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

Update prepared by
Climate Prediction Center / NCEP
January 23, 2006

Outline

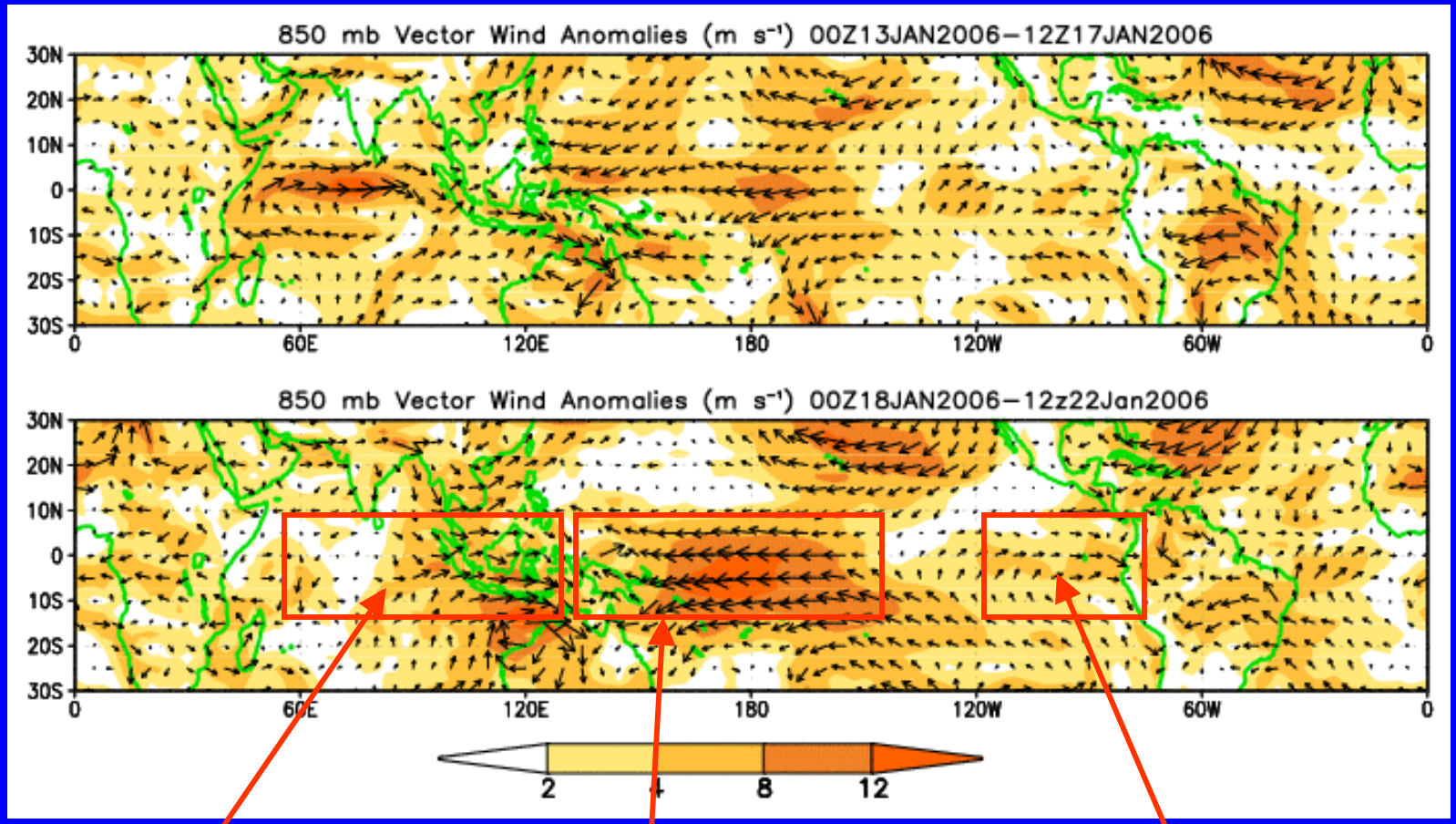
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- The MJO remains weak, however, there are indications of other types of intraseasonal variability that operate on somewhat faster time scales and are modulating the ongoing La Nina signal.
- During the past week, enhanced convection was observed across the eastern Indian Ocean, Indonesia, Australia and the southwestern Pacific. Suppressed convection was noted over the equatorial Pacific in the vicinity of the Date Line, eastern Brazil and portions of central Africa. Some of these conditions resemble those of a La Nina pattern.
- There is an increased chance for heavy precipitation along portions of the U.S. west coast towards the end of week 1, possibly into week 2.
- For week 1, there is an increased chance for above normal rainfall over Indonesia, northern Australia and the western Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific and east of the Philippines. A tropical system may develop north of Australia during the period. There is an increased chance for below average rainfall over eastern Brazil and central portions of Africa.
- 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 western Pacific. There is also an increased chance for above normal rainfall over Hawaiian Islands. There is also the potential for tropical cyclogenesis over the southwestern Pacific and east of the Philippines during week 2.

