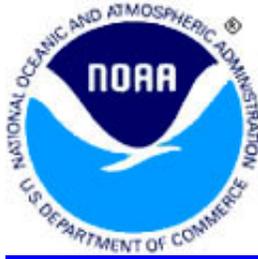




Madden/Julian Oscillation: **Recent Evolution, Current** **Status and Forecasts**

Update prepared by
Climate Prediction Center / NCEP
February 27, 2006



Outline

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



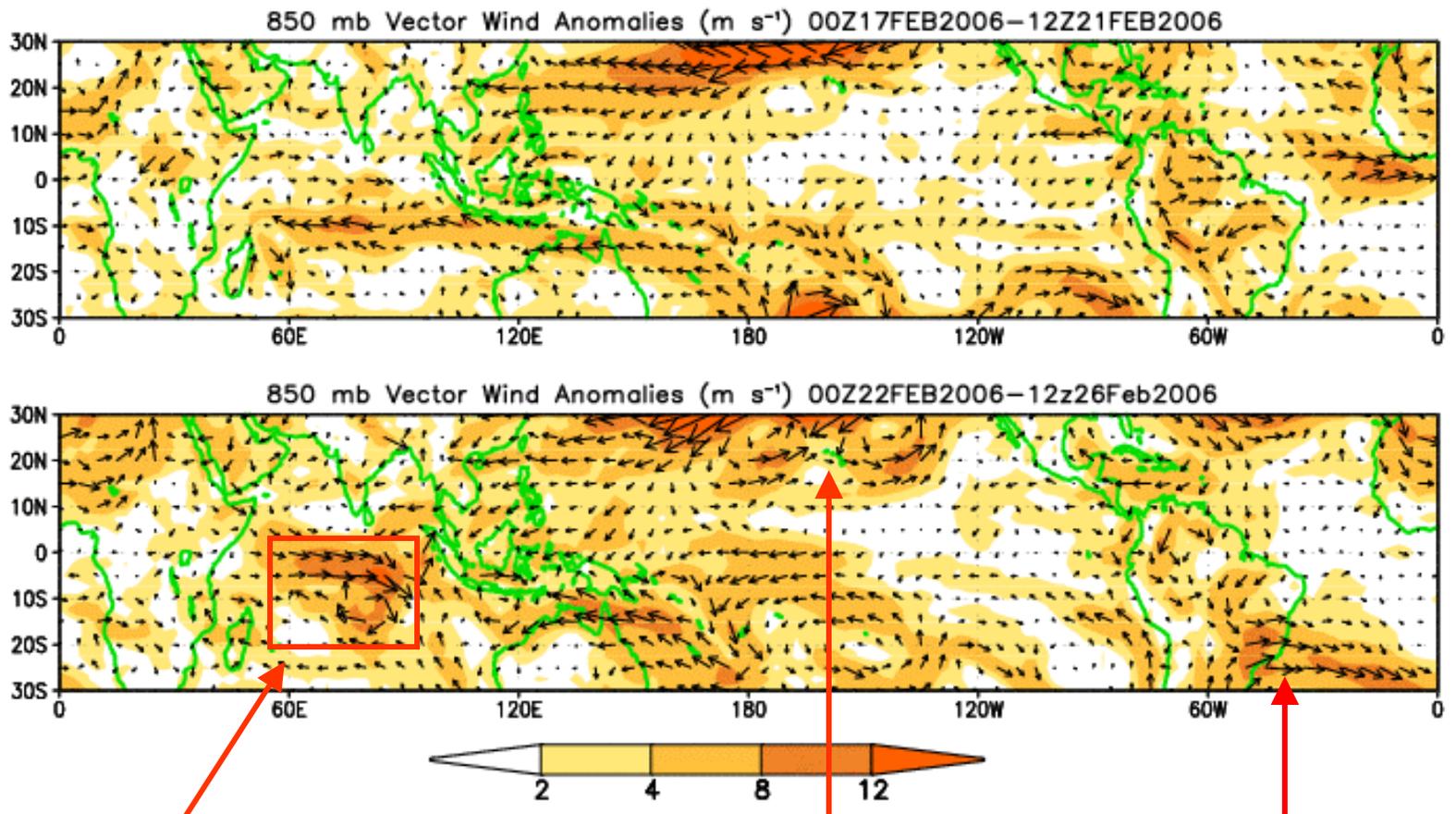
Overview

- The latest observations indicate that a weak to moderate MJO exists and this signal is superimposed upon the underlying La Nina pattern.
- During the past week, convection intensified across the eastern Indian Ocean and sections of Indonesia with low-level westerly anomalies now evident along the equator in the central Indian Ocean. Rainfall remained enhanced in the central Pacific Ocean in the vicinity of Hawaii. Tropical cyclones Carina and Kate developed during the past week in the southern Indian Ocean and off the coast of Australia south of New Guinea respectively.
- Based on the latest observational evidence, the MJO is expected remain at weak to moderate strength during the upcoming 1-2 week period.
- There exists several potential hazards/benefits across the global tropics during the upcoming period. During week 1, there is an increased chance for above normal rainfall stretching from the Indian Ocean across Indonesia and into the western Pacific Ocean south of the equator as a result of the combination of La Nina conditions and the enhanced phase of the MJO. There remains an increased chance of above (below) normal rainfall in the vicinity of Hawaii in the north-central Pacific Ocean (central equatorial Pacific Ocean) associated with La Nina conditions. Also, there is an increased chance of below average rainfall across northeast Brazil due to the suppressed phase of the MJO. In addition, there also exists increased chances of tropical cyclone development across sections of the southern Indian Ocean and in areas north and east of Australia as conditions remain favorable in these areas.
- During week 2, the region of increased chances of above average rainfall in the eastern hemisphere is expected to shift eastward to cover mainly Indonesia and the western Pacific including the South Pacific Convergence Zone (SPCZ) with the threat of tropical cyclone activity confined to the western Pacific Ocean. The increased chance of above (below) normal rainfall near Hawaii (central equatorial Pacific Ocean) associated with La Nina conditions is expected to continue.
- Ensemble numerical weather forecast models indicate the threat of above average rainfall along the west coast of the United States during both week 1 and 2 as episodic periods of storminess are anticipated.



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

Note that shading denotes the magnitude of the anomalous wind vectors



More extensive westerly anomalies have returned to the equatorial Indian Ocean and a low-level anticyclonic circulation, associated with tropical cyclone activity, is evident.

