WCRP /WWRP-THORPEX
YOTC Implementation Planning Meeting
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Large-Scale Overview of YOTC Period
(ENSO, MJO, CCEWs,….)

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Australian Government
Bureau of Meteorology

CSIRO

Outline

YOTC = May 2008 to October 2009

1. ENSO context
2. MJO activity
3. Convectively-coupled equatorial waves (CCEWs)
4. Australian monsoon
5. Other features in tropical convection
6. Suggested periods of interest?

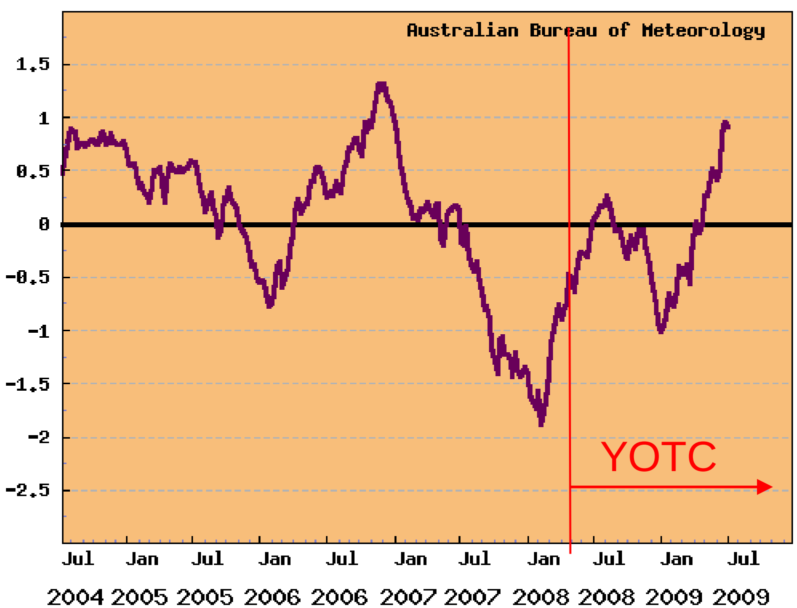
1. ENSO context

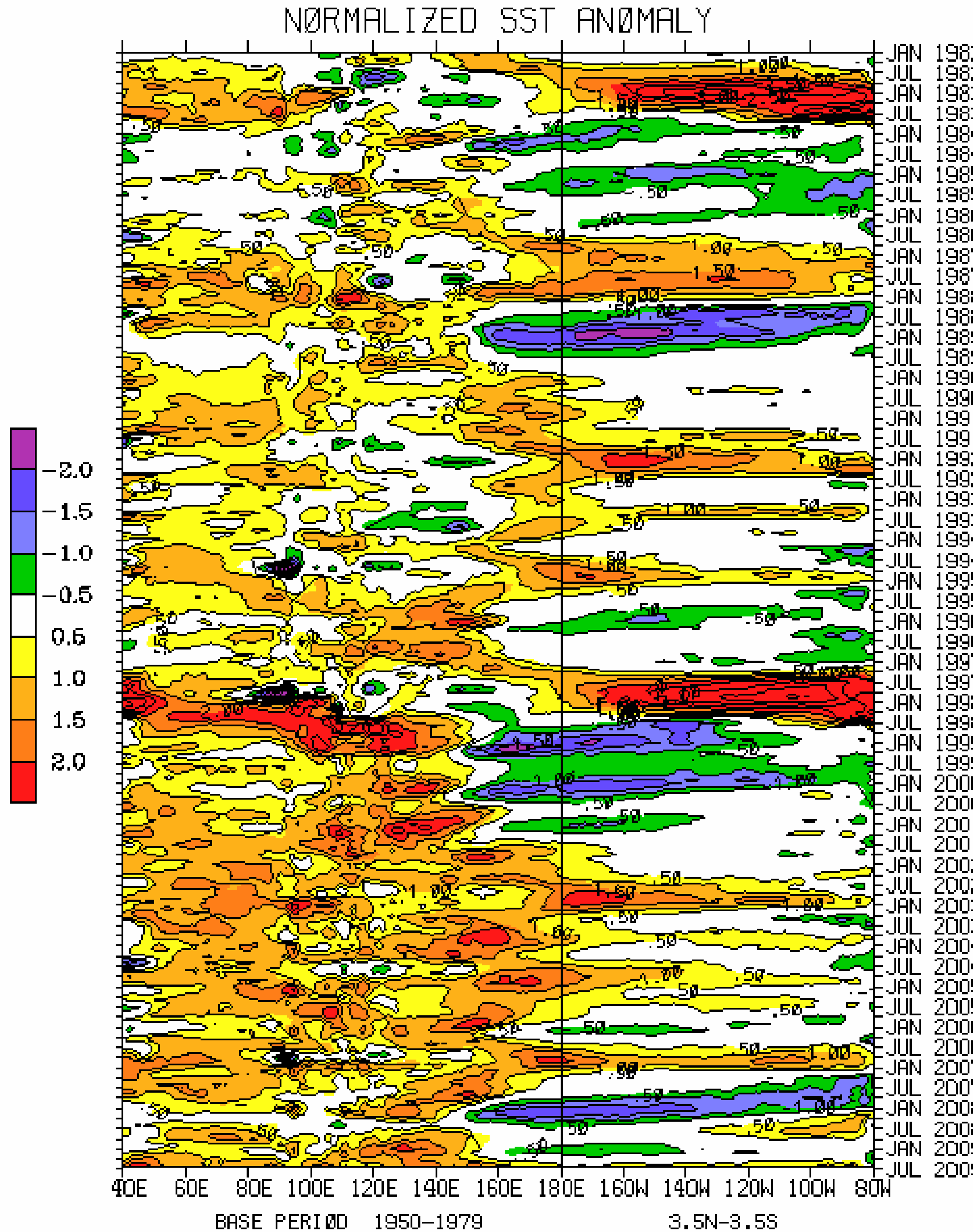
2007/08 was a moderately strong La Nina, peaking in ~February 2008.

The cool Pacific conditions weakened substantially by the start of YOTC (May 2008), only to reappear as a weak La Nina in DJF 2008/09.

However, a transition towards El Nino has now begun (in boreal spring/summer 2009).

Nino 3.4 SST index





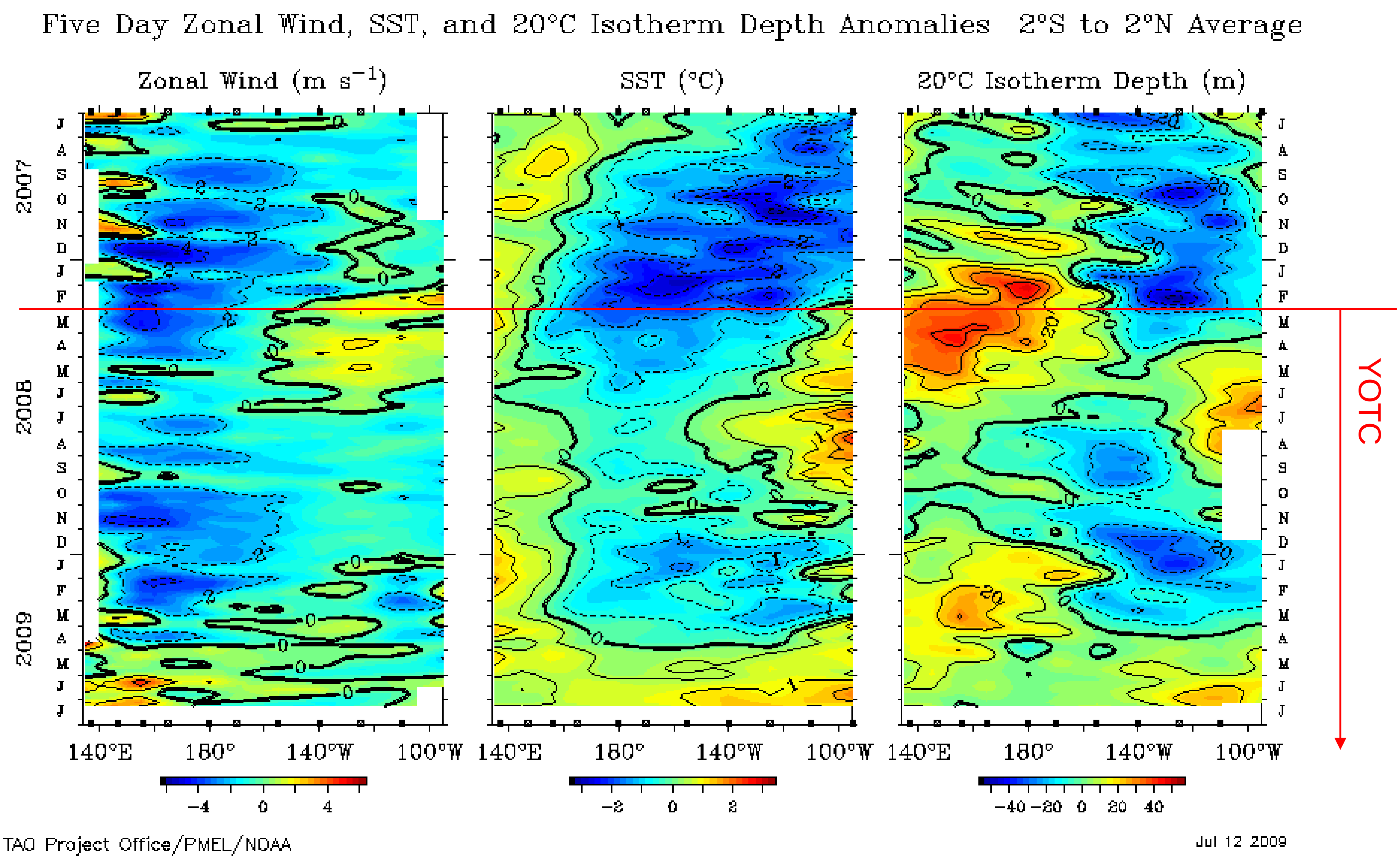
From PSD Map Room (Klaus Weickmann)

Looking in more detail….

