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

Update prepared by
Climate Prediction Center / NCEP
February 13, 2006

Outline

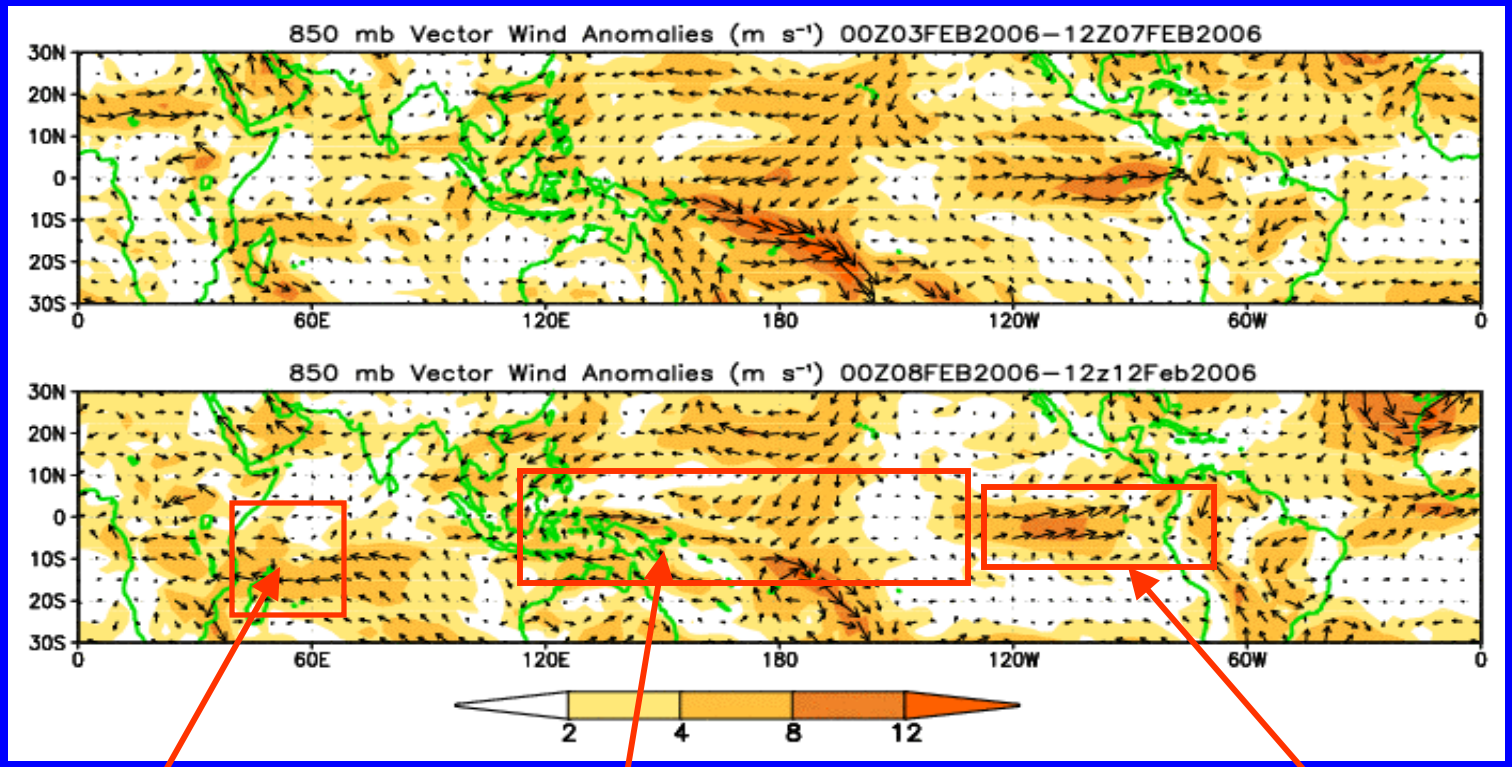
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- A weak MJO signal remains evident with its enhanced (suppressed) phases mainly located in the western Hemisphere (Indian Ocean) respectively.
- During the past week, upper-level convergence has dominated the Indian Ocean and sections of Indonesia suppressing rainfall in these regions. The main areas of enhanced rainfall included sections of Brazil, Bolivia, and Peru in South America, sections of the southern half of Africa, and in proximity of the South Pacific Convergence Zone (SPCZ) in the Pacific Ocean. Also, tropical cyclone Vaianu developed in the western Pacific Ocean south of the equator during the past week.
- The MJO is expected to remain weak during the upcoming 1-2 week period.
- 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, sections of northern South America, portions of the southern half of Africa and across areas in the western Pacific Ocean both north and south of the equator. There is also the potential for increased chances of below normal rainfall across southern Indonesia and northern Australia. More specific geographic details for these hazard regions can be seen by viewing slides 14 and 15.
- During week 2, increased chances of above normal rainfall remain in the central Pacific, sections of southern Africa and the western Pacific Ocean south of the equator. In addition, there is an increased chance of below average rainfall near the date line in the equatorial Pacific Ocean.
- Although not included on the hazard maps, tropical cyclone Vaianu will impact the southwest Pacific Ocean northeast of New Zealand early in the period. Also, there is the potential for tropical cyclogenesis east of Philippines early during week 1 and in the western Indian Ocean south of the equator during both weeks 1 and 2.