Couplet of cyclonic circulation evident near Hawaii.

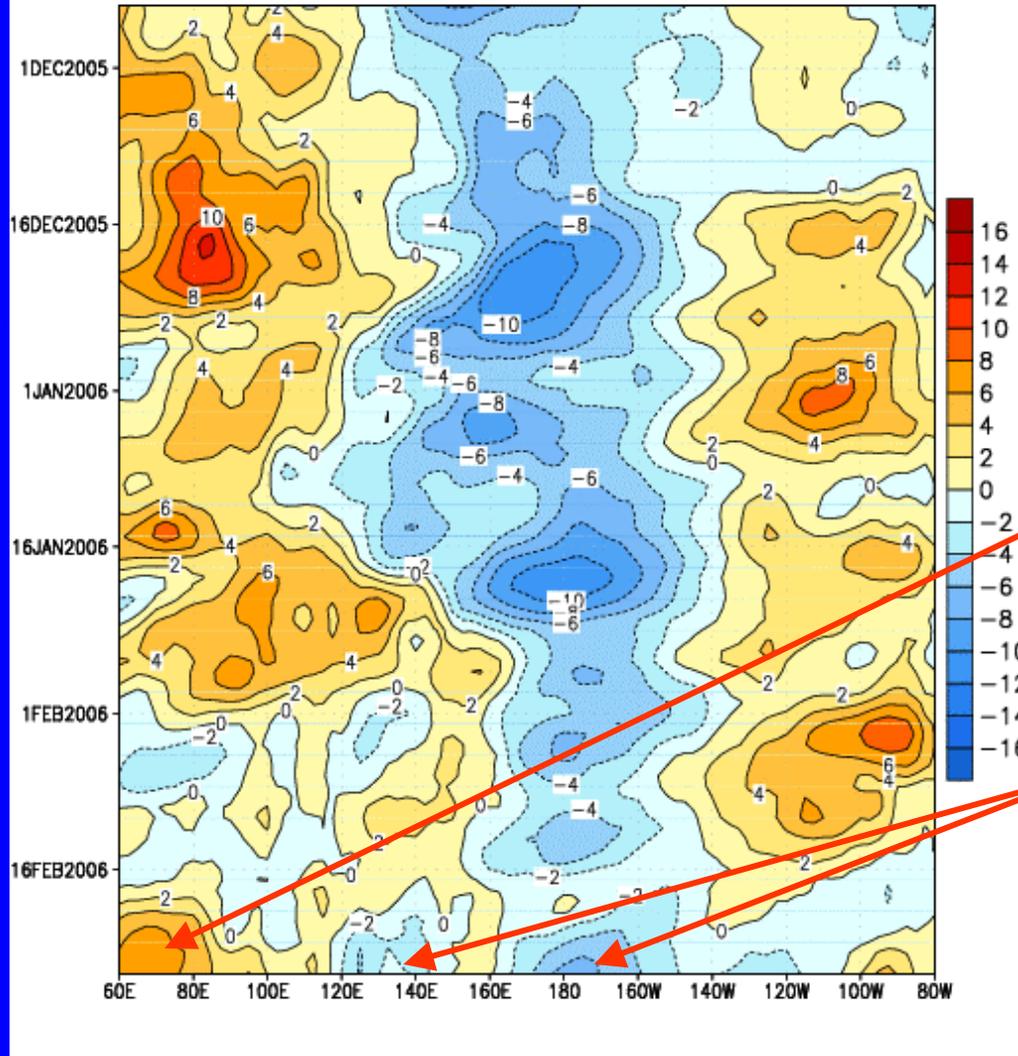
Westerly anomalies strengthened east of Brazil.



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

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

Time



Longitude

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

Stronger-than-average easterlies (blue shading).

Equatorial low-level westerly anomalies have strengthened in the Indian Ocean.

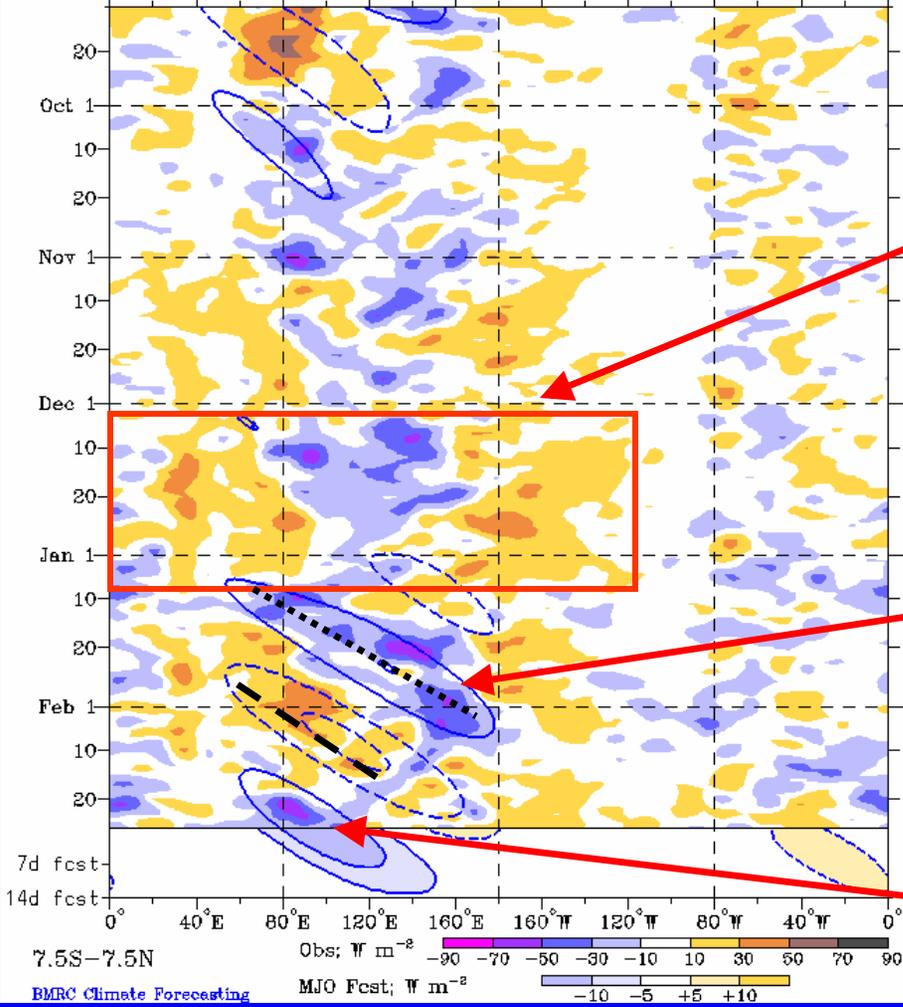
During the past week, areas of easterly anomalies have increased near the date line and across Indonesia.