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

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

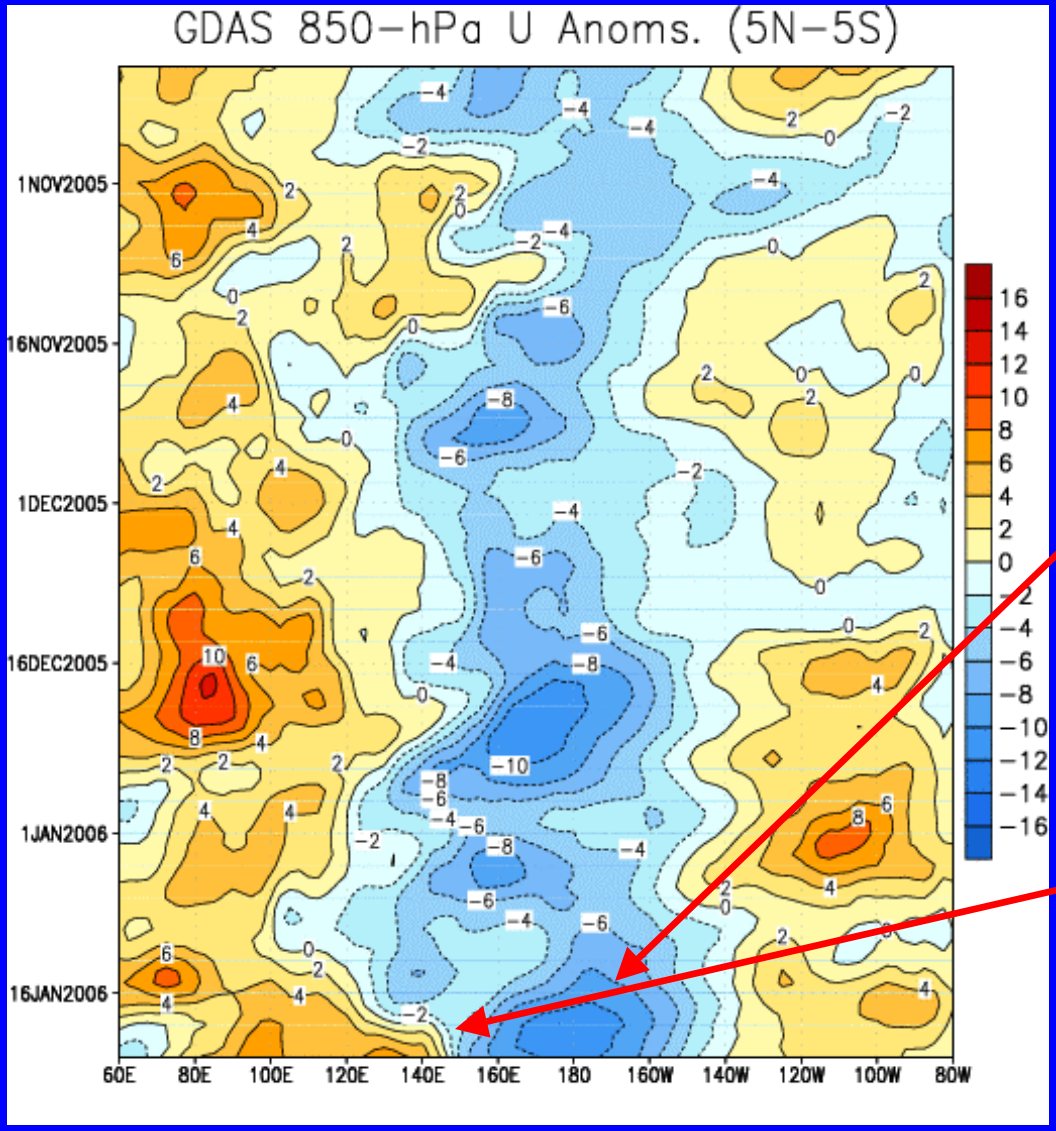


Westerly anomalies weakened across the western Indian Ocean, and continued over the eastern Indian Ocean

Easterly wind anomalies increased substantially across the western Pacific Ocean

Weak westerly anomalies continued east of 120W

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



Time

Longitude

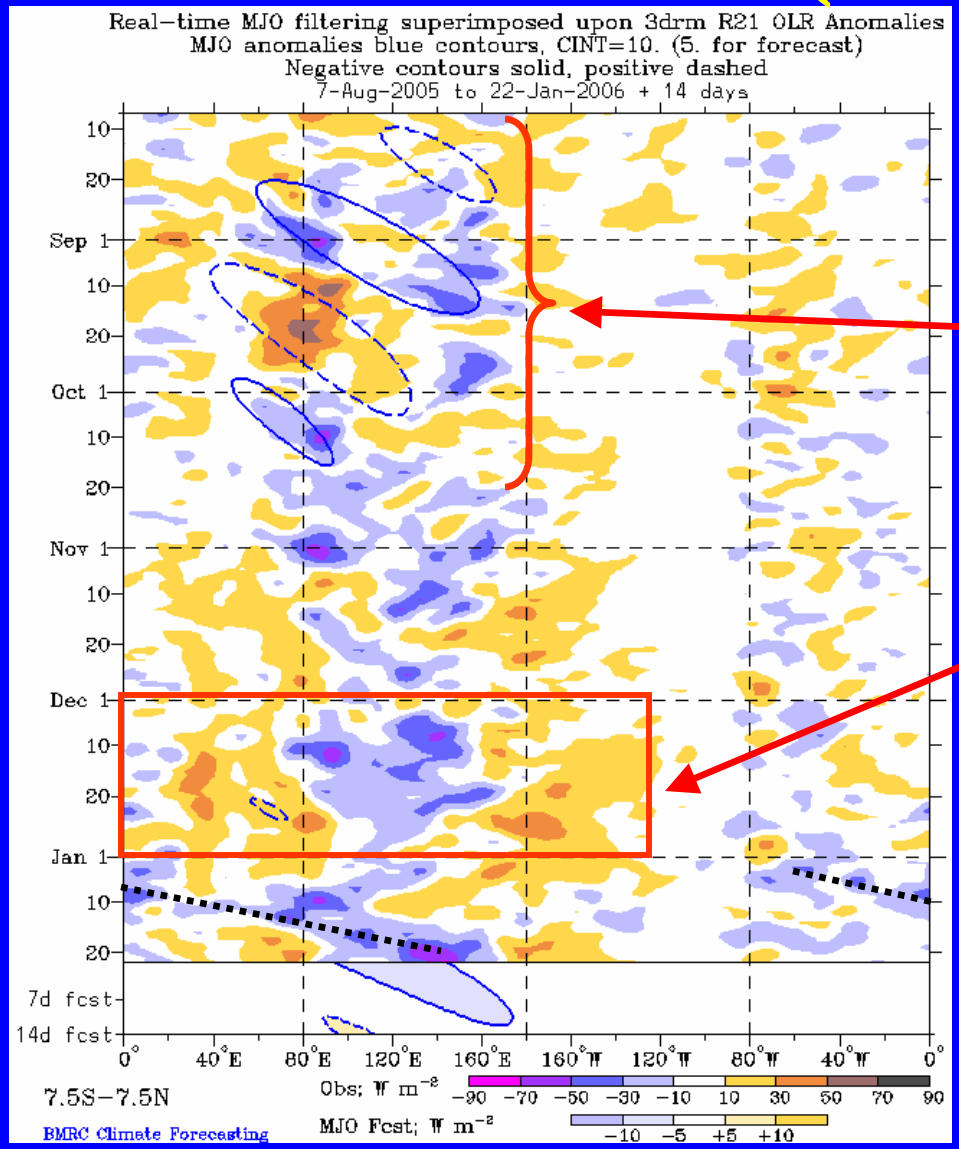
Weaker-than-average easterlies or westerlies (orange/red shading).

