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

Update prepared by
Climate Prediction Center / NCEP
January 9, 2006

Outline

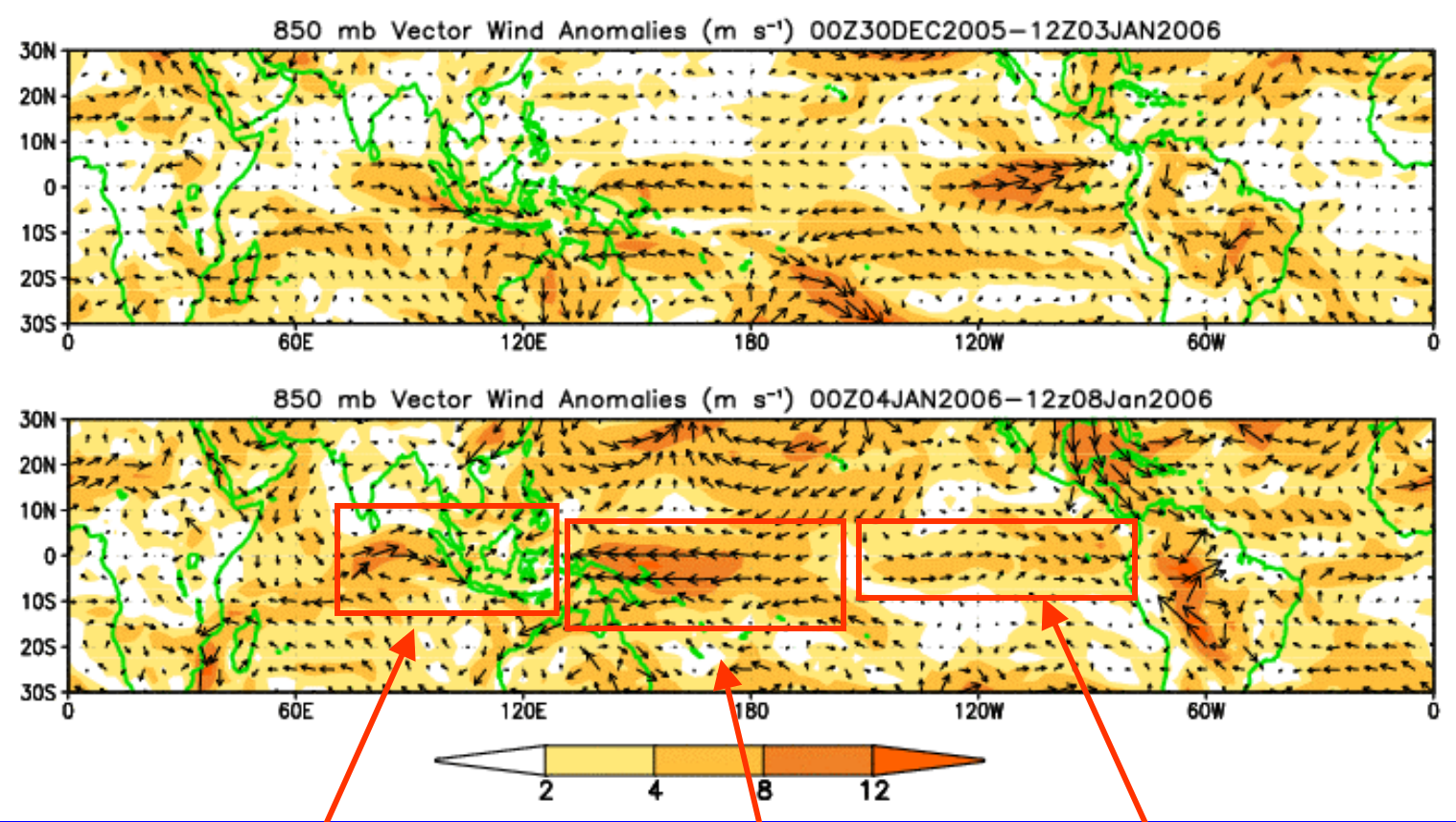
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- The MJO remains inactive. Observed velocity potential fields, however, do show enhancement over Africa and a reduction in the enhancement over the Maritime Continent.
- During the past week, enhanced convection continued over Indonesia, northern Australia and the surrounding ocean. Enhanced convection was also observed along the South Pacific Convergence Zone, with suppressed convection over the equatorial Pacific in the vicinity and east of the date line. These conditions resemble those of La Nina conditions. Based on the latest observational evidence and statistical and dynamical forecasts, the MJO is expected to remain weak during the upcoming period.
- For both weeks 1 and 2, there is an increased chance of above average rainfall across Indonesia, Australia into the southwestern Pacific Ocean and an increased chance of below average rainfall in the central Pacific Ocean due to a pattern suggestive of La Nina conditions. There is an increased chance of tropical cyclogenesis for both weeks 1 and 2 over the southern Indian Ocean as the tropical season begins.
- During both weeks 1 and 2, there is an above normal chance for heavy precipitation and strong winds over portions of western North America due to an active Pacific jet.
- Over Sun-Saharan Africa, Madagascar and the equatorial Atlantic, there is an enhanced probability for above normal rainfall during week 1.