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

Note that shading denotes the magnitude of the anomalous wind vectors

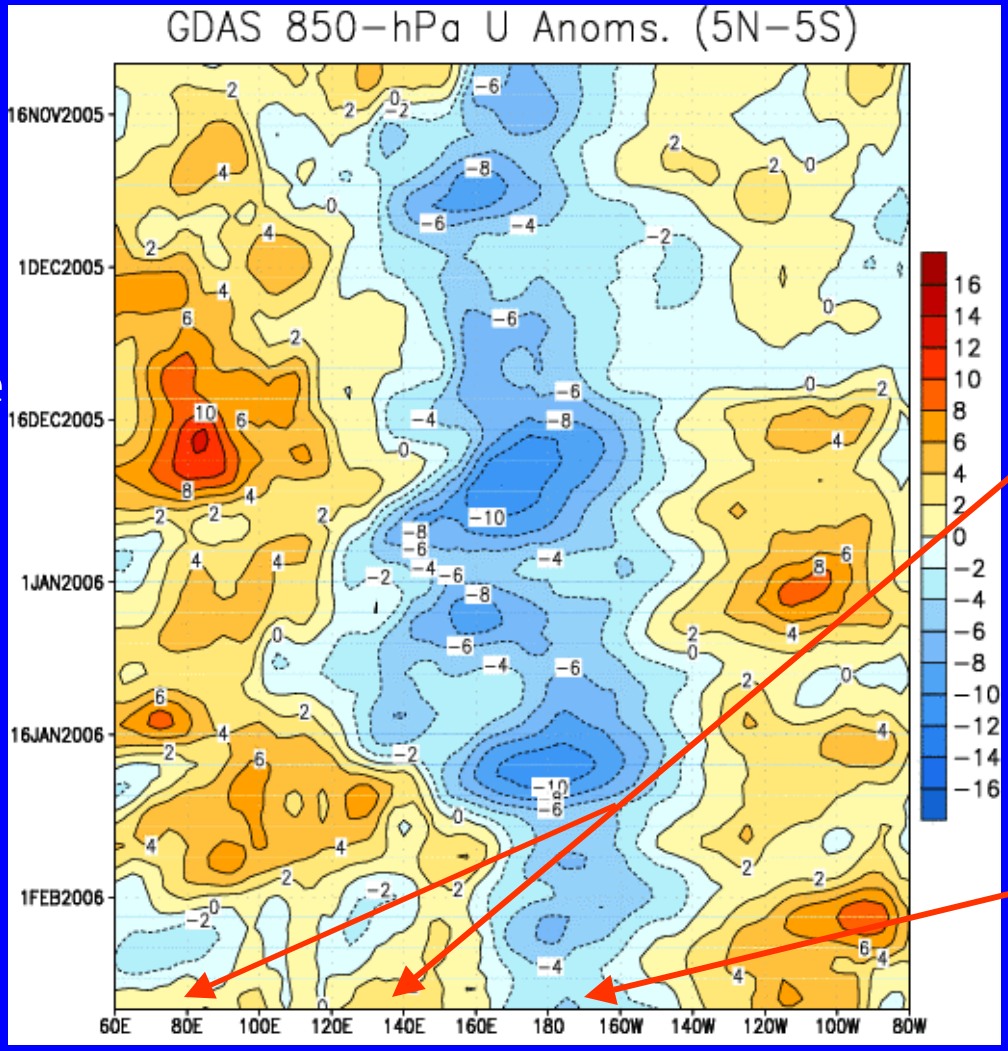


Mascarene high pressure system slightly weakened but easterlies remained strong across northern Madagascar into the Mozambique Channel

Westerly anomalies, although weakened, persisted east of New Guinea and southeastward across Polynesia into the subtropics

Westerly anomalies remain in the eastern Pacific Ocean

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



Time

Longitude

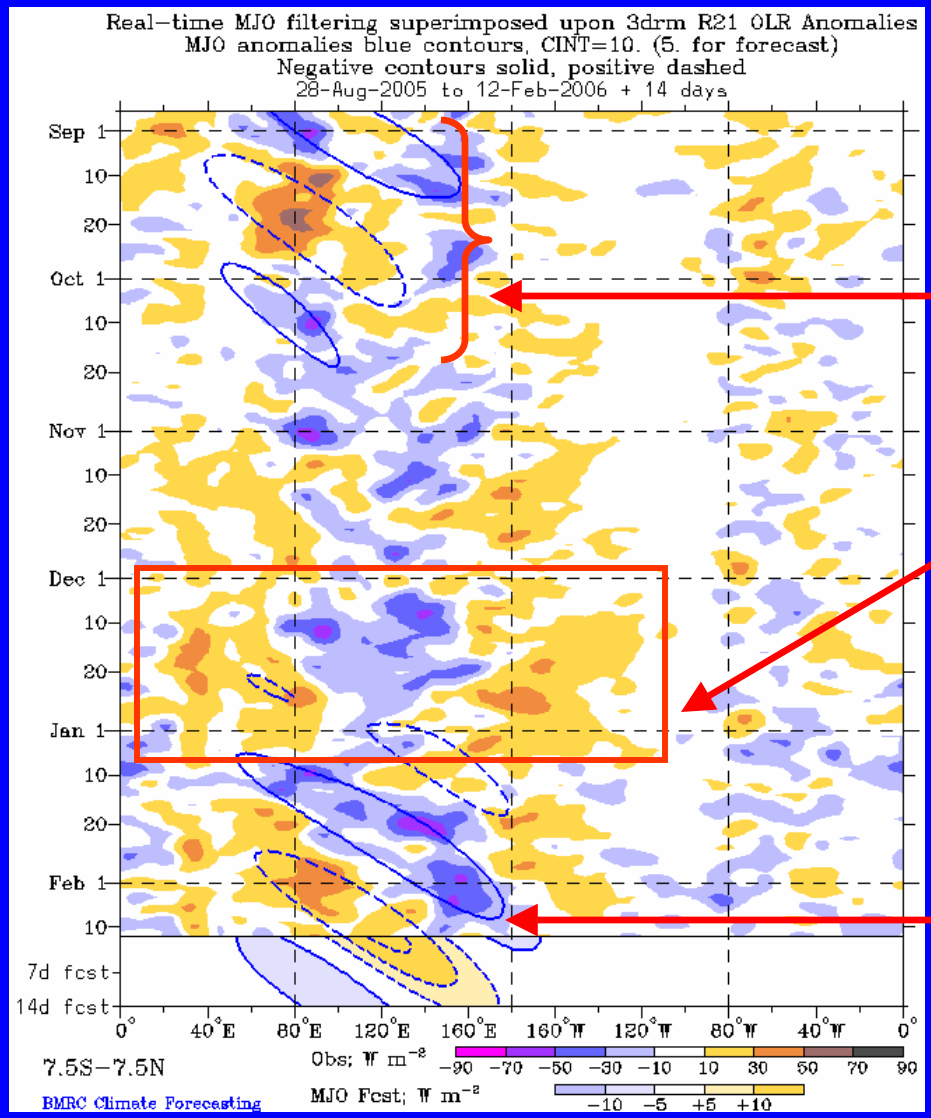
Weaker-than-average easterlies or westerlies (orange/red shading).

Stronger-than-average easterlies (blue shading).

