MJO Discussion

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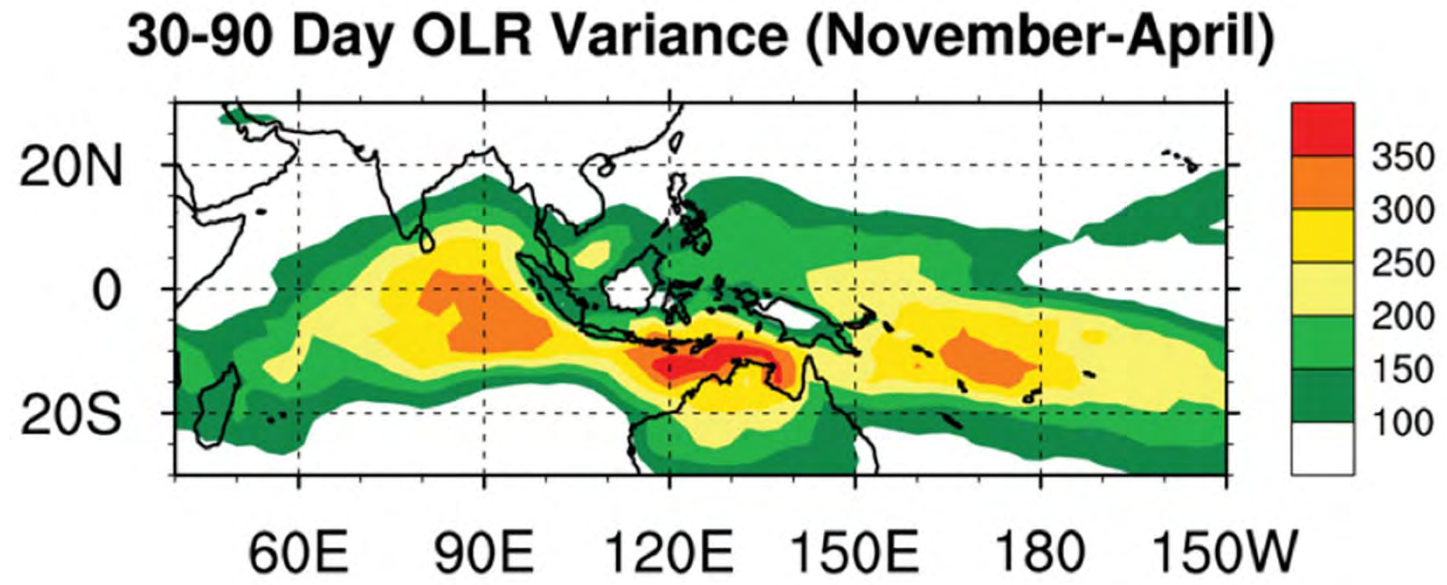
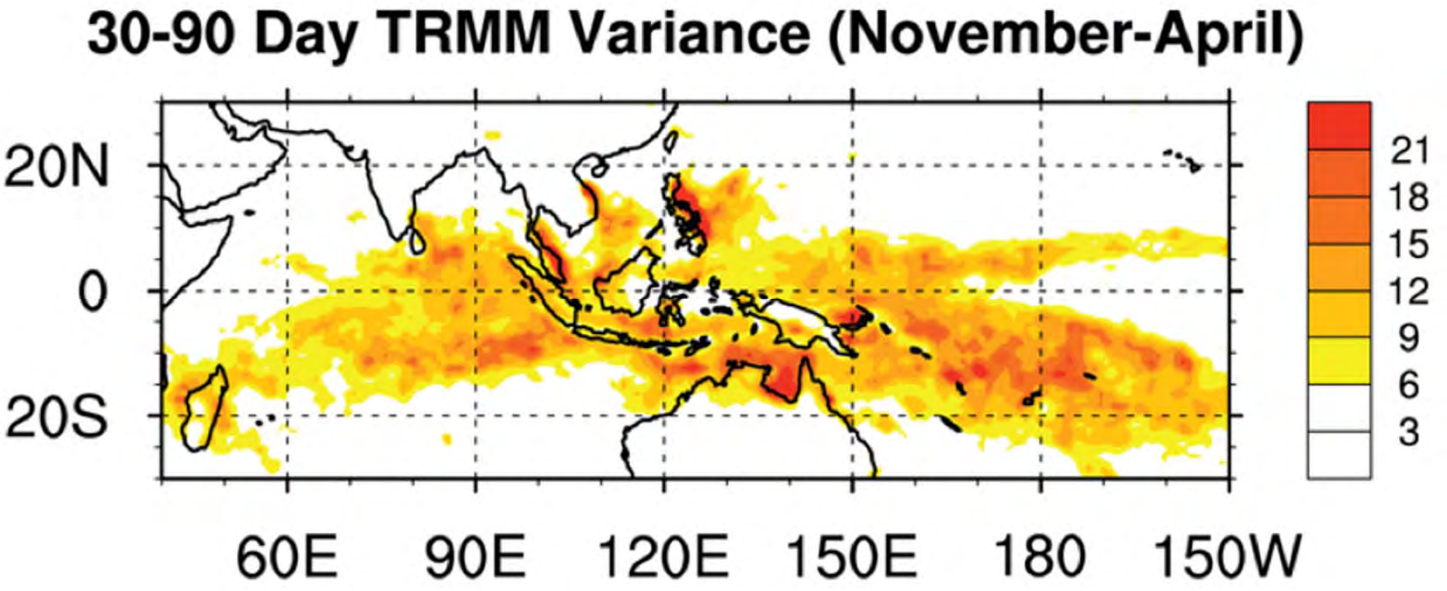
Thanks: Matthew Wheeler, Adrian Matthews, WGNE MJOTF