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

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

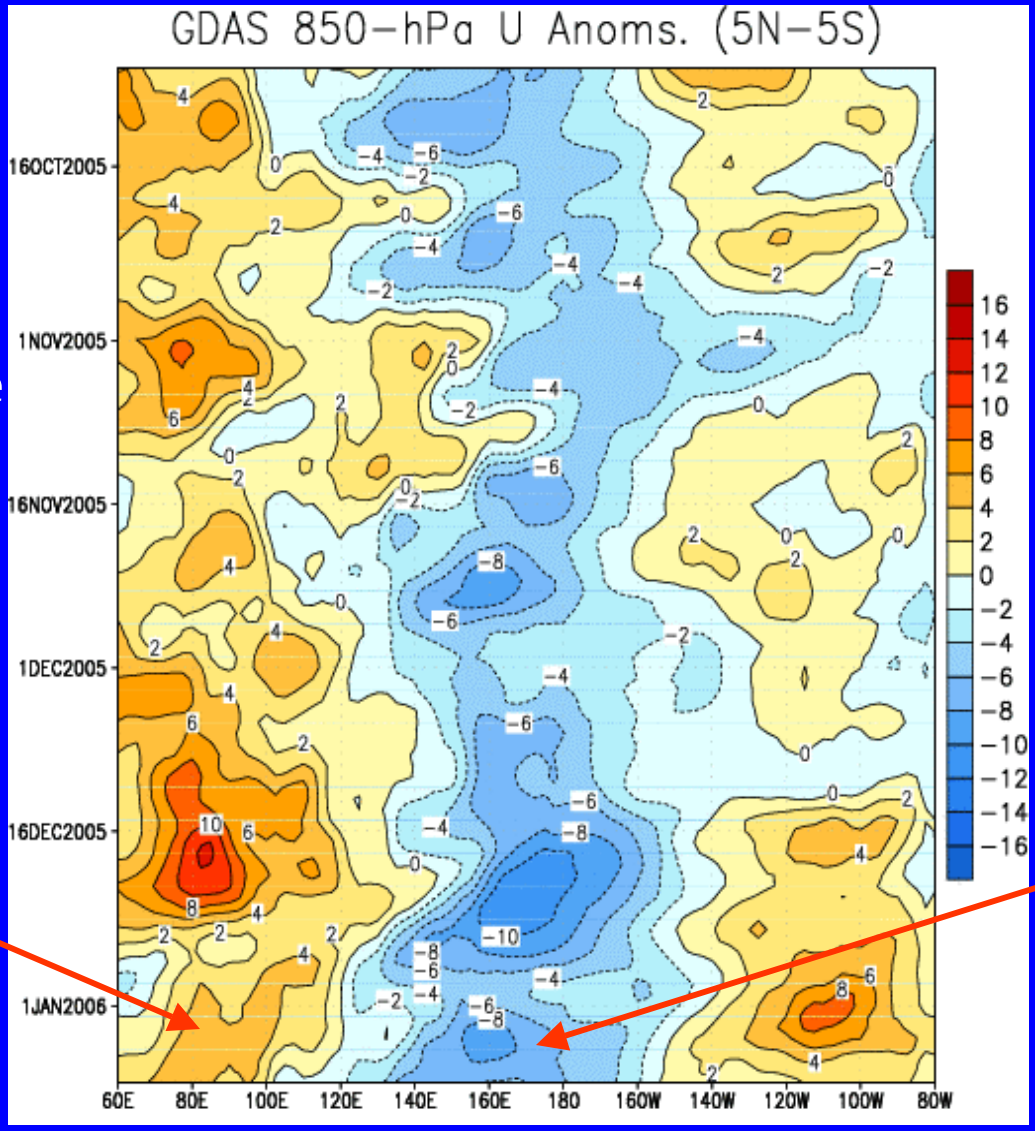


Westerly wind anomalies strengthened over the eastern Indian Ocean

Easterly wind anomalies strengthened across the western Pacific Ocean

Westerly wind anomalies persisted over the eastern Pacific 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).

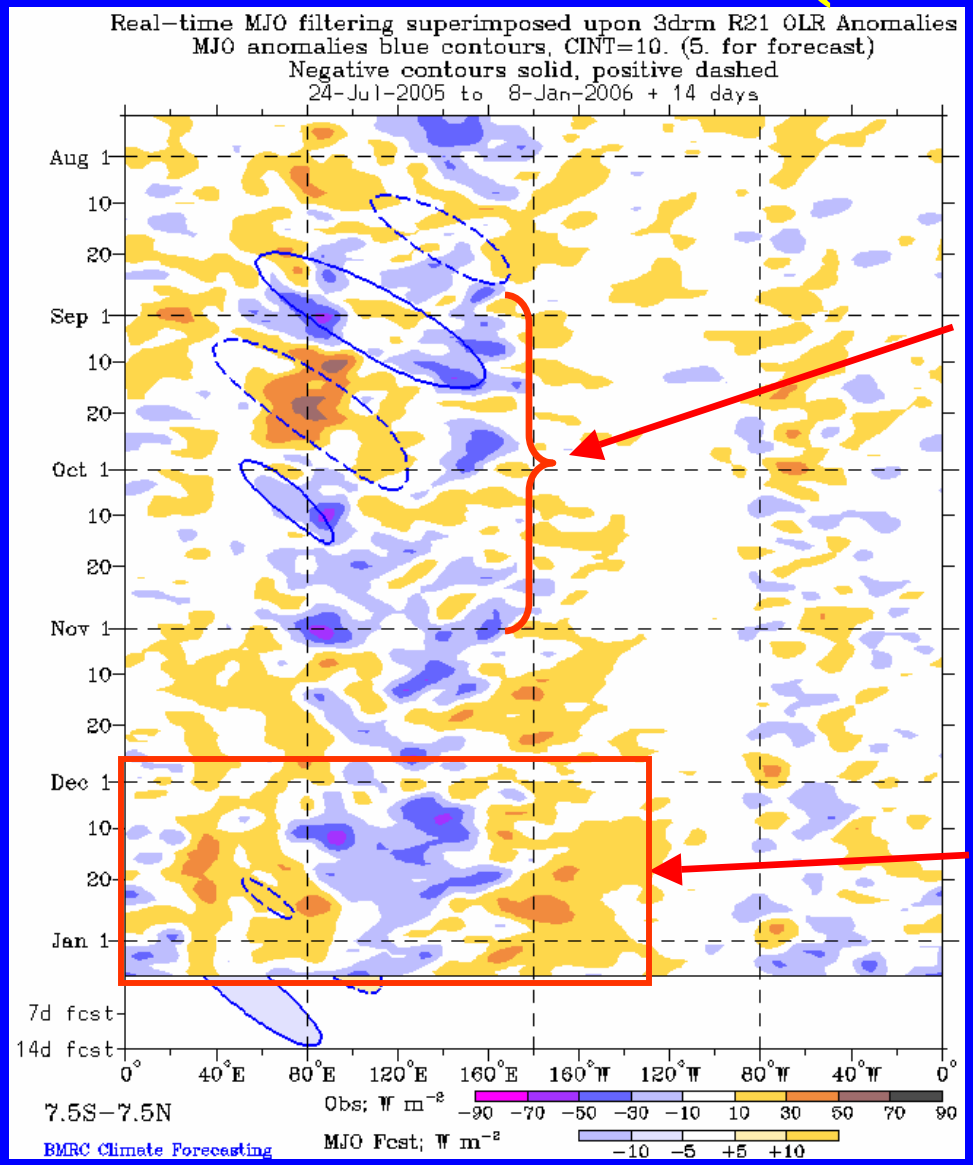
Lower tropospheric easterlies have been weaker than normal across the eastern equatorial Pacific during the last half of December.