For this transition to El Nino, April 2009 appears to have been a key month.

End of April saw a Pacific-wide switch in sign of anomalies of surface zonal wind and SST.

(in fact, an MJO event appears to have played an important role in this switch)



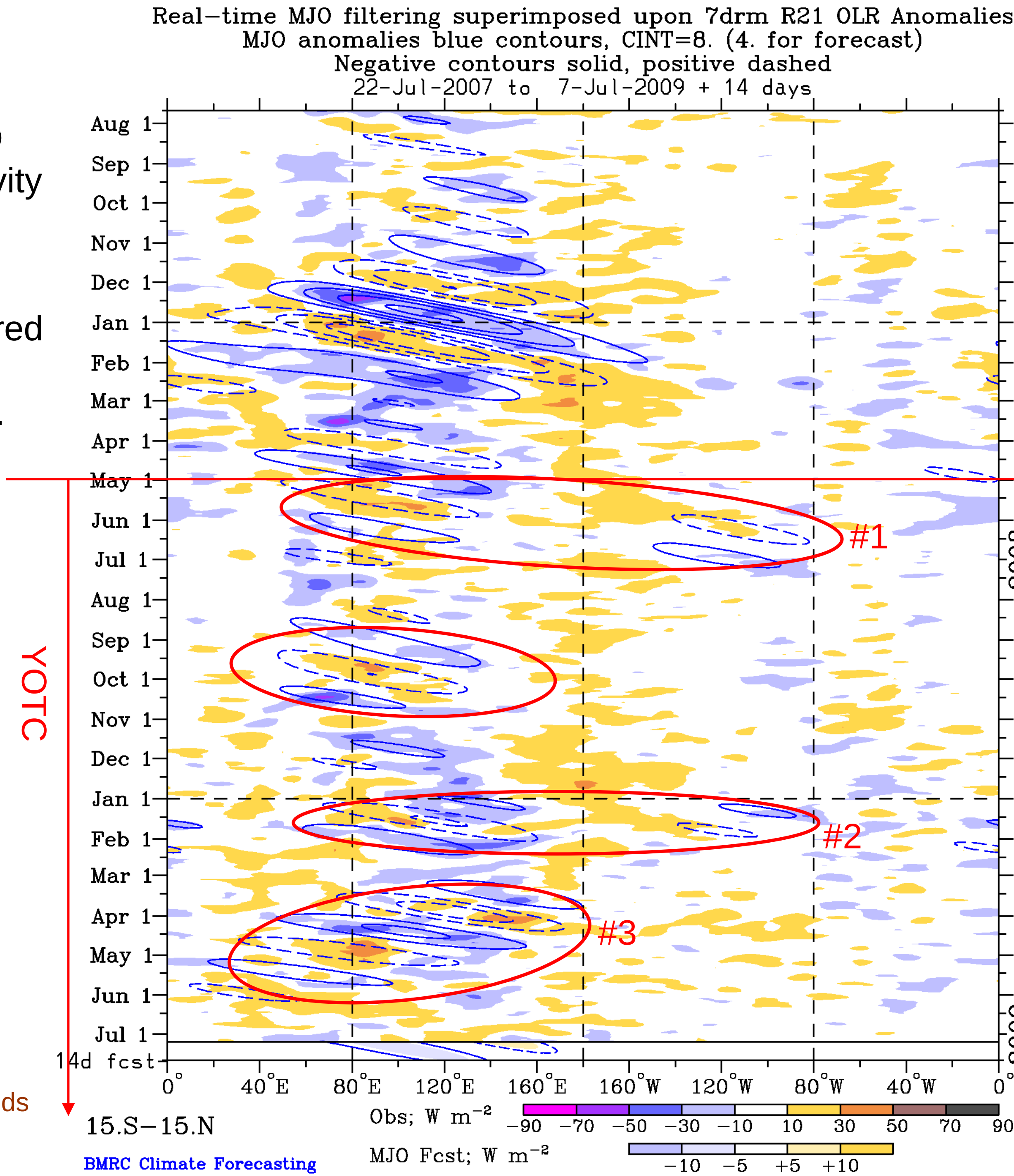
2. MJO activity

Compared to the very strong MJO activity of DJF 2007/08, MJO activity during YOTC has been weaker.

Nevertheless, important and interesting MJO activity still occurred in May-Jun 2008, Sept-Oct 2008, Jan-Feb 2009, and Mar-Jun 2009.

So far, the MJO activity centred on **April 2009** has been the strongest (using multiple measures).

Note also the tendency for suppressed convection near and to the east of the date line during much of the YOTC period (i.e. weak La Nina).



"MJO" defined in this plot through filtering of OLR anomalies for eastward waves 1-5, periods 30-96 days (Wheeler and Weickmann 2001)

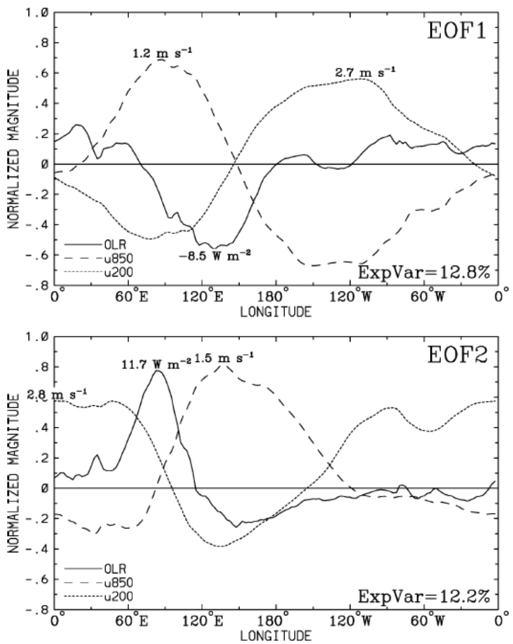
How does the YOTC MJO activity compare to other memorable periods?