Intraseasonal OLR and Precipitation Variance





Sobel et al. (2010)

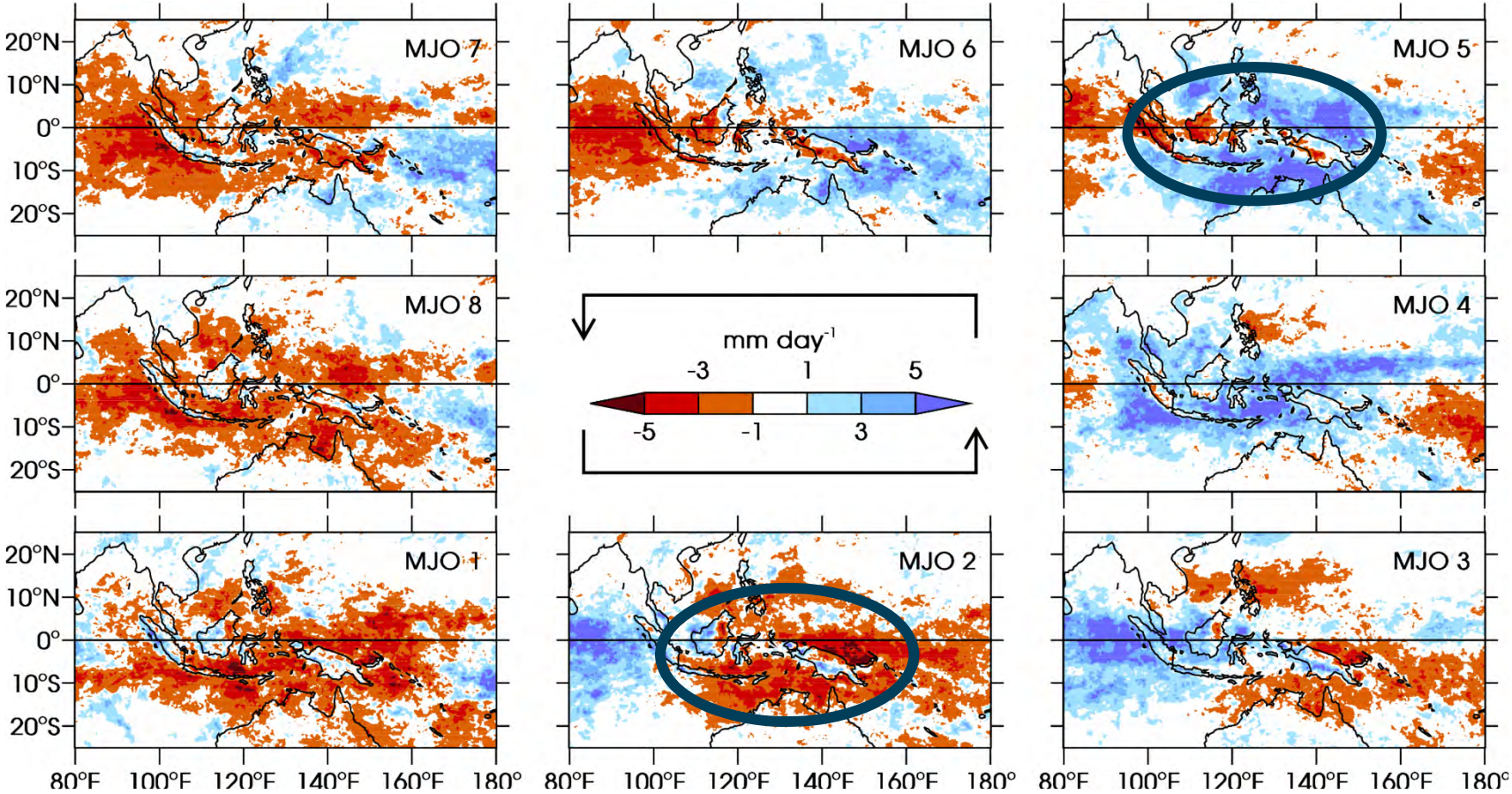
MJO cycle

Anomaly of daily mean TRMM precipitation

Peatman et al. (2013)

Courtesy of Adrian Matthews

- Vanguard of precipitation over maritime continent
- Precipitation anomaly has opposite sign over islands and surrounding sea



