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

Update prepared by
Climate Prediction Center / NCEP
January 30, 2006

Outline

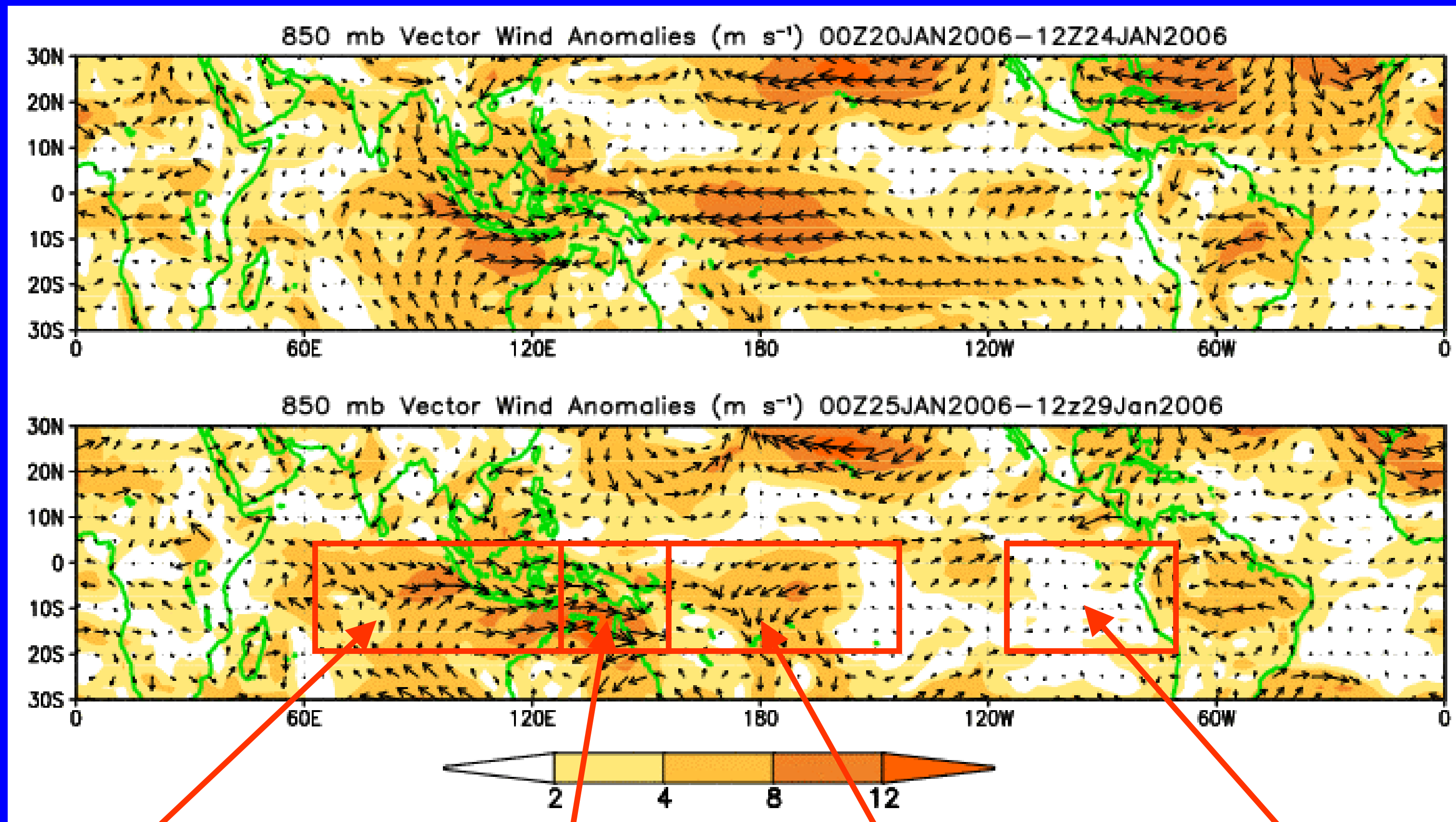
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- The MJO remains weak, however a pattern of intraseasonal variability that operates on a somewhat faster time scale than an MJO is producing MJO-like impacts and is modulating the evolving La Nina pattern.
- During the past week, enhanced convection was observed across Indonesia, northern Australia, the southwestern Pacific and southern Africa. Suppressed convection was noted over the central equatorial Pacific in the vicinity of the Date Line, Brazil, eastern Africa and the Indian Ocean. Some of these conditions resemble those expected during La Nina.
- There is an increased chance for heavy precipitation along portions of the U.S. west coast during week 1.
- For week 1, there is an increased chance for above normal rainfall over Indonesia, northern Australia and the southwestern Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific and north of Australia during the period. There is an increased chance for above average rainfall over northern South America and southern Africa, along with the potential for tropical cyclogenesis over the Mozambique Channel. Below normal rainfall is expected over the central equatorial Pacific.
- During week 2, there is an increased chance for below normal rainfall over the central equatorial Pacific. There is an increased chance for above normal rainfall over Indonesia, northern Australia and the southwestern Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific, as well as north of Australia.