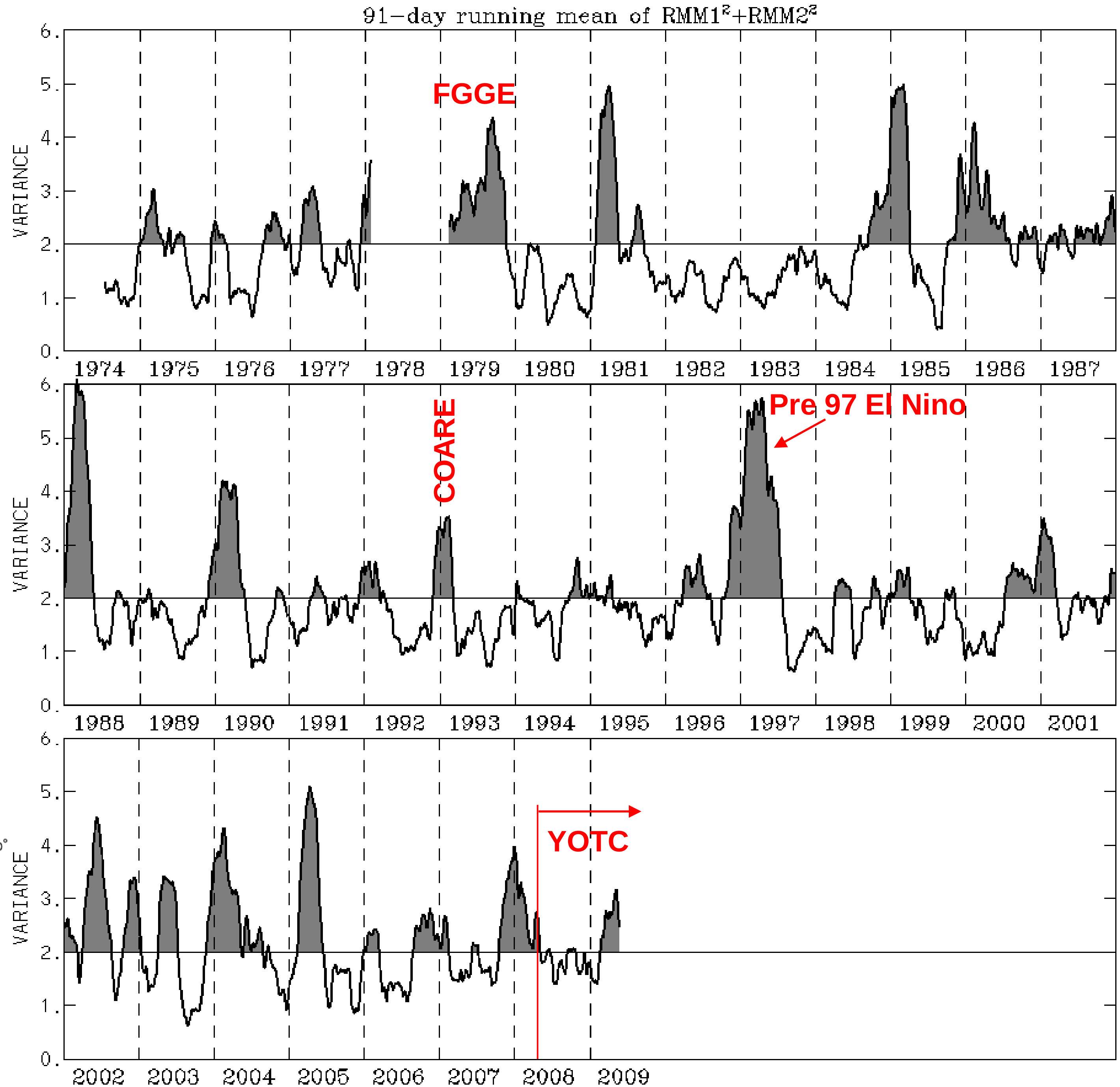
FGGE: 1979

COARE: 1992/93

Pre 97 El Nino

Measured as the variance of the Wheeler-Hendon EOFs

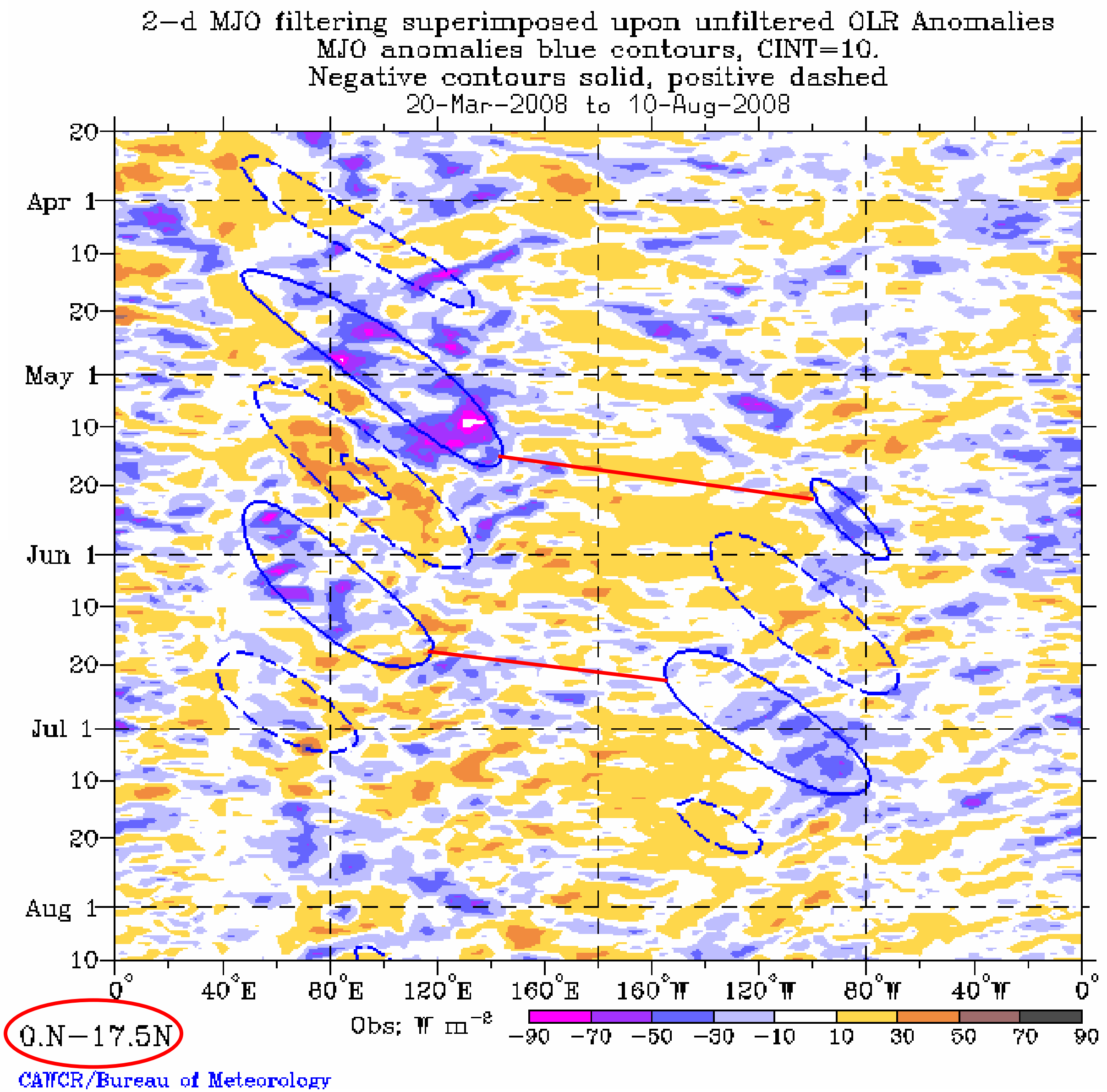


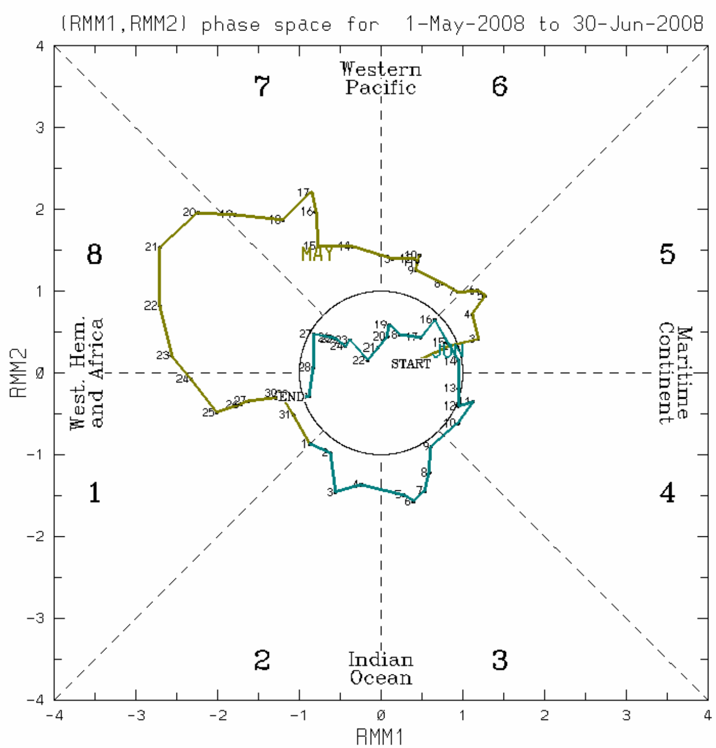


MJO case: May-June 2008

Involved in monsoon onset over India (Kerala onset ~ 31st May).

Caused strong modulation of East Pacific ITCZ, including the formation of several TCs, and impacts on North American monsoon.