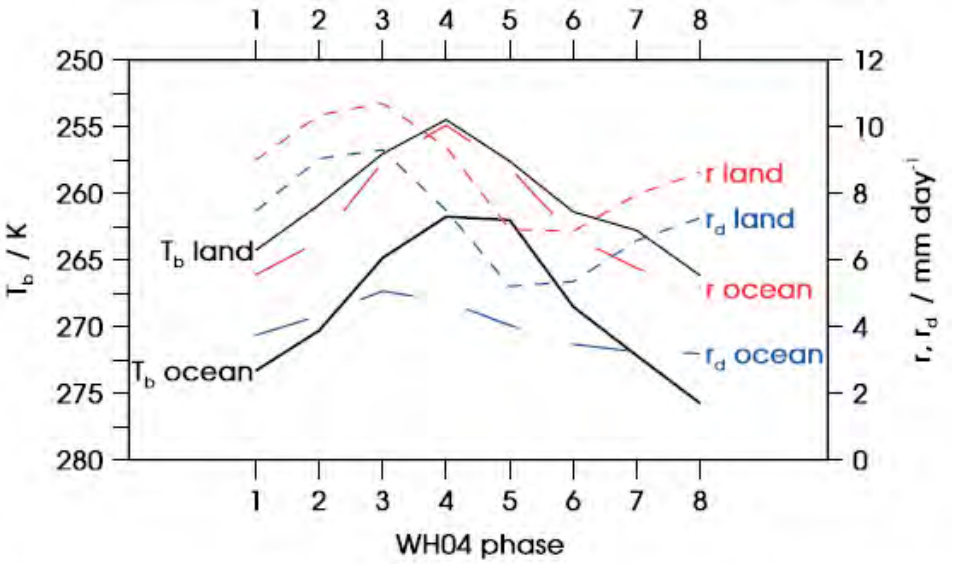


Figure 10. Means of $\overline{T}_b$ (from TRMM 3G01), $\overline{r}$ and r_d (both from TRMM 3B42HQ), all averaged separately over land and ocean, for the region 7°S–10°N, 100–120°E (most of Sumatra and Borneo), plotted against WH04 phase. Note that the brightness temperature axis is inverted. The GLOBE dataset (Figure 1) was used as the land mask. Solid black lines show $\overline{T}_b$ (bold for ocean, thin for land); dashed lines show $\overline{r}$ and r_d (long-dashed for ocean, short-dashed for land). This figure is available in colour online at wileyonlinelibrary.com/journal/qj

A good summary figure.

Ocean precip lags land precip by about 1-2 phases, and the OLR (Tb) signal is lagging even further.

So it is better to consider multiple MJO phases rather than simply "active" versus "suppressed" MJO.

Peatman et al. (2013)