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

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



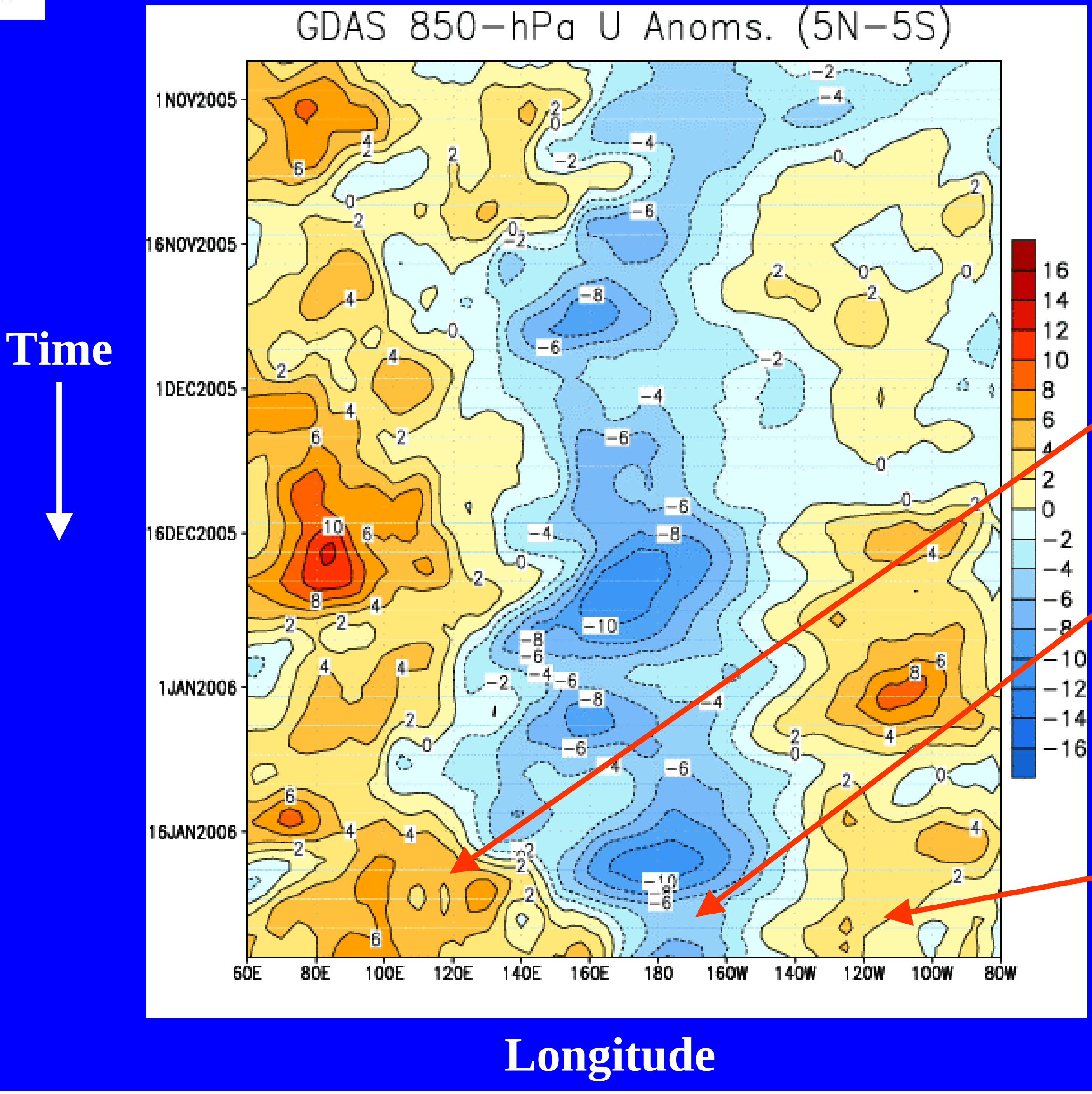
Westerly anomalies persisted over the eastern Indian Ocean

Easterlies weakened significantly over eastern Indonesia and New Guinea, resulting in westerly anomalies.

Easterly wind anomalies decreased markedly across the western Pacific Ocean, with enhanced convergence along the SPCZ.

Westerly anomalies weakened

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



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

Stronger-than-average easterlies (blue shading).

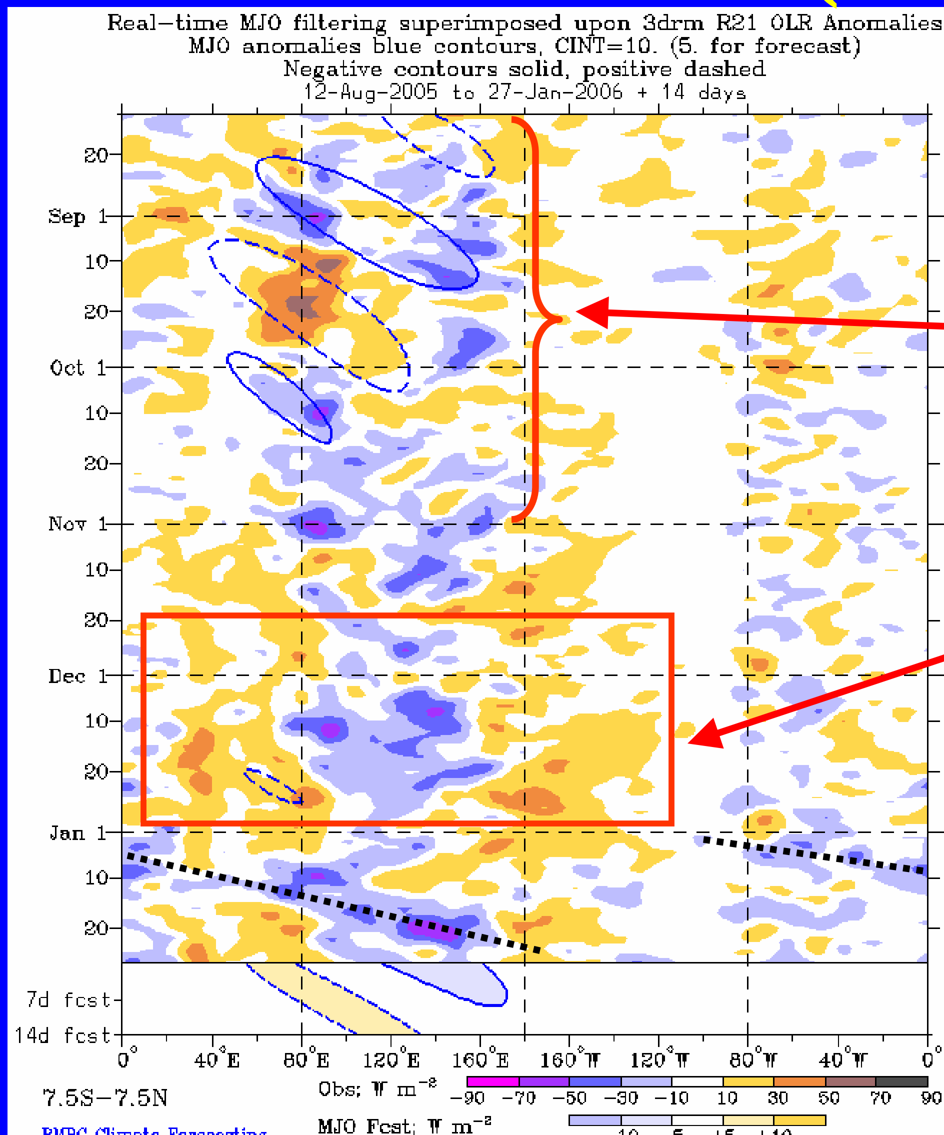
Westerly anomalies have spread eastward to 170E, contracting the area of enhanced easterlies

