The MJO and Tropical Convection in the CAM and the SP-CAM: A Few More Details

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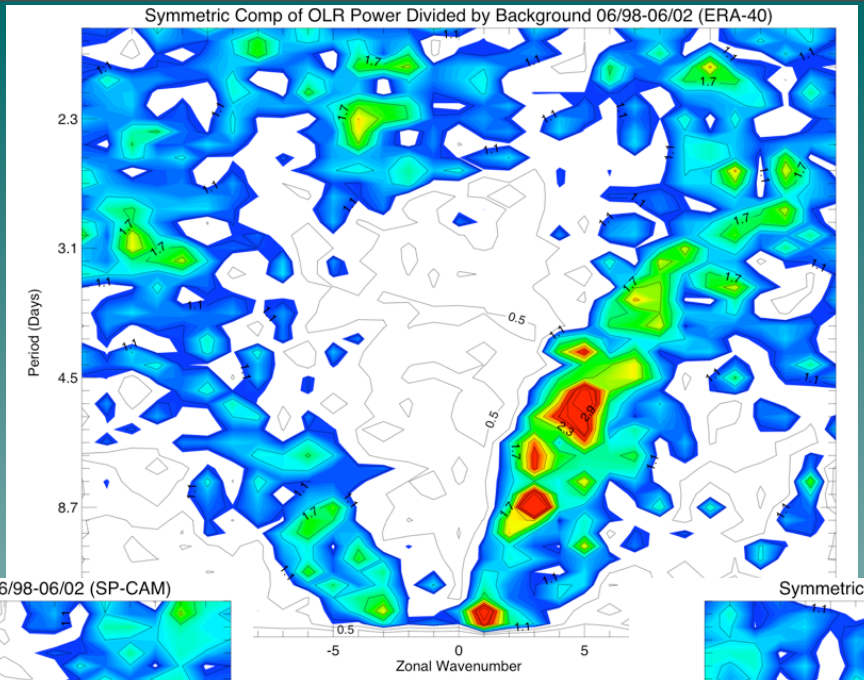
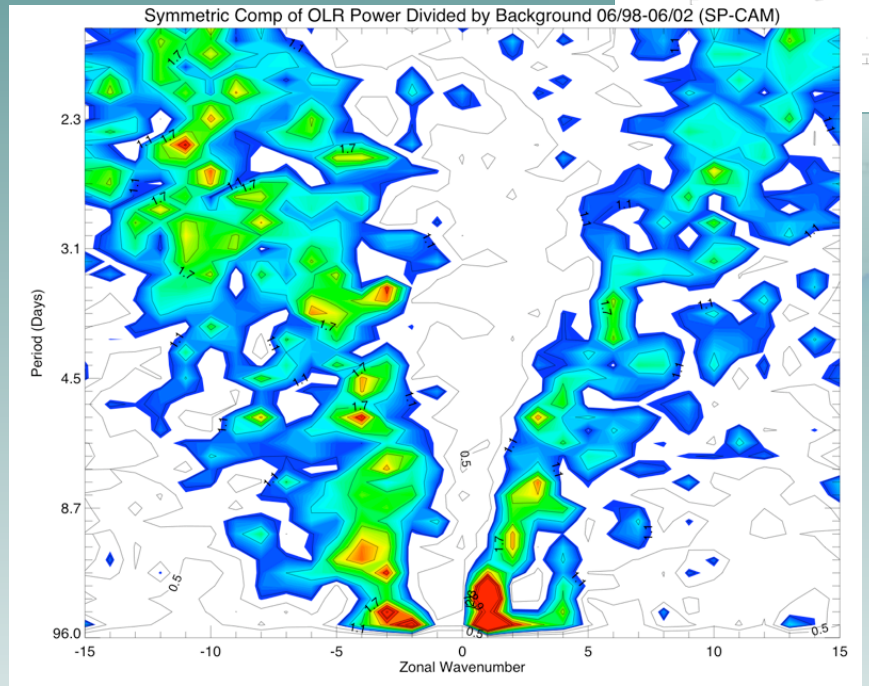
Outline