Stronger-than-average easterlies (blue shading).

Lower tropospheric easterly anomalies have increased in the vicinity of the Date Line.

Equatorial easterly anomalies persist from New Guinea eastward to 130W. Westerly anomalies have shifted eastward across western Indonesia over the past 10 days.

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



Time

Longitude

Drier-than-average conditions (/red shading)

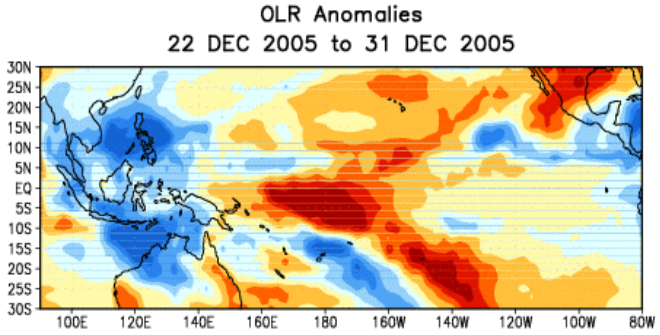
Wetter-than-average conditions (blue shading)

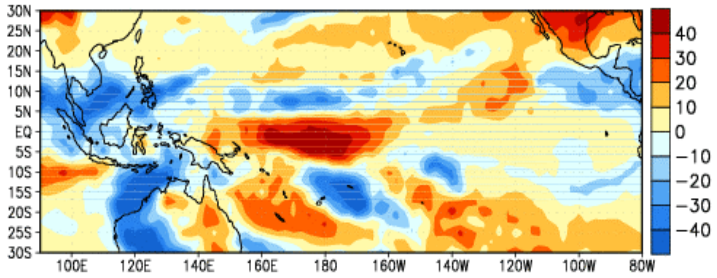
Weak MJO activity was evident during September and October as OLR anomalies propagated eastward from the Indian Ocean to the western Pacific Ocean.

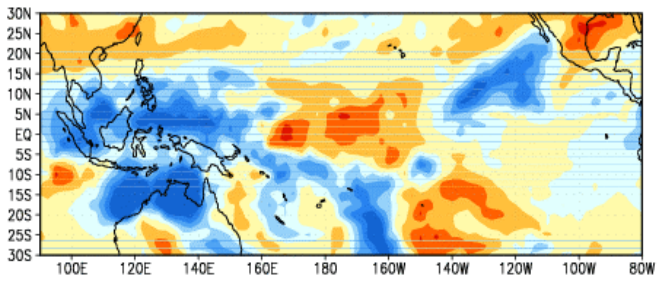
Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean while suppressed convection was evident both across Africa and in the central Pacific Ocean during late November and December.

Enhanced convection has moved across the Indian Ocean and is shifting east across Indonesia.

Anomalous OLR and 850-hPa Wind: Last 30 days

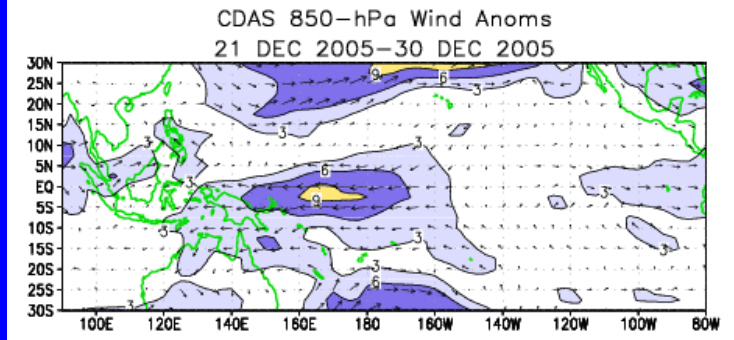


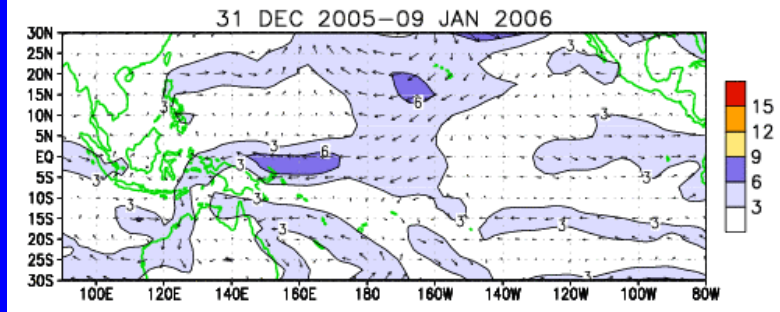


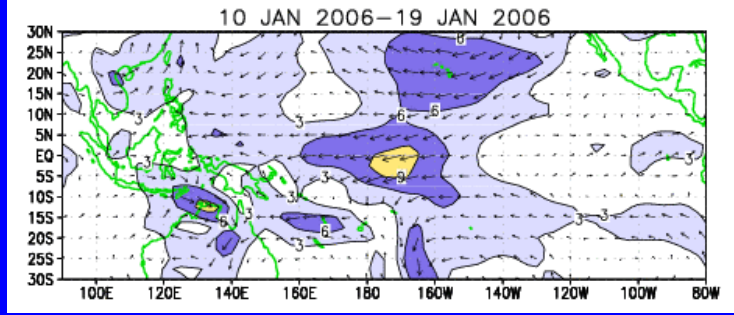


During the past 30 days, a pattern of enhanced (suppressed) convection has been evident across Indonesia (the central Pacific Ocean). The suppression over the central Pacific has decreased recently, while enhancement has increased over Indonesia.