Lower tropospheric easterly anomalies have decreased in the vicinity of the Date Line

Westerly anomalies persist east of 140W

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

Time



Longitude

Drier-than-average conditions (/red shading)

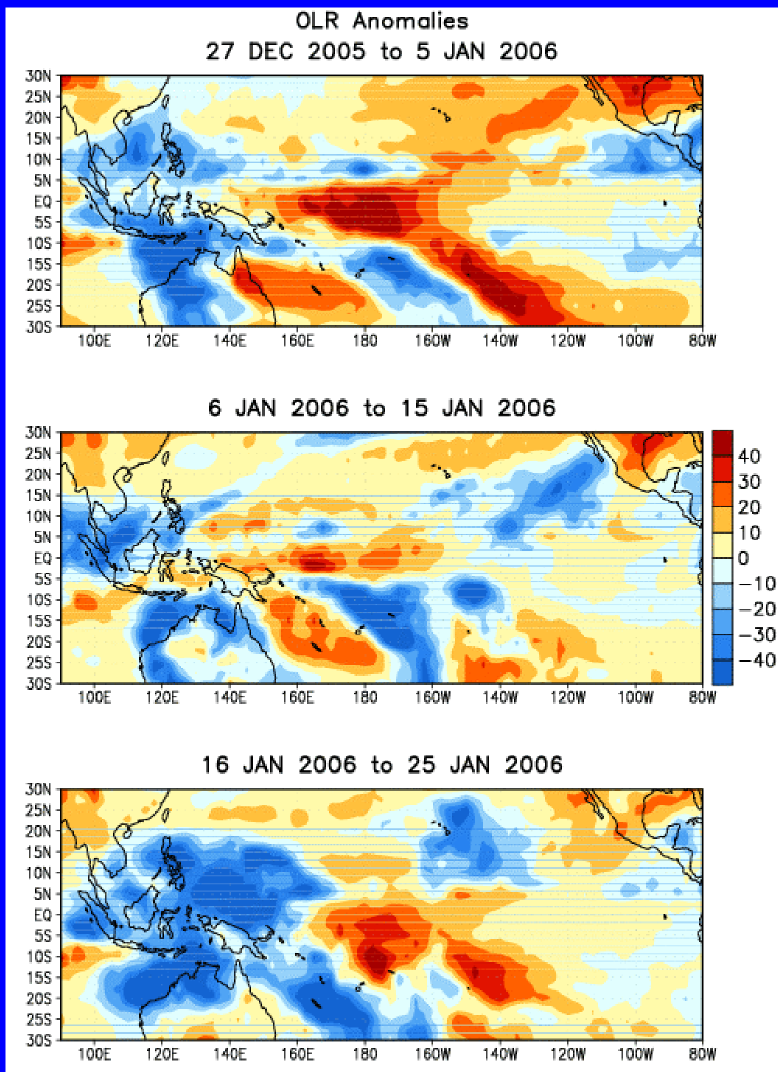
Wetter-than-average conditions (blue shading)

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

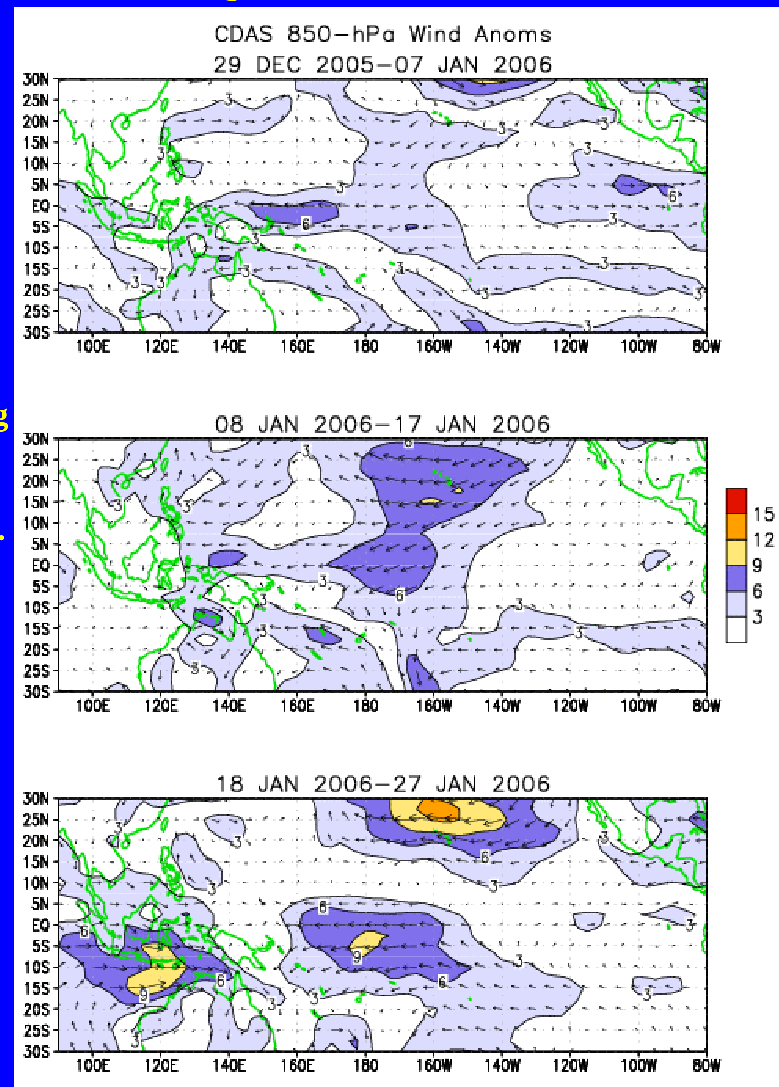
An MJO like wave developed during January, resulting in eastward propagating OLR anomalies. The propagation is faster than that typically associated with an MJO