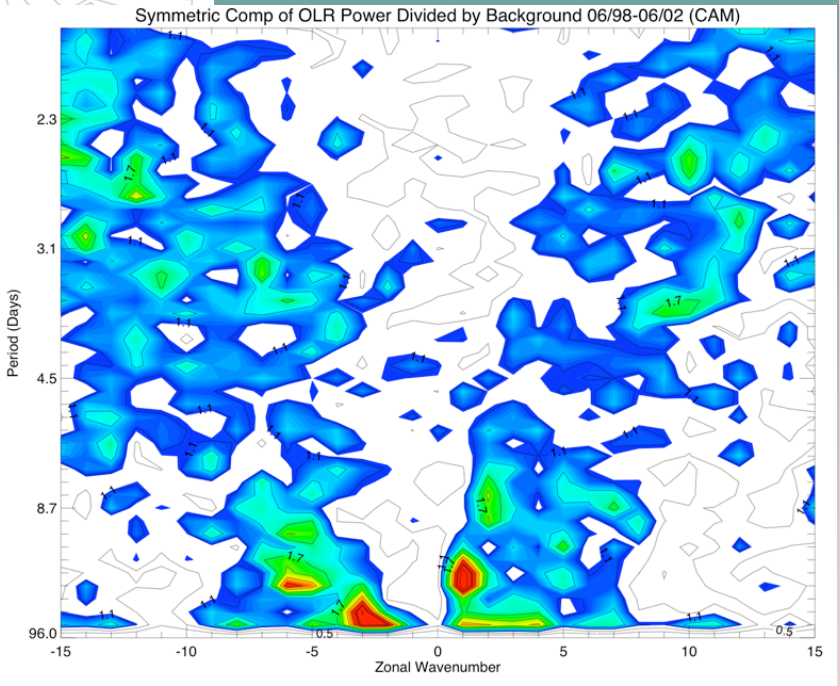
- Overview of my datasets
- Basic differences in CAM and SP-CAM MJOs
- MJO Moisture Profiles in CAM vs SP-CAM
- MJO Heating Profiles in CAM vs SP-CAM

Model Data

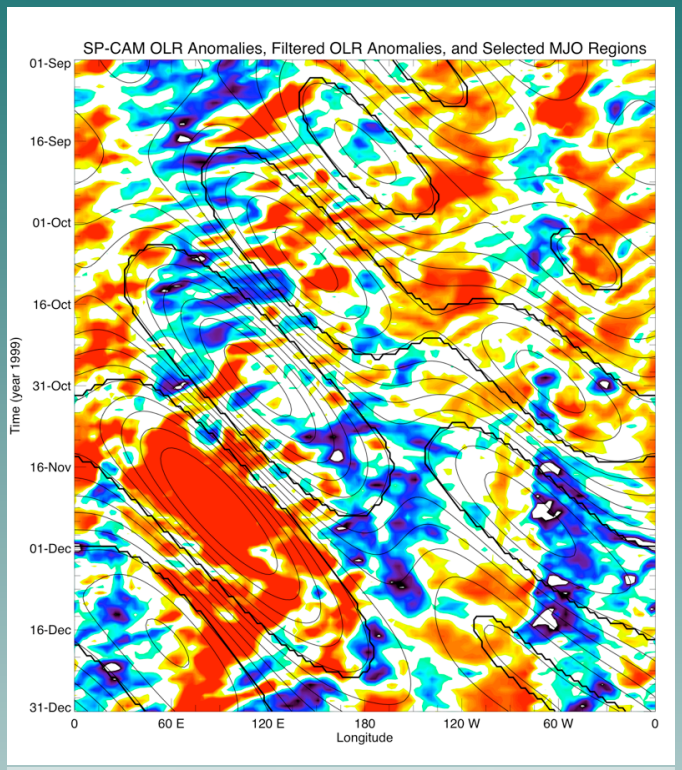
- Both runs were done at Pacific Northwest National Laboratory a little over a year ago.
- 4 years (June 98-May 02) of CAM 3.0 with Zhang & McFarlane (1995) with AMIP-style forcing
  - Finite Volume Dy-Core, 26 Vertical layers, 2° lat x 2.5° long
- 4 years (June 98-May 02) of Super Parameterized CAM (3.0) with AMIP-style forcing
  - Embedded CSRM with 64 columns at 4km spacing, 24 vertical layers aligned East-West