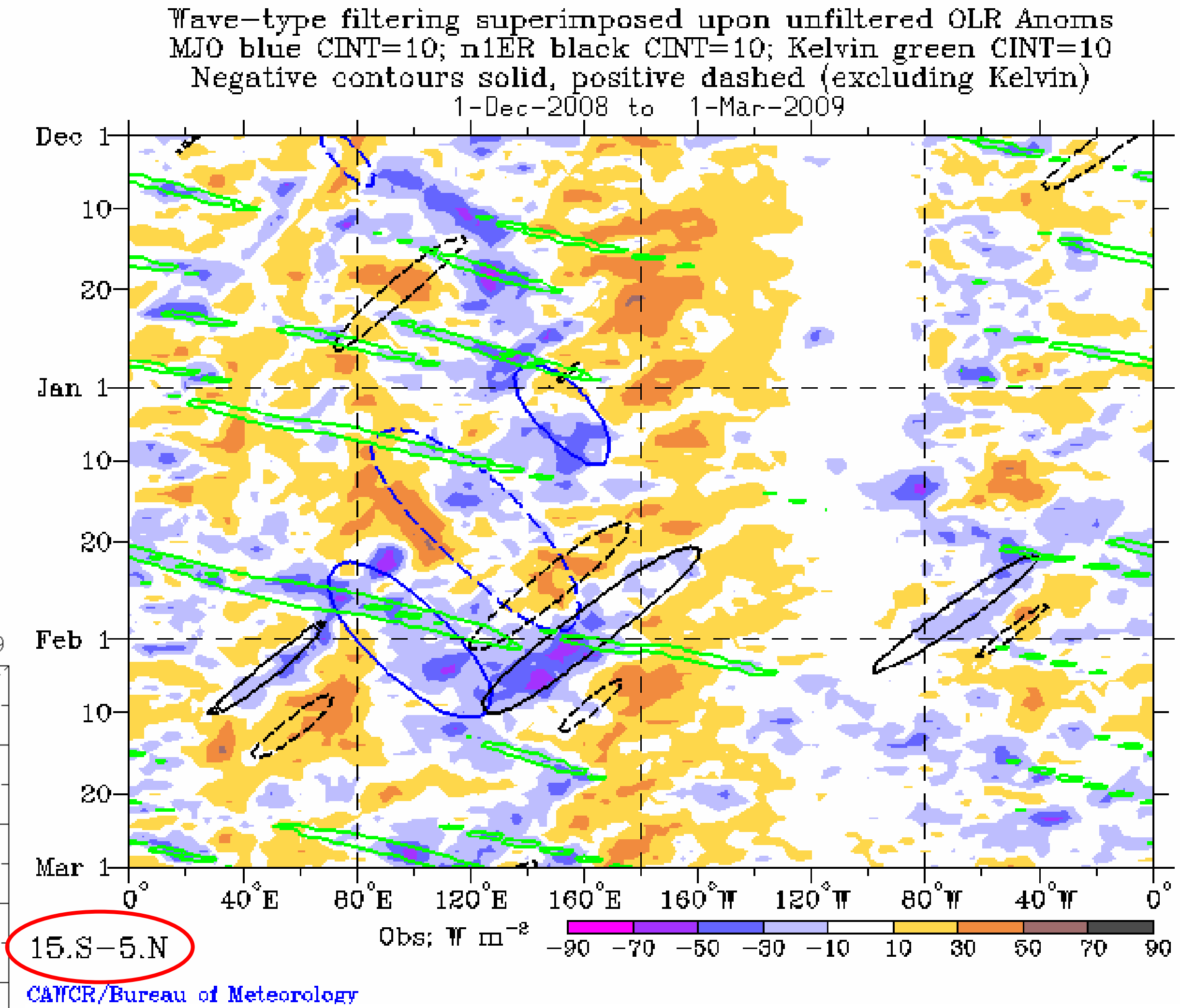


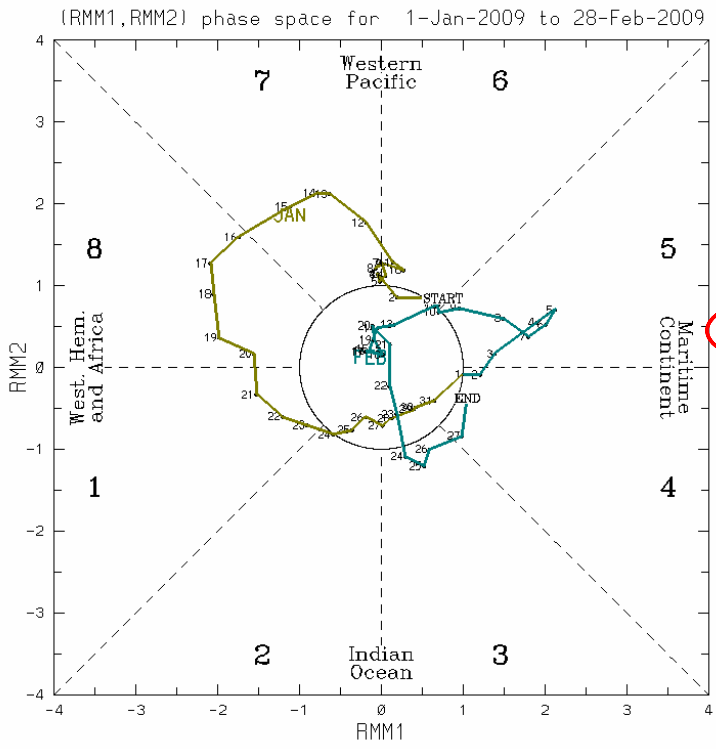
MJO case: Jan-Feb 2009

A weak MJO event that involved interactions with Kelvin and Rossby waves.

Southern Hemisphere TCs Dominic, Hettie, Ellie and Freddy.

(will hear more from Klaus)





Note: The Australian monsoon onset occurred in most places by late December, seemingly un-related to the MJO.

However, the monsoon burst in early February was apparently MJO-related, and was associated with much flooding in Queensland (~145°E). (Also had disastrous heat-waves and fires in south-eastern Australia at the same time.)

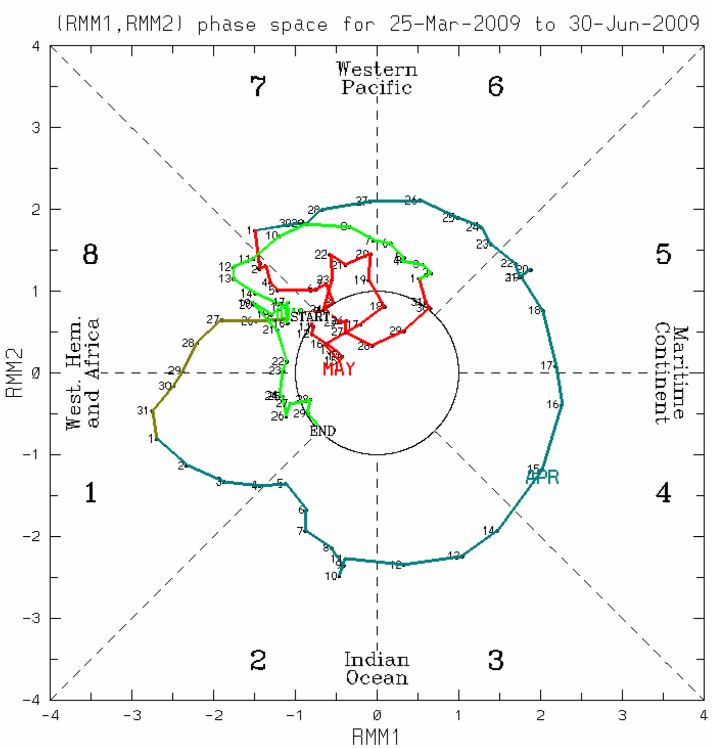
MJO case: March-June 2009

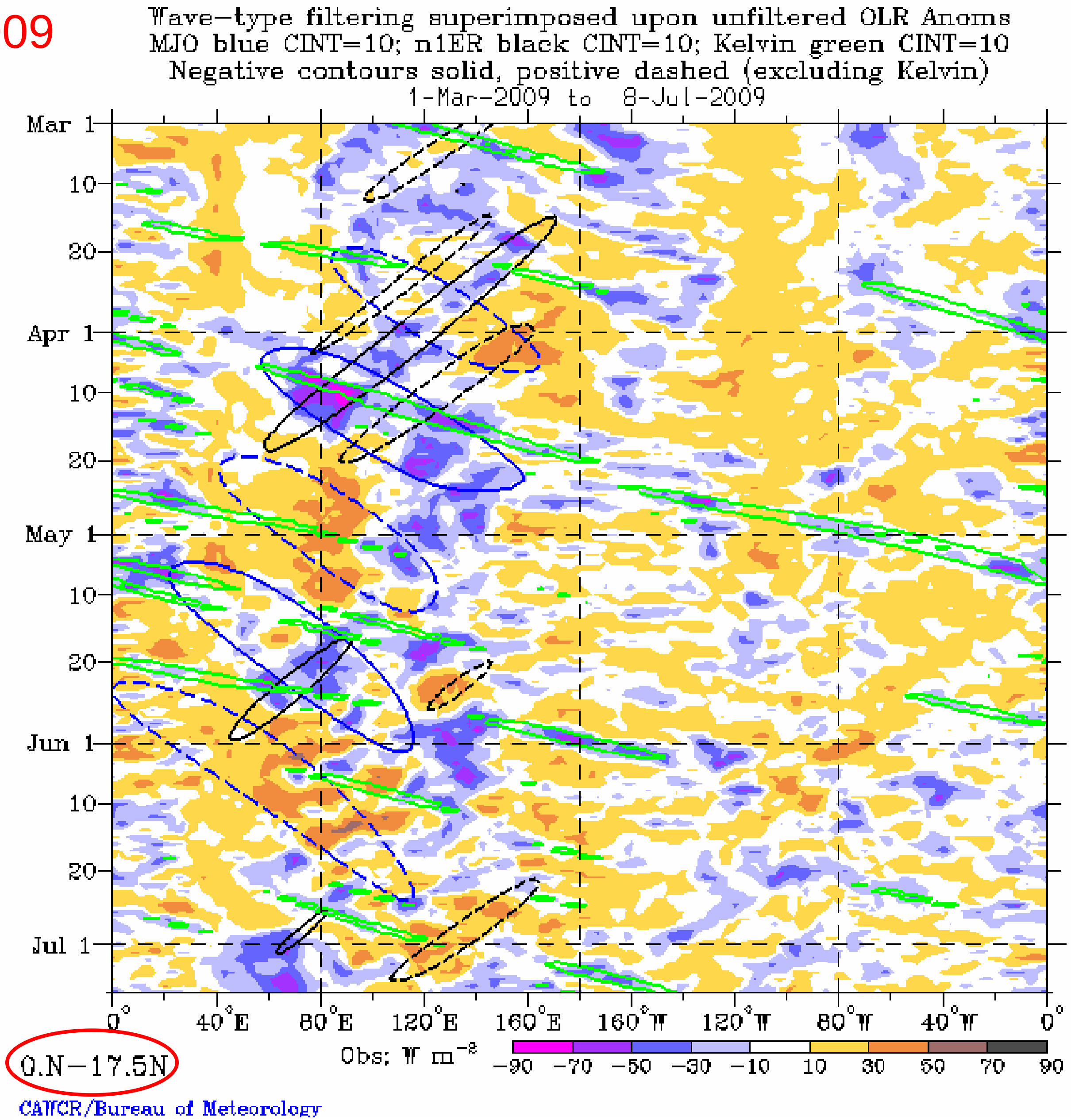
Strongest MJO activity so far.

However, unlike activity of boreal spring/summer of 2008, had no discernible East Pacific ITCZ signal.

Kelvin and Rossby waves also involved.

April envelope had relatively fast propagation.

