Surface fluxes and tropical intraseasonal variability

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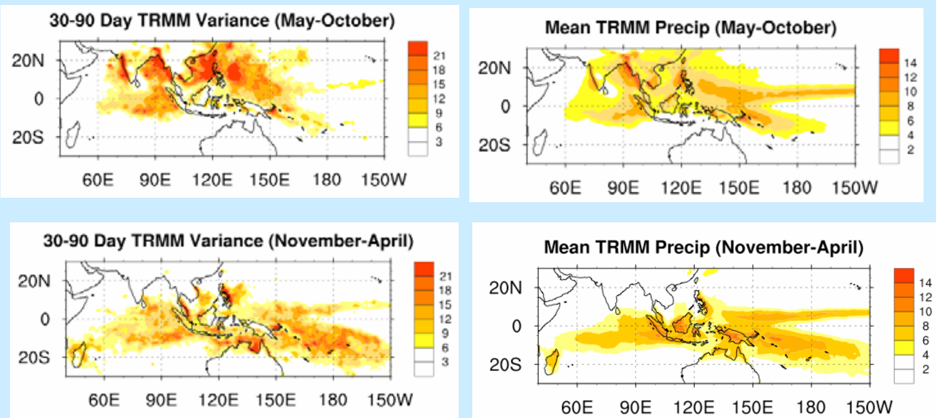

Figure 1: Intraseasonal precipitation variance and climatological Precipitation from the TRMM 3B42 data set

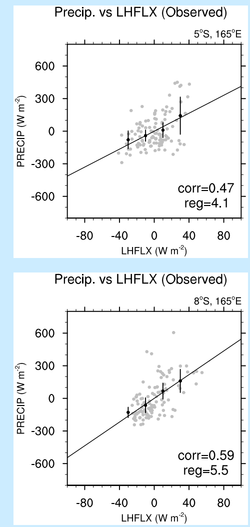

Figure 2: Intraseasonal TRMM precip. vs. TAO buoy latent heat flux at 165E, 5S and 165E, 8S during boreal winter.

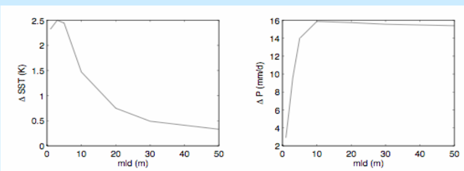

Figure 3: Amplitude of SST (left) and precipitation (right) in the idealized single-column model of SG03 forced by oscillating intraseasonal surface wind speed (MS04)

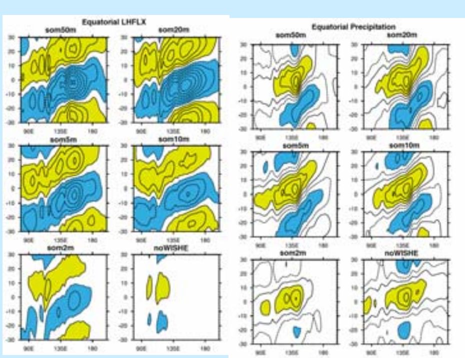

Figure 4: Time-longitude plots of Latent heat flux (left) and precipitation (right) for AGCM simulations coupled to an ocean mixed layer, with varying mixed layer depth, as well as a fixed SST simulation with surface wind speed set to climatology (MS04). These results show that WISHE plays an important role in the MJO dynamics in this model.

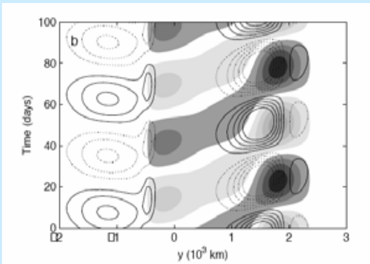

Figure 5: Time-latitude plot of precipitation (shading) and latent heat flux (contours) in an idealized axisymmetric model of northward-propagating intraseasonal variations of The Asian monsoon (BS07). In this model, WISHE is crucial to the disturbances.

The Argument:

- Intraseasonal precipitation variance is maximum over ocean, minimum over land, in both seasons and hemispheres.
- This is true even where mean precip maximizes over land (e.g., Indonesian islands in Nov-Apr).
- This is consistent with models in which interactive variations in surface energy flux are important to the dynamics of intraseasonal variability, as such variations cannot have significant magnitude over land.
- Such models, of varying levels of complexity, exist for both the northern and southern hemisphere intraseasonal variability.
- The net energy flux variations can be either in the turbulent fluxes, as in WISHE, or in radiative fluxes.
- The hypothesis that surface fluxes are important to intraseasonal variability can be tested in GCMs. It would be useful to do this in more models.
- To the extent we can use models and observations to assess the role of surface fluxes, we can narrow the field of acceptable theories for intraseasonal variability.
- If WISHE is important to the MJO (as in the GCM simulations of MS04), it must operate in an environment of mean surface westerlies, unlike the original WISHE theories (E87, N87). It is probably nonlinear.

References:

Emanuel 1987: JAS **44**, 2324-2340. (E87)

Neelin, Held, and Cook 1987: JAS **44**, 2341-2348. (N87)

Maloney and Sobel 2004: J. Climate **17**, 4368-4386. (MS04)

Sobel and Gildor 2003: J. Climate **16**, 3978-3992.

Bellon and Sobel 2007: submitted manuscripts, see http://www.columbia.edu/~ahs129/pubs.html