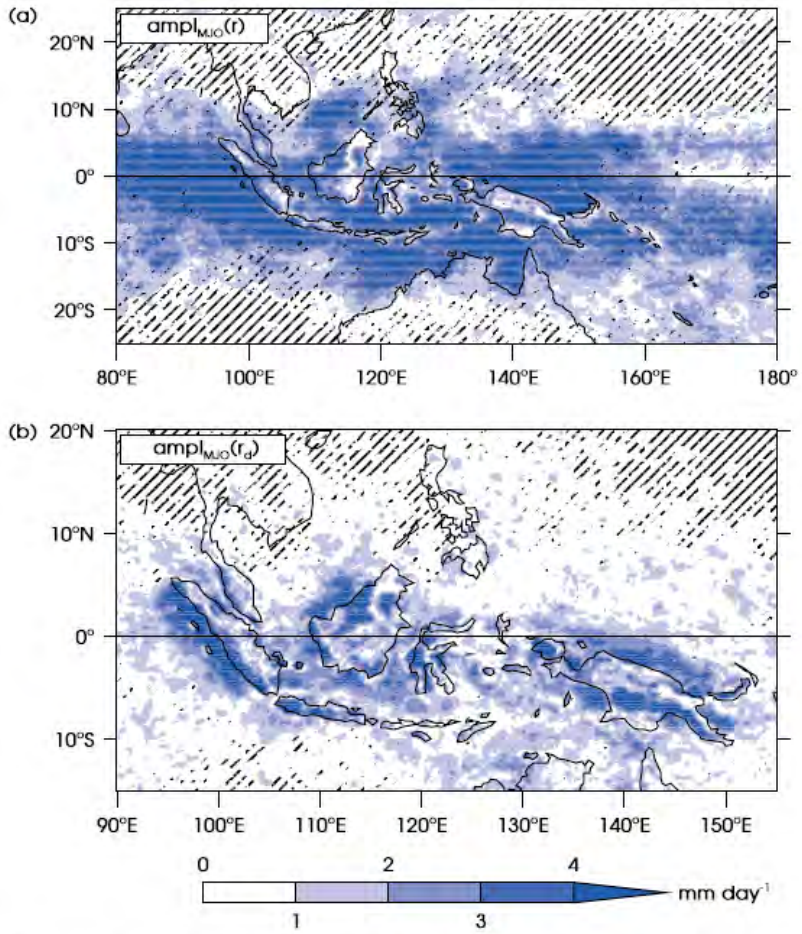