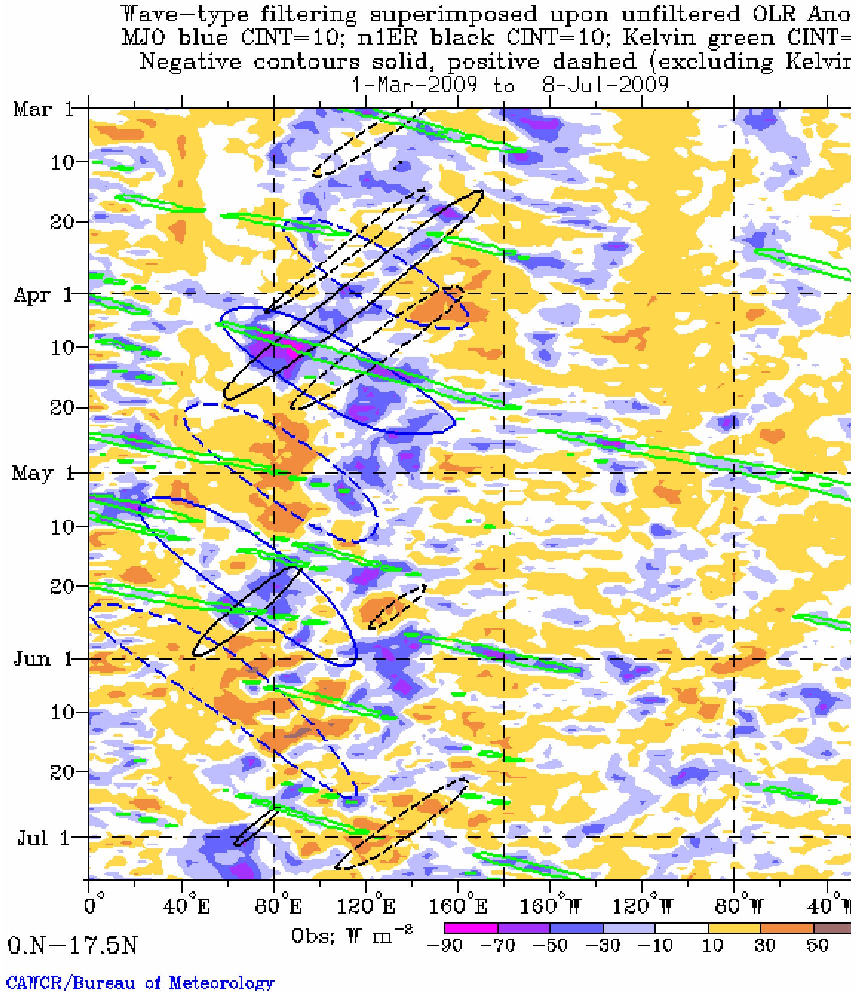


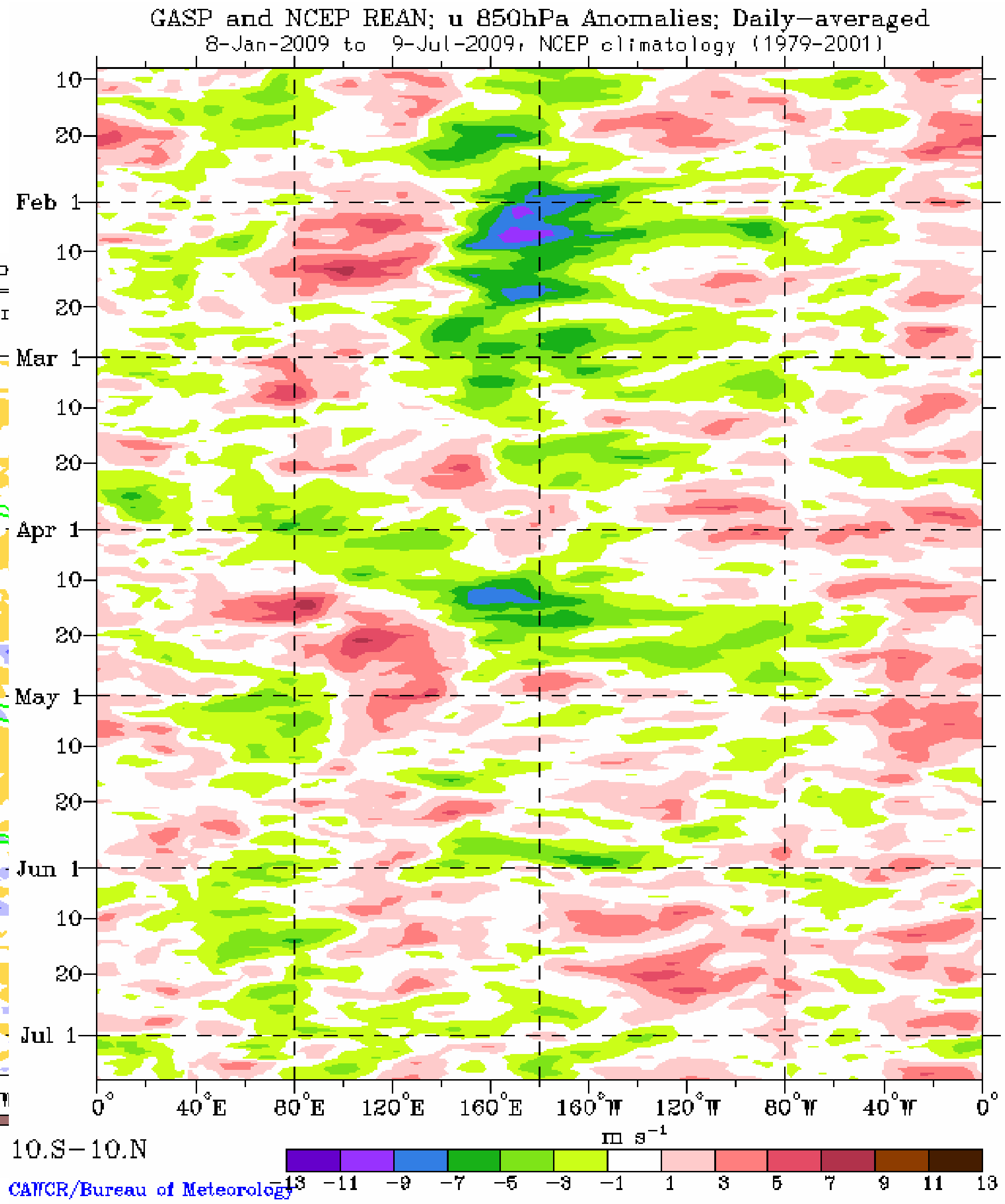


Indian monsoon onset at Kerala ~23rd May 2009

MJO also somewhat involved in June monsoon break over India

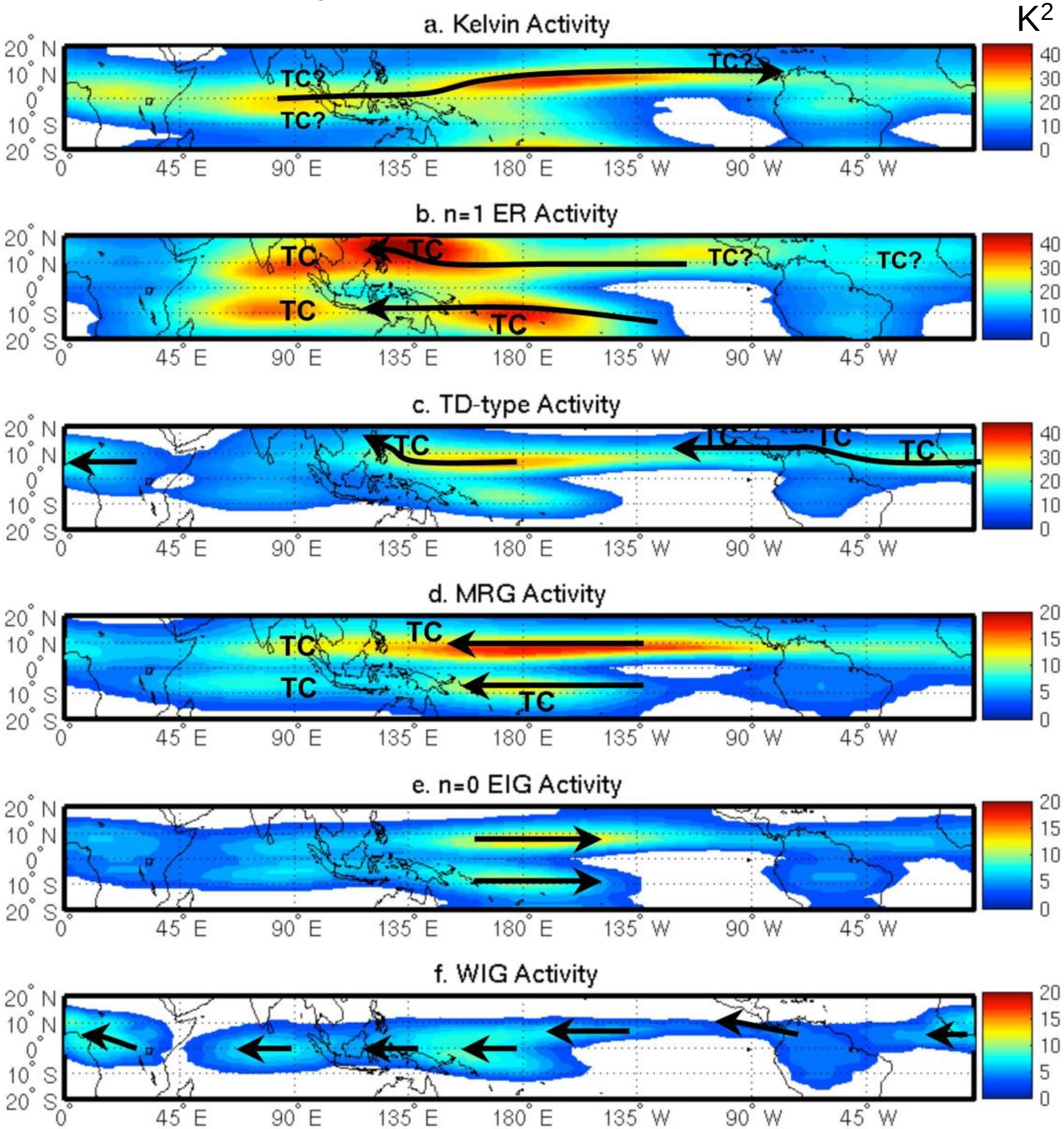
April MJO/Kelvin wave event appears instrumental in the shift to westerly anomalies across the Pacific, and subsequent basin-wide rise in SSTs.