Westerly anomalies developed over the central and eastern Indian Ocean and extend into the western Pacific

Lower tropospheric easterly anomalies have slightly increased near the date line

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



Time

Longitude

Drier-than-average conditions (/red shading)

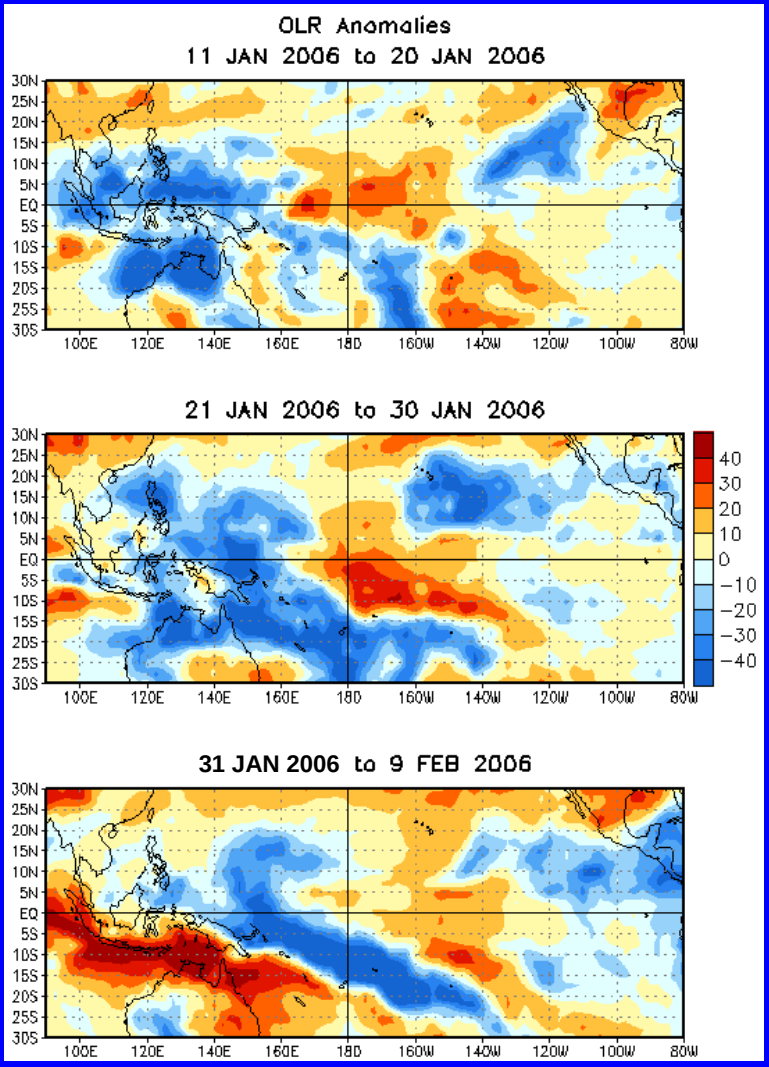
Wetter-than-average conditions (blue shading)

Weak MJO activity was evident during September and October as OLR anomalies propagated eastward from the Indian Ocean to the western Pacific Ocean

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

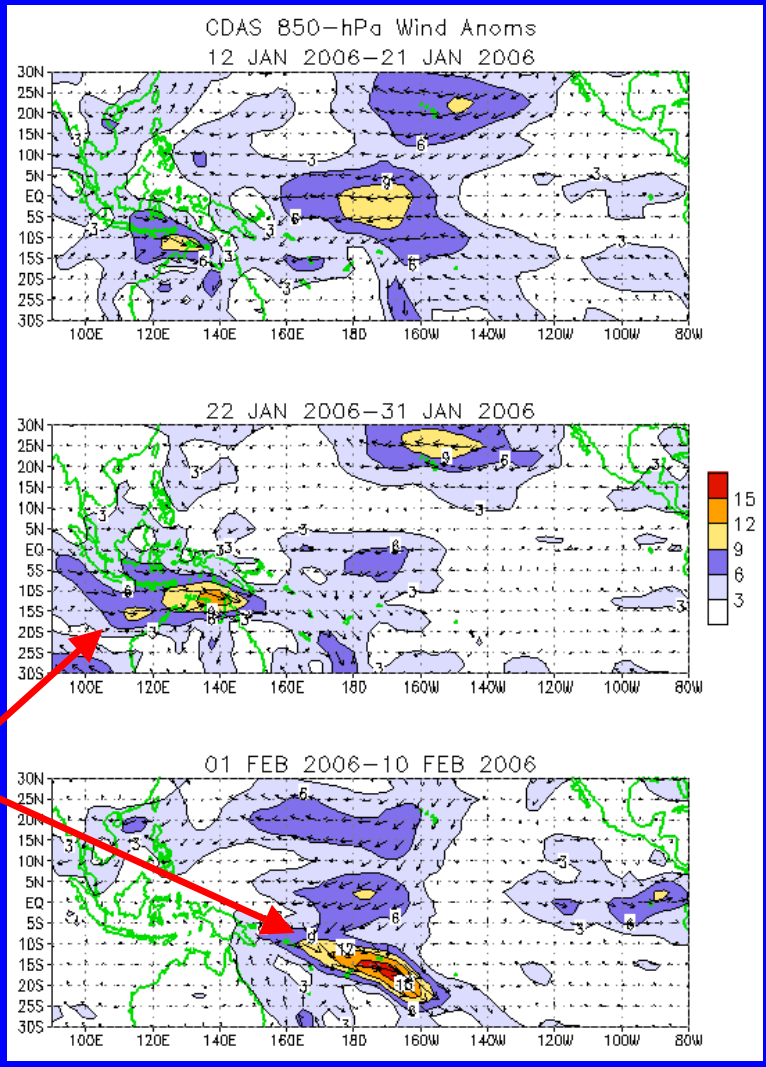
During the past week, a couplet of suppressed and enhanced convection stretching from Indonesia into the western Pacific Ocean continued to propagate east but has weakened.

