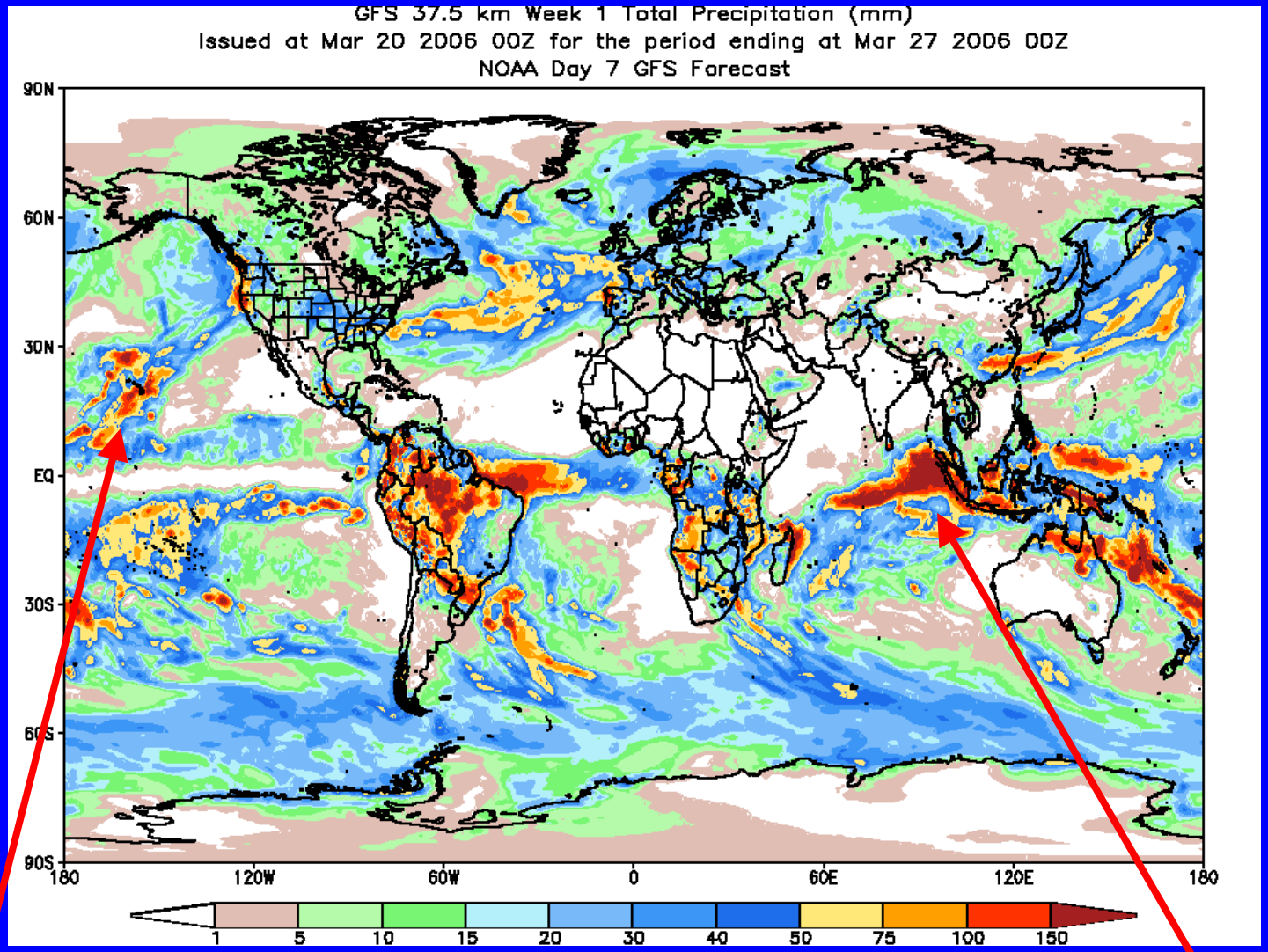
The MJO signal remains weak.

Statistical OLR MJO Forecast



A statistical MJO forecast indicates no MJO signal expected during the upcoming two week period.