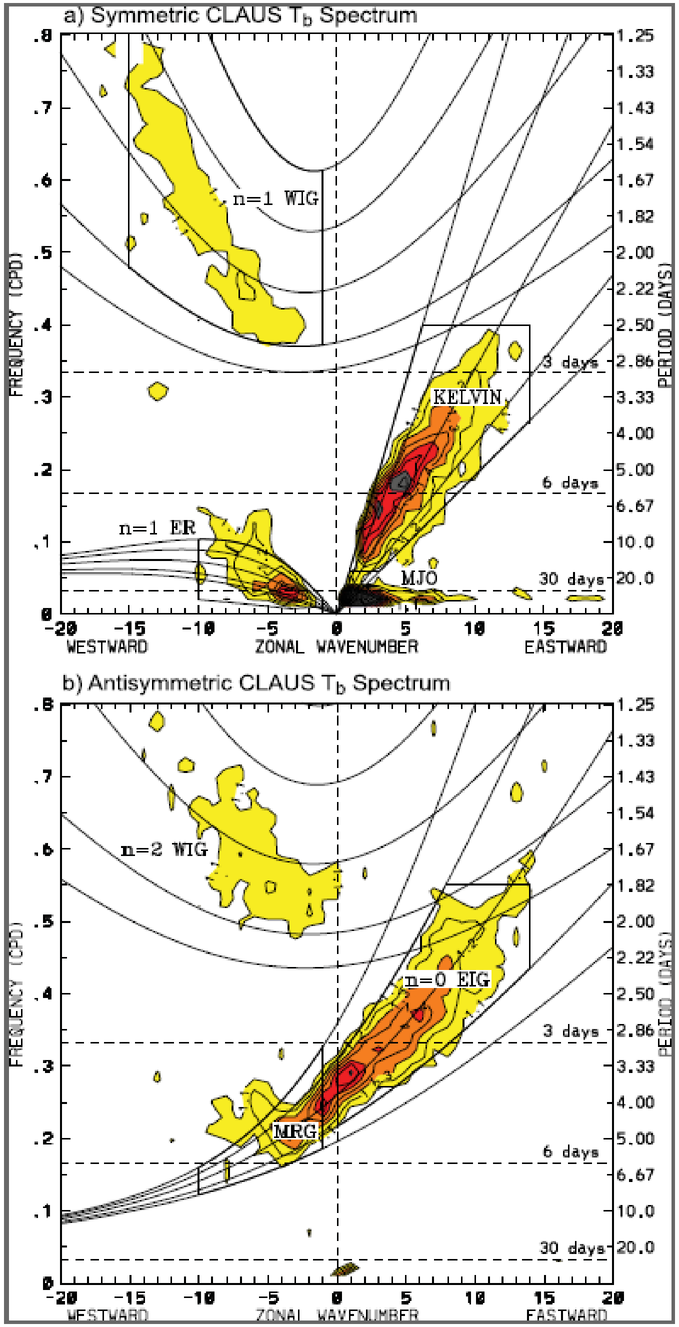


3. CCEWs

Long-term T_b variance maps from Kiladis et al. (2009)



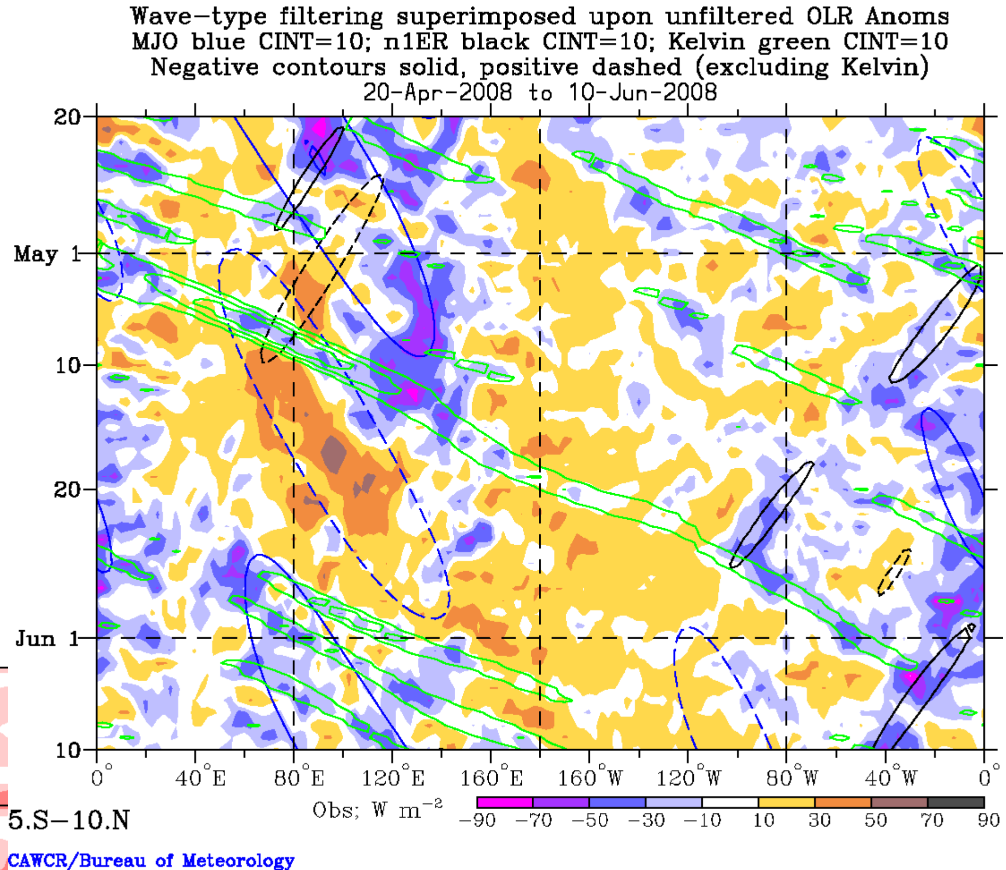
Wave filtering regions

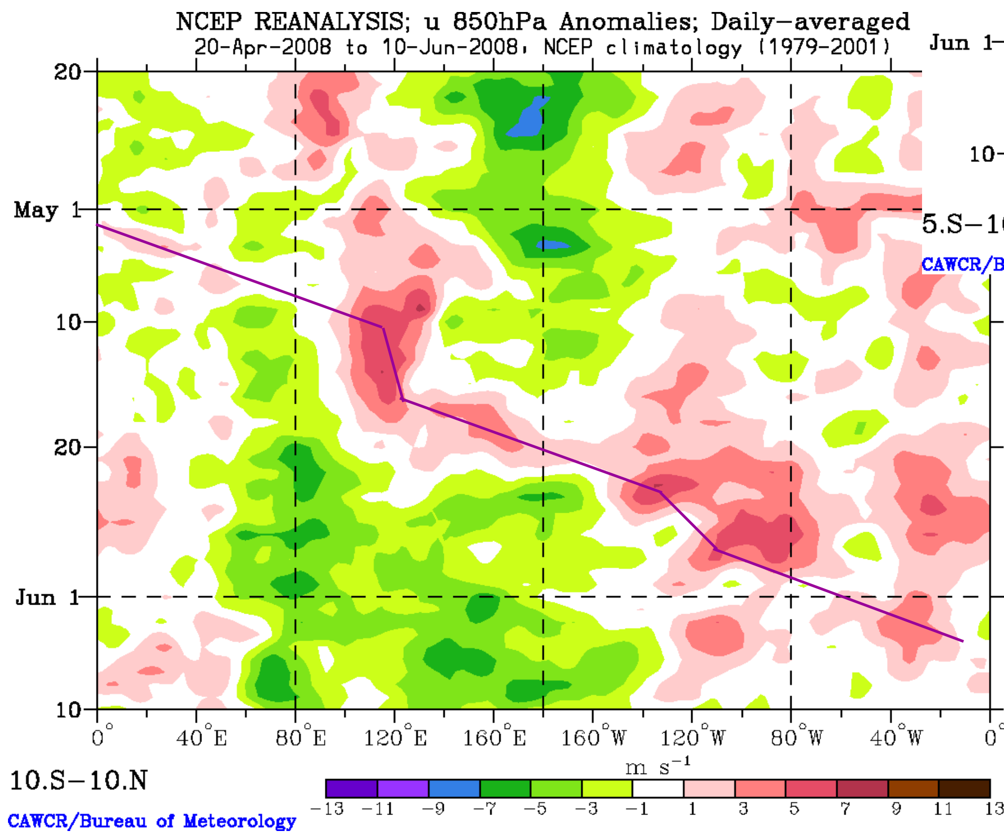


(1) May 2008 Kelvin wave

There have been numerous cases of C-C Kelvin waves during YOTC. This is just one example.

It is notable because its associated westerly wind anomalies over the Pacific brought a temporary easing of the 2007/08 La Nina cool Pacific SSTs.