Anomalous OLR and 850-hPa Wind: Last 30 days

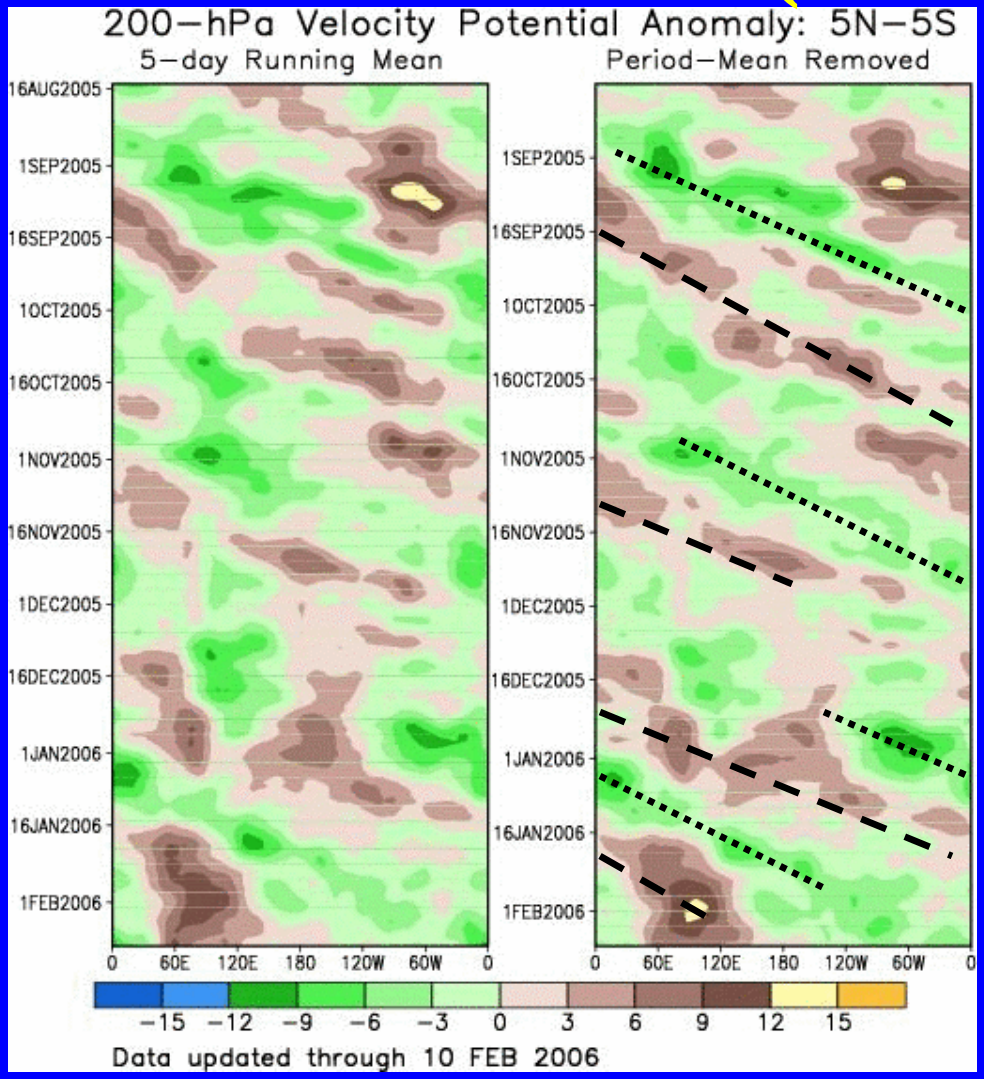


During the past 10 days, enhanced convection in the vicinity of the SPCZ has shifted eastward with strong suppression becoming evident across southern Indonesia and northern Australia

Strong westerly anomalies have shifted eastward during the past 10 days



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



Time

Longitude

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

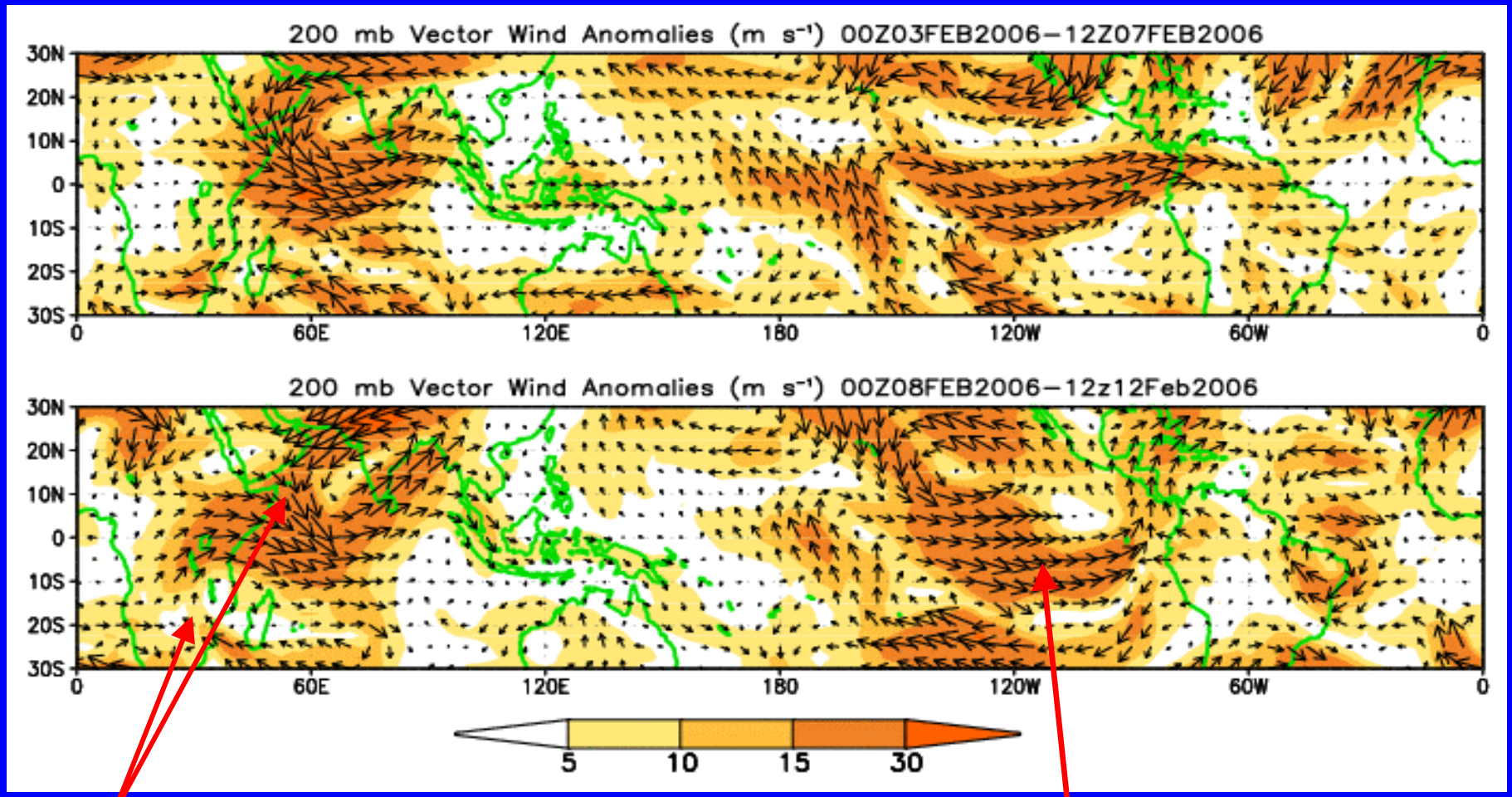
Negative anomalies (green shading) indicate favorable conditions for precipitation.