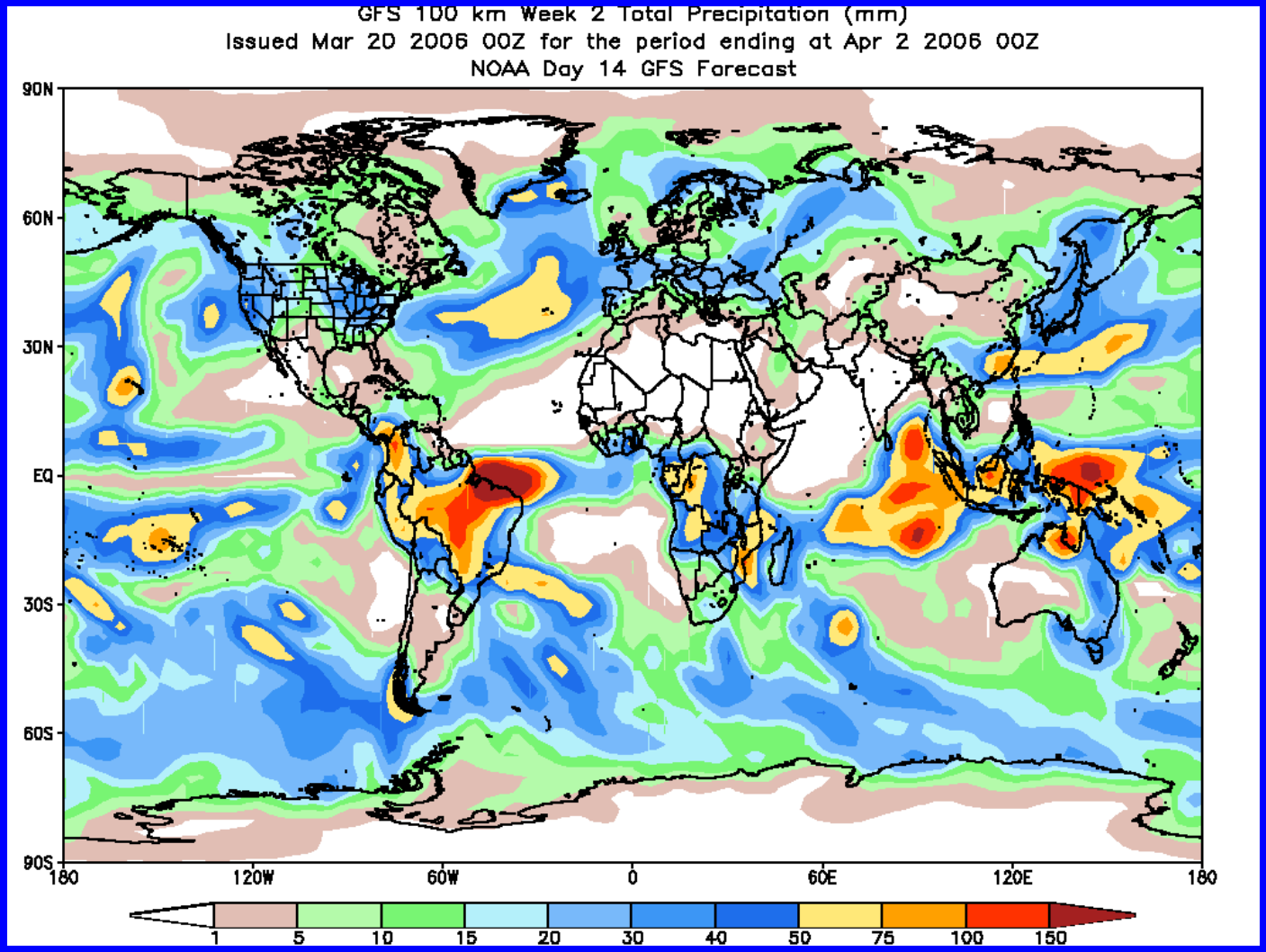
Global Forecast System (GFS) Week 1 Precipitation Forecast