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

Real-time MJO filtering superimposed upon 3drn R21 OLR Anomalies
MJO anomalies blue contours, CINT=10. (5. for forecast)
Negative contours solid, positive dashed
11-Sep-2005 to 26-Feb-2006 + 14 days

Time
↓



Drier-than-average conditions (/red shading)
Wetter-than-average conditions (blue shading)

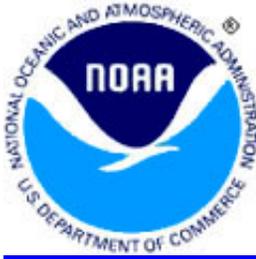
Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean during December

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 the Indian Ocean and Indonesia.

Longitude

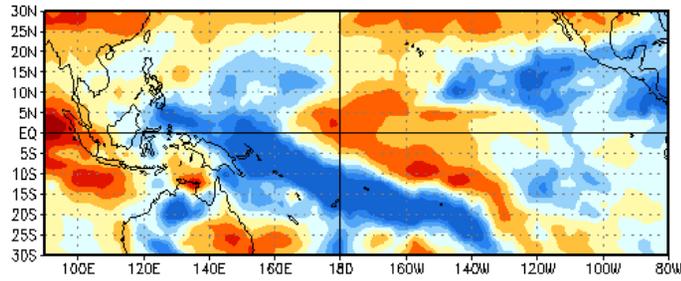
7.5S-7.5N
Obs; $W m^{-2}$ -90 -70 -50 -30 -10 10 30 50 70 90
MJO Fcst; $W m^{-2}$ -10 -5 +5 +10
BMRC Climate Forecasting



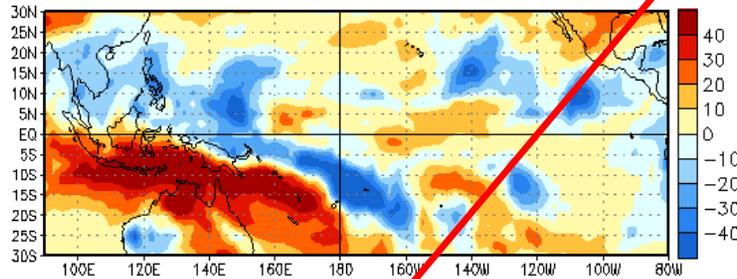
Anomalous OLR and 850-hPa Wind

Wind: Last 30 days

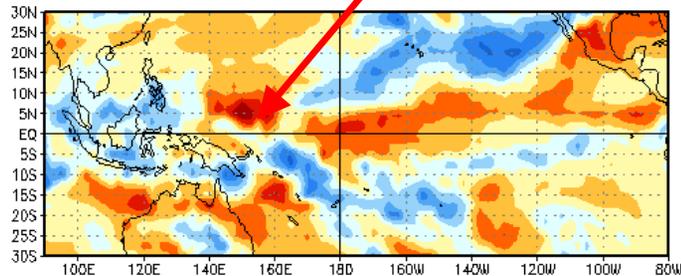
OLR Anomalies
26 JAN 2006 to 4 FEB 2006



5 FEB 2006 to 14 FEB 2006



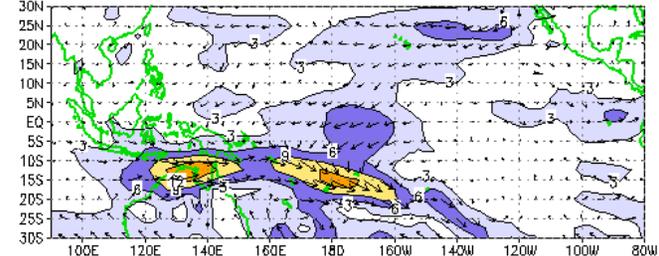
15 FEB 2006 to 24 FEB 2006



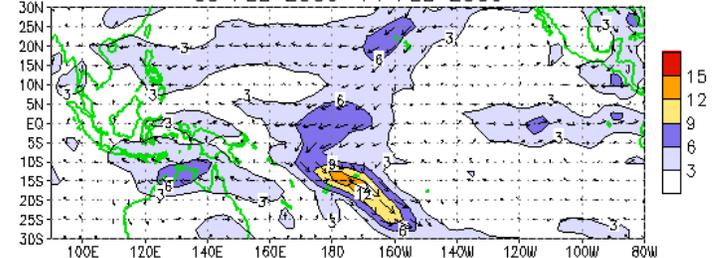
During the past 10 days, enhanced convection in the vicinity of the SPCZ has weakened, but has gradually returned across southern Indonesia. Suppression has eased over northern Australia.

During the past 20 days, strong westerly anomalies over Indonesia and northern Australia have generally been replaced with easterly anomalies.

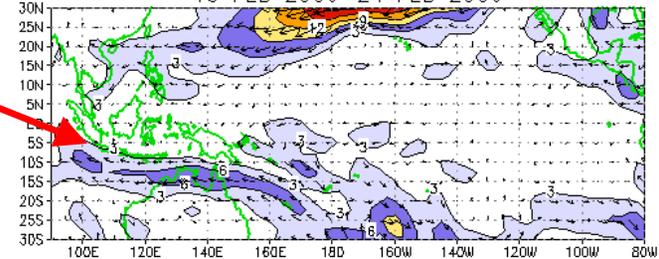
CDAS 850-hPa Wind Anoms
26 JAN 2006-04 FEB 2006