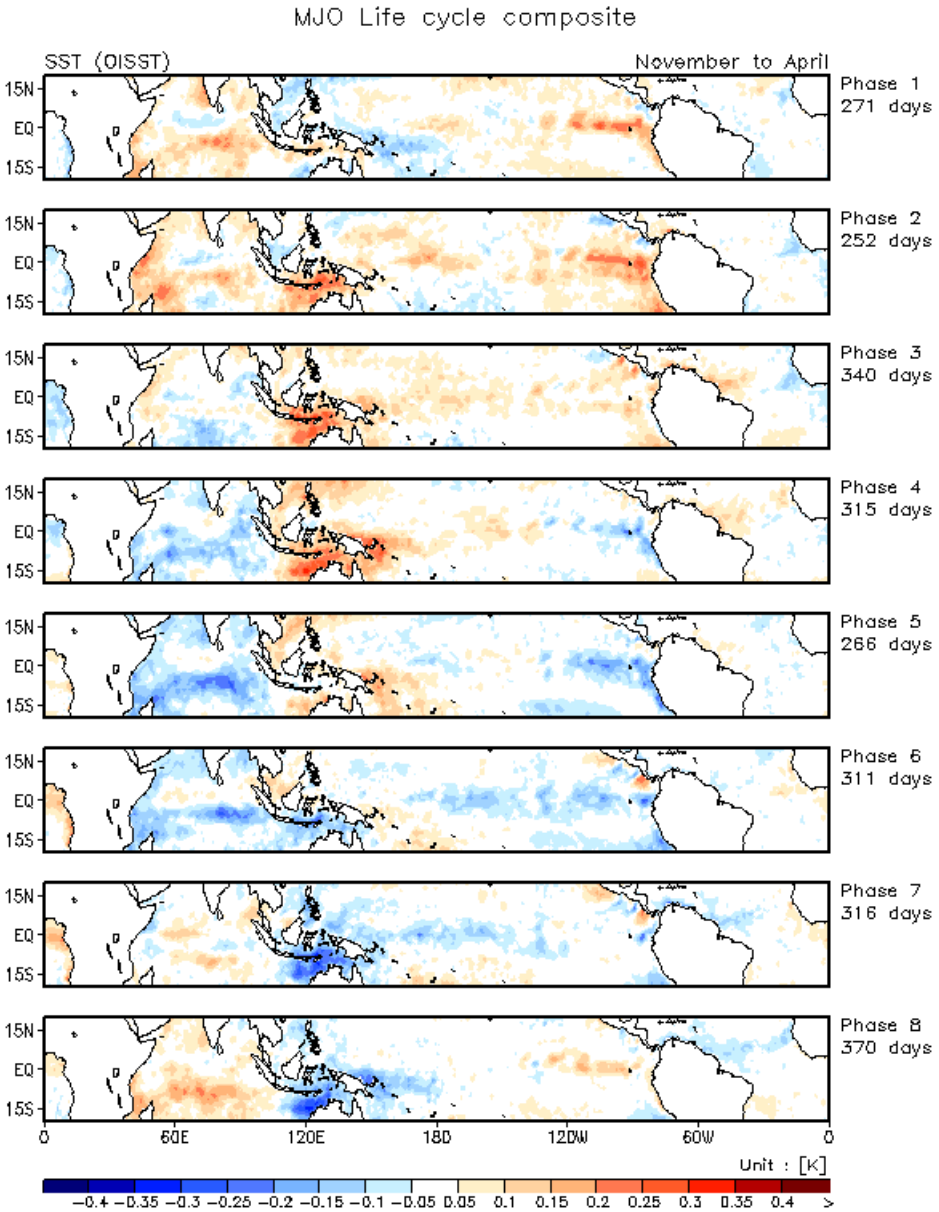