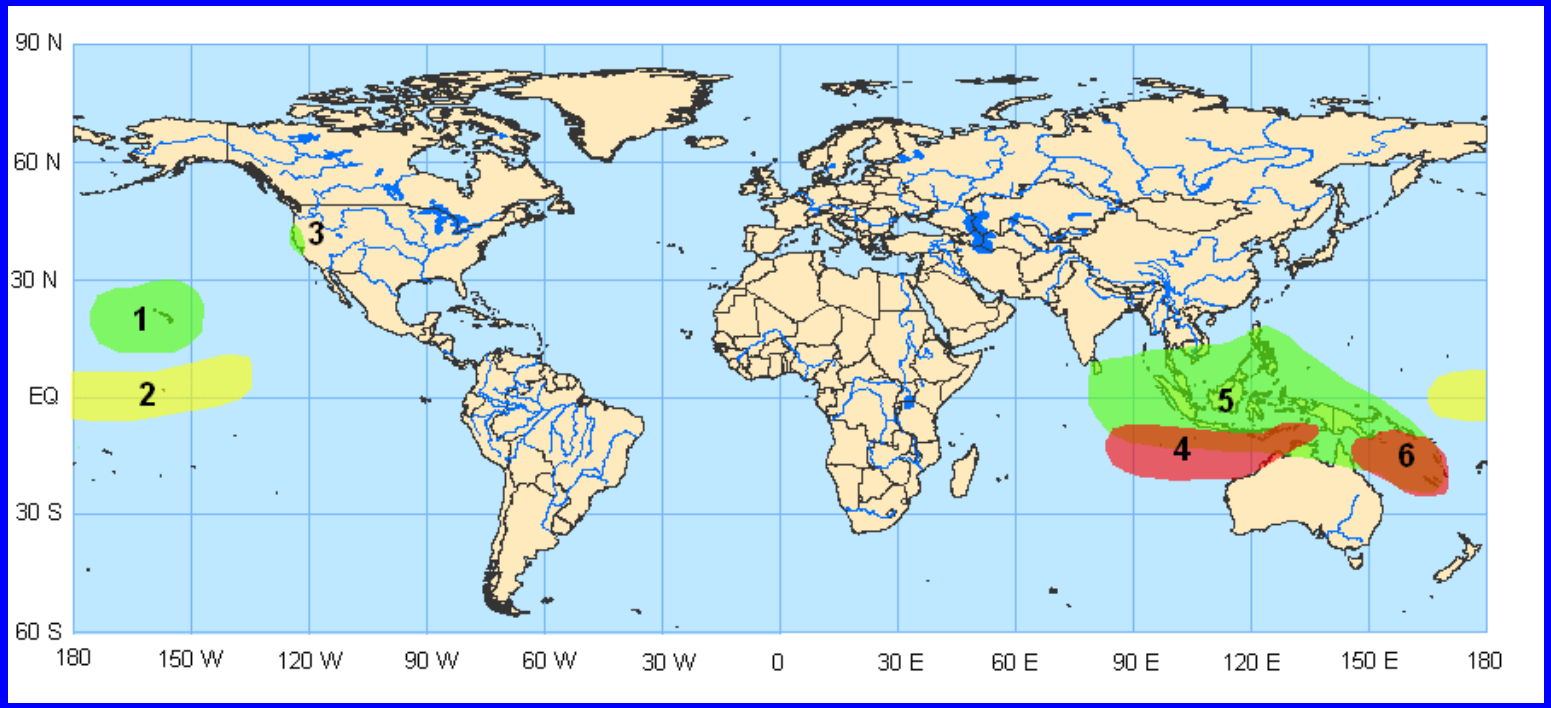
Rainfall is expected to continue in the vicinity of Hawaii

