



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

Update prepared by
Climate Prediction Center / NCEP
April 3, 2006



Outline

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



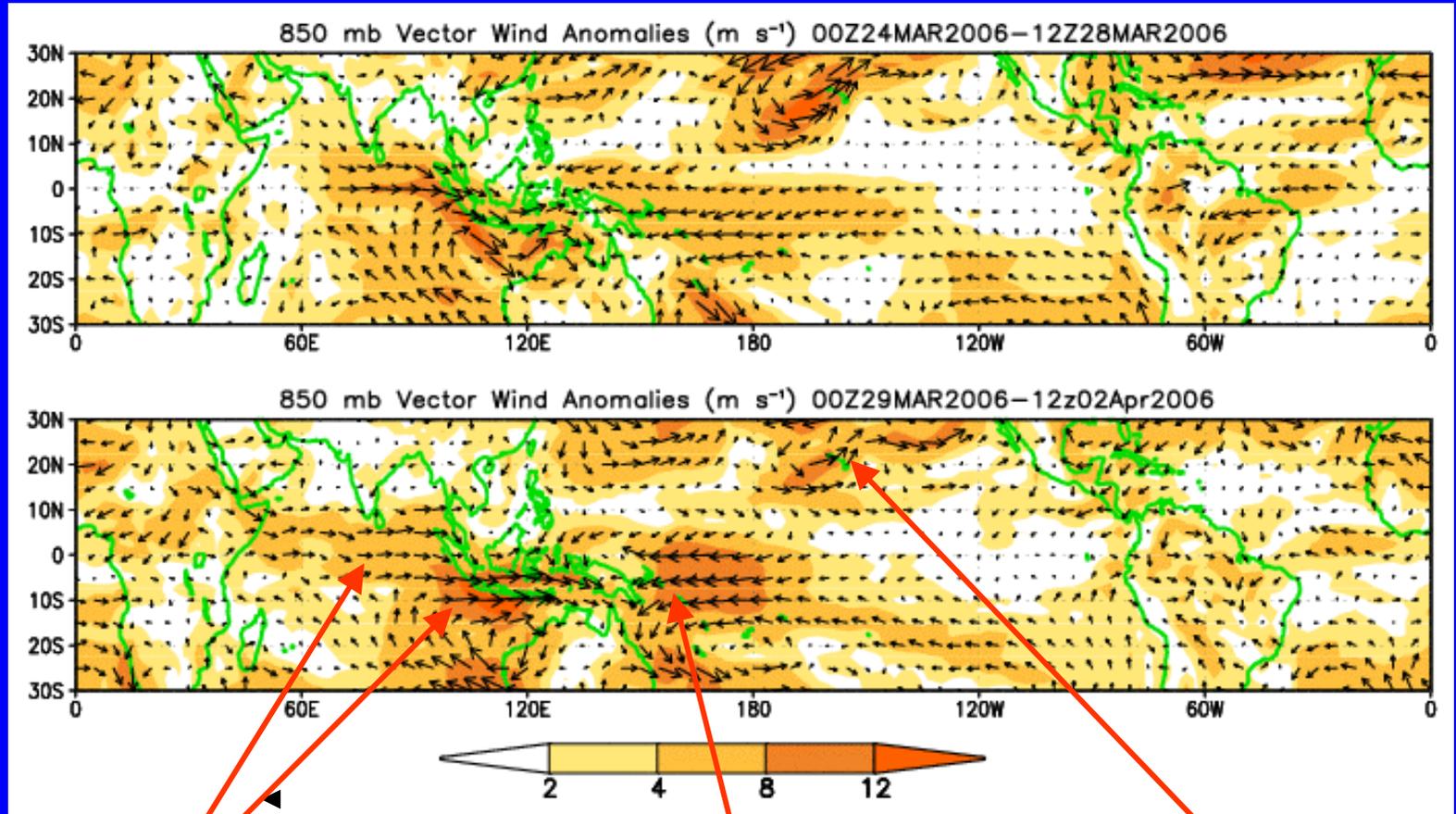
Overview

- The latest observations indicate the possible development of a weak MJO 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 across Indonesia, the western Pacific Ocean, and far northern Australia 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 and across the Indian Ocean as conditions remain favorable for tropical development. During week 2, increased chances for above normal rainfall return to Hawaii.