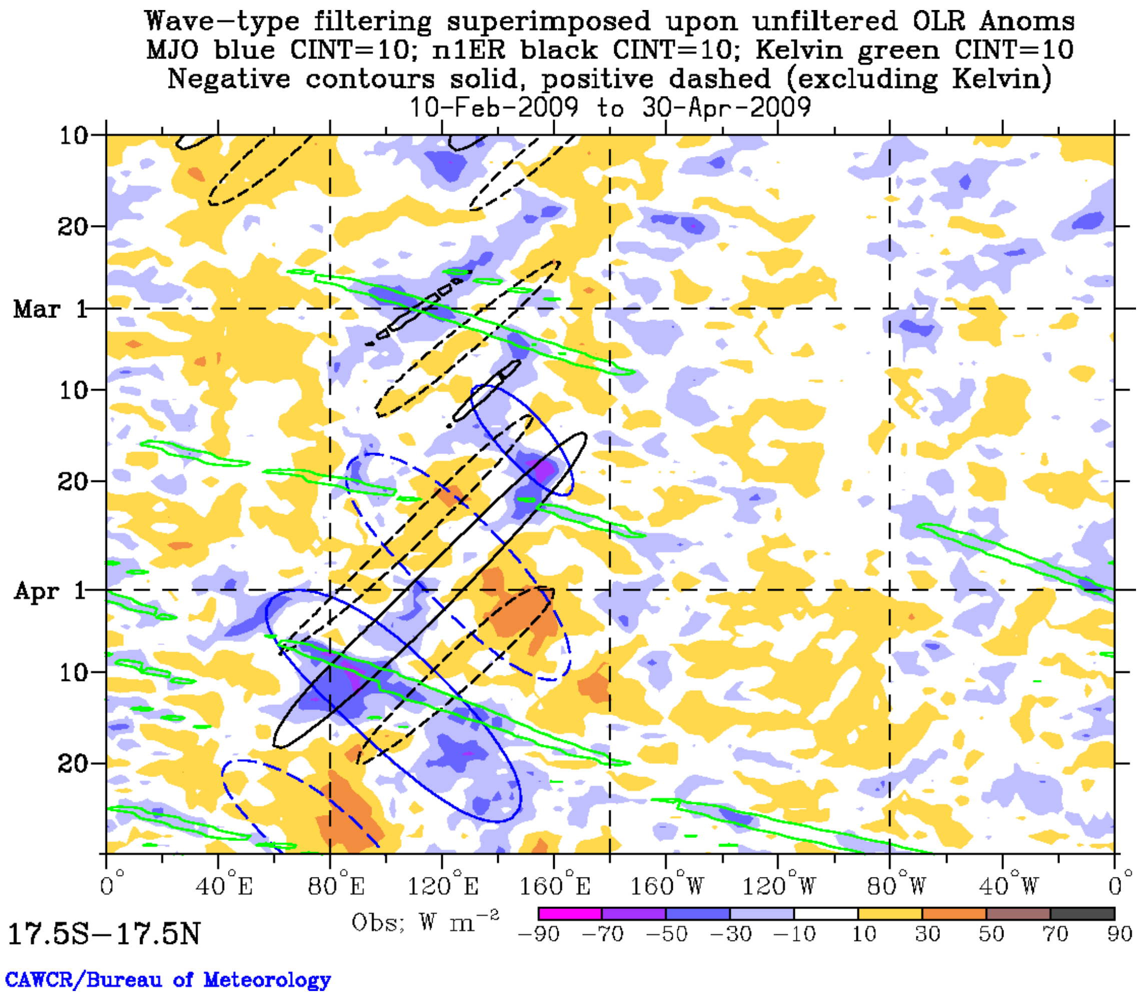
(2) The multiple interacting waves of March-April 2009

Co-existence of MJO, C-C Kelvin waves, and C-C Equatorial Rossby (ER) waves.

ER wave convection was mostly maximized off the equator (in both hemispheres), whereas Kelvin wave convection is maximized close to the equator.

Sometimes, (e.g. 1st March near 110°E), the interaction appears remarkably linear.

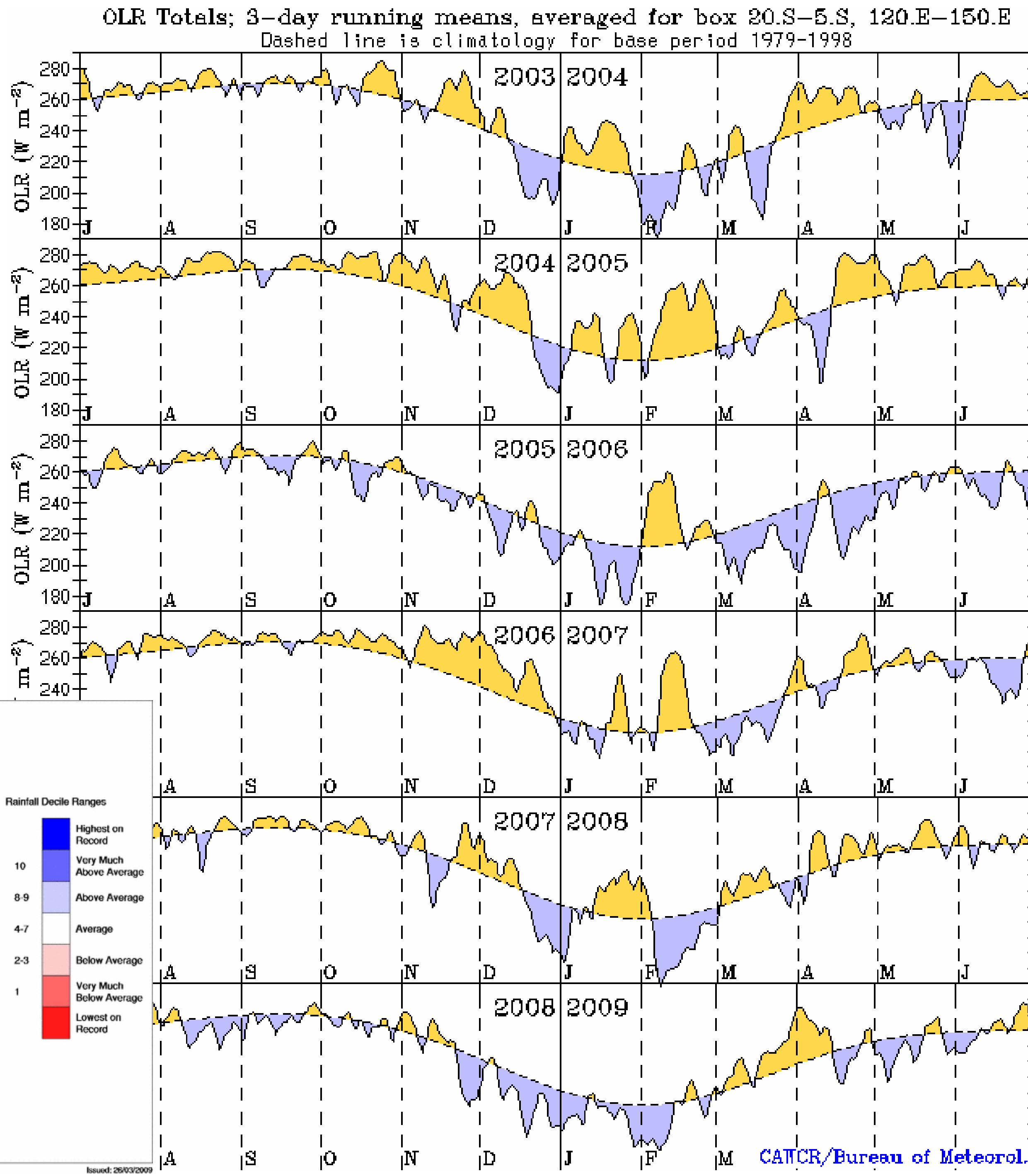
Can a model reproduce this linear interaction?

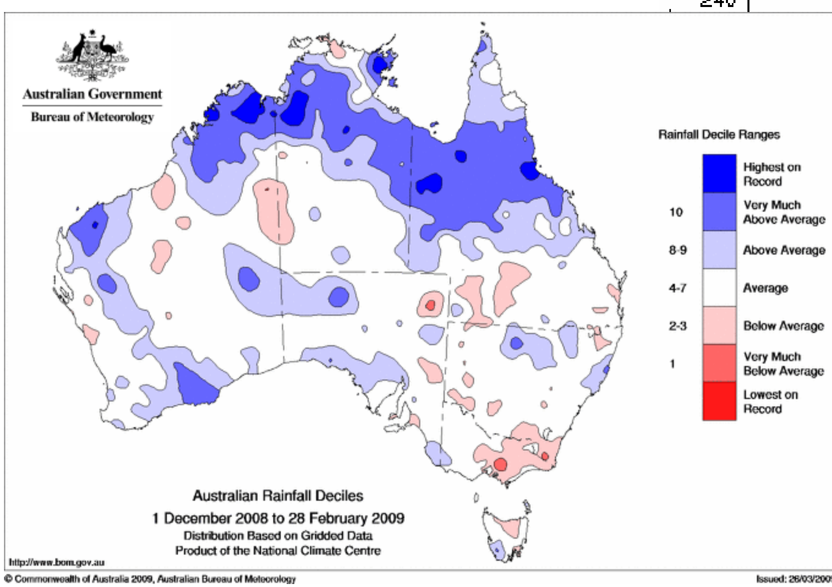


4. Australian monsoon

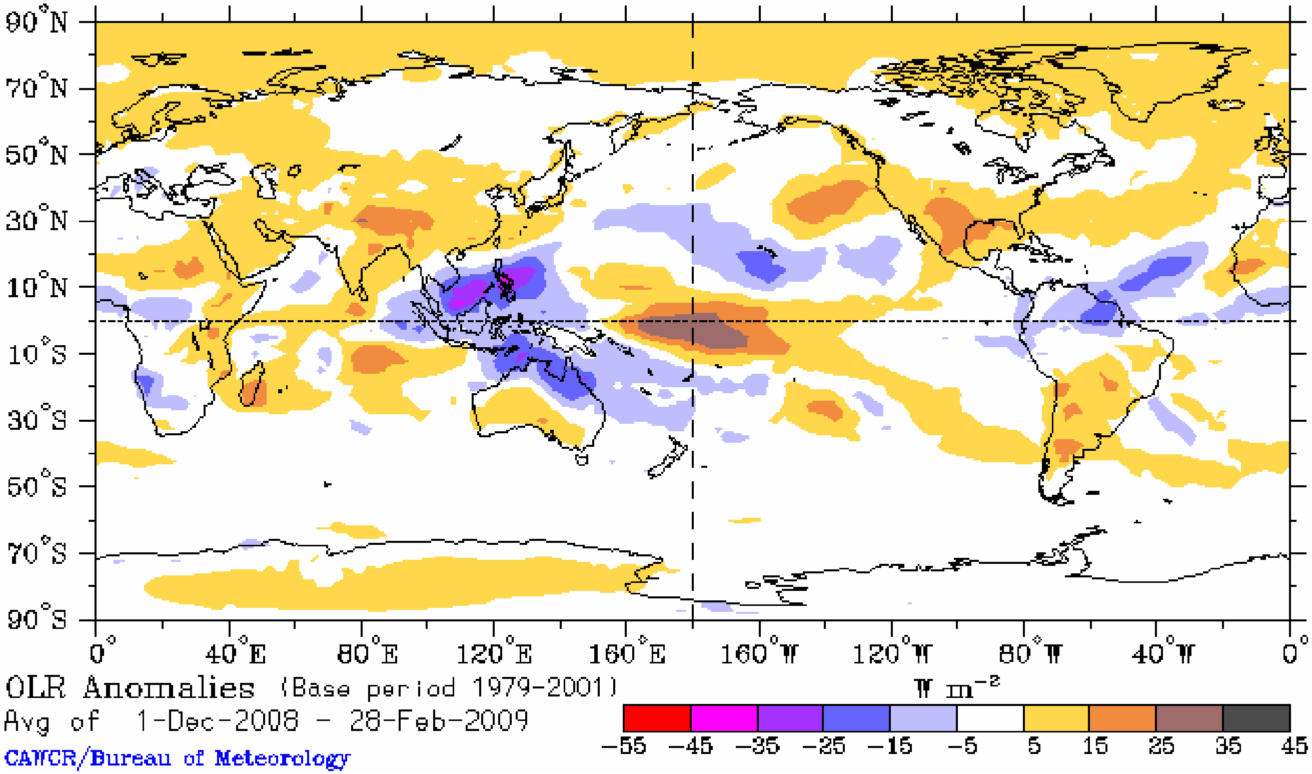
2008/09 was wetter than normal, and suffered much less intraseasonal variability than other years (e.g. 2007/08).