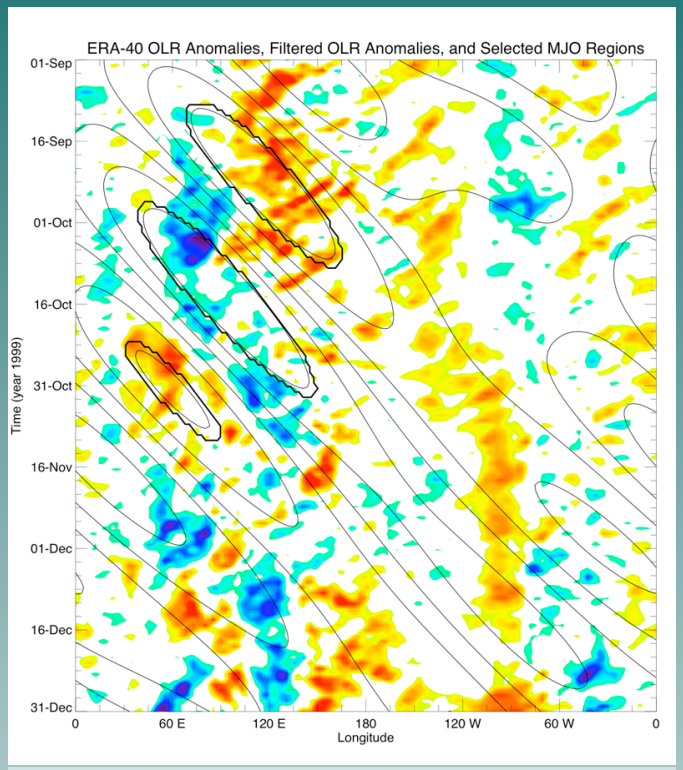


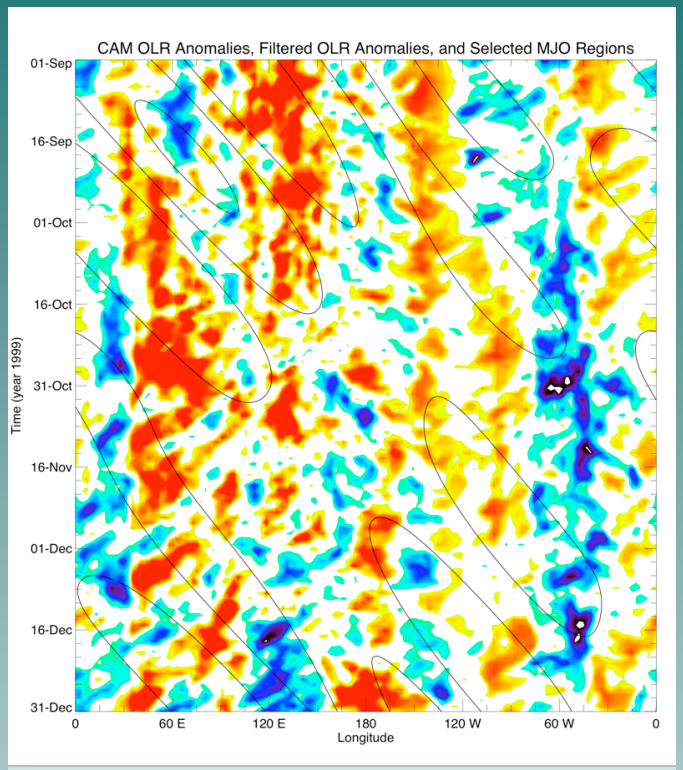




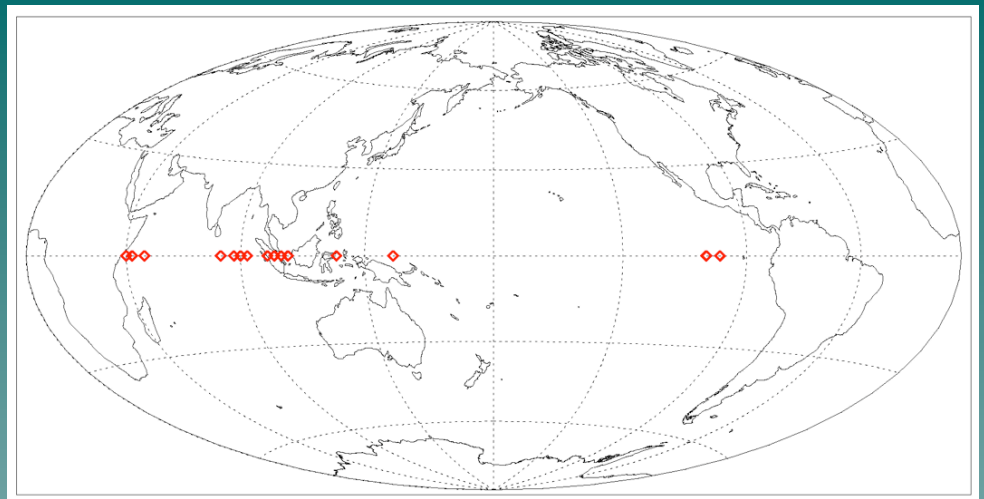