Plentiful rainfall is expected to remain across the eastern Indian Ocean

Global Forecast System (GFS) Week 2 Precipitation Forecast

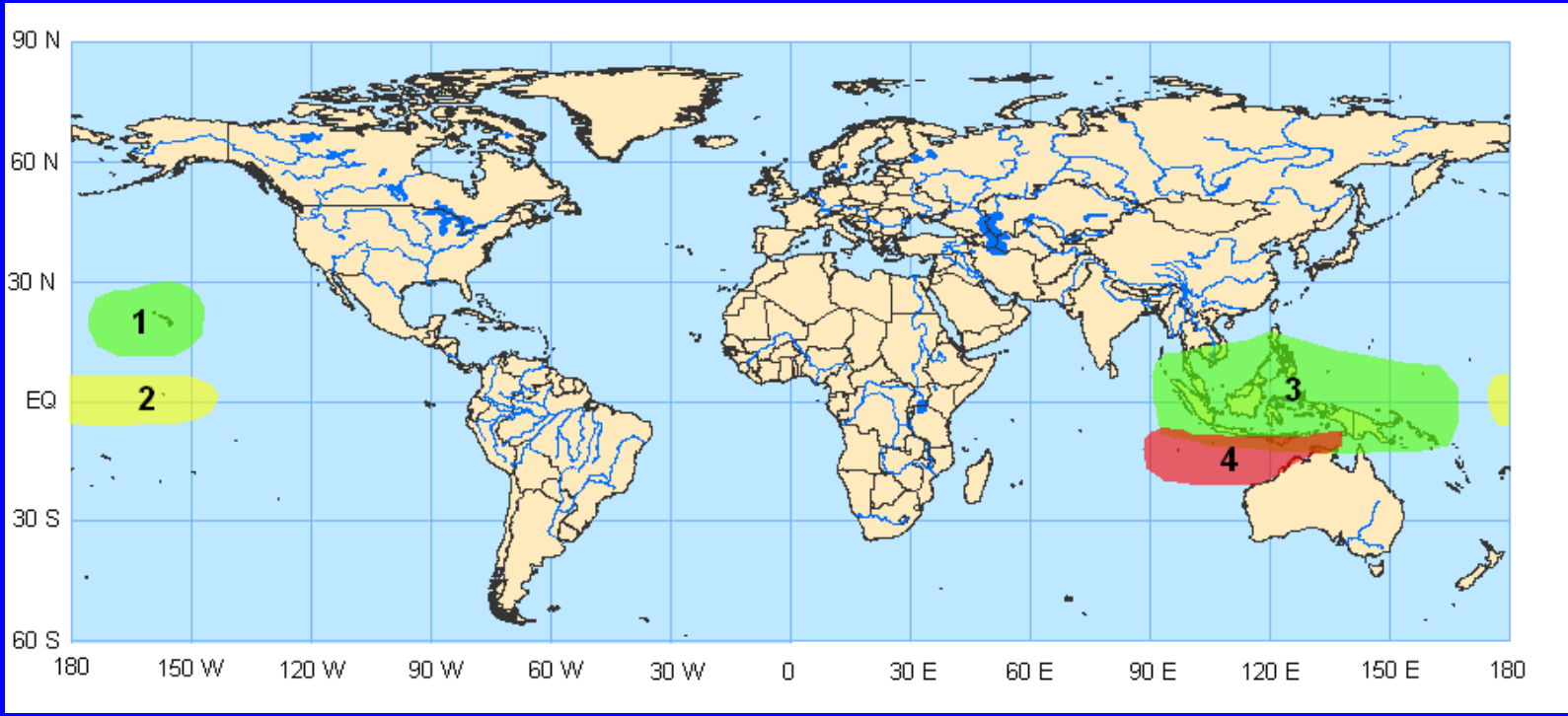


Potential Benefits/Hazards – Week 1
Valid March 21, 2006 - March 27, 2006



1. An increased chance for above normal rainfall due to frequent low pressure systems common during La Nina.
2. An increased chance for below normal rainfall due to the cool sea surface temperatures associated with La Nina.
3. An increased chance for above normal rainfall across sections of the west coast of the US
4. An increased chance for tropical cyclogenesis northwest of Australia as conditions are expected to become more favorable (enhanced convection, large scale upper-level divergence, and westerly low-level wind anomalies) in this region.
5. An increased chance for above normal rainfall across sections of the Indian Ocean, Indonesia, and the western Pacific Ocean due to convection typical during La Nina and areas of above average SSTs.
6. An increased chance for tropical cyclogenesis northeast of Australia and Tropical cyclone Wati will impact sections of the Coral Sea

Potential Benefits/Hazards – Week 2
Valid March 28, 2006 - April 5, 2006



1. An increased chance for above normal rainfall due to frequent low pressure systems common during La Nina.
2. An increased chance for below average rainfall due to the cool sea surface temperatures associated with La Nina.
3. An increased chance for above normal rainfall across sections of Indonesia and the western Pacific Ocean due to convection typical during La Nina and areas of above average SSTs.
4. An increased chance for tropical cyclogenesis in the Indian Ocean as conditions are expected to become more favorable (enhanced convection, large scale upper-level divergence, and westerly low-level wind anomalies) in this region.

Summary

- The latest observations indicate a very weak MJO signal with the continuation of La Nina conditions.
- Based on the latest observational evidence, the MJO is expected to remain weak during the upcoming 1-2 week period.
- Potential hazards/benefits across the global tropics during the upcoming period are consistent with the continuation of La Nina and include increased chances of above normal rainfall in proximity to Hawaii, sections of the Indian Ocean, Indonesia, and the western Pacific Ocean with drier than average conditions expected in the equatorial central Pacific Ocean.
- In addition, during both week 1 and 2, there is an increased likelihood of tropical cyclogenesis to the northwest of Australia as conditions are expected to become more favorable for tropical development. For week 1 only, there is also an increased chance of above average rainfall along sections of the California and Oregon coasts of the United States and tropical cyclone Wati will impact the Coral Sea in the western Pacific Ocean.