Anomalous OLR and 850-hPa Wind: Last 30 days



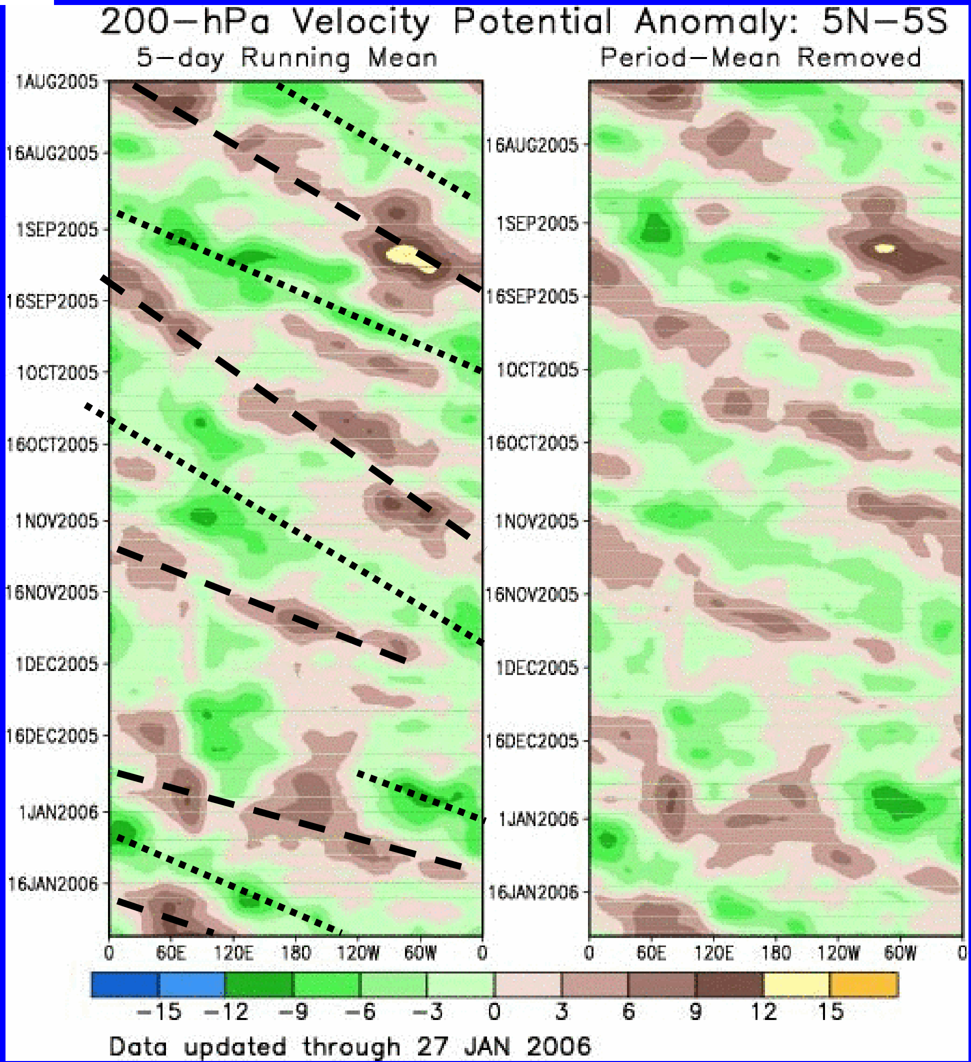
During the past 30 days, a pattern of enhanced (suppressed) convection has been evident across Indonesia (the central Pacific Ocean). The pattern had decreased during the second week of January, but has recently redeveloped.

Easterly anomalies have been evident in the western Pacific Ocean during the past month. Strong westerly anomalies developed across the eastern Indian Ocean and Java over the past 10 days.



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

Time



Longitude

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

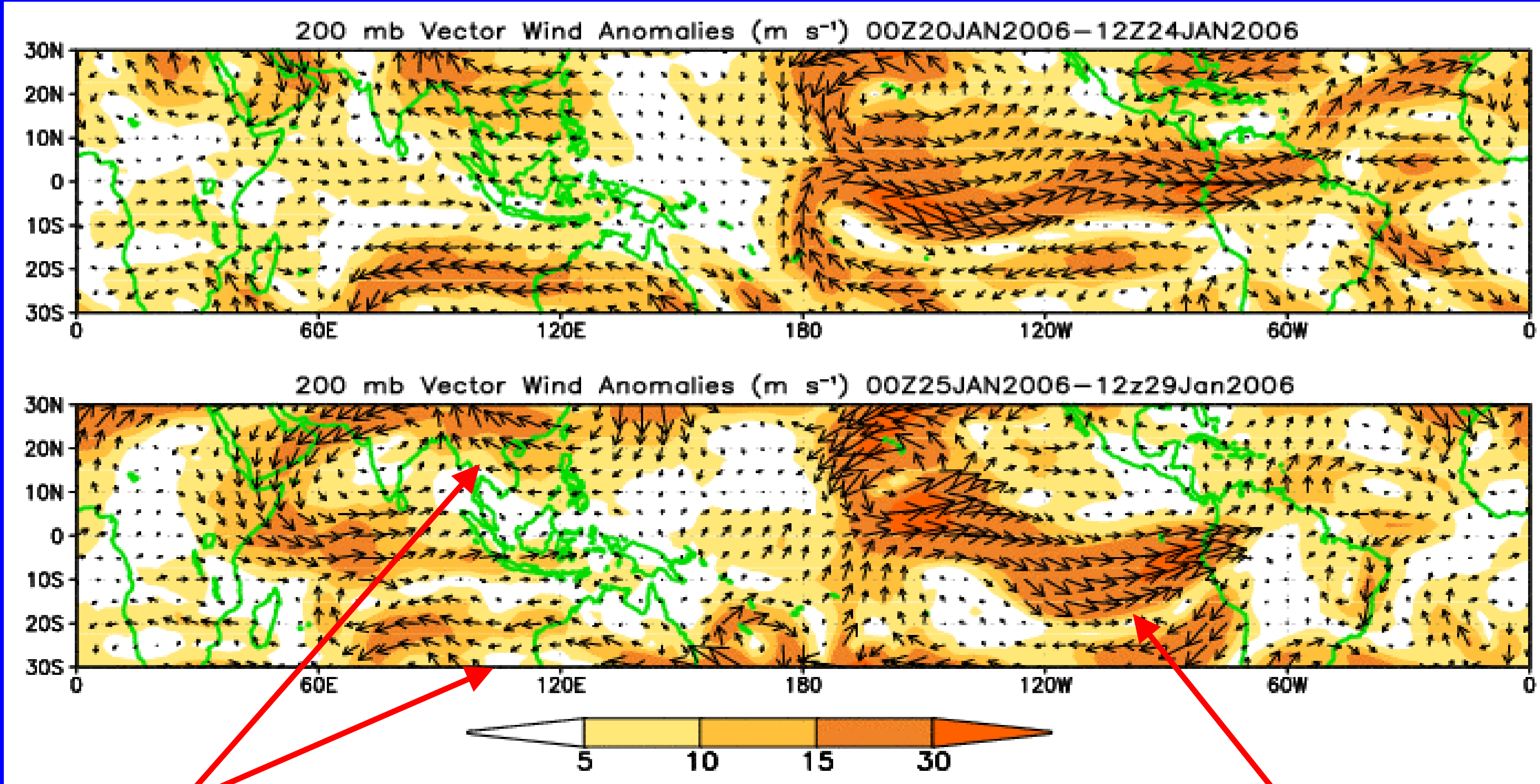
Negative anomalies (green shading) indicate favorable conditions for precipitation.