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

Note that shading denotes the magnitude of the anomalous wind vectors



Westerlies remain in the equatorial Indian Ocean and across Indonesia

Easterlies have strengthened west of Date Line

Cyclonic circulation persists near Hawaii

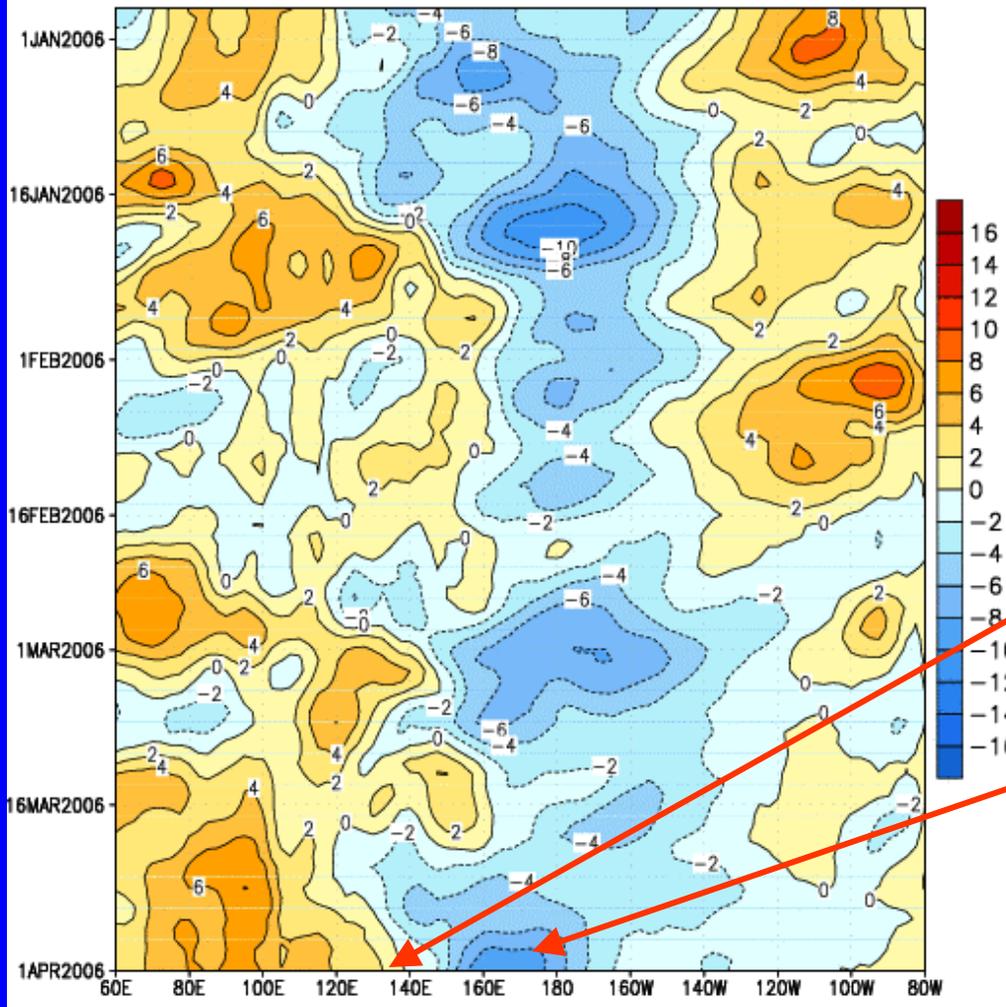


Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

Time



GDAS 850-hPa U Anoms. (5N-5S)



Longitude

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

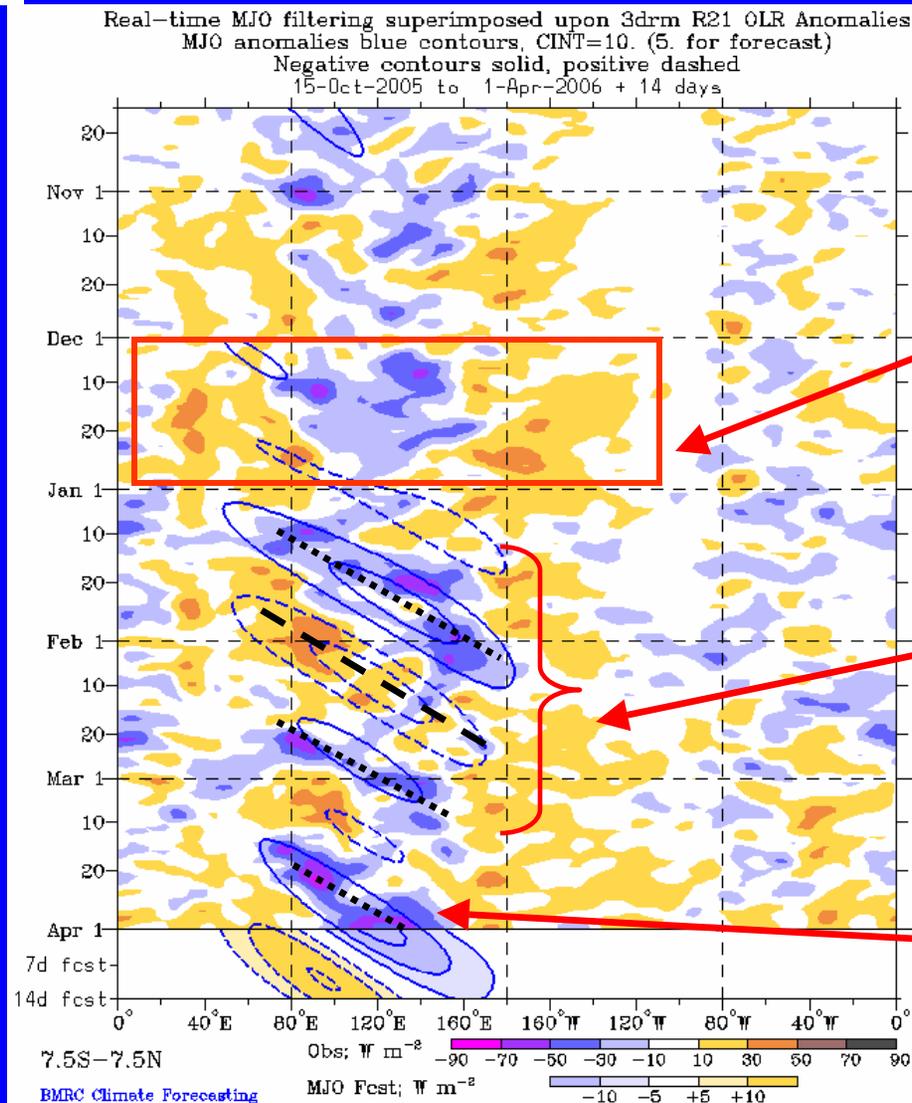
Stronger-than-average easterlies (blue shading)

Equatorial low-level westerly anomalies have expanded from Indonesia into the far western Pacific

Equatorial low-level easterly anomalies are quite strong west of the Date Line



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



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

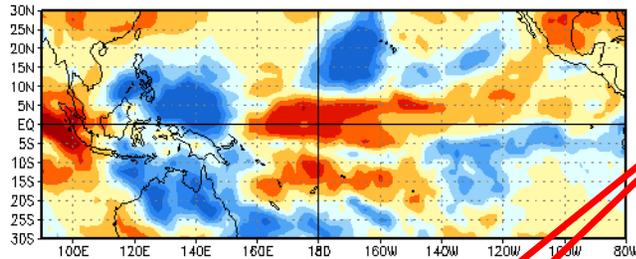
During the past two weeks, enhanced convection has shifted eastward with a weakening trend now observed in the Indian Ocean