Equatorial easterly anomalies persist from New Guinea eastward to the central equatorial Pacific.

This overall pattern in the low level zonal winds has persisted since October.

The strong westerly anomalies over the Indian Ocean and Indonesia persist, although they are not as strong as in mid December

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



Time

Longitude

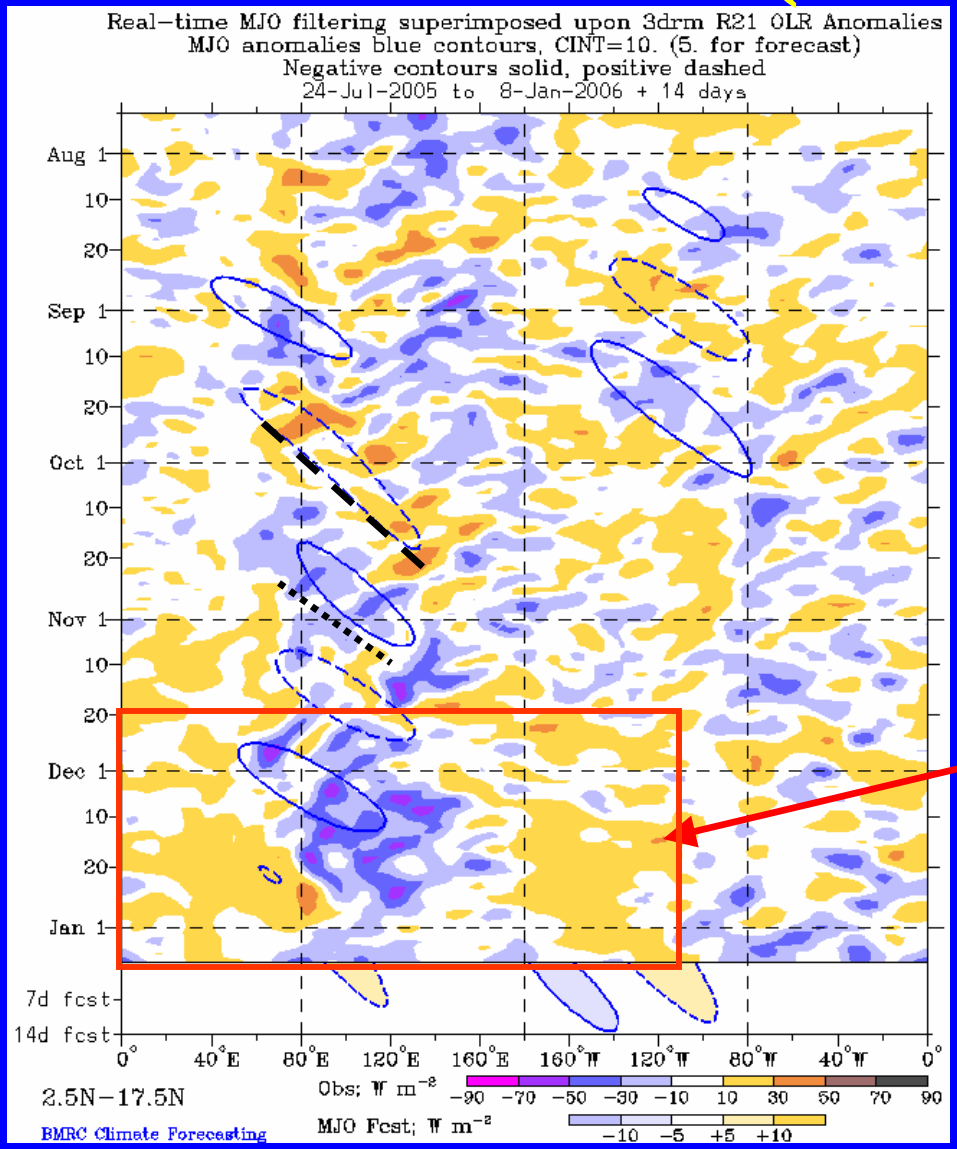
Drier-than-average conditions (/red shading)

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 has been quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean while suppressed convection is evident both across Africa and in the central Pacific Ocean during late November and December. The enhanced convection has lessened somewhat over Indonesia during the past two weeks.

Outgoing Longwave Radiation (OLR) Anomalies (2.5°N-17.5°N)



Time

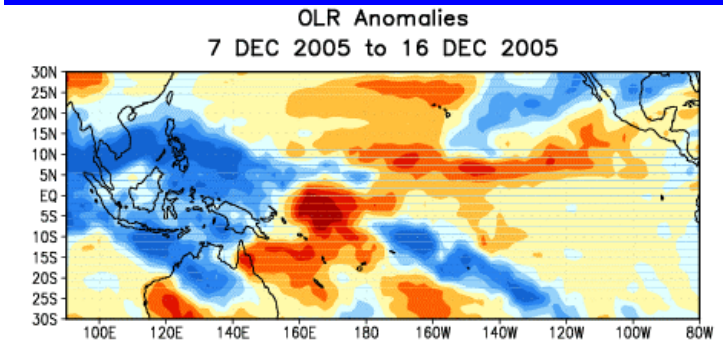
Longitude

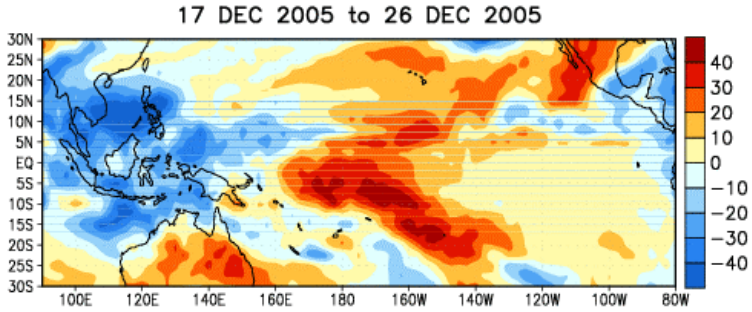
Drier-than-average conditions (orange/red shading)

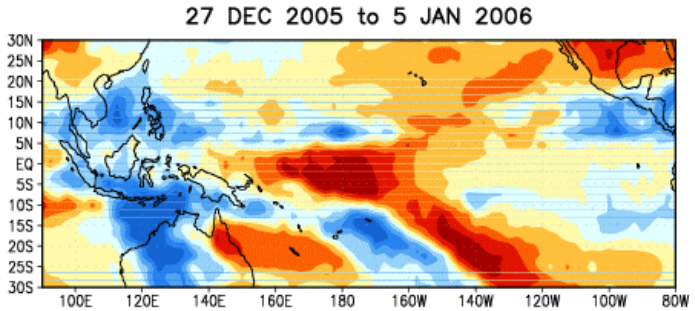
Wetter-than-average conditions (blue shading)

A similar pattern north of the equator is evident with generally stationary areas of enhanced (suppressed) convection across sections of the Bay of Bengal, Indonesia, and the far western Pacific (Africa and the central Pacific Ocean). Over the past week, convection has increased over the Indian Ocean from Sumatra to the Maldives.