Most of monsoonal Australia was in the highest decile.





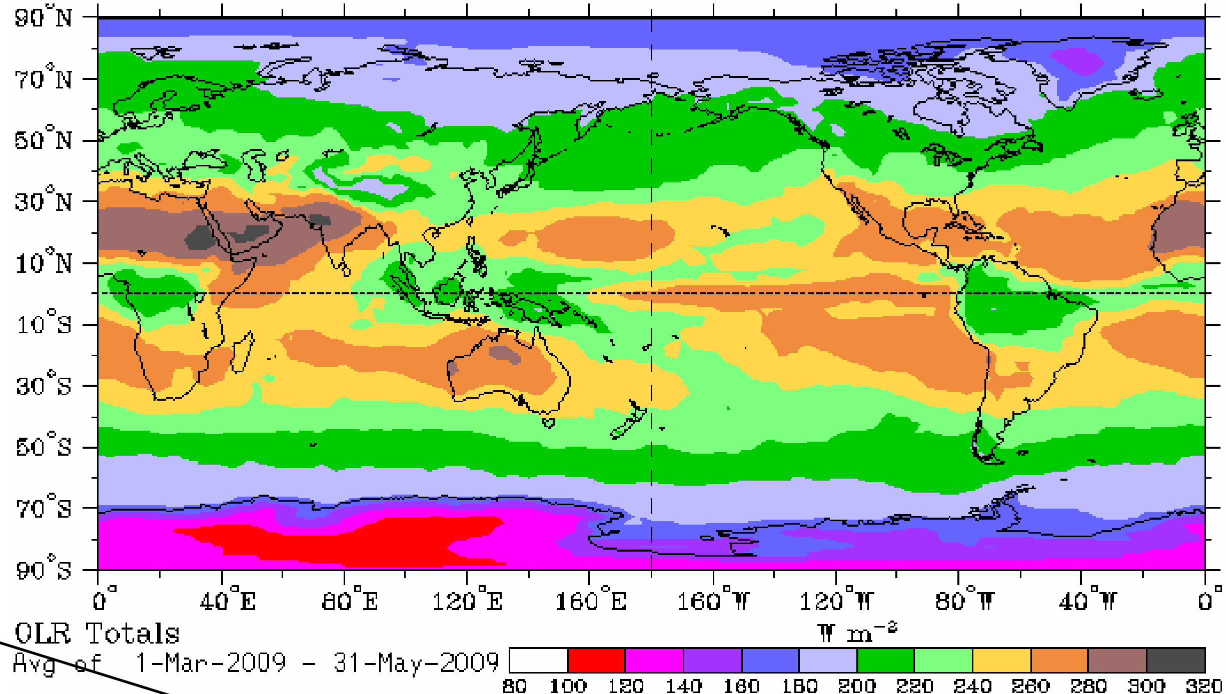
This enhanced Australian monsoon rainfall was consistent with the wider weak-La Nina-like pattern.

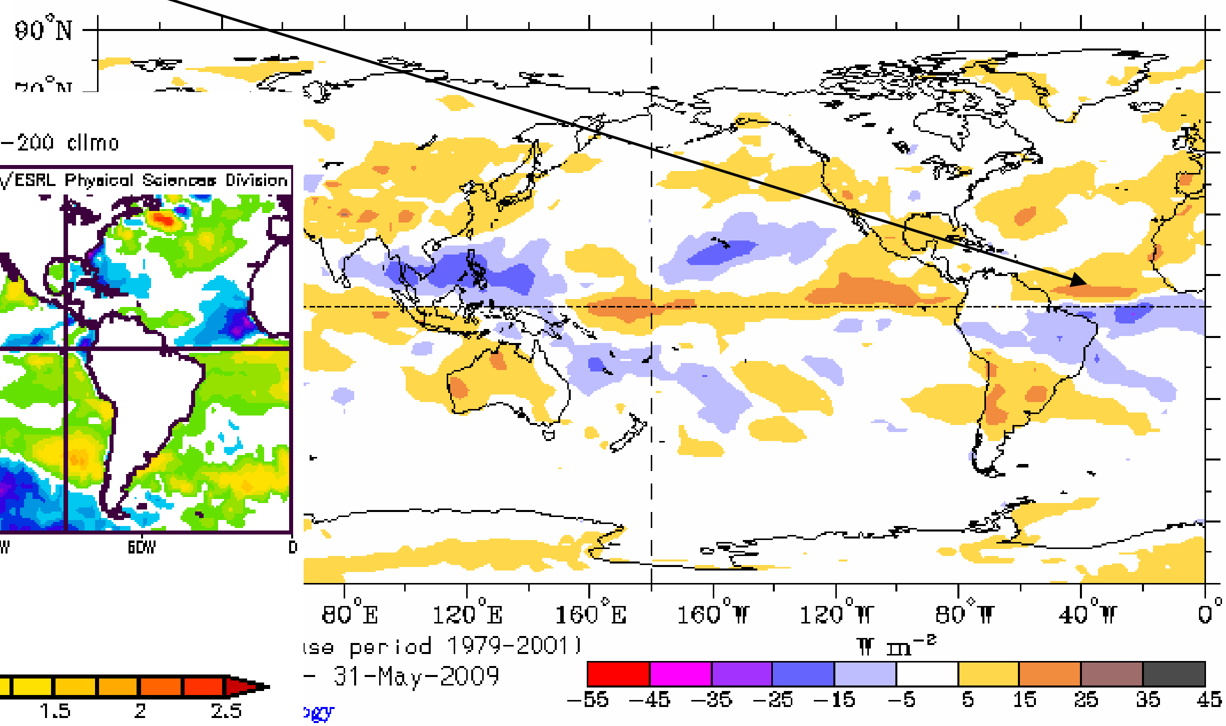


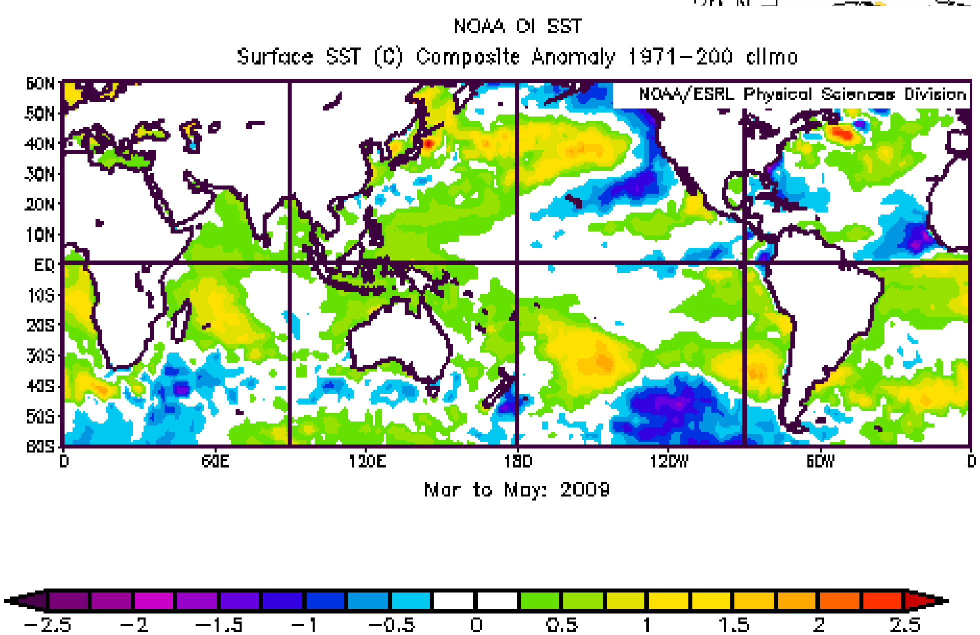
5. Other features in tropical convection during YOTC

"Atlantic Dipole" during MAM 2009

Air France disaster ~31st May







6. Suggested periods of interest?

MJO case periods:

1. May-Jun 2008 (impacts in Asia and the Americas)
2. Jan-Feb 2009 (only real event of SH summer + other waves)
3. ~April 2009 (strongest event so far and Pacific warming)

CCEWs:

1. May 2008 Kelvin wave (overlaps 1st MJO case above)
2. The multiple interacting waves of March-April 2009

Other:

1. March-May 2009 Atlantic Dipole (requires coupled model)