05 FEB 2006-14 FEB 2006

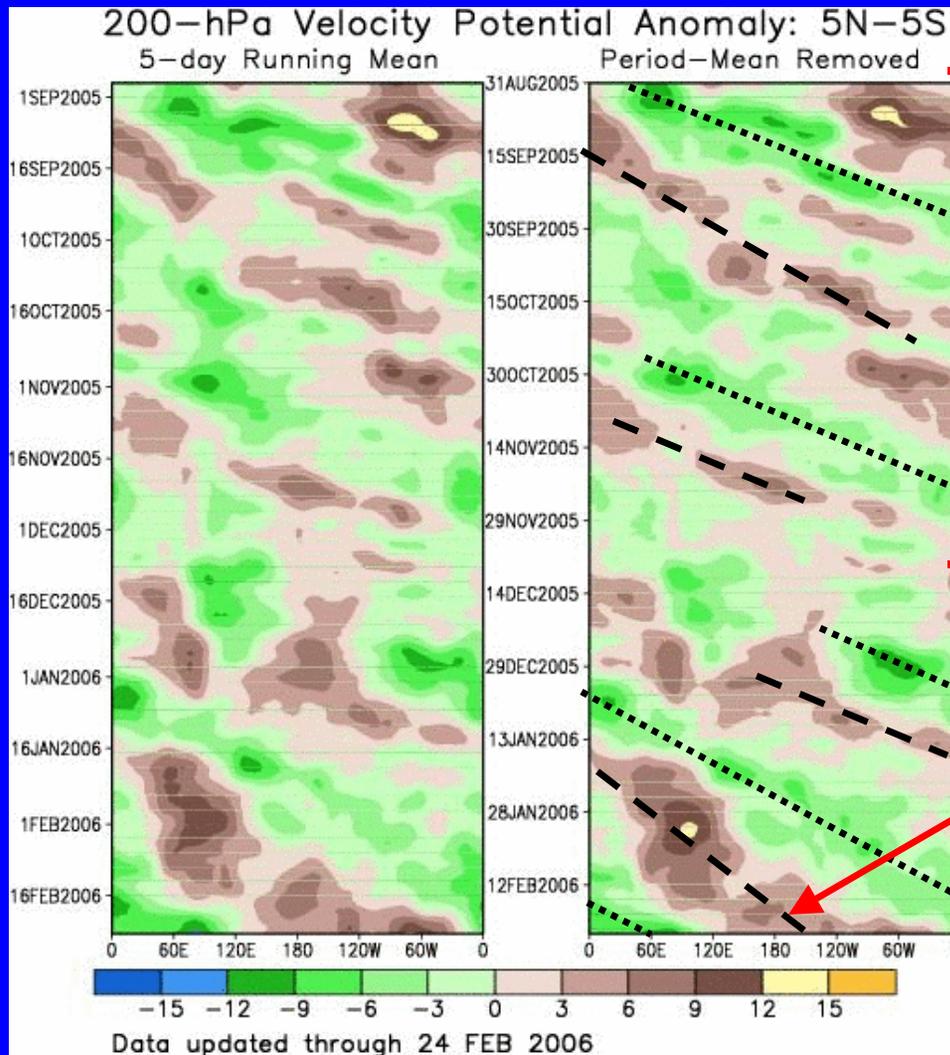


15 FEB 2006-24 FEB 2006





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.

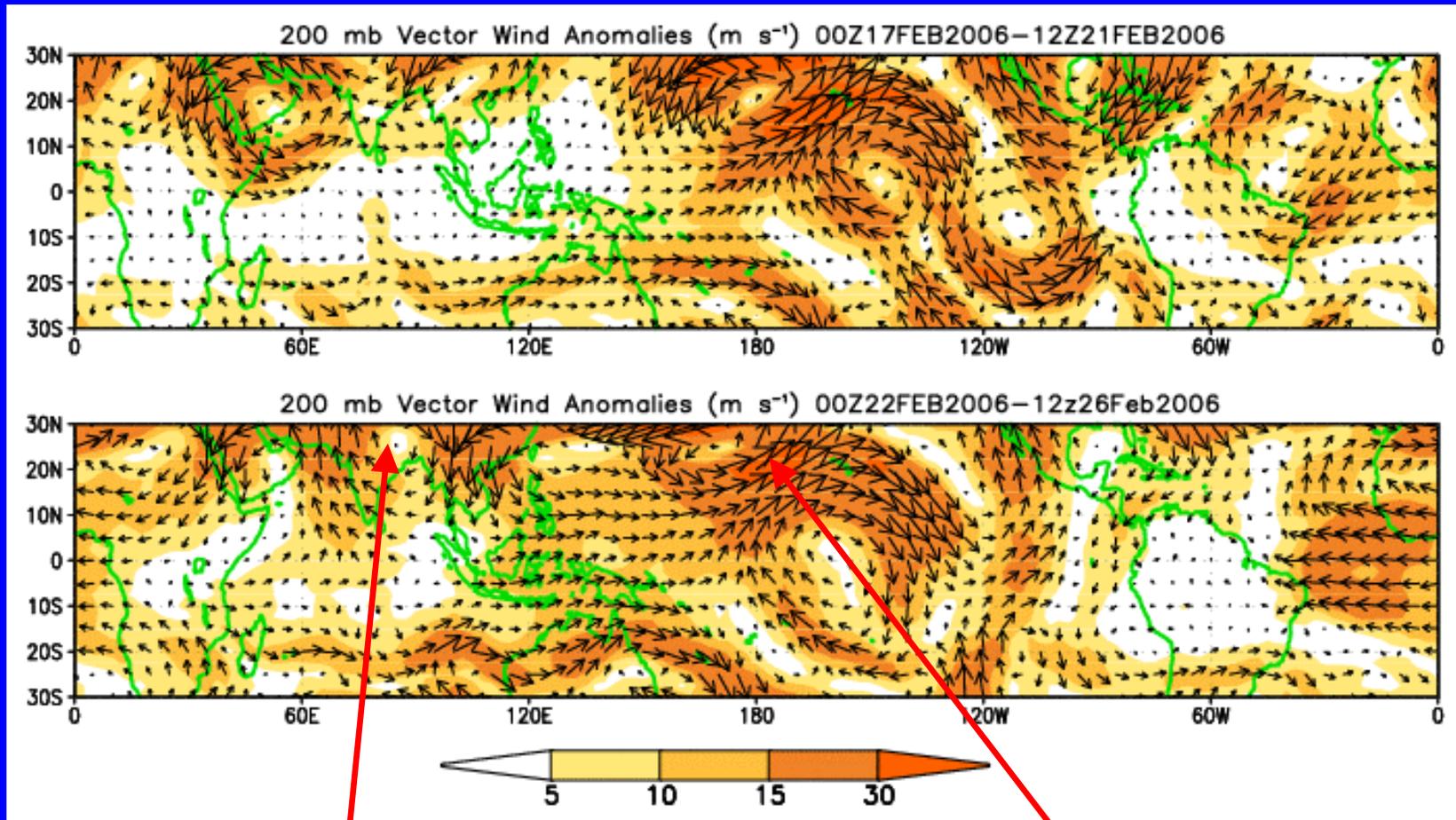
Weak to moderate MJO activity was observed during the period from August into November

During the past week, strong upper-level convergence 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.