Weak to moderate MJO activity was observed from August into November.

Along the equator, upper-level divergence (convergence) was strong during late December across Latin America and the Atlantic (Africa and the Indian Ocean). This enhanced divergence (convergence) propagated eastward during January.

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

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

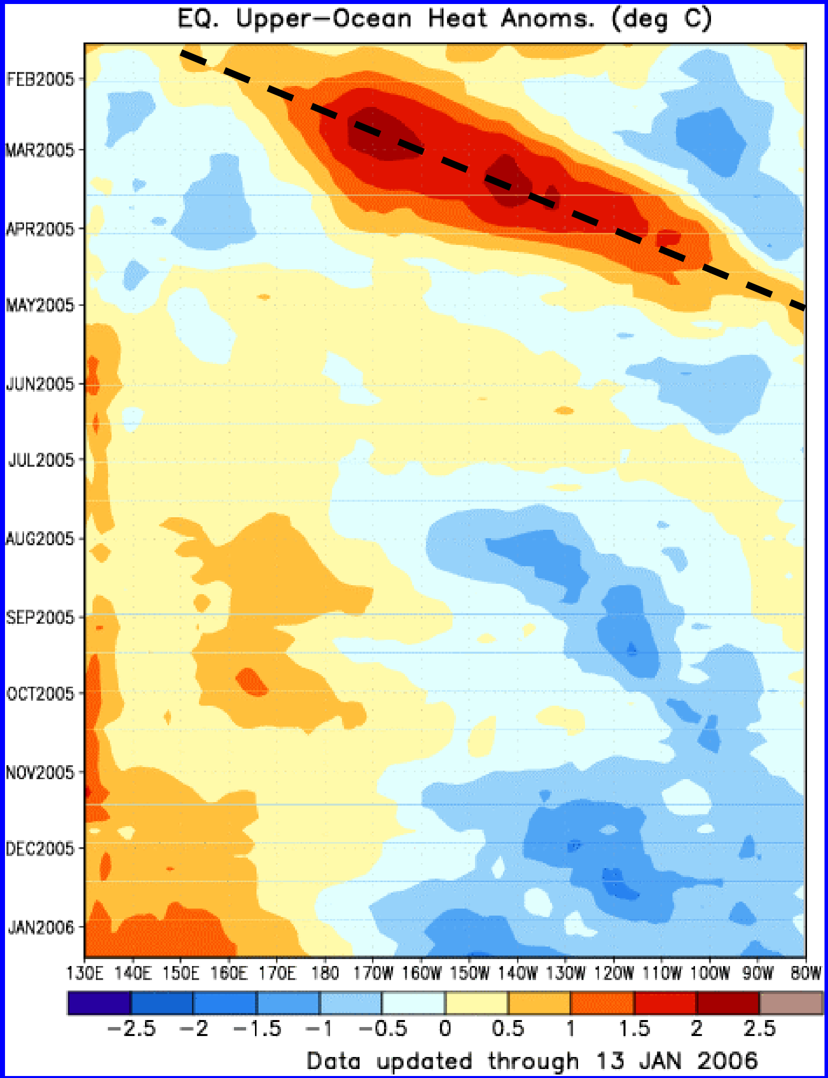


Anticyclonic anomalies symmetric about the equator developed over eastern Asia and the southeastern Indian Ocean last pentad.

Upper tropospheric westerlies are stronger than normal along the equator from the Date Line eastward to South America