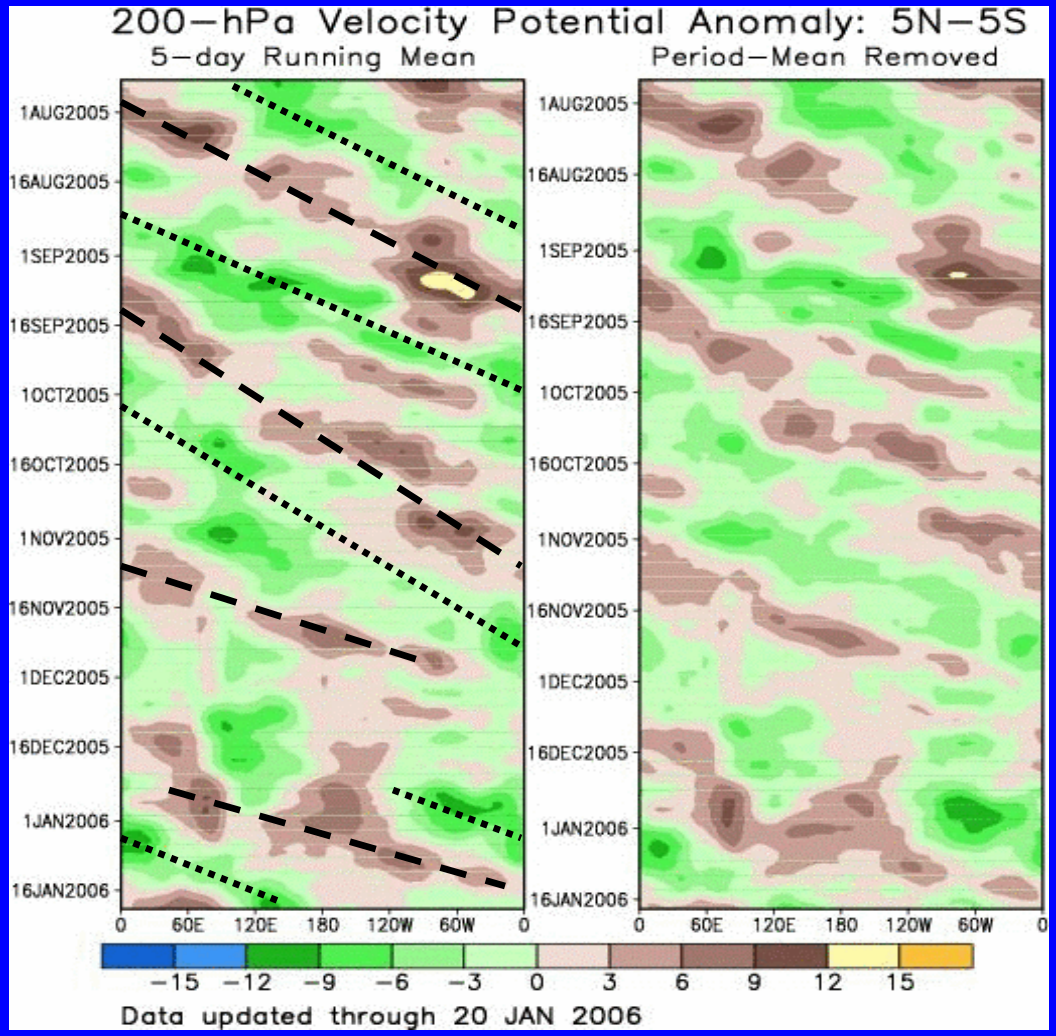
Easterly anomalies have been evident in the western Pacific Ocean during the past month, and have increased over the past few weeks.







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



Time

Longitude

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

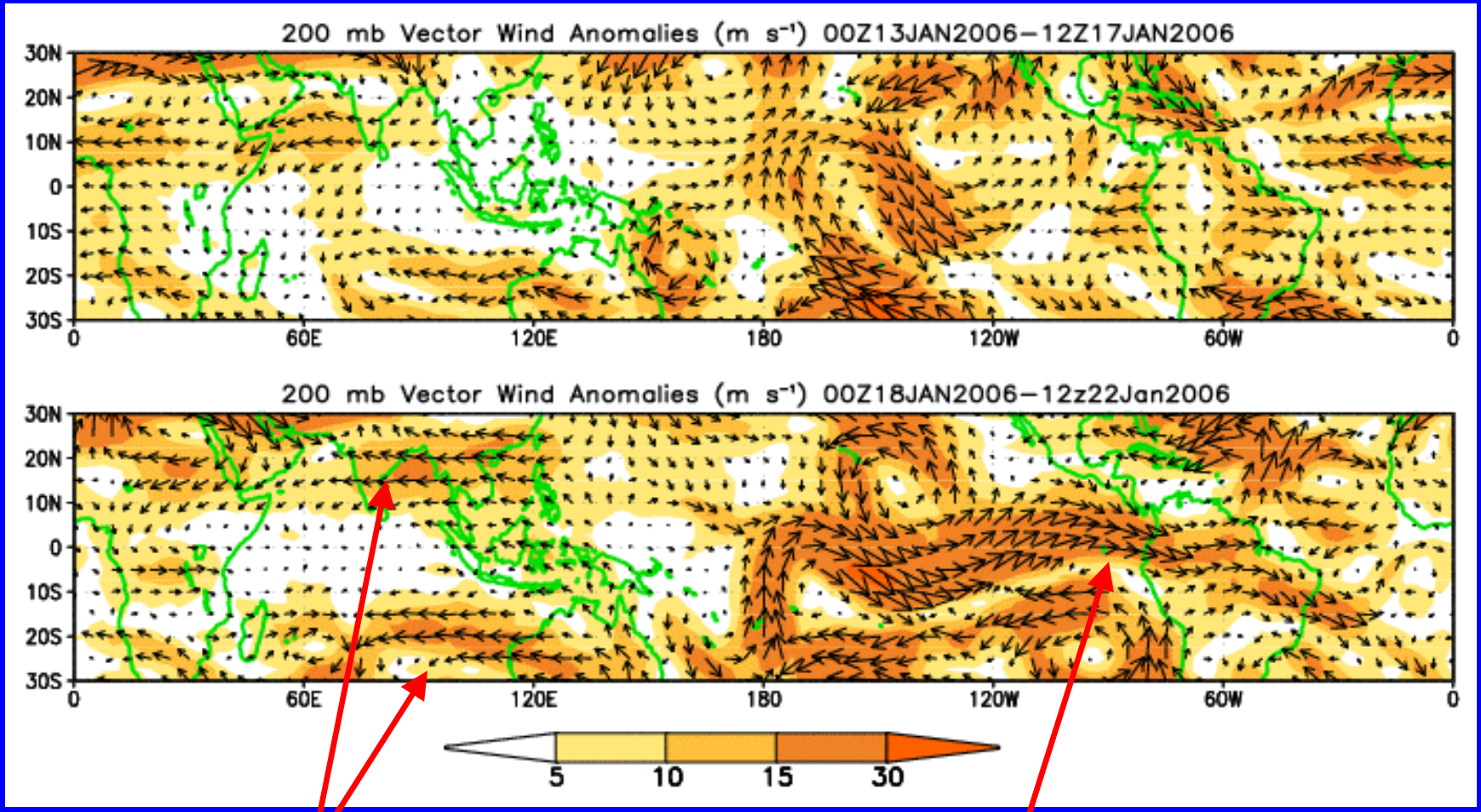
Negative anomalies (green shading) indicate favorable conditions for precipitation.