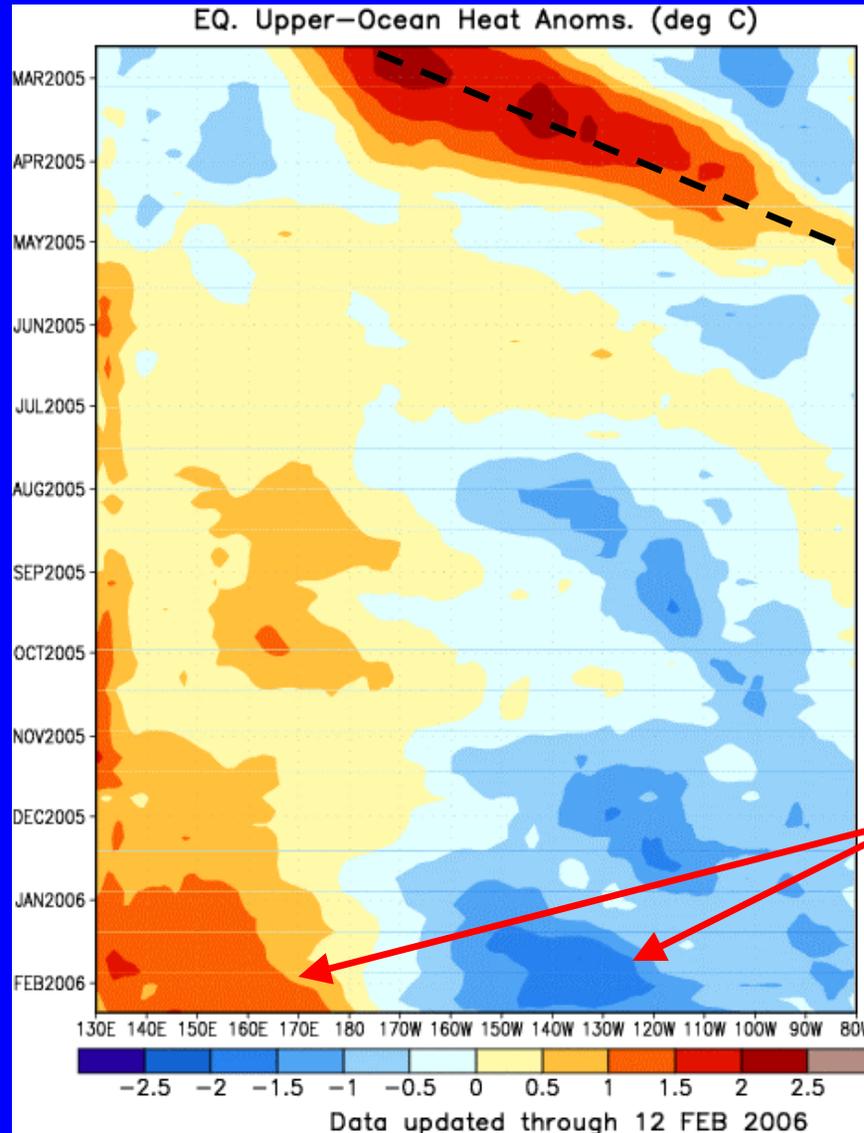


Upper-level anticyclonic circulation centered over India

Upper-level cyclonic circulation and strong southwesterly anomalies near and 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

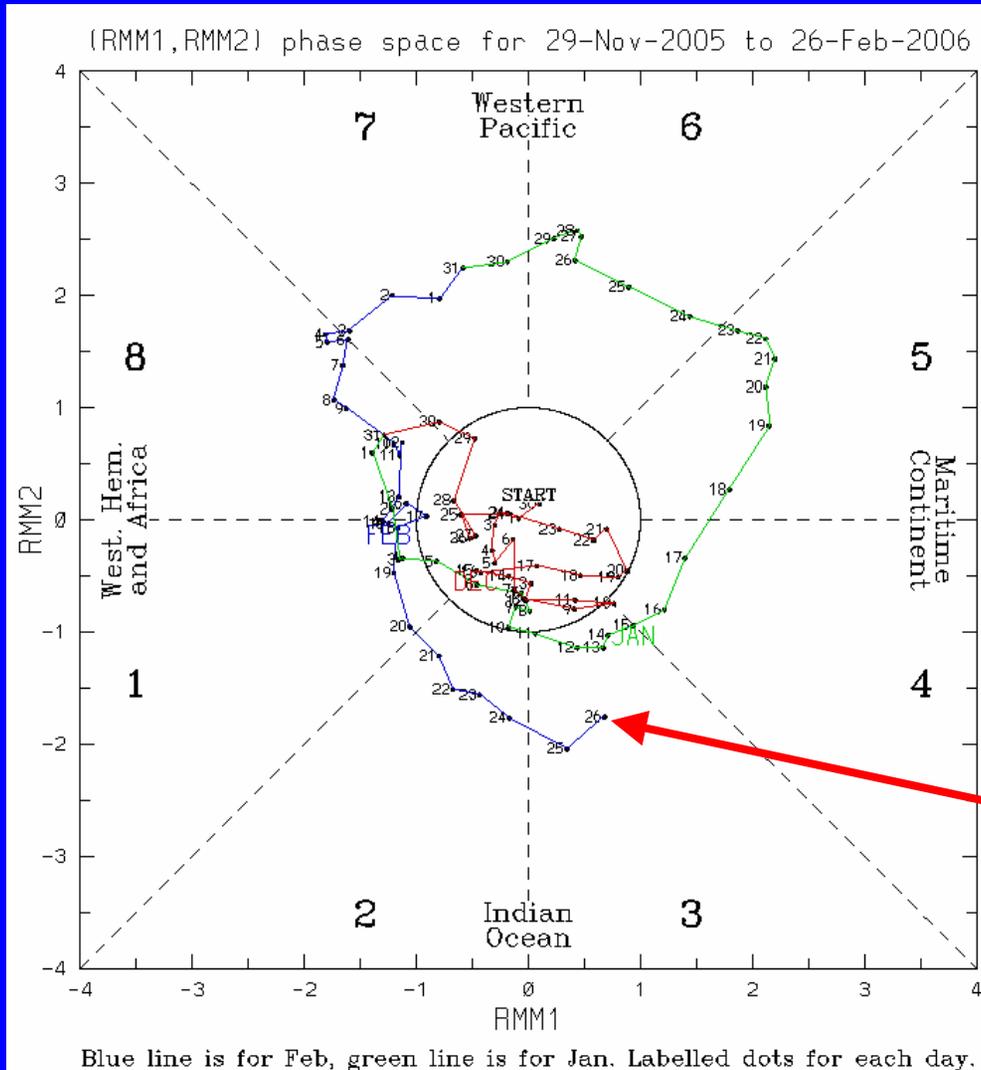
Heat content has been above average in the western Pacific since June while cooler water has been observed across the central and eastern Pacific.