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

During the past week, strong upper-level convergence was evident across the Indian Ocean and western Indonesia. During the past week, this area has become nearly stationary

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

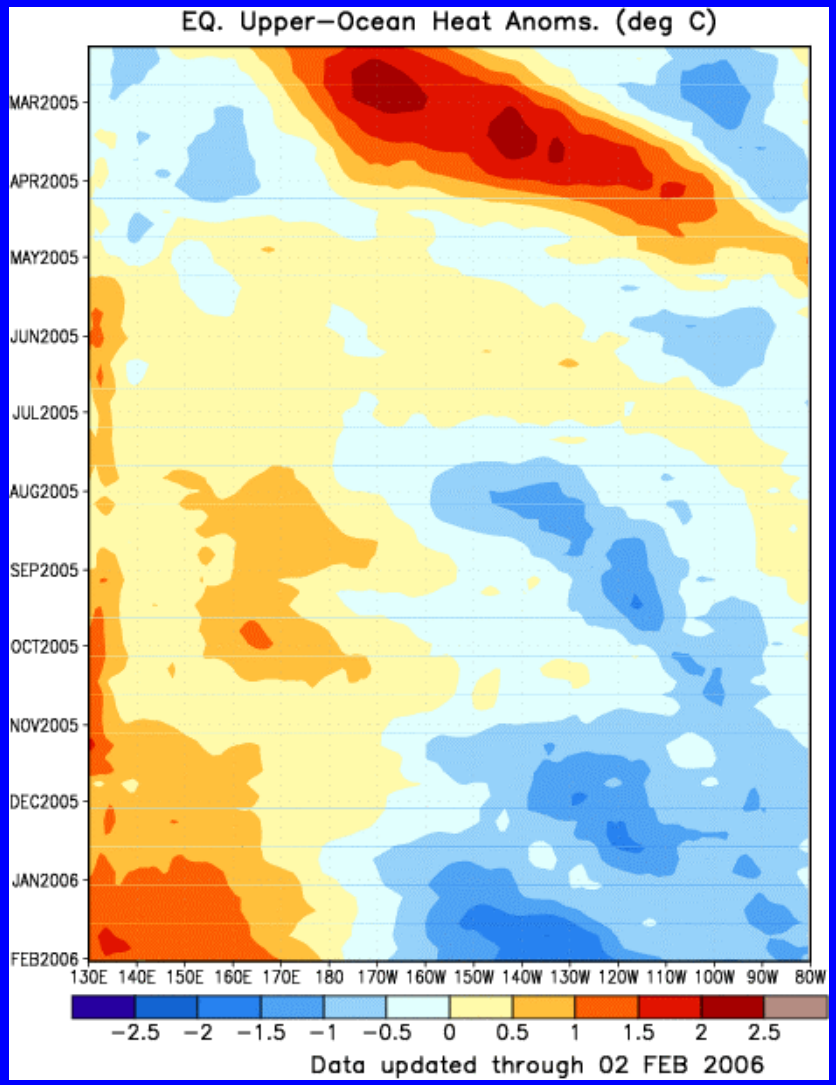
Note that shading denotes the magnitude of the anomalous wind vectors.



A couplet of cyclonic circulation across both hemispheres in the eastern Indian Ocean remains

Upper tropospheric westerlies along the equator in the east-central Pacific remained stronger than normal