Basic Differences



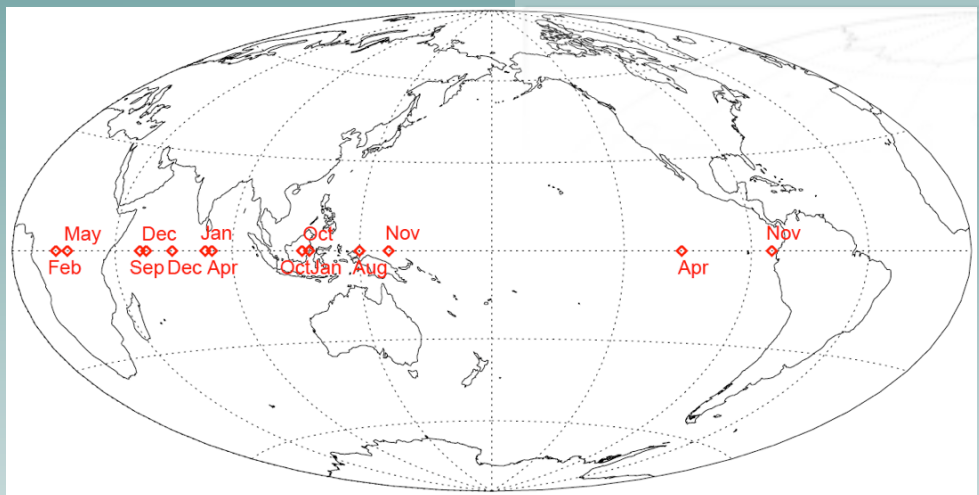




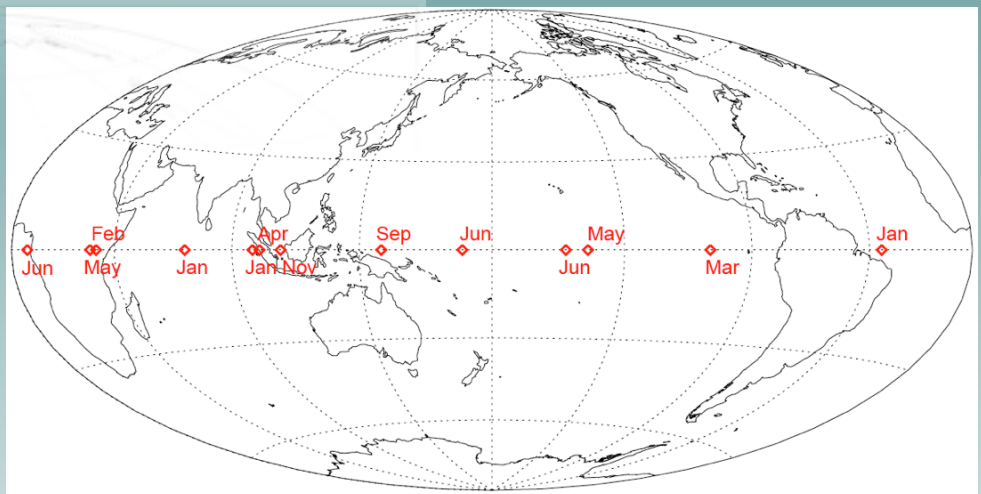
Basic Differences