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).

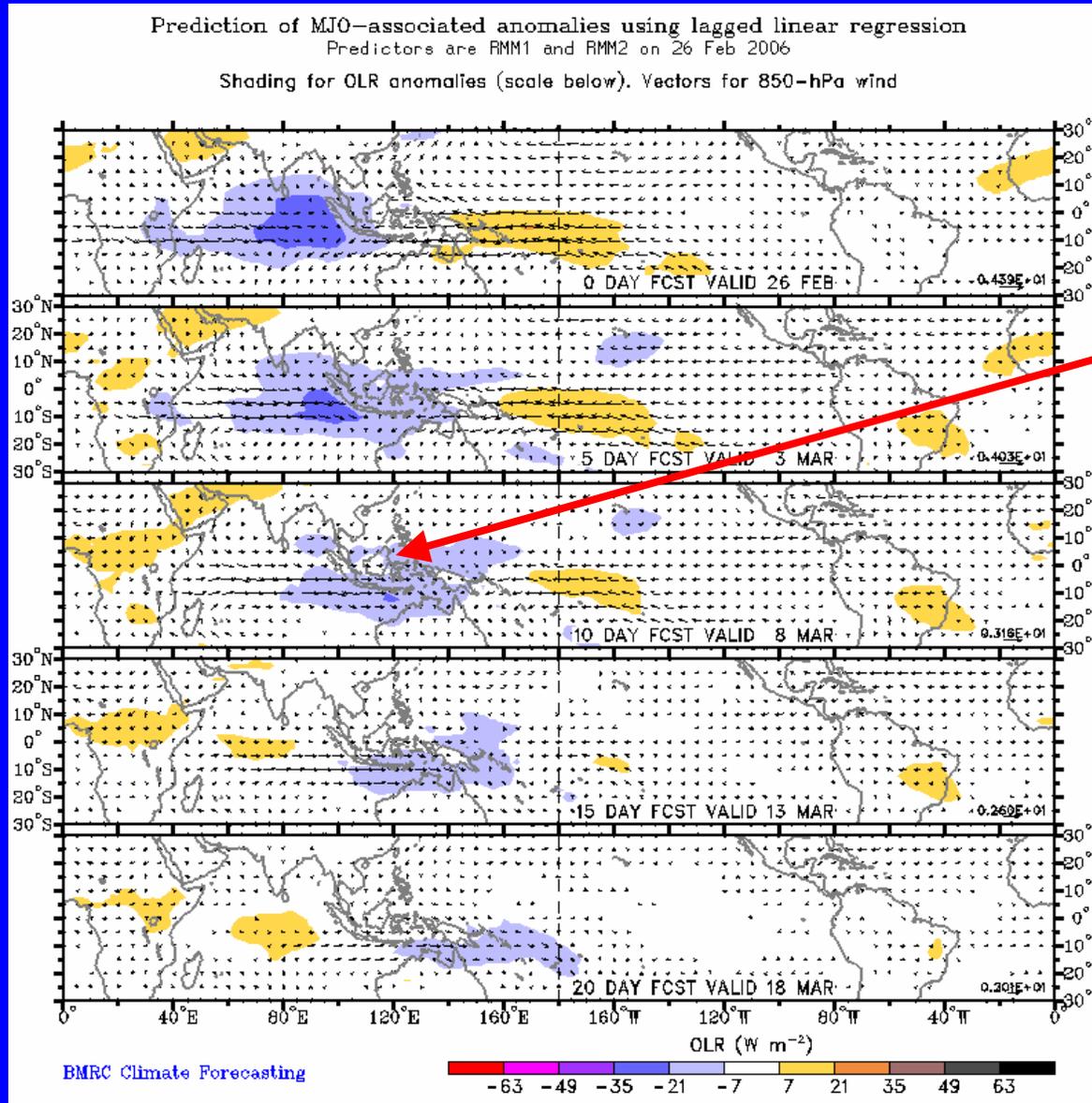
The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate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



The MJO signal continues with the enhanced phase in the Indian Ocean during the past week.