Anomalous OLR and 850-hPa Wind

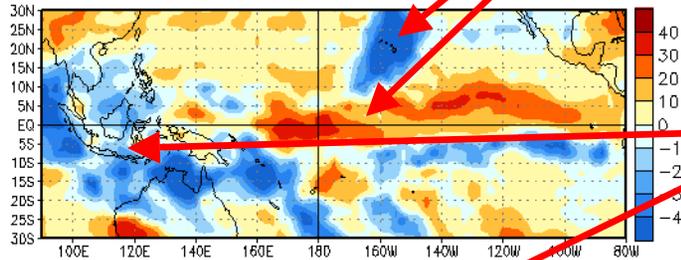
Wind: Last 30 days

OLR Anomalies
2 MAR 2006 to 11 MAR 2006



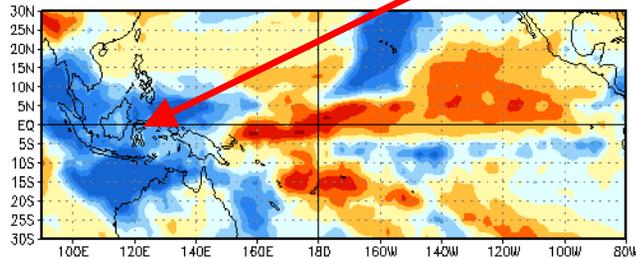
Enhanced convection in the vicinity of Hawaii is evident throughout the period as is suppressed convection in the equatorial central Pacific Ocean.

12 MAR 2006 to 21 MAR 2006



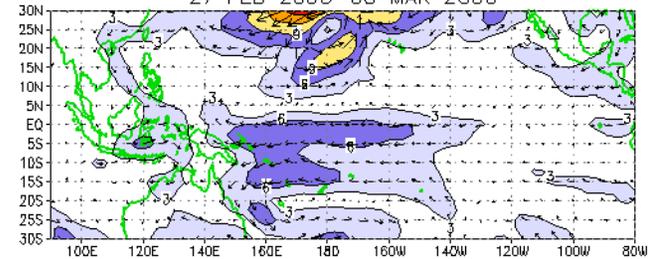
Enhanced convection developed in western Indonesia during mid to late March.

22 MAR 2006 to 31 MAR 2006

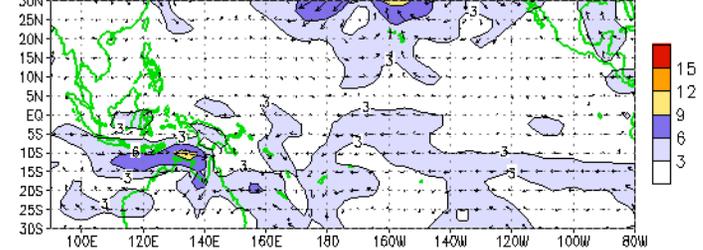


During the past 10 days, westerly anomalies have returned to western Indonesia.

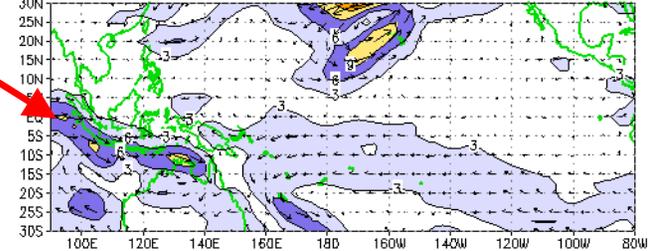
CDAS 850-hPa Wind Anoms
27 FEB 2006-08 MAR 2006



09 MAR 2006-18 MAR 2006



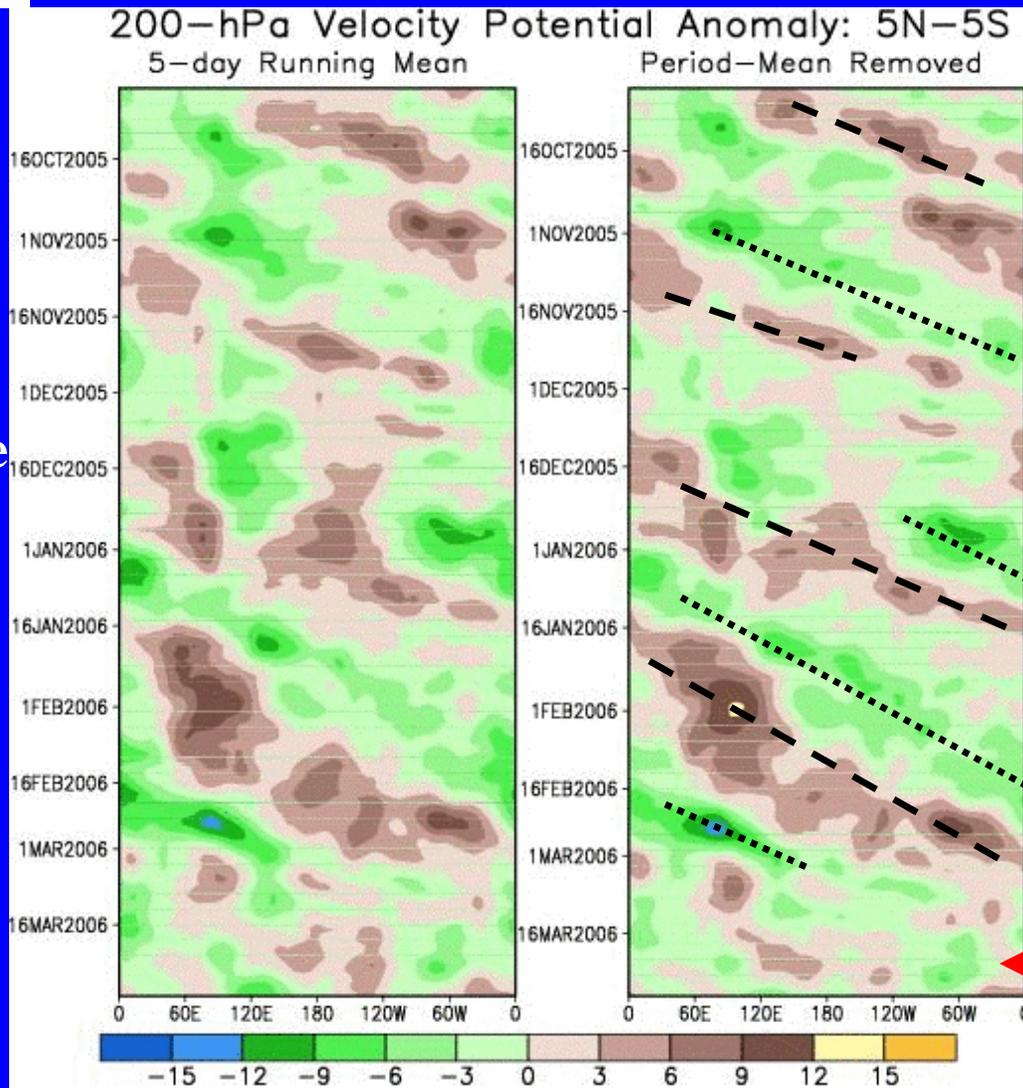
19 MAR 2006-28 MAR 2006





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.