Locations of Filtered OLR Minima 06/98-06/02 (ERA-40)



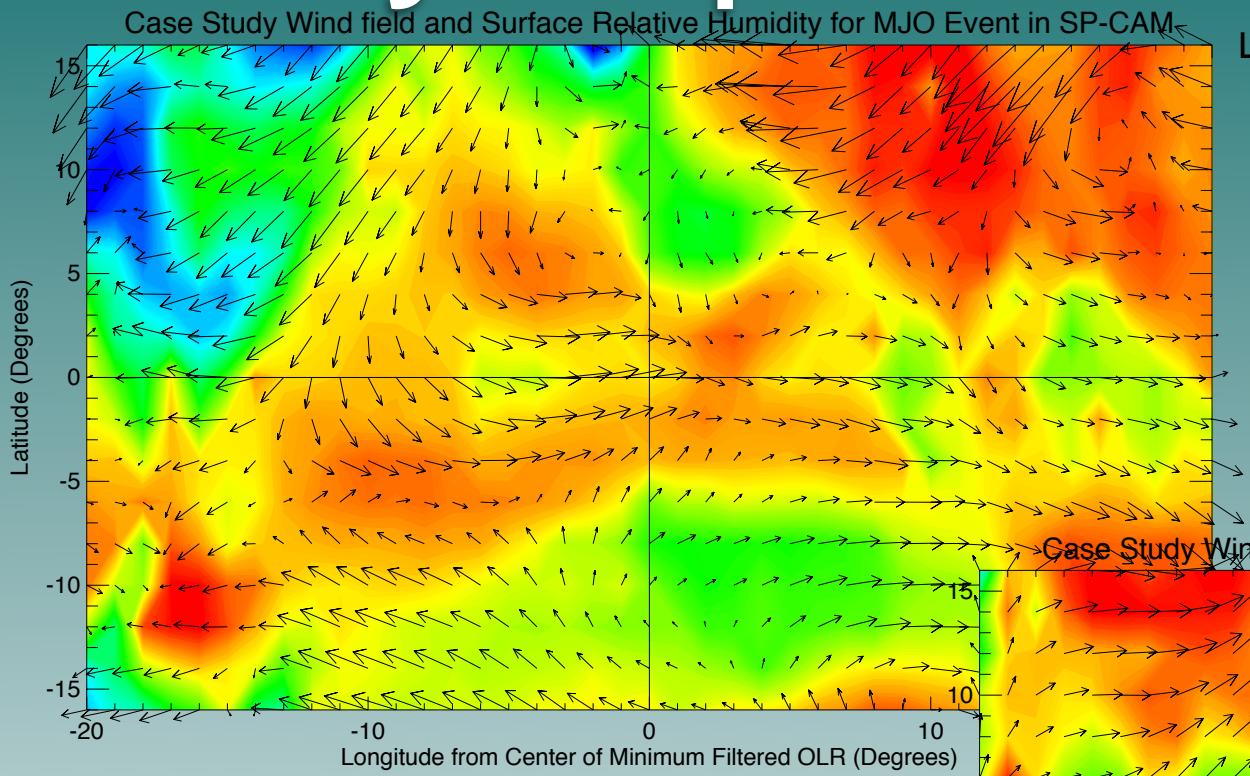
Locations of Filtered OLR Minima from 6/98-6/02 (SP-CAM)