Weak to moderate MJO activity was observed from July 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) has shifted over Africa and into the Indian Ocean (the Pacific and Latin America) during early January.

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

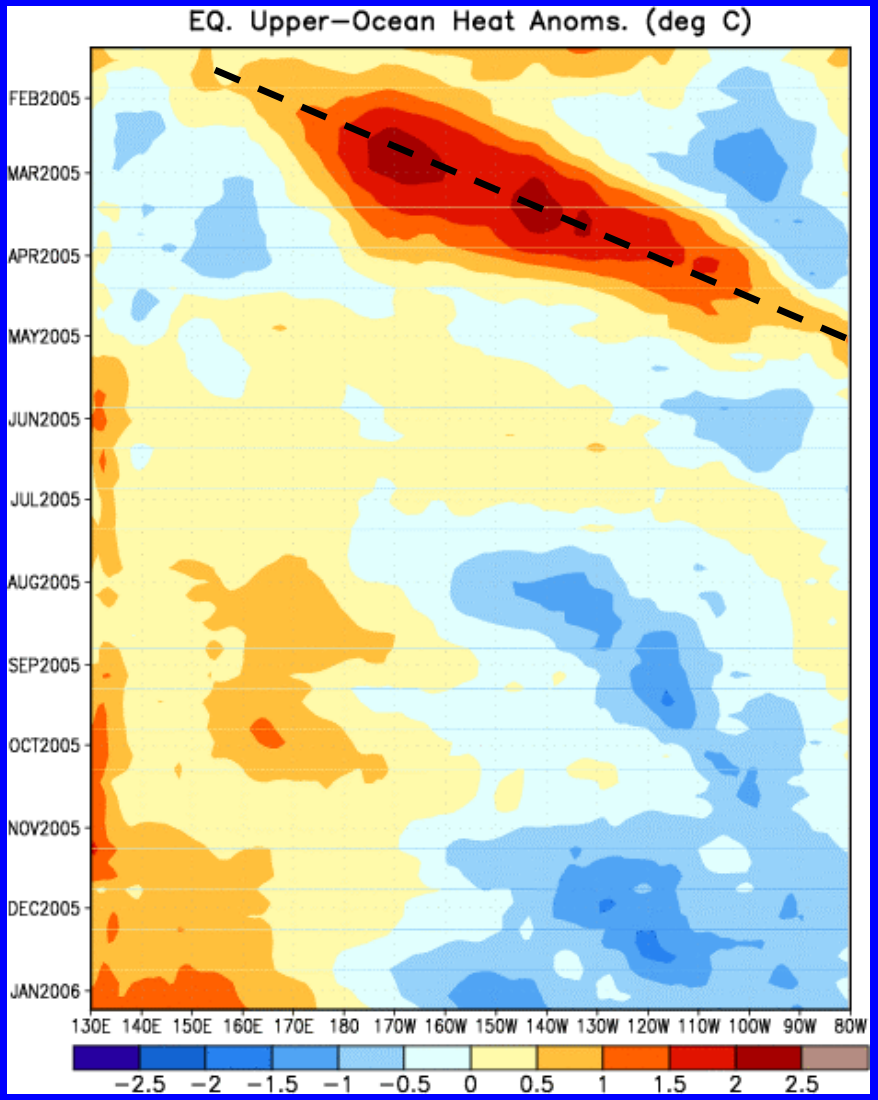
Note that shading denotes the magnitude of the anomalous wind vectors.



Anticyclonic anomalies symmetric about the equator have developed over Asia and the southeastern Indian Ocean