Anomalous OLR and 850-hPa Wind: Last 30 days

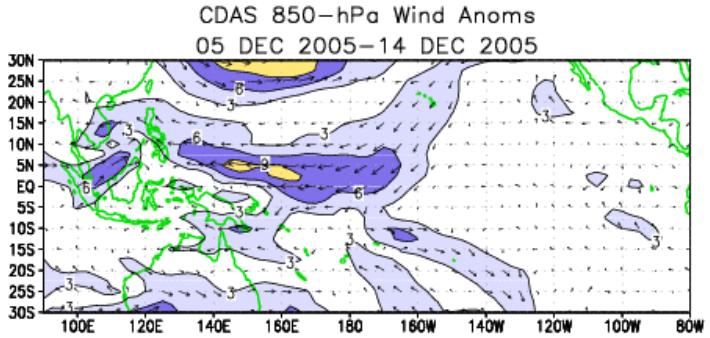


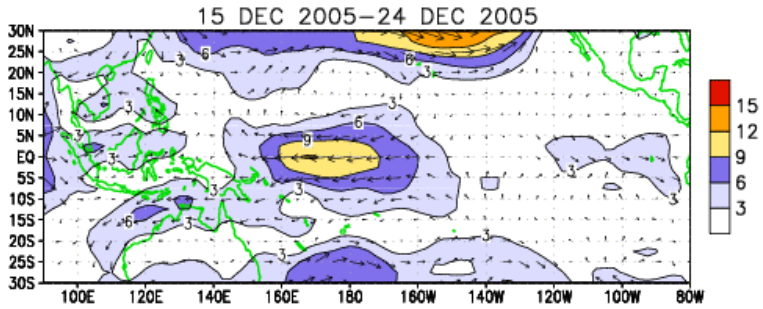


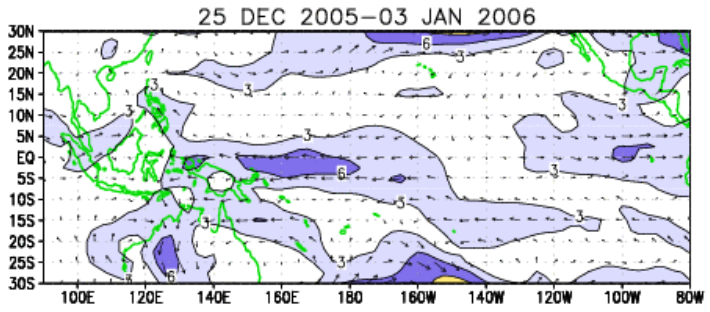


During the past 30 days, a quasi-persistent pattern of enhanced (suppressed) convection has been evident across Indonesia (west-central Pacific Ocean)

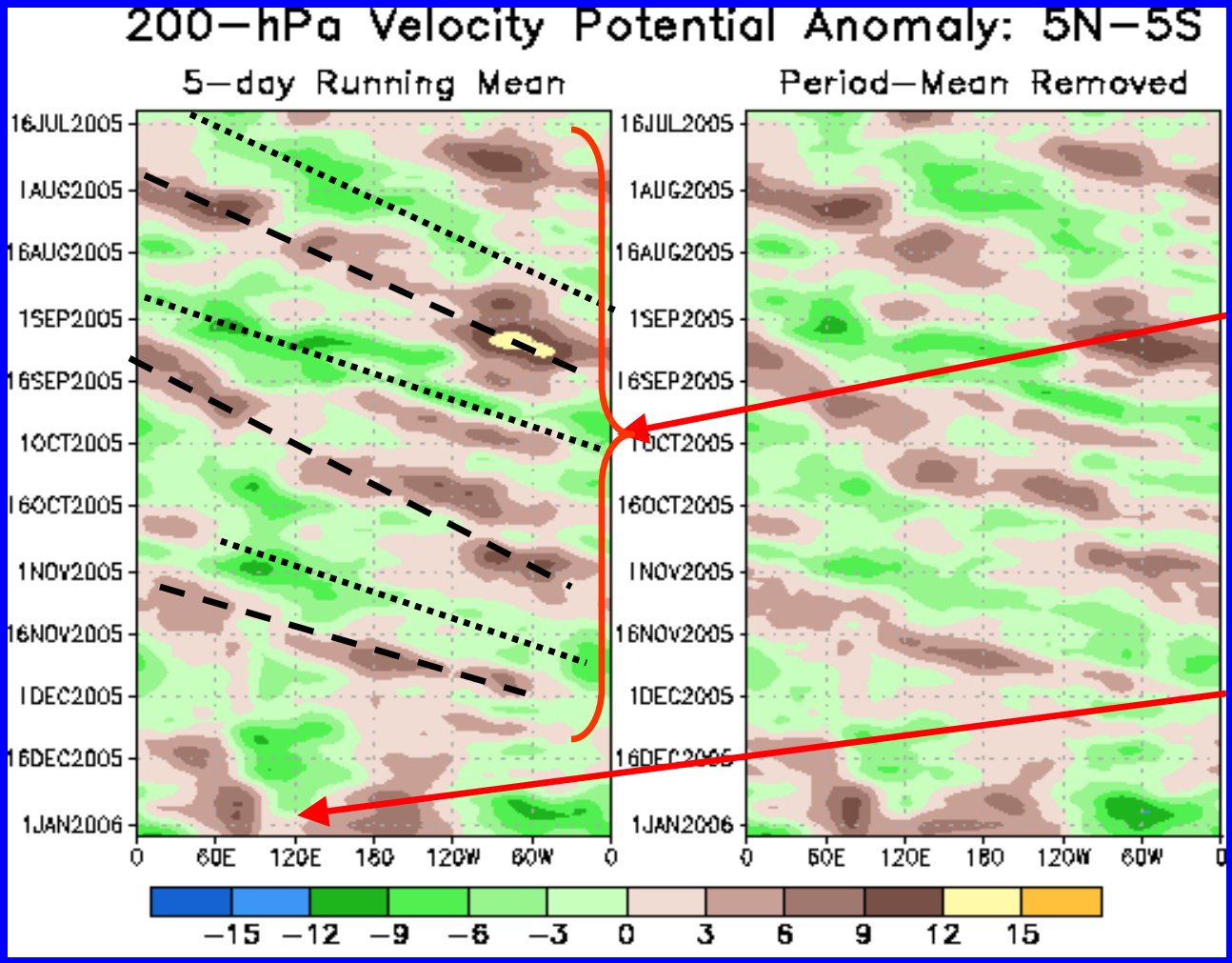
Easterly anomalies have been evident in the western Pacific Ocean during the past month and have weakened slightly