Heat Content Evolution in the Eq. Pacific



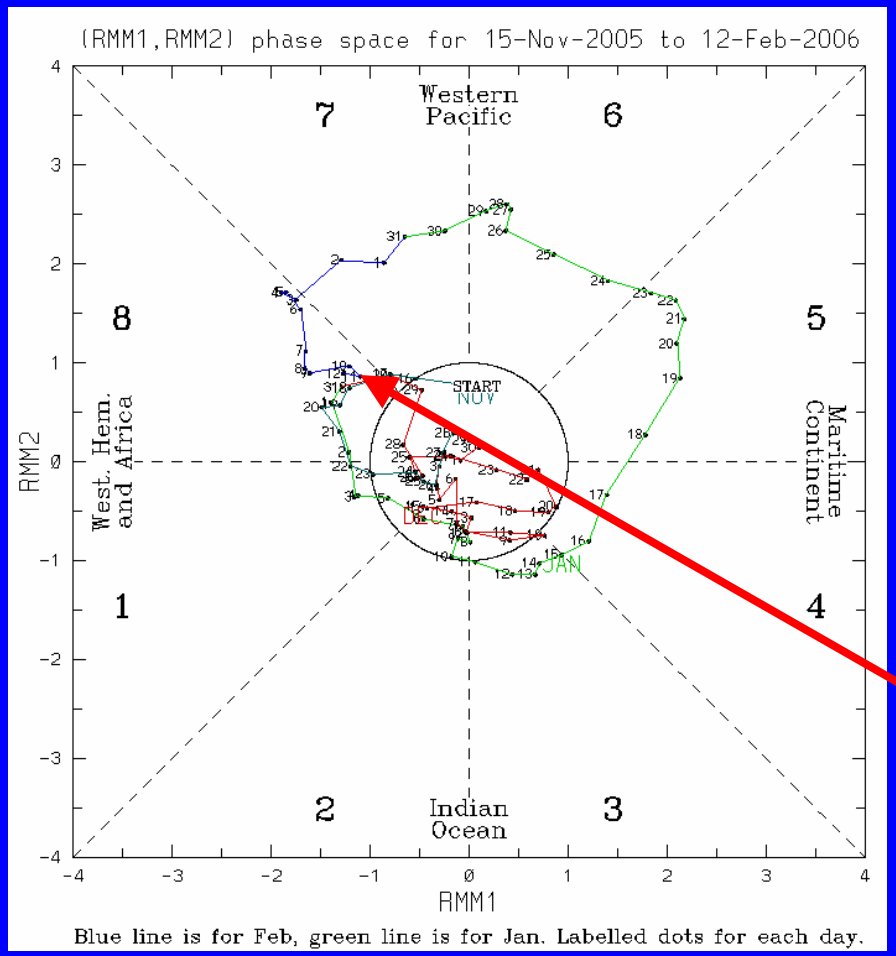
Time

Longitude

During February 2005, a strong Kelvin wave developed and continued to strengthen during March and reached the South American coast during early April. The Kelvin wave was initiated when the easterlies weakened over the equatorial Pacific in association with MJO activity.

Heat content has been above average in the western Pacific since June and has slightly increased. Cooler water observed across the eastern Pacific with a westward extension evident since November has also amplified in the central Pacific.

MJO Index (Magnitude and Phase)

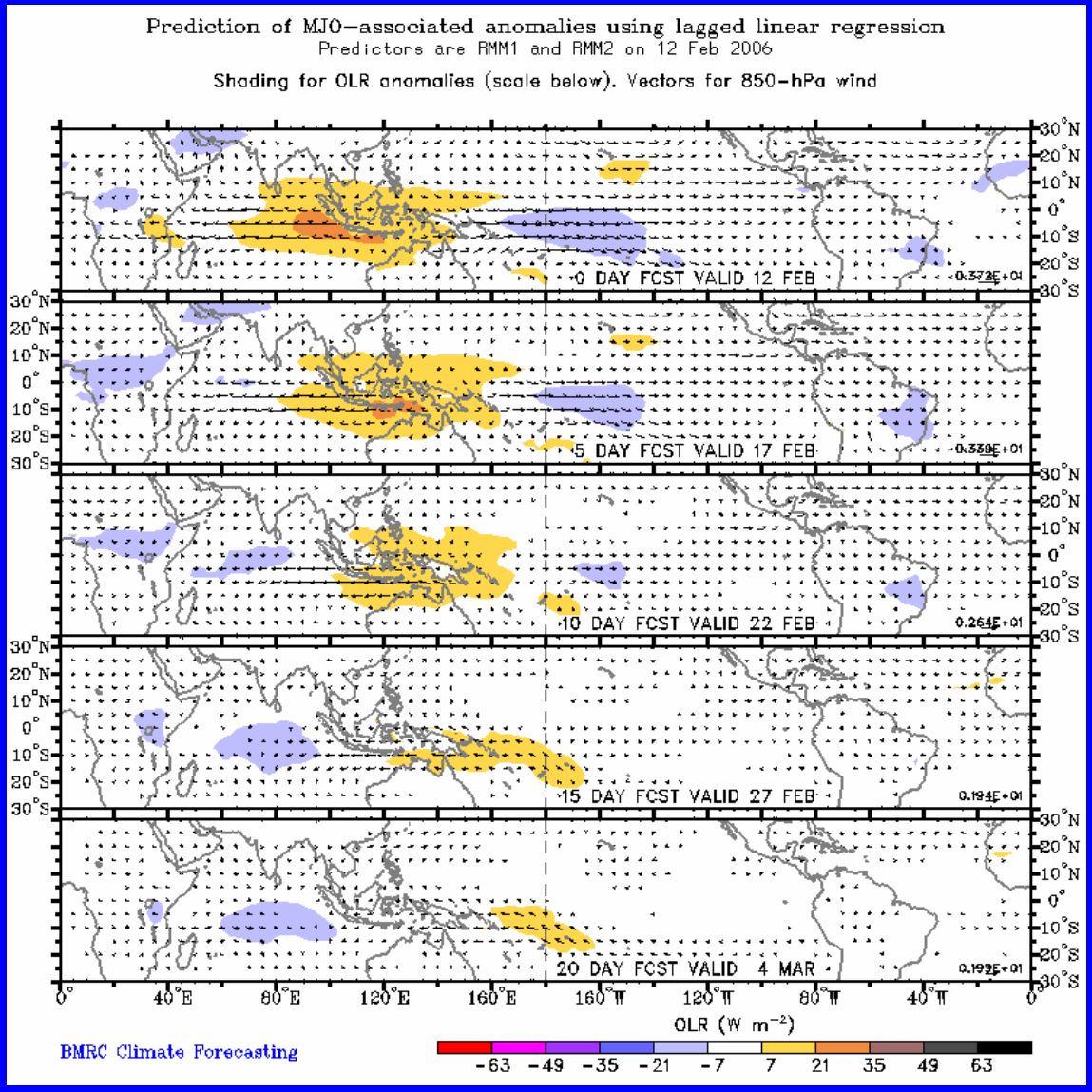


The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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.