Statistical OLR MJO Forecast

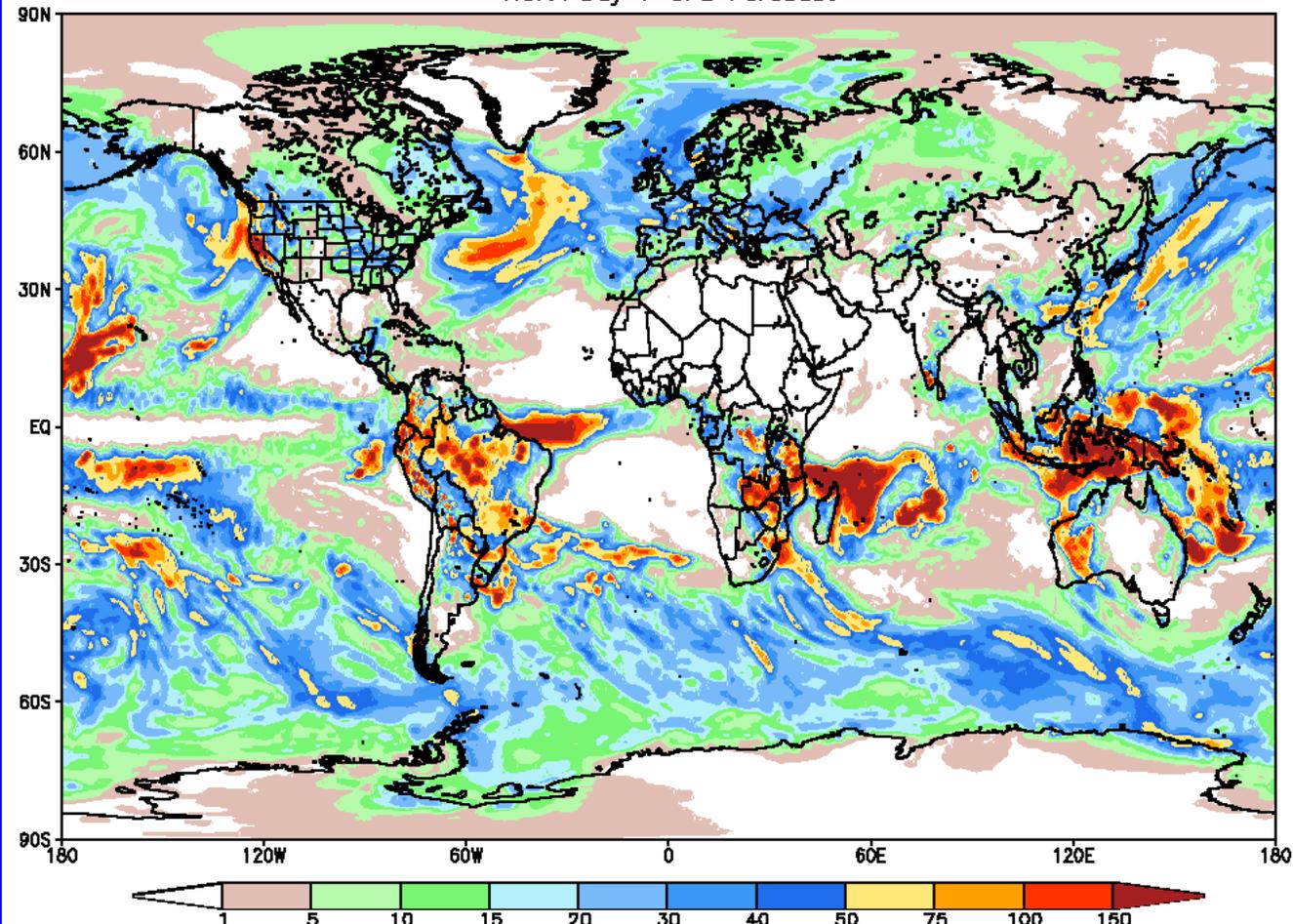


A statistical MJO forecast indicates enhanced convection (blue shades) slowly shifting east from eastern Africa to Indonesia during the period.



Global Forecast System (GFS) Precipitation Forecast

GFS 37.5 km Week 1 Total Precipitation (mm)
Issued at Feb 27 2006 00Z for the period ending at Mar 6 2006 00Z
NOAA Day 7 GFS Forecast

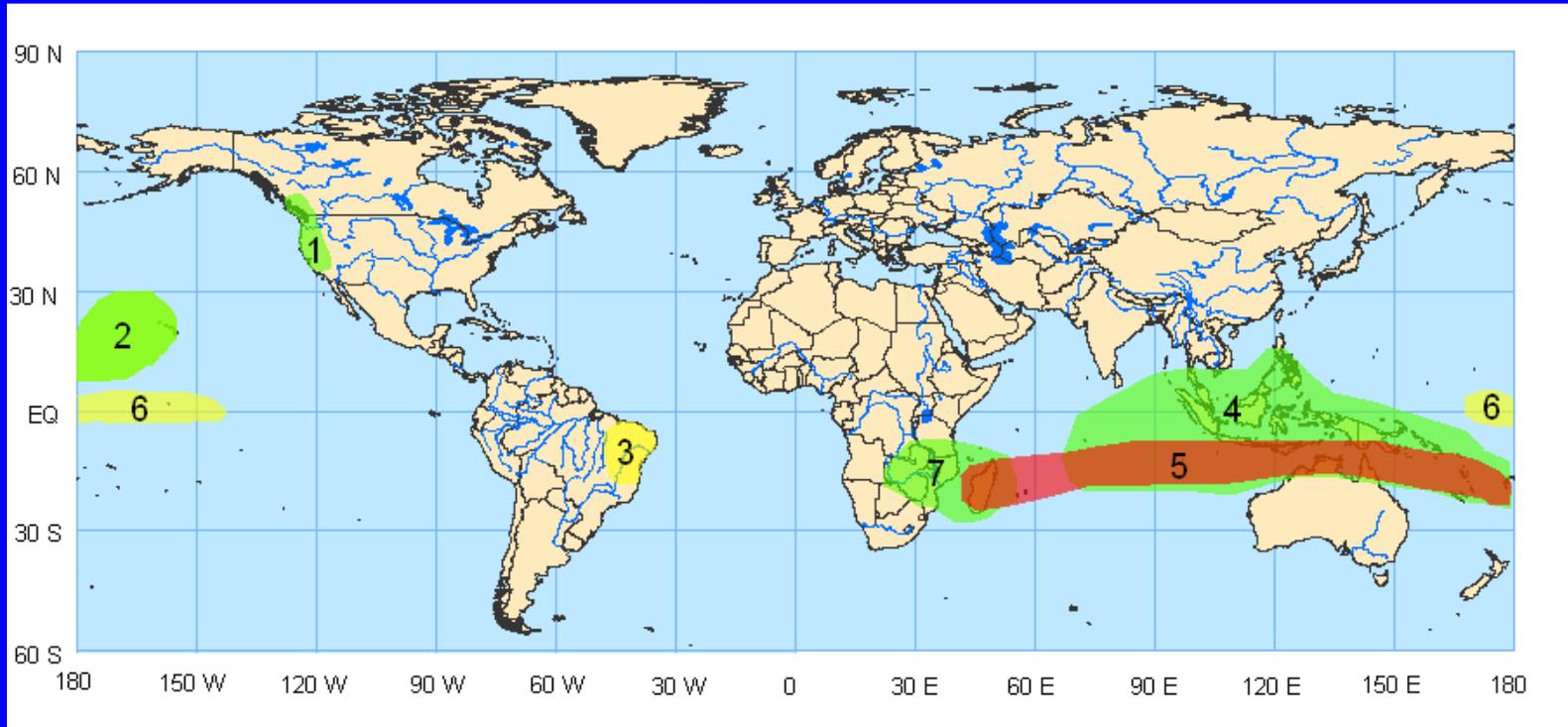


The GFS indicates plentiful rainfall over the eastern half of southern Africa, the western Indian Ocean, Indonesia and sections of the western Pacific, as well as in vicinity of Hawaii in the north-central Pacific Ocean.