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



Time

Longitude

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

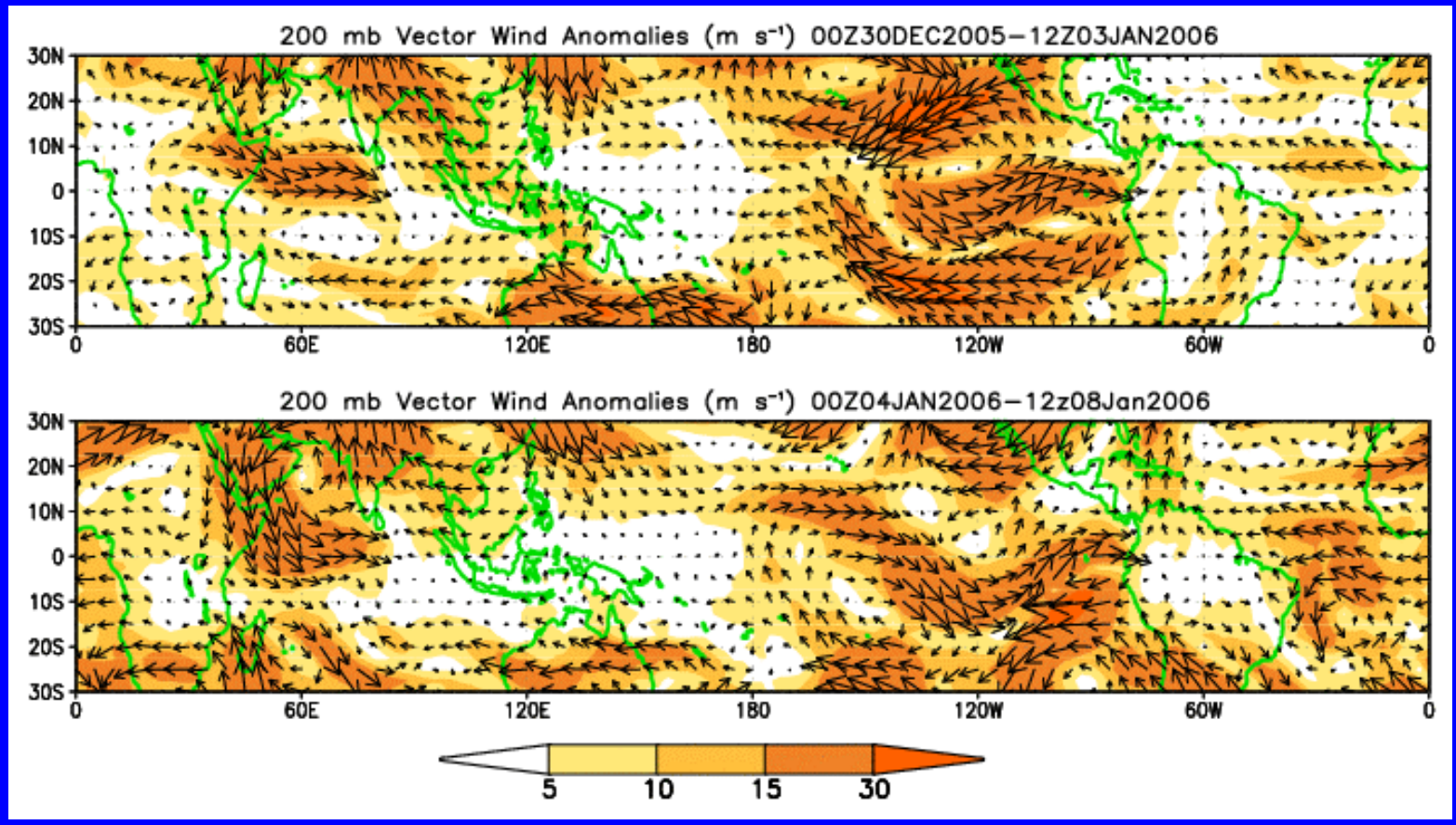
Negative anomalies (green shading) indicate favorable conditions for precipitation.

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

Along the equator, upper-level divergence (green) during late November and December has been strong over the eastern Indian Ocean, Indonesia and the far western Pacific Ocean. This pattern has weakened over the past two weeks.