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

Through the end of March the MJO signal has remained incoherent.

Time

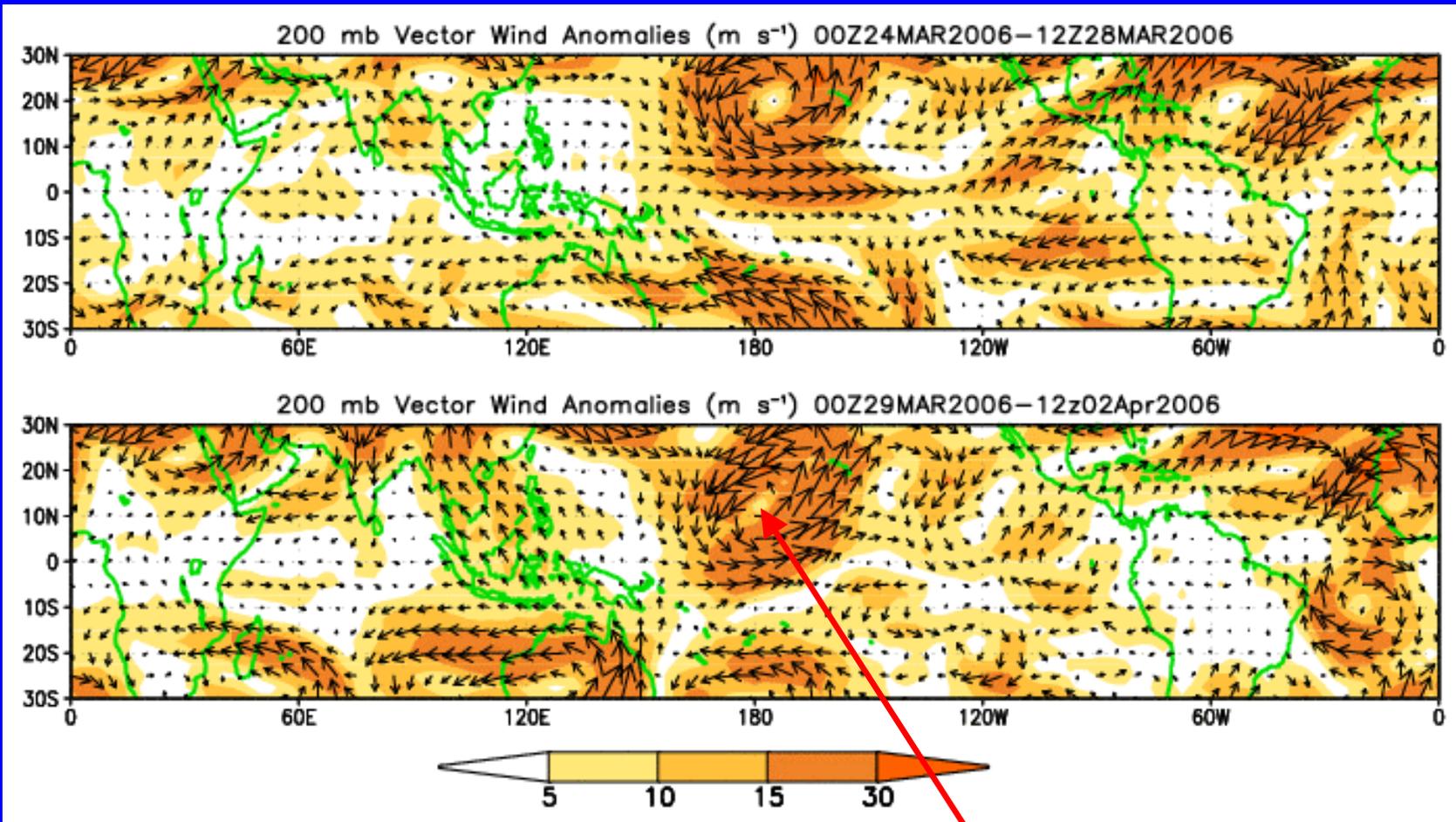


Longitude



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

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

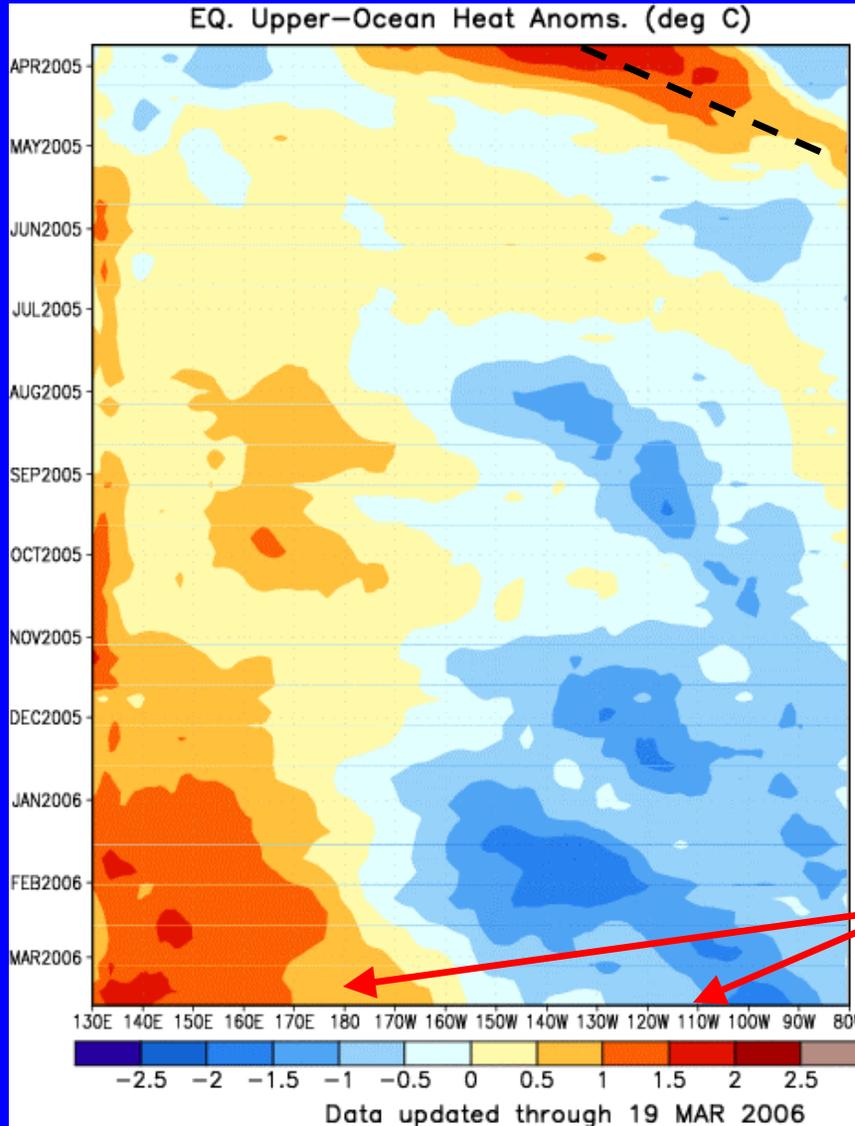


Strong cyclonic circulation near Hawaii continues



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.