Potential Benefits/Hazards – Week 1

Valid February 28 – March 6, 2006

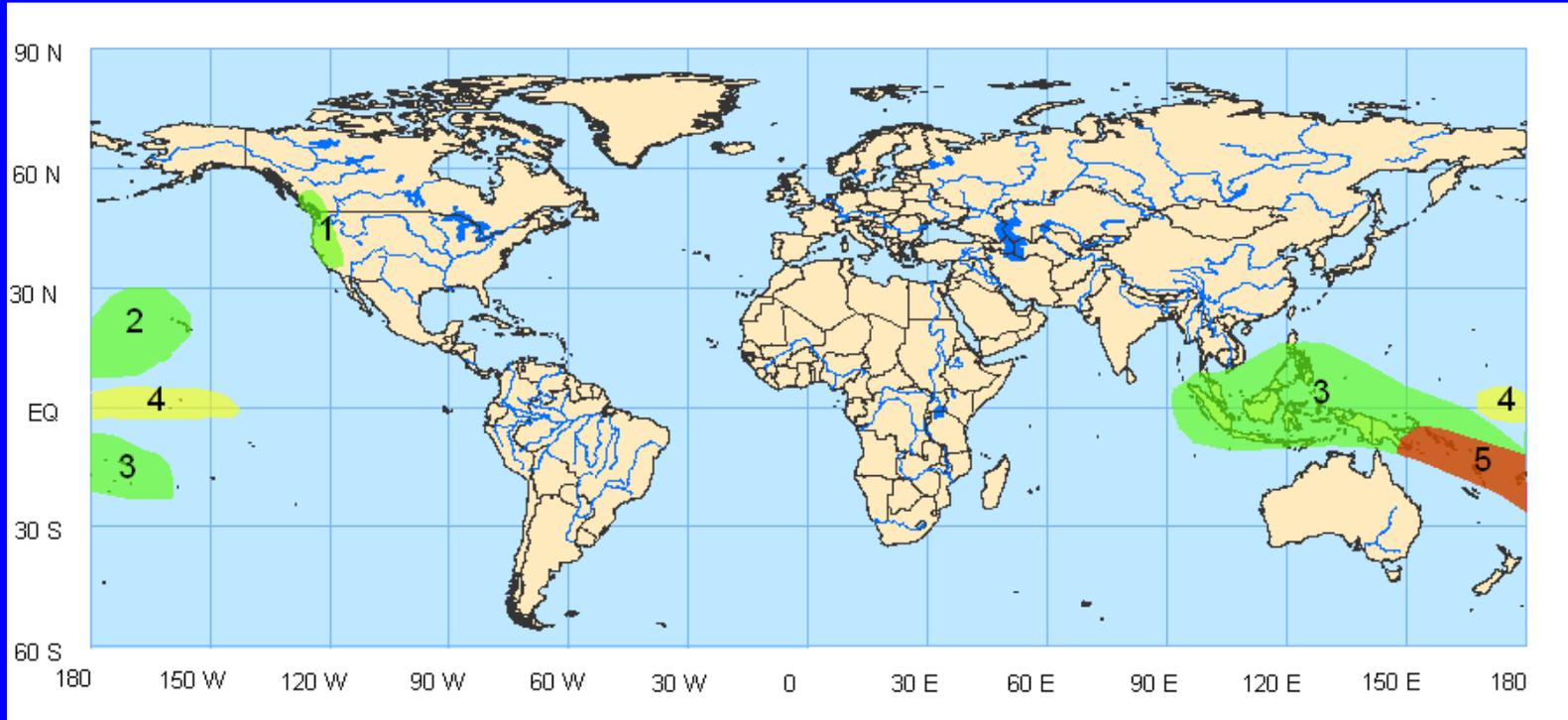


1. An increased chance for above normal precipitation along the US west coast
2. An increased chance for above normal rainfall in the central Pacific due to upper-level low pressure common during La Nina
3. An increased chance for below normal rainfall across northeast Brazil due to the suppressed phase of the MJO
4. An increased chance for above normal rainfall from the eastern Indian Ocean across Indonesia into sections of the western Pacific Ocean due to a combination of the enhanced phase of the MJO and the re-establishment of convection typical during La Nina
5. Increased chances for tropical cyclogenesis in the Indian Ocean south of the equator and north 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. Also, tropical cyclone Carina will impact the western Indian Ocean.
6. An increased chance for below average rainfall due to cool sea surface temperatures
7. An increased chance for above average rainfall across sections of southeast Africa and Madagascar (La Nina, MJO, TC activity)



Potential Benefits/Hazards – Week 2

Valid March 7-March 13, 2006



1. An increased chance for above normal precipitation along the US west coast
2. An increased chance for above normal rainfall in the central Pacific due to upper-level low pressure common during La Nina
3. An increased chance for above normal rainfall from the eastern Indian Ocean across Indonesia into sections of the western Pacific Ocean due to a combination of the enhanced phase of the MJO and the re-establishment of convection typical during La Nina
4. An increased chance for below average rainfall due to cool sea surface temperatures
5. Increased chances for tropical cyclogenesis in the western Pacific Ocean south of the equator northeast of Australia in vicinity of the South Pacific Convergence Zone (SPCZ) 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.



Summary

- The latest observations indicate that a weak to moderate MJO exists and this signal is superimposed upon the underlying La Nina pattern.
- During the past week, convection intensified across the eastern Indian Ocean and sections of Indonesia with low-level westerly anomalies now evident along the equator in the central Indian Ocean. Rainfall remained enhanced in the central Pacific Ocean in the vicinity of Hawaii. Tropical cyclones Carina and Kate developed during the past week in the southern Indian Ocean and off the coast of Australia south of New Guinea respectively.
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