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

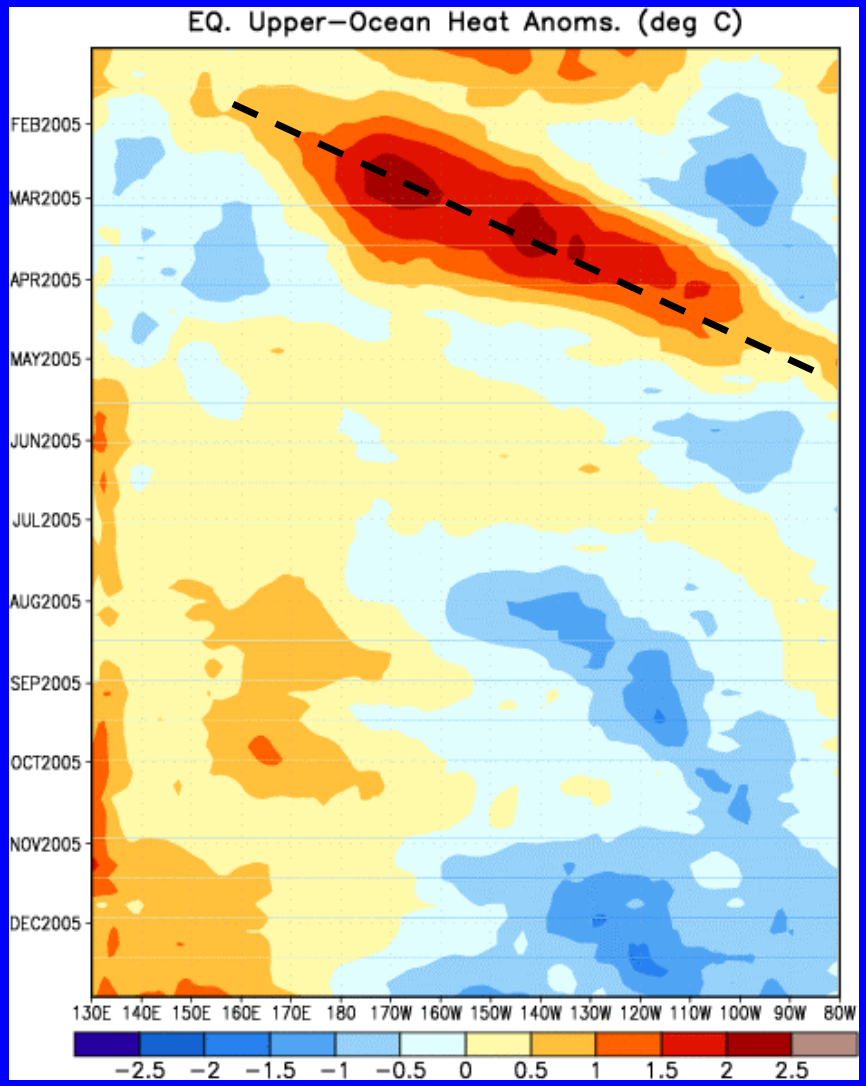
Note that shading denotes the magnitude of the anomalous wind vectors.



Numerous mid-latitude anomalies extend into the sub tropics and tropics in both hemispheres.

Heat Content Evolution in the Eq. Pacific

Time



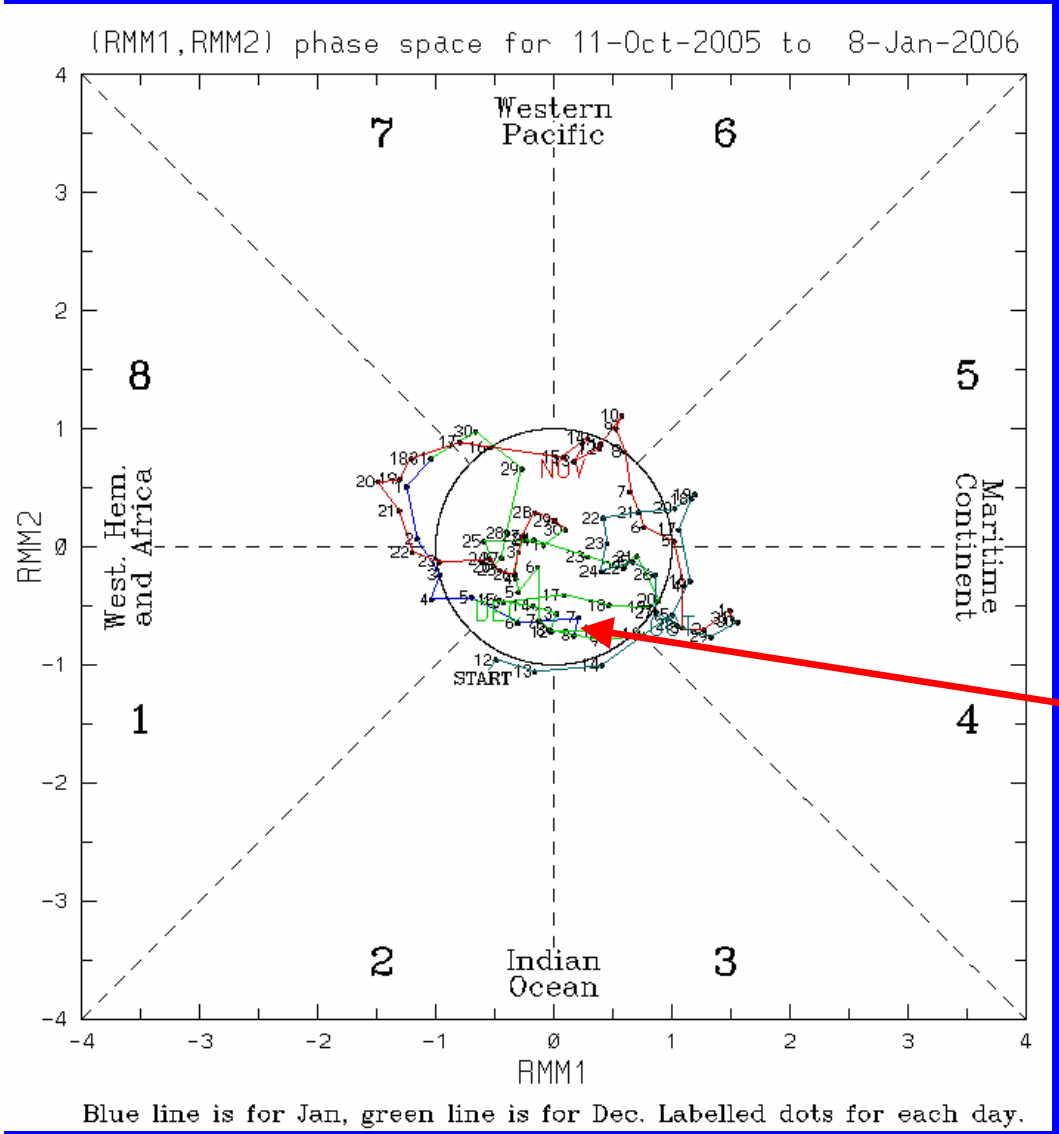
Longitude

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 and early January.

MJO Index (Magnitude and Phase)



Blue line is for Jan, green line is for Dec. Labelled dots for each day.