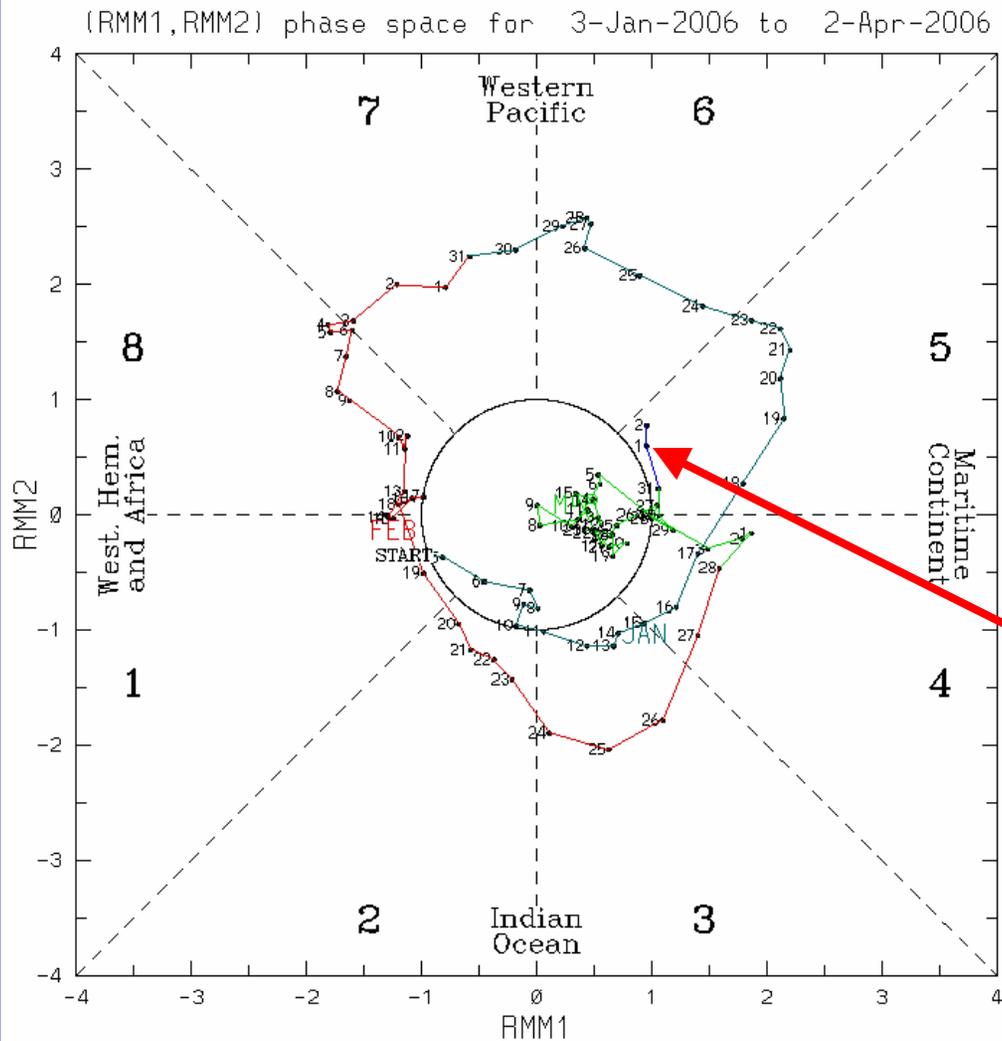
Heat content has been above average in the western Pacific since June while cooler water has been observed across the central and eastern Pacific. Warmer water in the western Pacific has expanded slightly east during February and March.



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.



Blue line is for Apr, green line is for Mar. Labelled dots for each day.

The MJO signal remains weak.