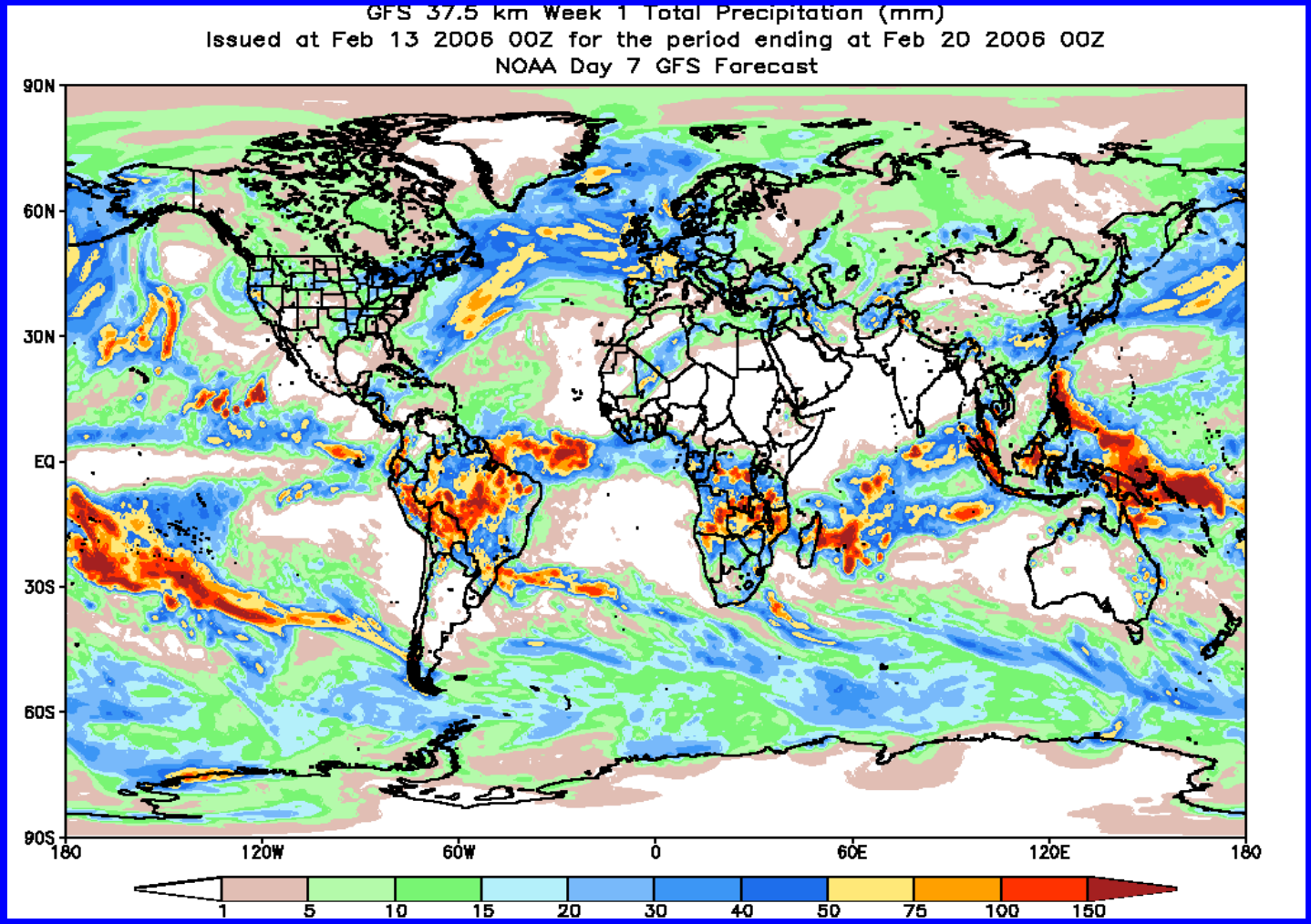
The MJO index continues to indicate a weak MJO signal. This pattern is superimposed upon the quasi-stationary La Nina pattern.

Statistical OLR MJO Forecast



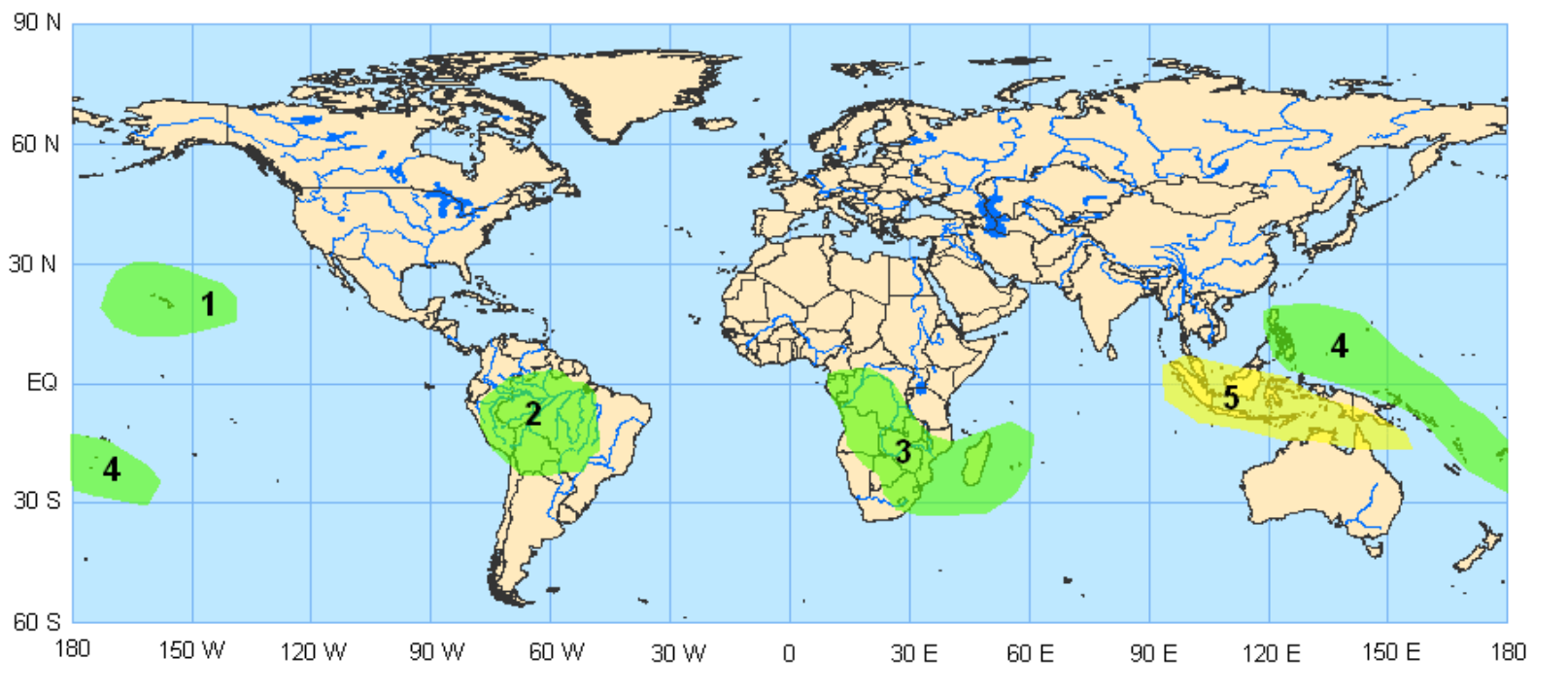
A statistical MJO forecast indicates enhanced convection over the western Pacific Ocean into the southern hemisphere subtropics and over Brazil during week 1, with suppression over the eastern Indian Ocean, across Indonesia, and northern Australia.