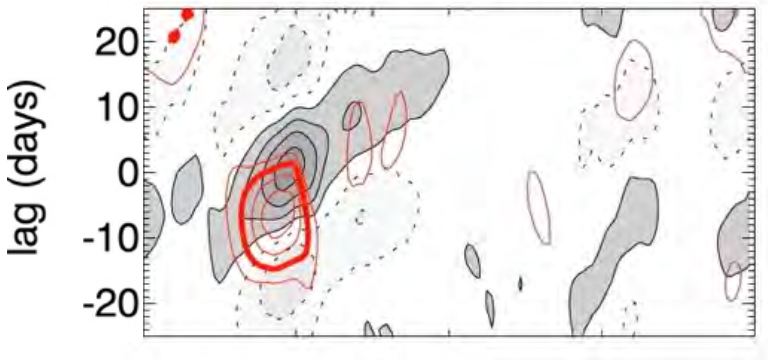
Figure 12. Amplitude of the 'MJO harmonic' (section 4.2) of: (a) daily mean precipitation $\overline{r}$ and (b) diurnal amplitude of precipitation r_d (both from TRMM 3B42HQ). Black hatching is used as in Figure 11. This figure is available in colour online at wileyonlinelibrary.com/journal/qj

SST Variability during MJO Events

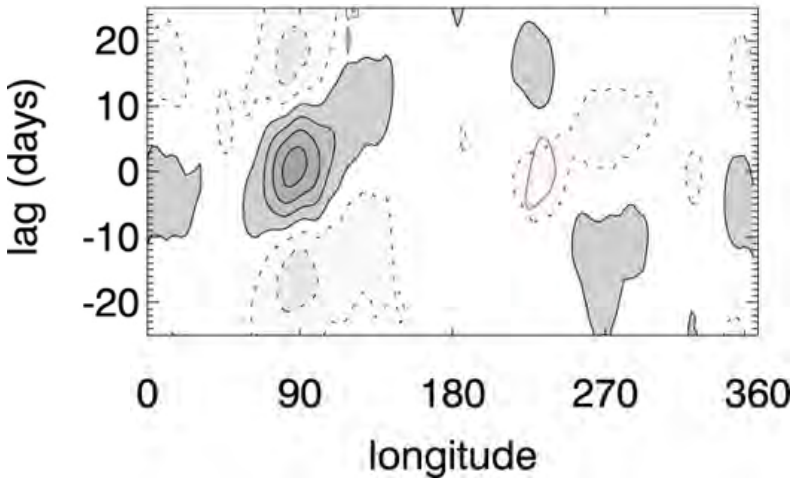


DeMott et al. 2014

Ocean-coupled SP-CAM



Uncoupled SP-CAM



CLIVAR MJO Working Group

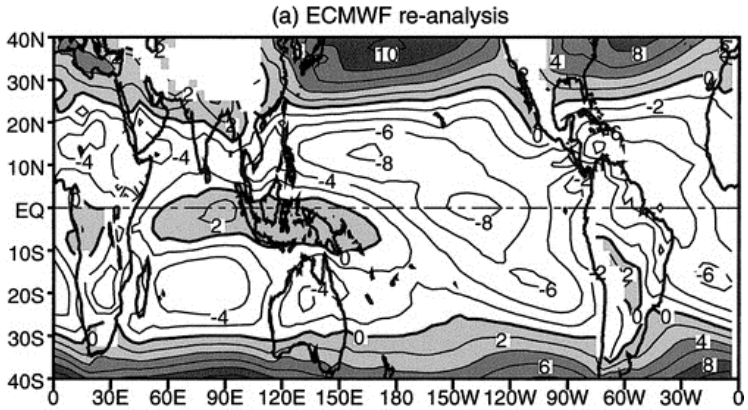
Mean State Bias and the MJO

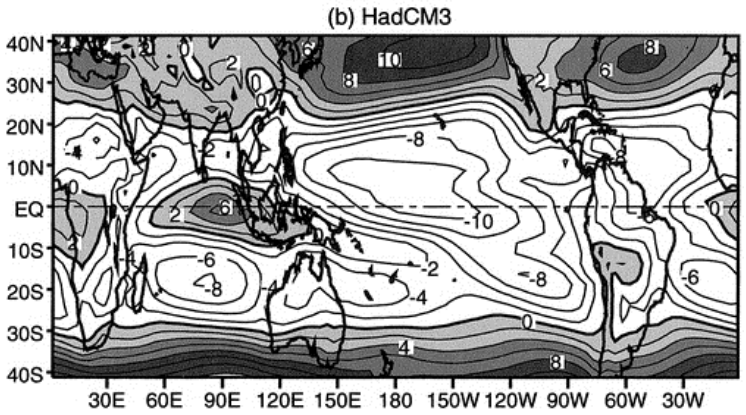
Inness et al. (2003)

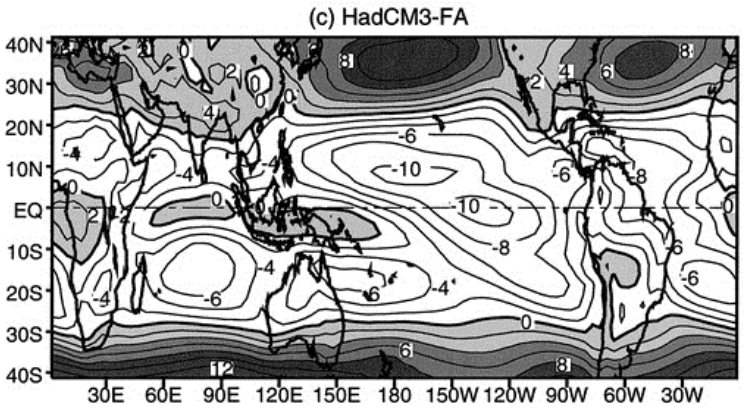
"Obs"