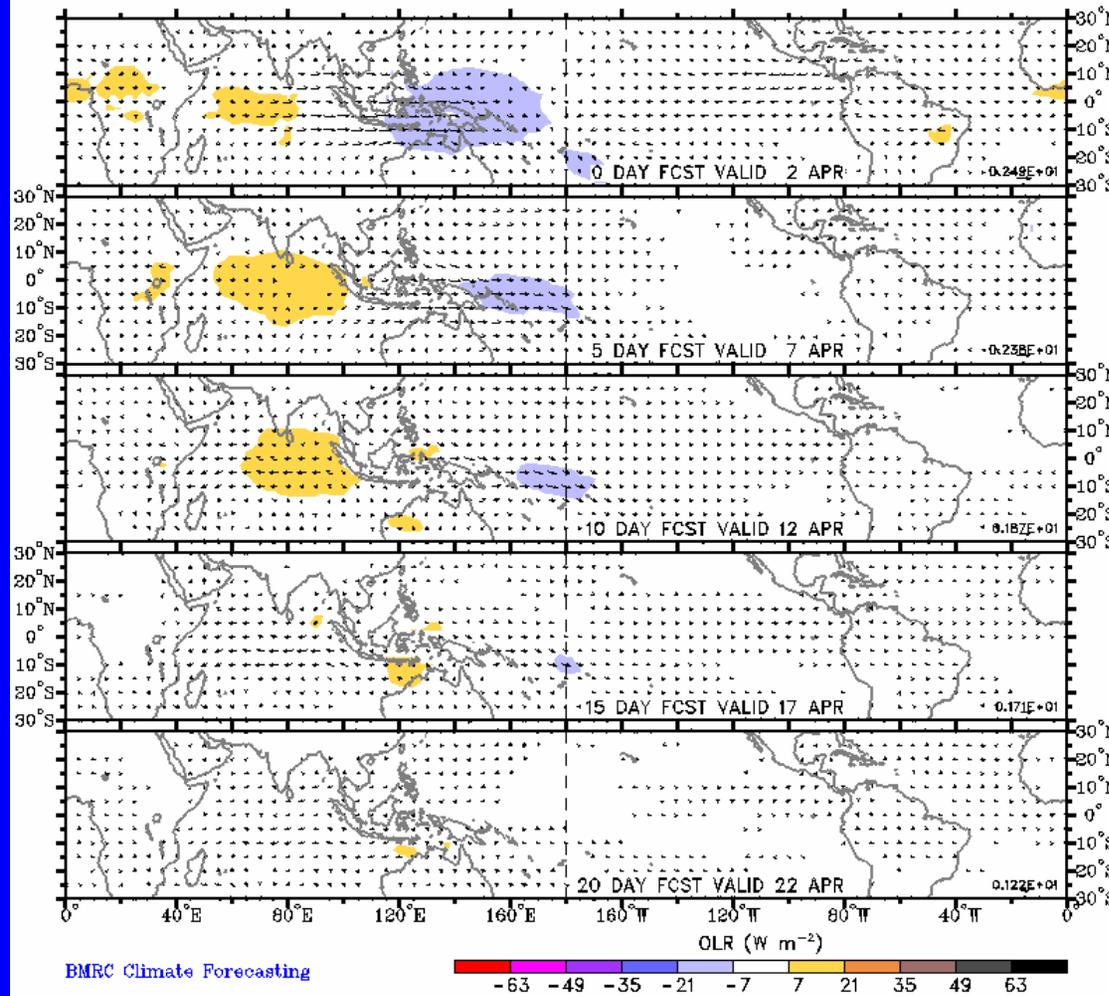


Statistical OLR MJO Forecast

Prediction of MJO-associated anomalies using lagged linear regression

Predictors are RMM1 and RMM2 on 2 Apr 2006

Shading for OLR anomalies (scale below). Vectors for 850-hPa wind

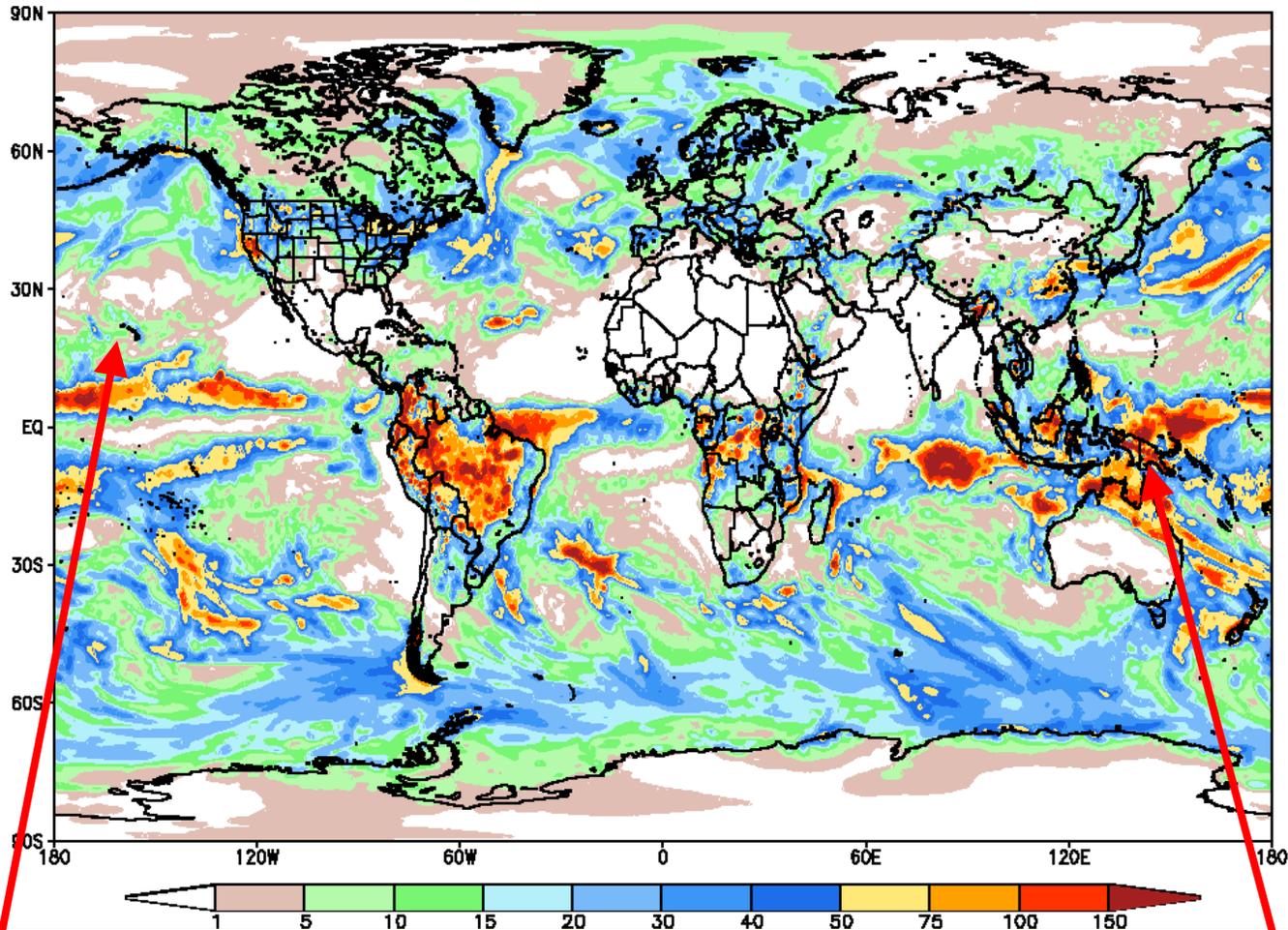


A statistical MJO forecast indicates a weak MJO signal developing during the next two weeks.