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



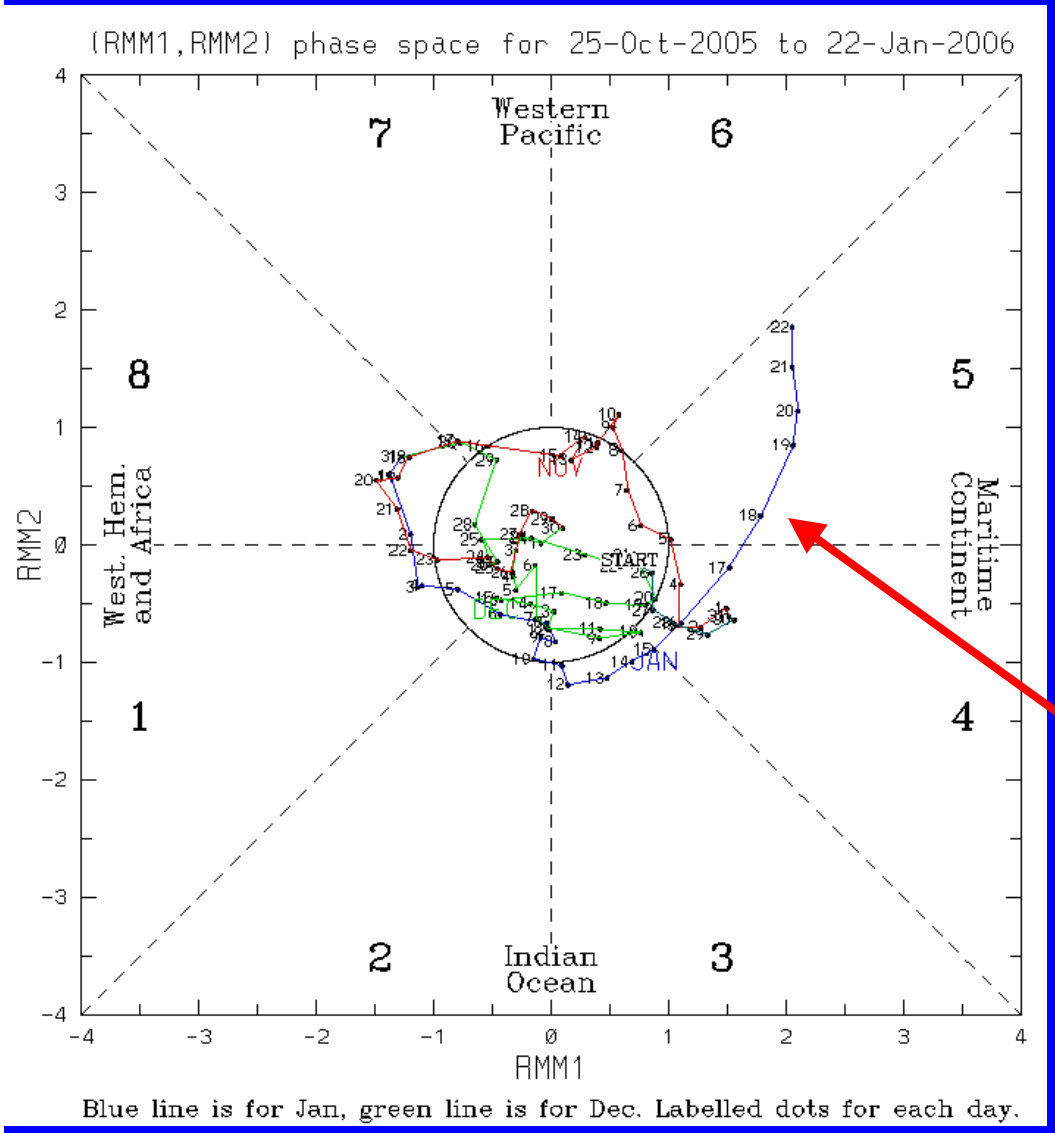
Time

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)



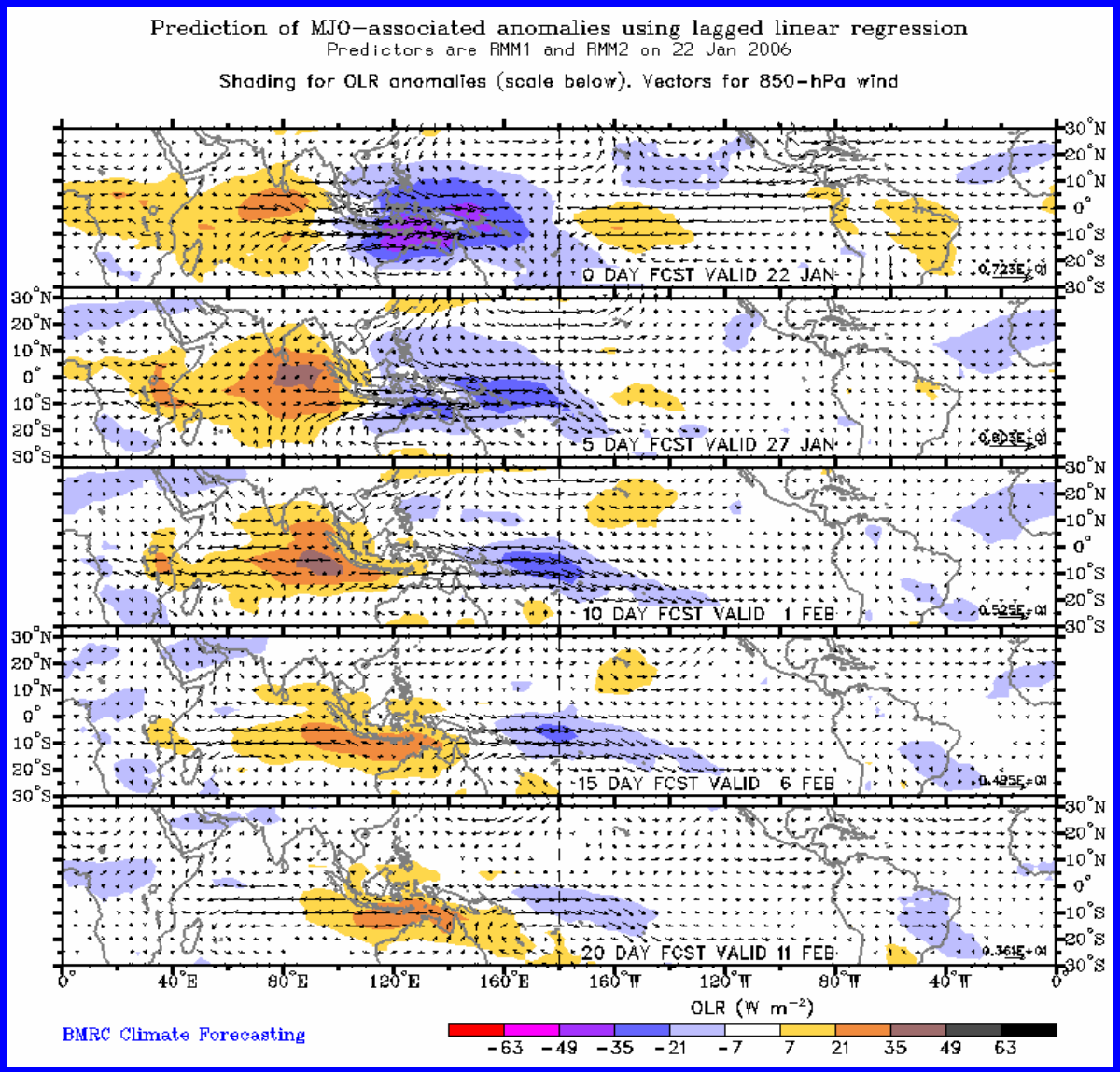
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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 MJO has been weak during the months of October, November and December indicated by periods of low amplitude eastward propagation

The global OLR, wind, and upper level divergence plots suggest a more cohesive, fast moving MJO type pattern. However, a pattern of somewhat faster intraseasonal variability superimposed upon the stationary La Nina pattern is most likely responsible.