Global Forecast System (GFS) Precipitation Forecast



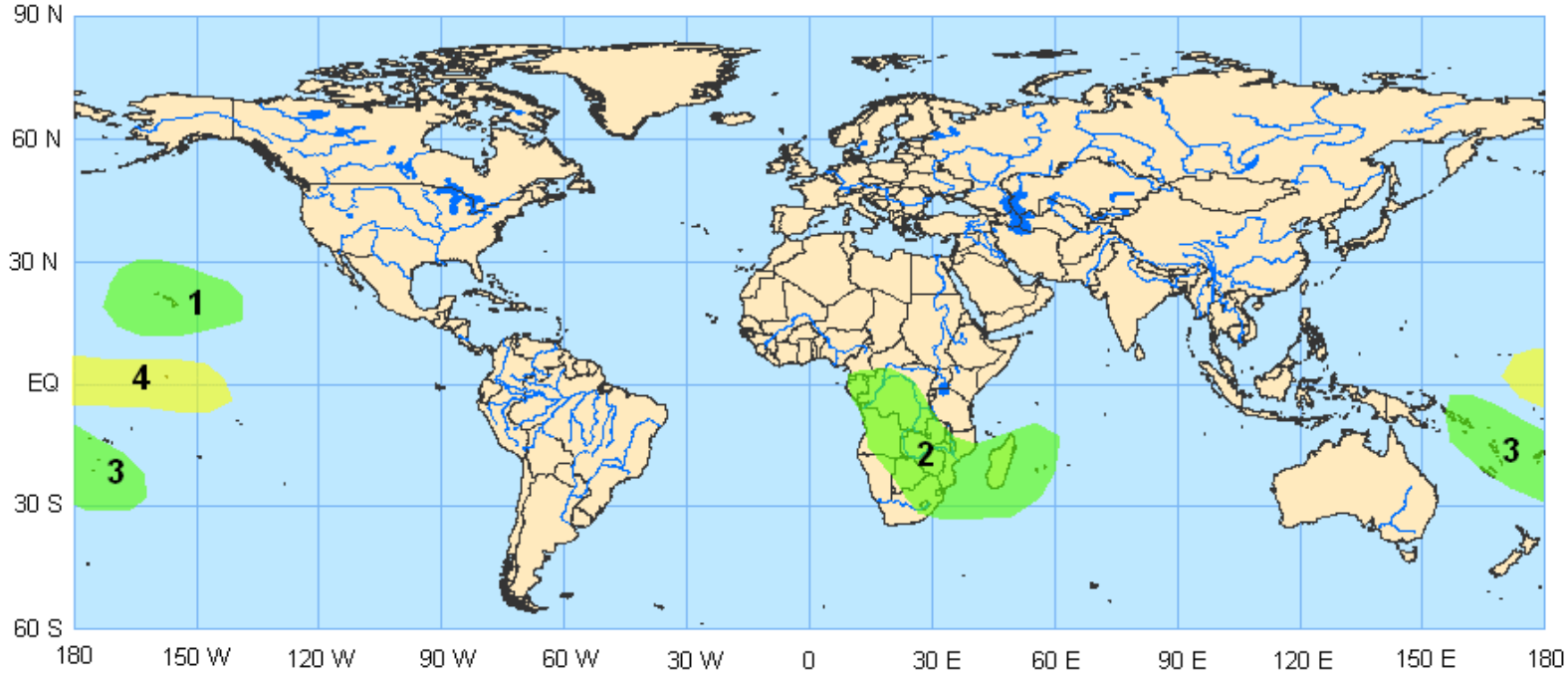
The GFS indicates plentiful rainfall over sections of the western Pacific north of the equator, the southwestern Pacific, as well as sections of north-central Brazil, and southern Africa.

Potential Benefits/Hazards – Week 1
Valid February 14 – February 20, 2006



1. **An increased chance for above normal rainfall in the north central Pacific due to expected low pressure systems common with La Nina conditions**
2. **An increased chance for above normal rainfall over the western two thirds of Brazil, Bolivia, and Peru due to the enhanced phase of the MJO and conditions consistent with La Nina**
3. **An increased chance for above normal rainfall over sections of southern and eastern Africa including Madagascar due to a continuation of La Nina conditions**
4. **An increased chance for above normal rainfall along the South Pacific Convergence Zone (SPCZ) spreading northeast to and just east of the Philippines**
5. **An increased chance for below normal rainfall across much of southern Indonesia and extreme northern Australia associated with the suppressed phase of the MJO**

Potential Benefits/Hazards – Week 2
Valid February 21-27, 2006



1. An increased chance for above normal rainfall in the north central Pacific due to expected low pressure systems common with La Nina conditions
2. An increased chance for above normal rainfall over sections of southern and eastern Africa including Madagascar due to a continuation of La Nina conditions
3. An increased chance for above normal rainfall along the South Pacific Convergence Zone (SPCZ)
4. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures

Summary

- A weak MJO signal remains evident with its enhanced (suppressed) phases mainly located in the western Hemisphere (Indian Ocean) respectively.
- During the past week, upper-level convergence has dominated the Indian Ocean and sections of Indonesia suppressing rainfall in these regions. The main areas of enhanced rainfall included sections of Brazil, Bolivia, and Peru in South America, sections of the southern half of Africa, and in proximity of the South Pacific Convergence Zone (SPCZ) in the Pacific Ocean. Also, tropical cyclone Vaianu developed in the western Pacific Ocean south of the equator during the past week.
- The MJO is expected to remain weak during the upcoming 1-2 week period.
- 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, sections of northern South America, portions of the southern half of Africa and across areas in the western Pacific Ocean both north and south of the equator. There is also the potential for increased chances of below normal rainfall across southern Indonesia and northern Australia. More specific geographic details for these hazard regions can be seen by viewing slides 14 and 15.
- During week 2, increased chances of above normal rainfall remain in the central Pacific, sections of southern Africa and the western Pacific Ocean south of the equator. In addition, there is an increased chance of below average rainfall near the date line in the equatorial Pacific Ocean.
- Although not included on the hazard maps, tropical cyclone Vaianu will impact the southwest Pacific Ocean northeast of New Zealand early in the period. Also, there is the potential for tropical cyclogenesis east of Philippines early during week 1 and in the western Indian Ocean south of the equator during both weeks 1 and 2.