Global Forecast System (GFS) Week 1 Precipitation Forecast

GFS 37.5 km Week 1 Total Precipitation (mm)
Issued at Apr 03 2006 00Z for the period ending at Apr 10 2006 00Z



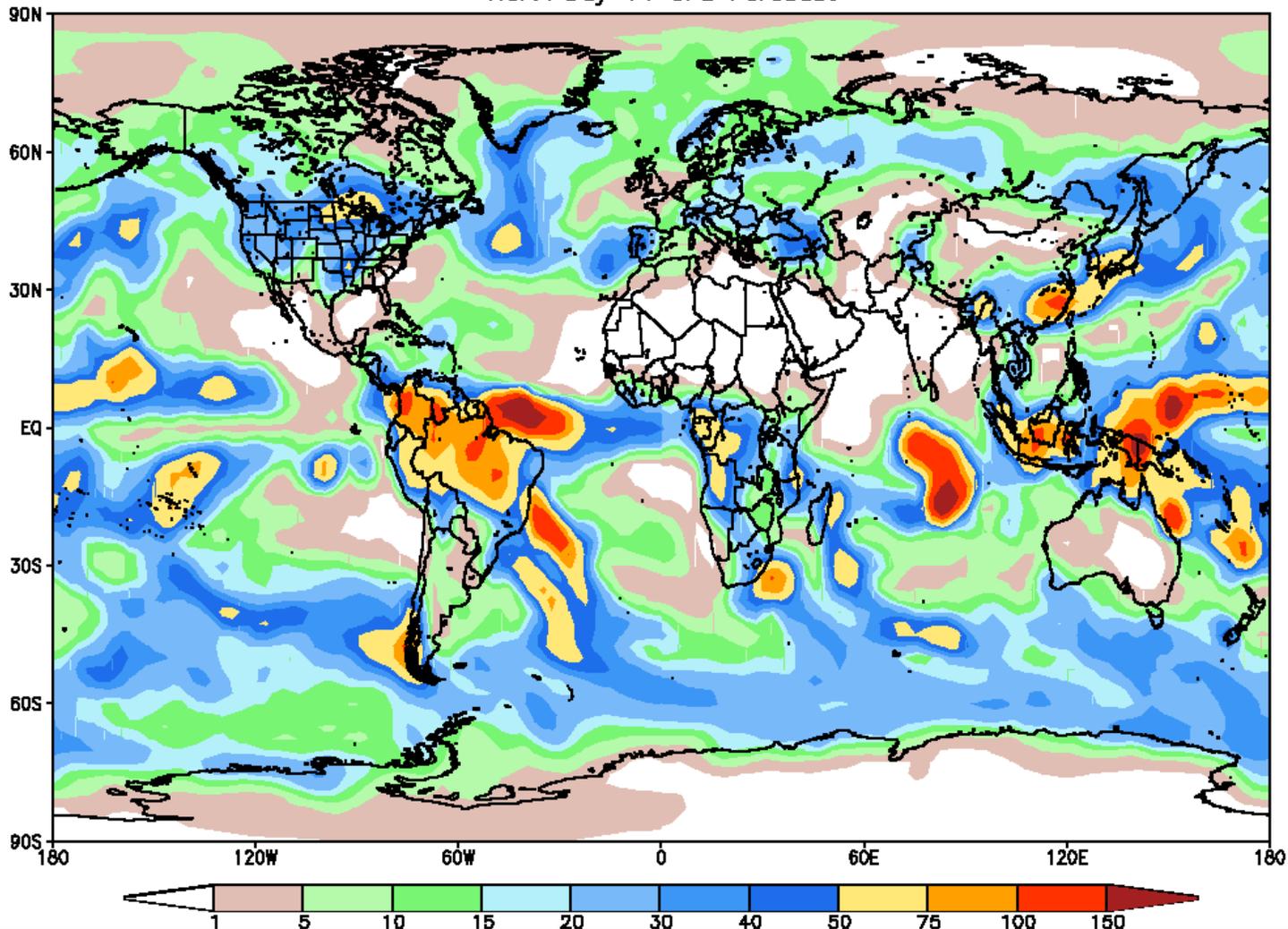
**Drier weather finally returns
to Hawaii**