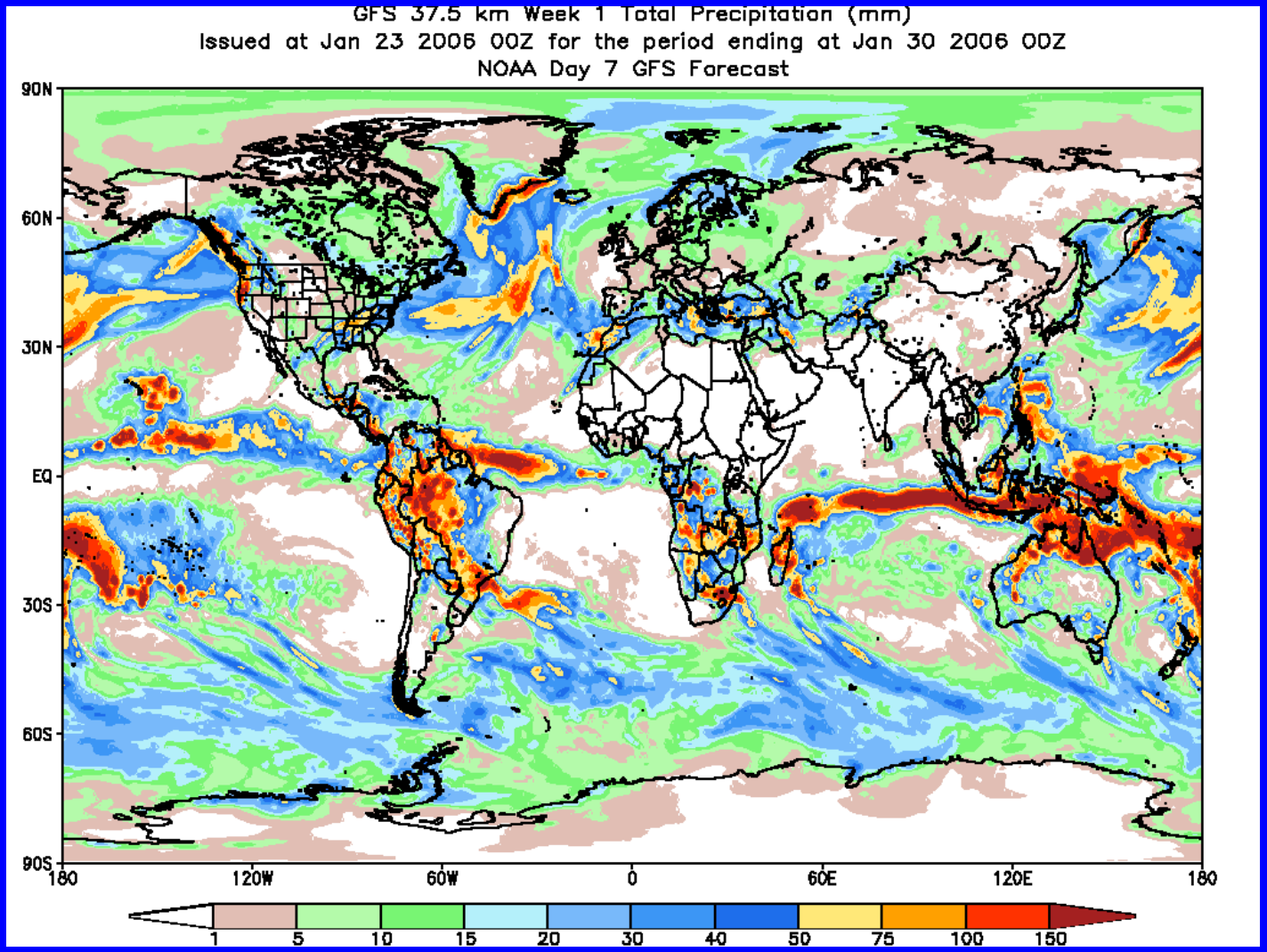
Statistical OLR MJO Forecast



The statistical MJO forecast indicates that enhanced convection will occur over the Maritime Continent and the western Pacific during week 1, and over the SPCZ, as well as South America by week 2.

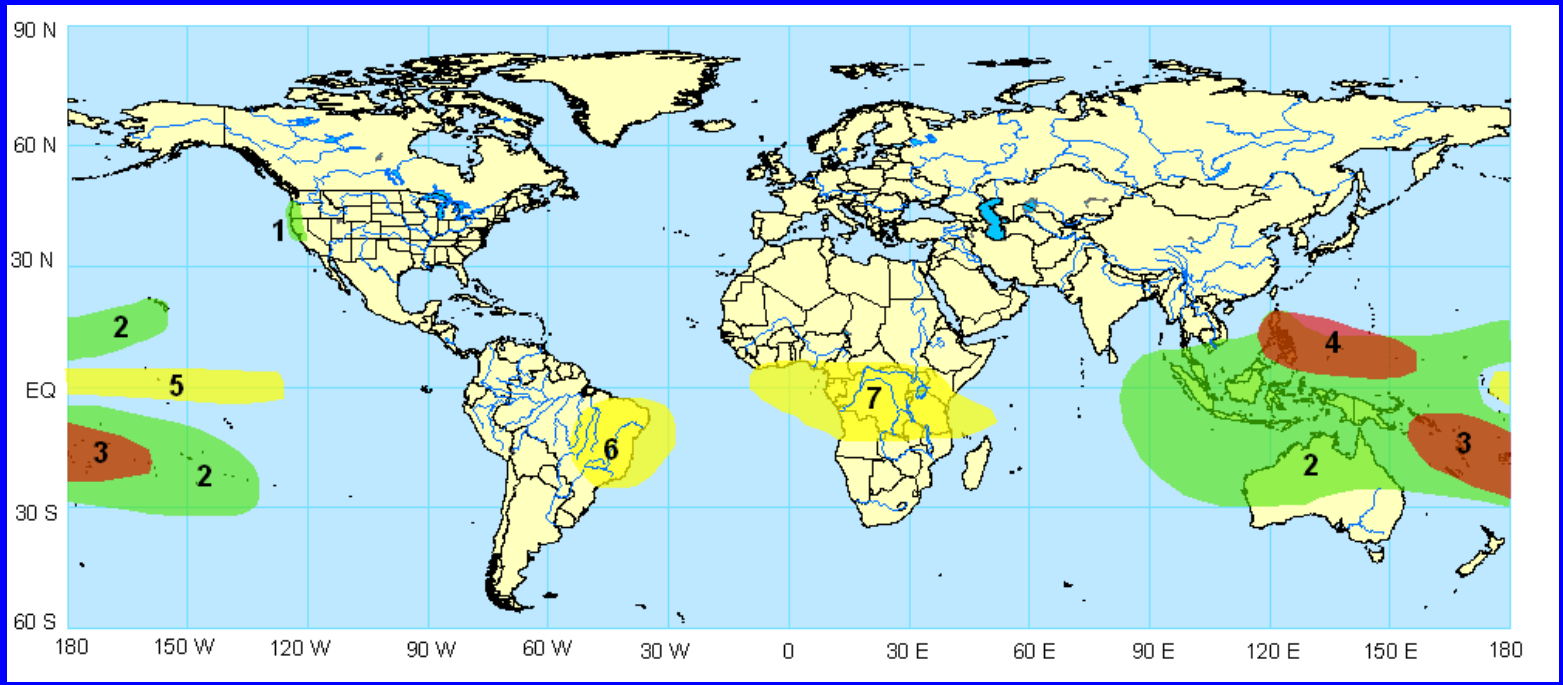
The statistical MJO forecast indicates that suppressed convection will occur over the Indian Ocean during week 1 and Indonesia/northern Australia during week 2.