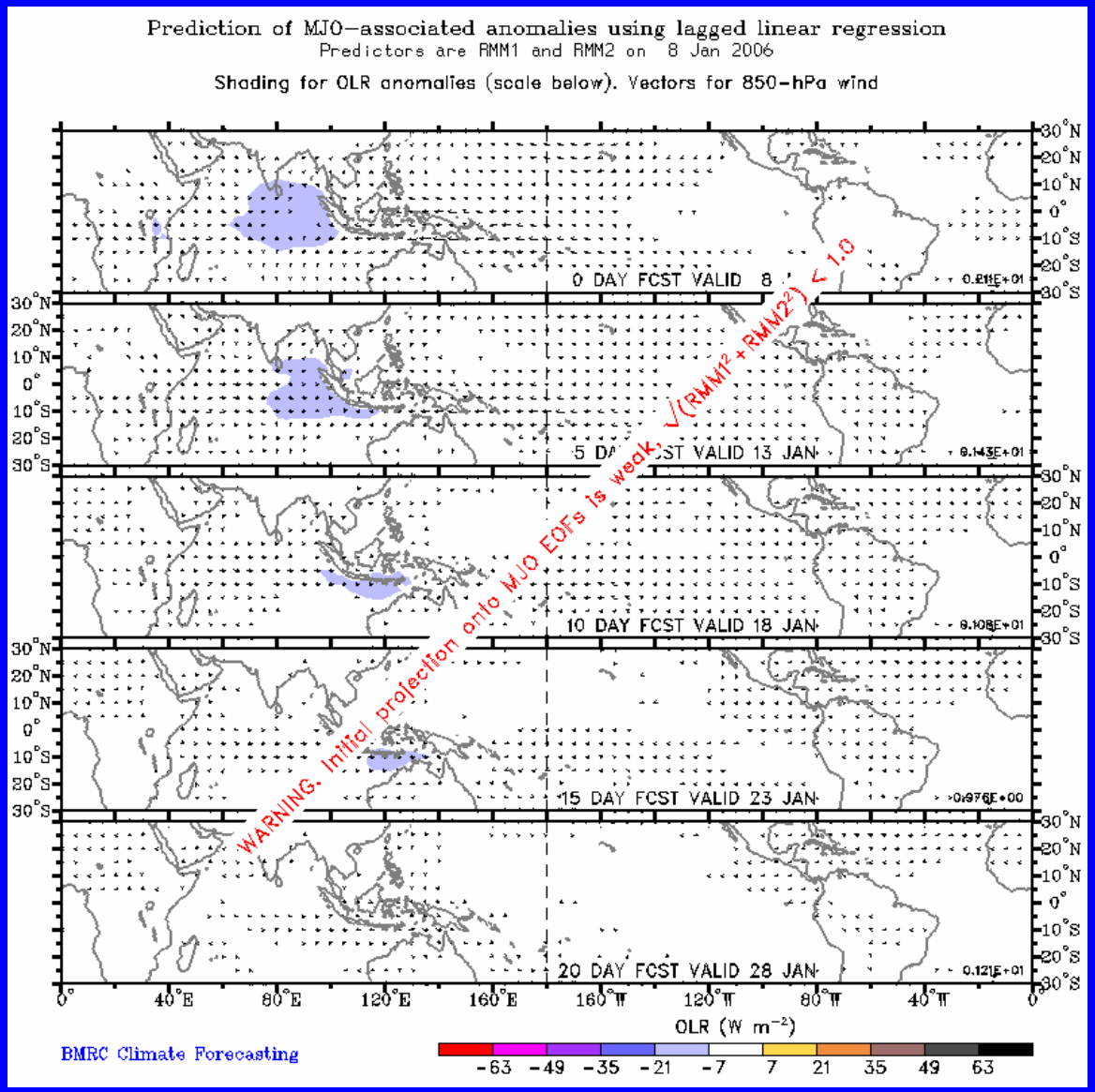
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

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

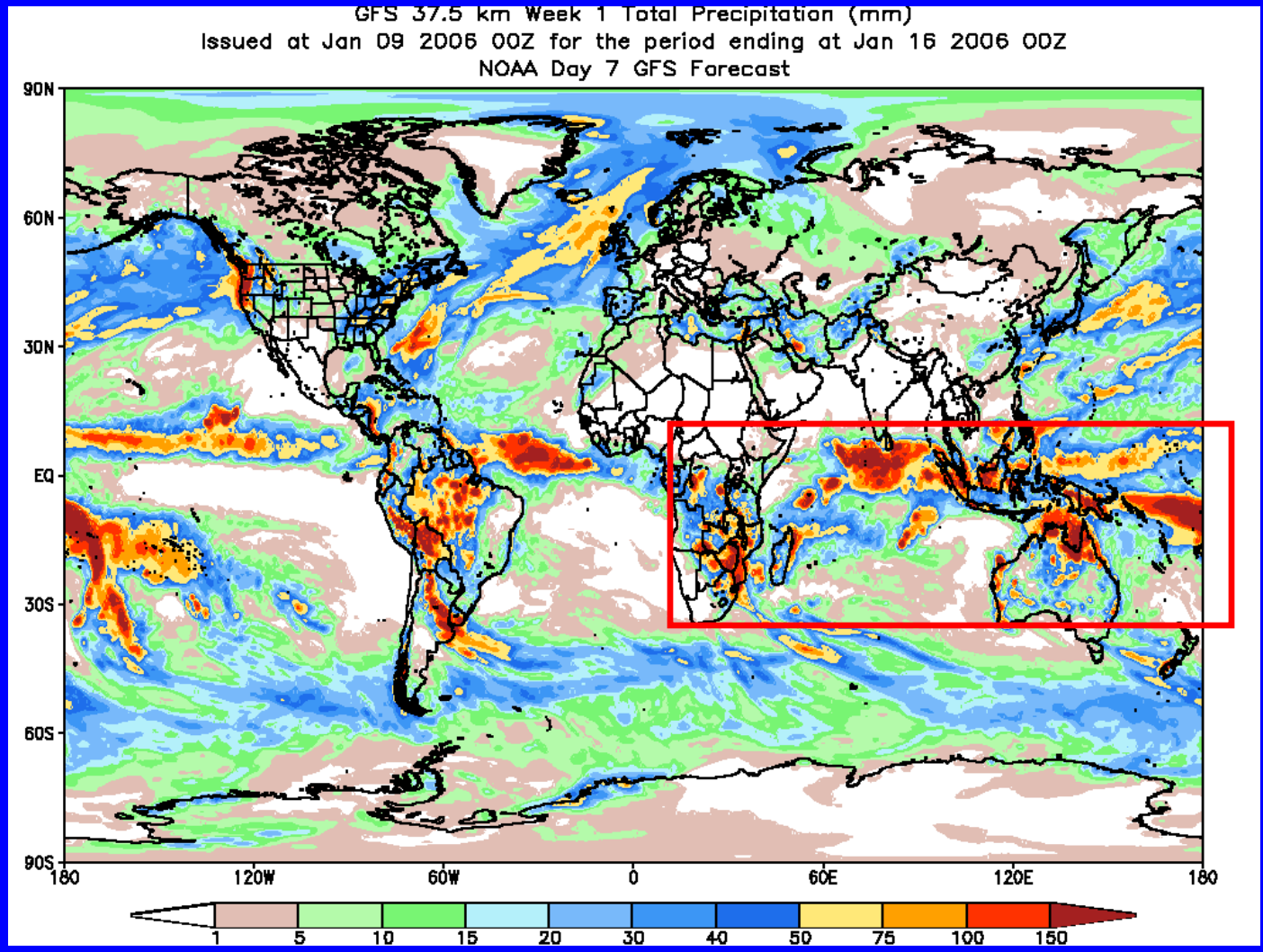
Currently, the MJO remains weak as the projection from the most recent data continues to be located within the unit circle.