Heat Content Evolution in the Eq. Pacific

Time

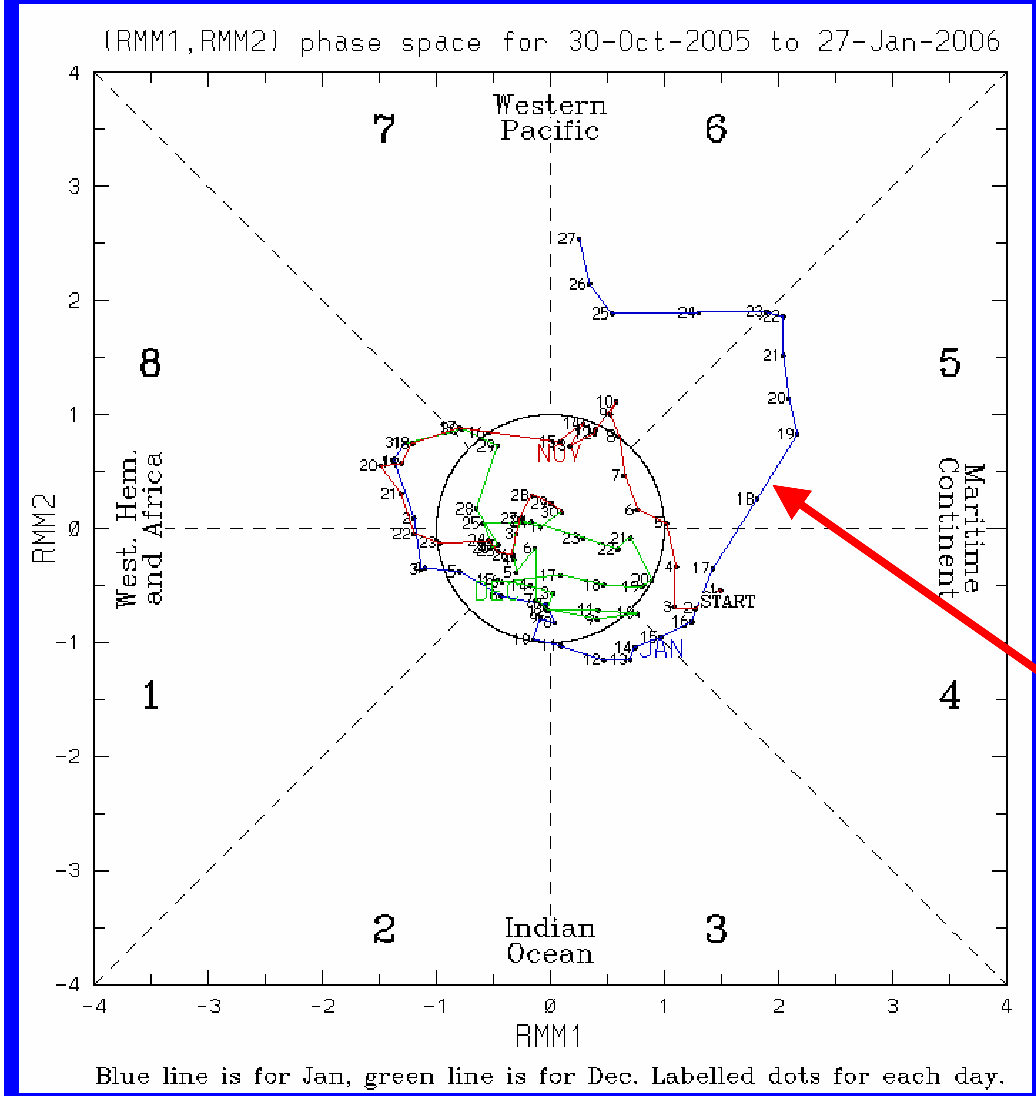


Longitude

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 while cooler water has been observed across the eastern Pacific with a westward extension evident during November, December.

MJO Index (Magnitude and Phase)

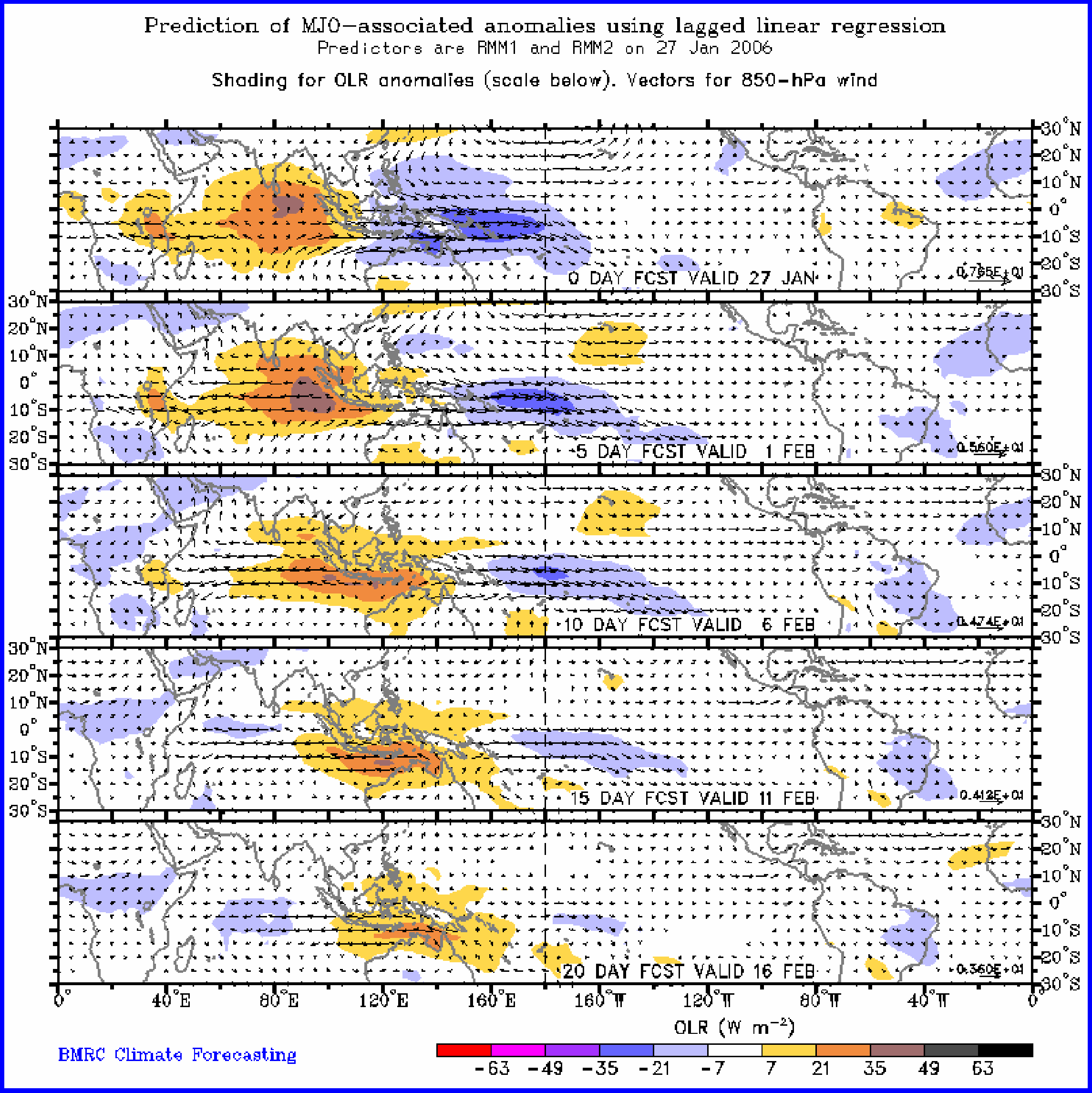


The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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 global OLR, low level wind, and upper level wind data suggest a more coherent, fast moving MJO type pattern. However, a pattern of higher frequency intraseasonal variability superimposed upon the quasi-stationary La Nina pattern is more likely responsible