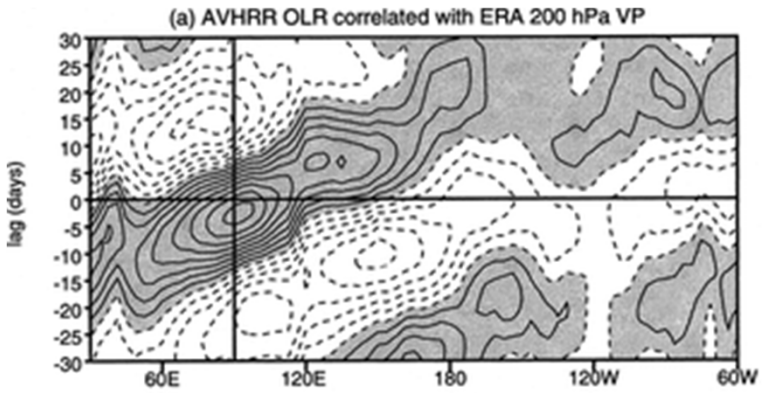
Control

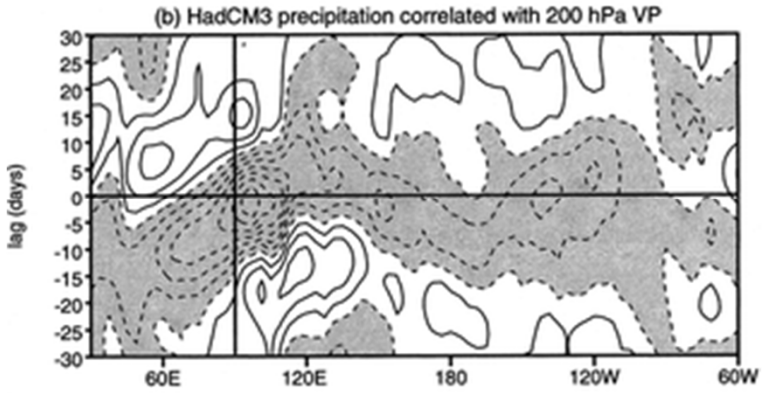
Flux Corrected

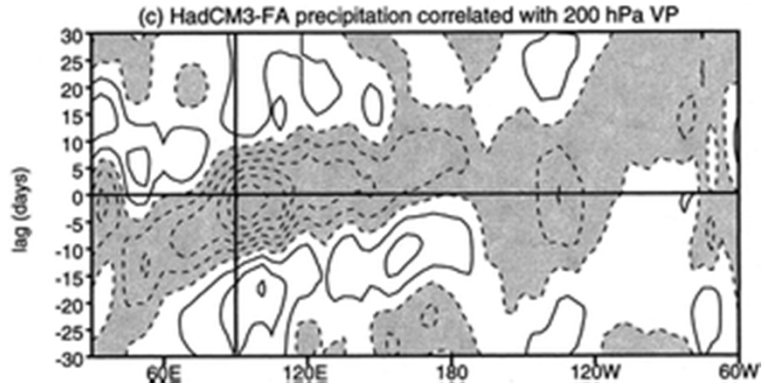












Key Science Questions for the MJO

- What processes determine the strength, propagation speed, and rainfall distribution of the MJO over the MC? Specifically, what are the roles of the diurnal cycle, surface-atmosphere interaction, land-sea distribution, and topographically modified flow in the MC effects on the MJO?
- To what extent is the evolution of the cloud population over the MC different from that over the open oceans and to what extent do such differences cultivates the unique behavior of the MJO over the MC?
- How are the incorrect diurnal cycle, the lack of MJO signals, and biases in mean precipitation and winds over the MC in global climate models related? How does the ability to predict and simulate MJO propagation across the MC depend on model mean state bias?
- How is MJO forecast skill affected by reproductions of the MC processes mentioned above in operation systems?

Key Questions from MJO Task Force- S2S Collaboration

- What is the current skill of operation systems at predicting the passage of precipitating/active phases of the MJO into and across the MC, including aspects such as reliability?
- What processes determine whether individual MJOs propagate through the Maritime Continent?
- How is the simulated propagation of the MJO through the Maritime Continent related to biases in models?
- How does the partitioning of variability from diurnal to seasonal, including equatorial wave characteristics, influence the MJO and MC interaction?
- Does the above partitioning depend on model resolution, and is accordingly affected by the use of explicitly resolved convection versus parameterized convection?