Statistical OLR MJO Forecast



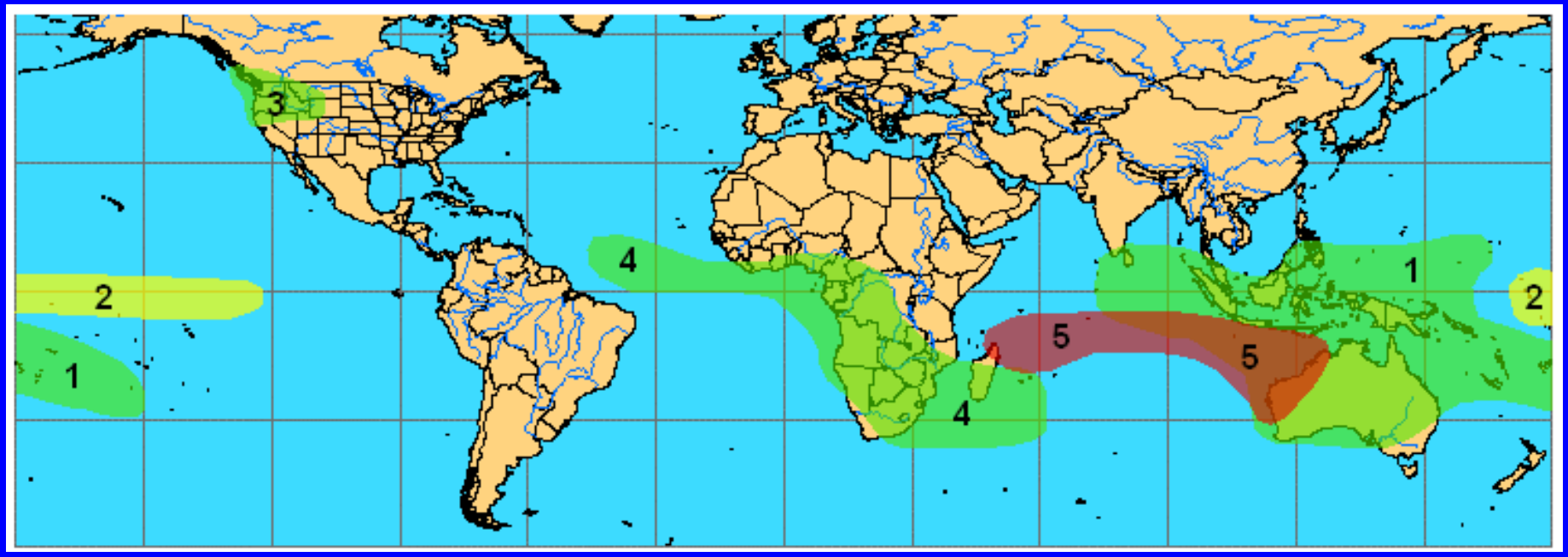
The statistical MJO forecast indicates that the MJO will remain weak over the next few weeks.

Global Forecast System Precipitation Forecast



GFS indicates the likelihood of enhanced rainfall across the Indian Ocean Basin, the West Pacific, Africa, Australia and Indonesia.

Potential Benefits/Hazards – Week 1
Valid January 10 – 16, 2006



1. An increased chance for above normal rainfall over the eastern Indian Ocean, Indonesia, large portions of Australia, Fiji, Samoa and the Cook Islands. There is also the possibility for tropical cyclogenesis in the southwestern Pacific.
2. There is an increased chance for below normal rainfall across the western and central Equatorial Pacific.
3. There is an increased chance for above normal precipitation across the northwestern United States and southwestern Canada.
4. There is an increased chance for above normal rainfall over the near-equatorial Atlantic, Sub-Saharan Africa and Madagascar. Unseasonable showers are possible over western portions of the Sahel and the Sahara.
5. Tropical cyclogenesis is possible over the South Indian Ocean.

Potential Benefits/Hazards – Week 2
Valid January 17 - 23, 2006

1. An increased chance for above normal rainfall over Indonesia, large portions of Australia, Fiji, Samoa and the Cook Islands. There is also the possibility for tropical cyclogenesis in the southwestern Pacific.
2. There is an increased chance for below normal rainfall across the western and central Equatorial Pacific.
3. Tropical cyclogenesis is possible over the South Indian Ocean.
4. There is an increased chance for above normal precipitation across the western United States.

Summary

- The MJO remains inactive. Observed velocity potential fields, however, do show enhancement over Africa and a reduction in the enhancement over the Maritime Continent.
- During the past week, enhanced convection continued over Indonesia, northern Australia and the surrounding ocean. Enhanced convection was also observed along the South Pacific Convergence Zone, with suppressed convection over the equatorial Pacific in the vicinity and east of the date line. These conditions resemble those of La Nina conditions. Based on the latest observational evidence and statistical and dynamical forecasts, the MJO is expected to remain weak during the upcoming period.
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- During both weeks 1 and 2, there is an above normal chance for heavy precipitation and strong winds over portions of western North America due to an active Pacific jet.
- Over Sun-Saharan Africa, Madagascar and the equatorial Atlantic, there is an enhanced probability for above normal rainfall during week 1.