Global Forecast System Precipitation Forecast



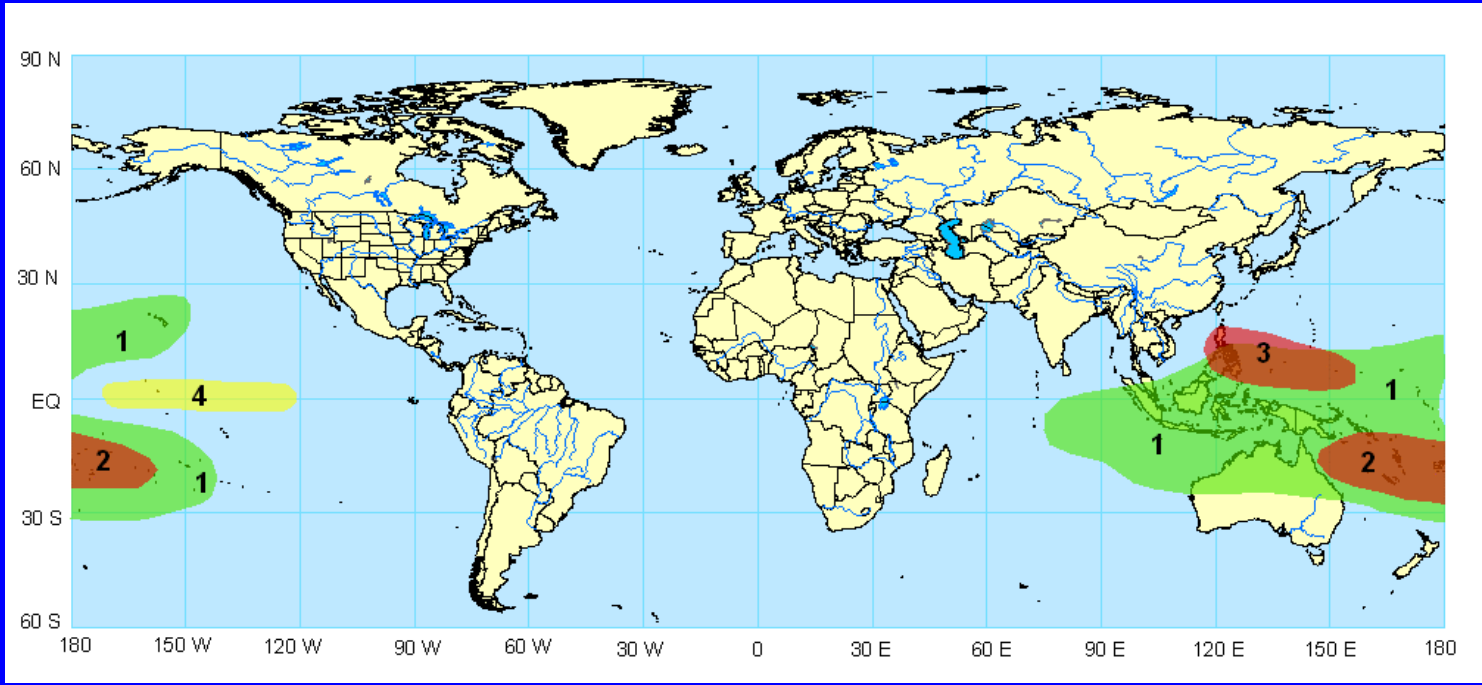
The GFS is indicating enhanced rainfall over the equatorial Indian Ocean, Indonesia, northern Australia and the western Pacific. The GFS is also indicating suppressed rainfall over northeastern Brazil and the central Pacific. Normal rainfall is indicated over Africa and the Amazon.

Potential Benefits/Hazards – Week 1
Valid January 24 - 30, 2006



1. There is an increased chance for above normal precipitation along the U.S. west coast late in the period due to the potential for the development of a tropical connection over the Pacific. This event may persist into the early part of week 2.
2. An increased chance for above normal rainfall over the Maritime Continent, northern Australia and the western Pacific due to enhancement of convection..
3. Tropical cyclogenesis is possible over the southwestern Pacific due to favorable atmospheric conditions and convective enhancement.
4. Tropical cyclogenesis is possible over the western Pacific near and east of the Philippines due to favorable atmospheric conditions and convective enhancement.
5. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures.
6. An increased chance for below normal rainfall over eastern Brazil due to suppression of convection.
7. An increased chance for below normal rainfall over central Africa due to suppression of convection. However, a tropical storm may develop east of Madagascar early in the period.

Potential Benefits/Hazards – Week 2
Valid January 31 – February 6, 2006



1. An increased chance for above normal rainfall over the eastern Indian Ocean, Indonesia, northern Australia and the western Pacific due to enhancement of convection. It is possible that a tropical cyclone may develop north of Australia.
2. Tropical cyclogenesis is possible over the southwestern Pacific due to favorable atmospheric conditions and convective enhancement.
3. Tropical cyclogenesis is possible over the western Pacific near and east of the Philippines due to favorable atmospheric conditions and convective enhancement.
4. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures.

Summary

- The MJO remains weak, however, there are indications of other types of intraseasonal variability that operate on somewhat faster time scales and are modulating the ongoing La Nina signal.
- During the past week, enhanced convection was observed across the eastern Indian Ocean, Indonesia, Australia and the southwestern Pacific. Suppressed convection was noted over the equatorial Pacific in the vicinity of the Date Line, eastern Brazil and portions of central Africa. Some of these conditions resemble those of a La Nina pattern.
- There is an increased chance for heavy precipitation along portions of the U.S. west coast towards the end of week 1, possibly into week 2.
- For week 1, there is an increased chance for above normal rainfall over Indonesia, northern Australia and the western Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific and east of the Philippines. A tropical system may develop north of Australia during the period. There is an increased chance for below average rainfall over eastern Brazil and central portions of Africa.
- 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 western Pacific. There is also an increased chance for above normal rainfall over Hawaiian Islands. There is also the potential for tropical cyclogenesis over the southwestern Pacific and east of the Philippines during week 2.