**Abundant rainfall persists across
eastern Indonesia**



Global Forecast System (GFS) Week 2 Precipitation Forecast

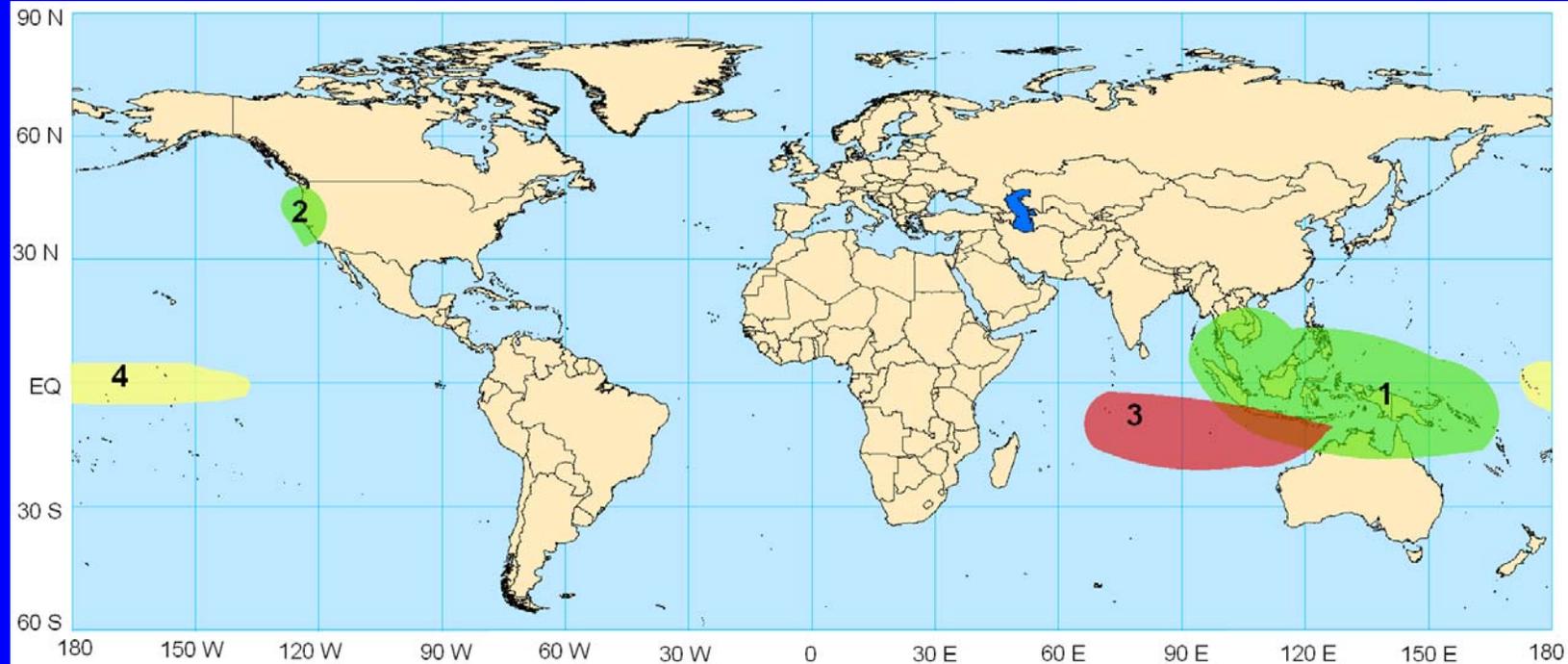
GFS 100 km Week 2 Total Precipitation (mm)
Issued Apr 3 2006 00Z for the period ending at Apr 16 2006 00Z
NOAA Day 14 GFS Forecast



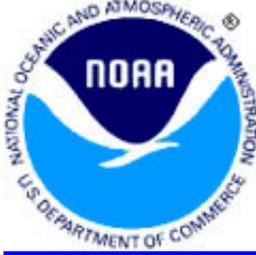


Potential Benefits/Hazards – Week 1

Valid April 4 - 10, 2006

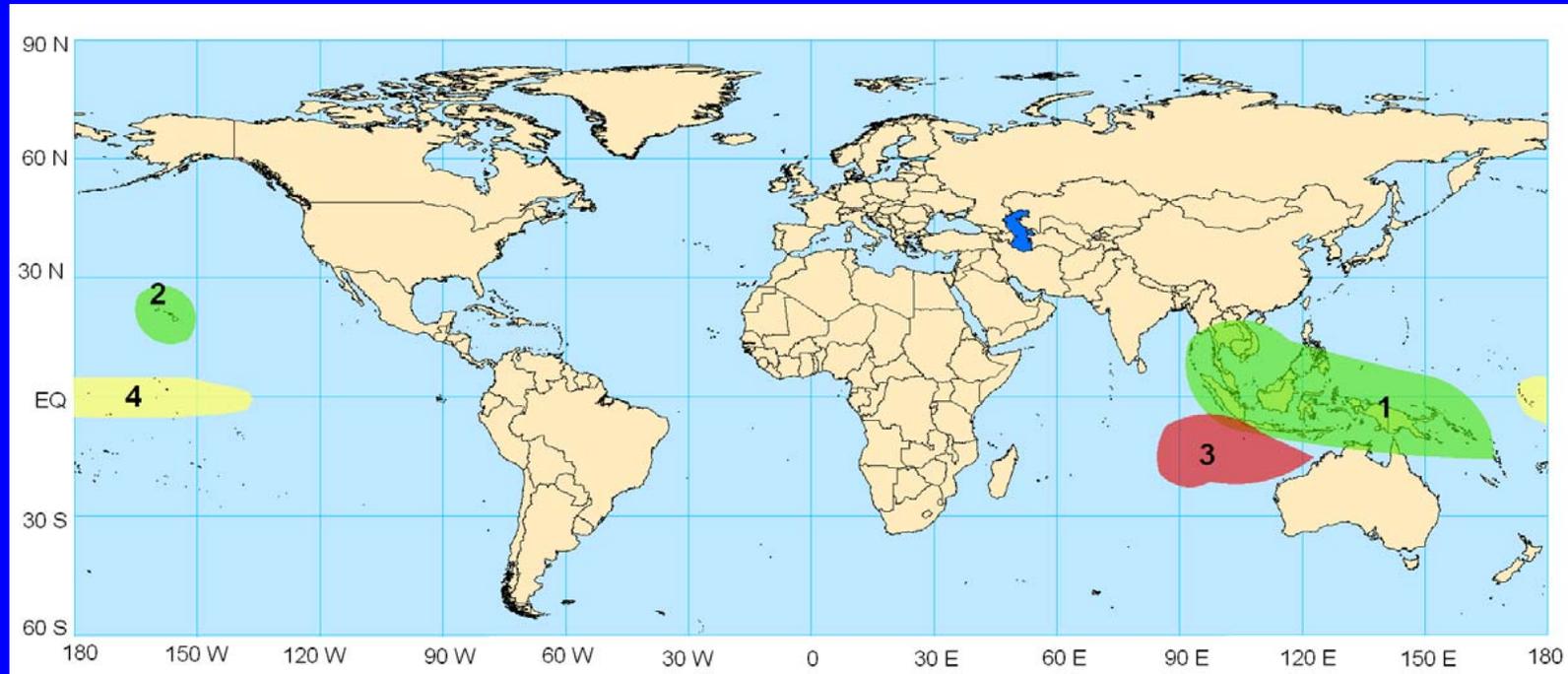


1. An increased chance for above normal rainfall across Indonesia, the western Pacific Ocean, and far northern Australia due to convection typical during La Nina and areas of above average SSTs.
2. An increased chance for above normal rainfall across the West Coast.
3. An increased chance for tropical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



Potential Benefits/Hazards – Week 2

Valid April 11 - 17, 2006



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



Summary

- The latest observations indicate the possible development of a weak MJO 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 across Indonesia, the western Pacific Ocean, and far northern Australia with drier than average conditions expected in the equatorial central Pacific Ocean.
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