- How does the ocean-atmosphere coupling in the context of the MC influence the MJO and MC interaction?
- How does topography versus land-sea contrast play a role in the MJO and MC interaction?
- How do land-atmosphere interactions (temperature, soil moisture, diurnal cycle) influence the MJO and MC interaction?
- How is forecast skill associated with the MJO over the MC influenced by the above science elements?

Discussion

- What questions/issues are missing?
  - Missing land-atmosphere interactions
  - Model resolution
  - Parameterized vs. non-parameterized
  - Assessment of forecast skill
  - Connection of research questions to observations
  - A bit more development of physical hypotheses

- Comments on MJO discussion in science draft?

  Organizational issues:

  –Too pervasive and diffuse?

  –Too much repetition

MJO Points Hit

- MC as propagation barrier
- Global hazards
- Deficiencies in model propagation across MC
- MJO and diurnal cycle
- MJO and MCSs in MC region, and interaction with diurnal cycle
- Model biases in MJO simulation associated with diurnal cycle biases
- Air-sea interaction and the MJO
- Reasons for interruption of MJO by MC (weak IS surface evaporation, topographic blocking, interactions with diurnal cycle, Chikira mechanism)
- Parameterization deficiencies affecting both MJO and diurnal cycle
- Grid resolution and MJO simulation problems, including propagation across MC
- Necessary field measurements and campaign duration

- Coordination with MJOTF and S2S
- Predicting MJO precipitation in the MC region.
- Extended range forecast errors due to poor MJO simulation
- Senstivity tests with hires models.
- MC as an MJO predictability barrier?
- MJO and mean state bias (precip, wind, moisture)
- Possible global modeling expts
- MJO and soil moisutre