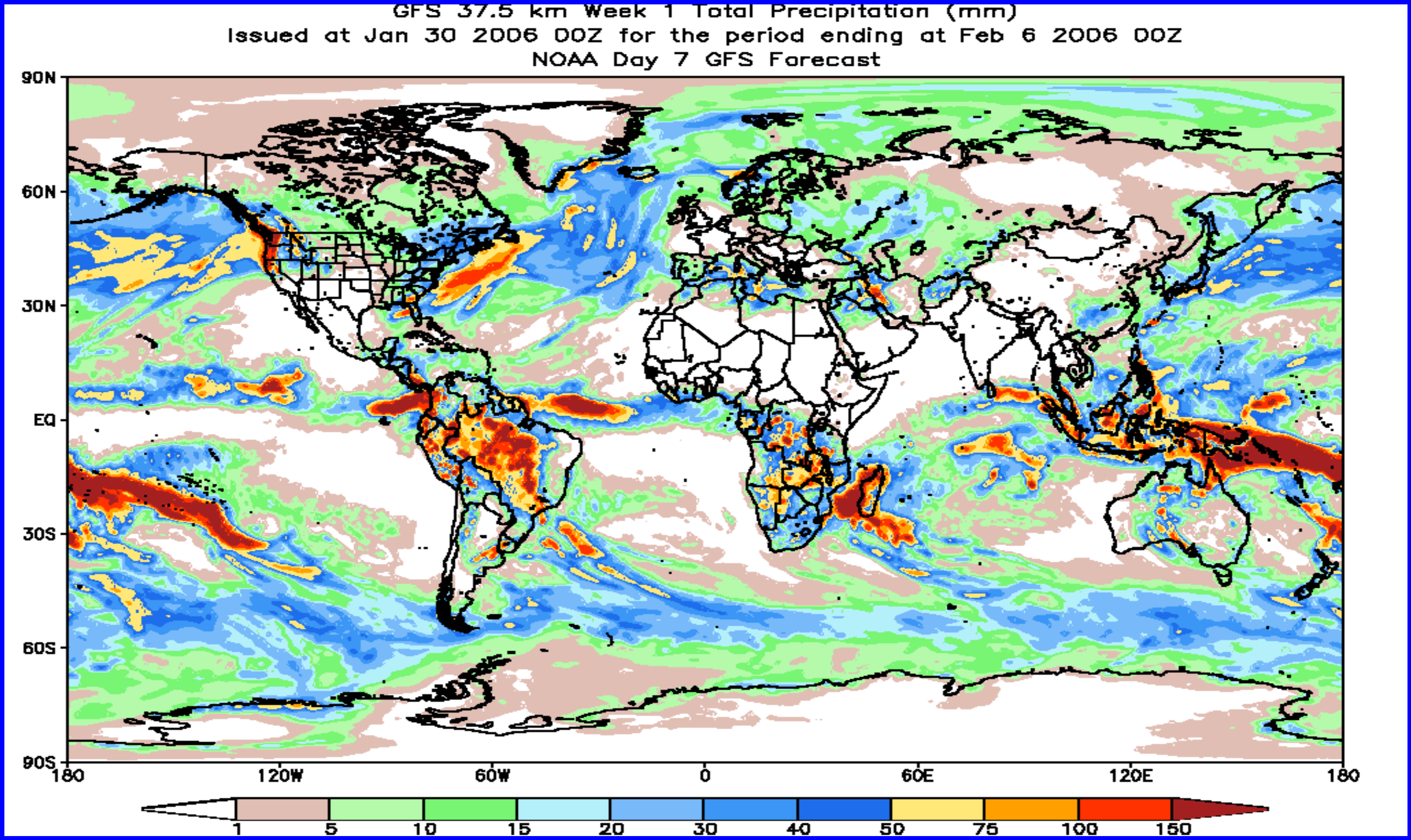
Statistical OLR MJO Forecast



A statistical MJO forecast indicates enhanced convection over the western Pacific and Indonesia during week 1, with suppression over the Indian Ocean.

For week 2, the statistical MJO forecast indicates enhanced convection over the central Pacific and suppression over the Maritime Continent.

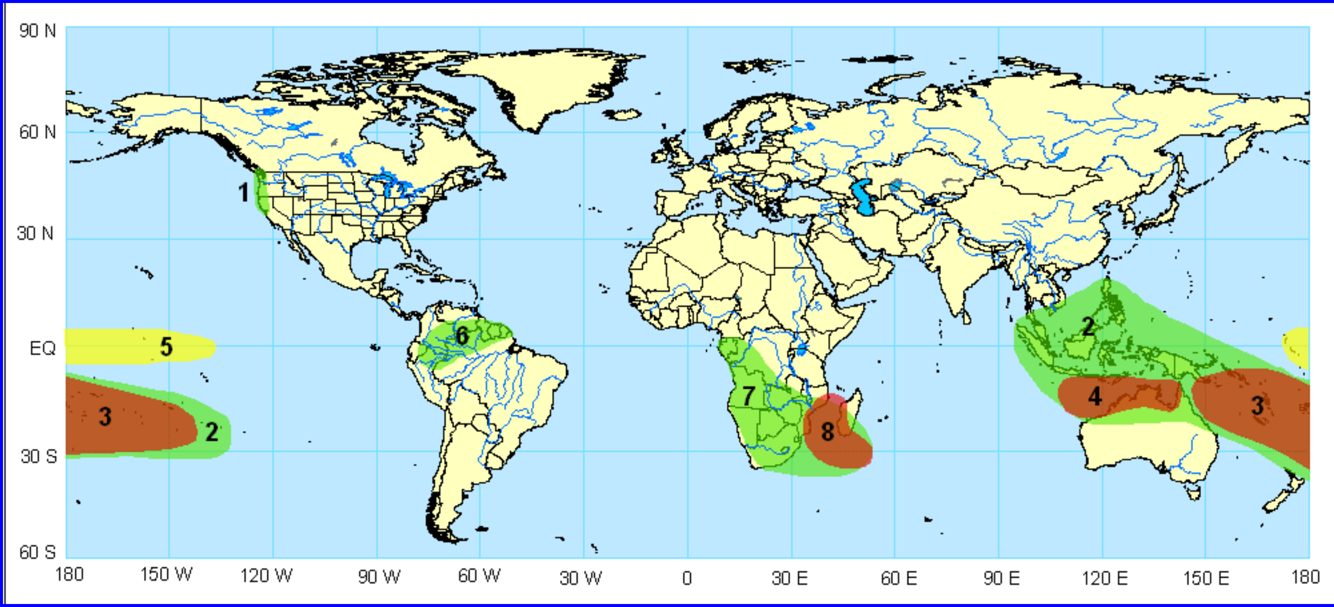
Global Forecast System Precipitation Forecast



The GFS is indicating enhanced rainfall over the Pacific Northwest, New Guinea, and the southwestern Pacific.

The GFS is showing seasonal rains over Africa and much of South America.

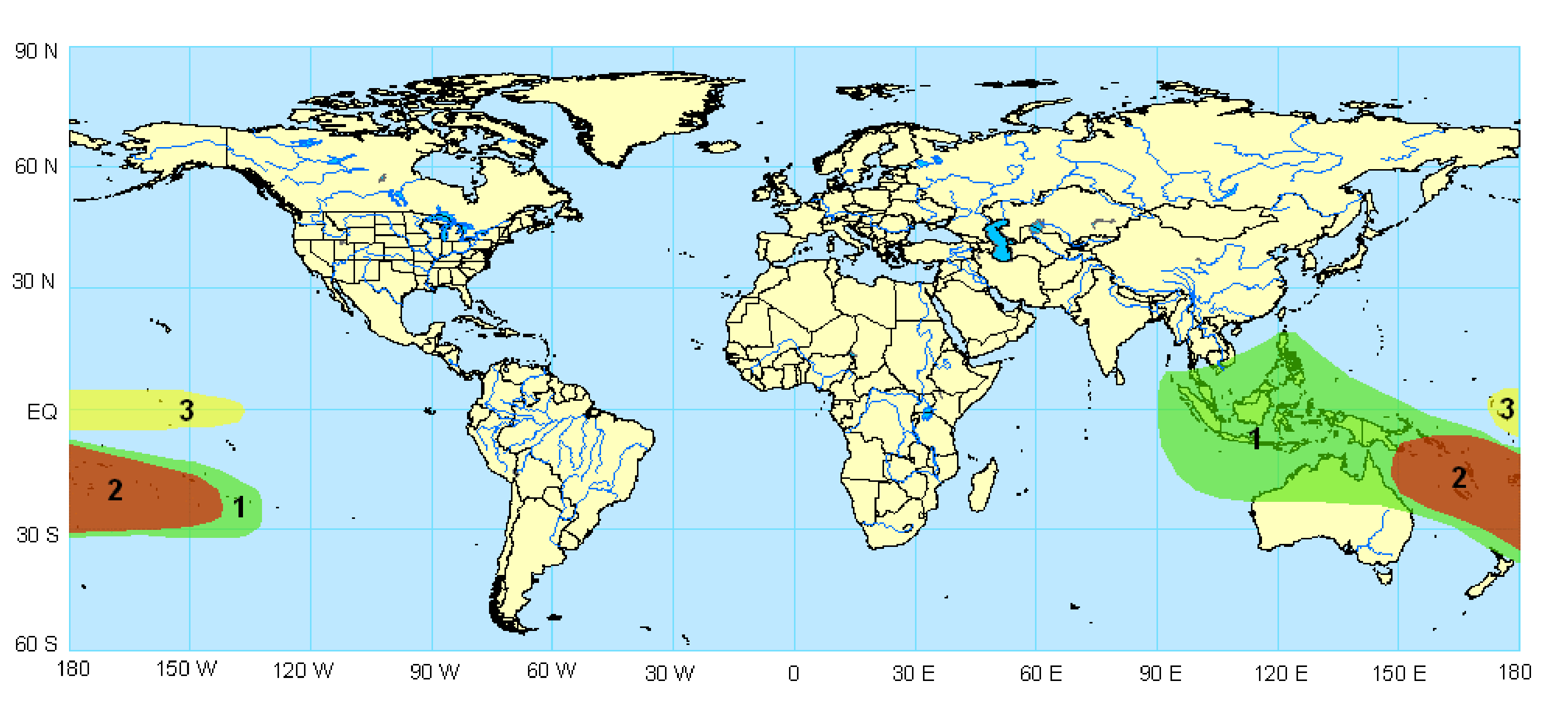
Potential Benefits/Hazards – Week 1
Valid January 31 – February 6, 2006



1. There is an increased chance for heavy precipitation along the U.S. northwest coast mainly early in the period as a result of a continuation of an active Pacific jet
2. An increased chance for above normal rainfall over the Maritime Continent, northern Australia and the southwestern Pacific due to enhancement of convection associated with the continuation of La Nina conditions
3. Tropical cyclogenesis is possible over the southwestern Pacific due to favorable atmospheric conditions (enhanced convection, low level westerly anomalies)
4. Tropical cyclogenesis is possible north of Australia due to favorable atmospheric conditions (enhanced convection, low level westerly anomalies)
5. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures
6. An increased chance for above normal rainfall over parts of northern South America due to enhancement of convection
7. An increased chance for above normal rainfall over southern Africa as a result of interaction with the extratropics
8. There is the potential for tropical cyclogenesis over the warm waters of the Mozambique Channel

Potential Benefits/Hazards – Week 2

Valid February 7 - 13, 2006



1. An increased chance for above normal rainfall over the Maritime Continent, northern Australia and the southwestern Pacific due to enhancement of convection associated with the continuation of La Nina conditions. Tropical cyclogenesis is also possible north of Australia

2. Tropical cyclogenesis is possible over the southwestern Pacific due to favorable atmospheric conditions (enhanced convection, low level westerly anomalies)

3. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures.

Summary

- The MJO remains weak, however a pattern of intraseasonal variability that operates on a somewhat faster time scale than an MJO is producing MJO-like impacts and is modulating the evolving La Nina pattern.
- During the past week, enhanced convection was observed across Indonesia, northern Australia, the southwestern Pacific and southern Africa. Suppressed convection was noted over the central equatorial Pacific in the vicinity of the Date Line, Brazil, eastern Africa and the Indian Ocean. Some of these conditions resemble those expected during La Nina.
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- For week 1, there is an increased chance for above normal rainfall over Indonesia, northern Australia and the southwestern Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific and north of Australia during the period. There is an increased chance for above average rainfall over northern South America and southern Africa, along with the potential for tropical cyclogenesis over the Mozambique Channel. Below normal rainfall is expected over the central equatorial Pacific.
- During week 2, there is an increased chance for below normal rainfall over the central equatorial Pacific. There is an increased chance for above normal rainfall over Indonesia, northern Australia and the southwestern Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific, as well as north of Australia.