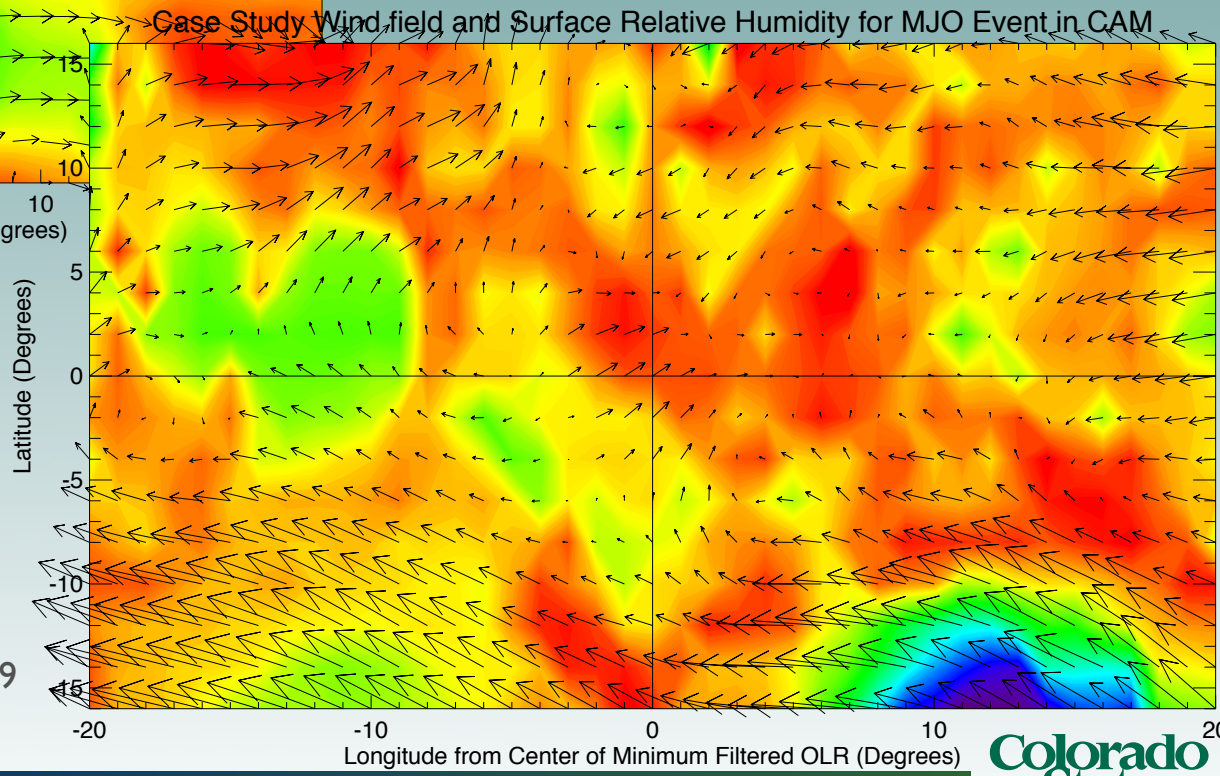


Locations of Filtered OLR Minima from 6/98-6/02 (CAM)

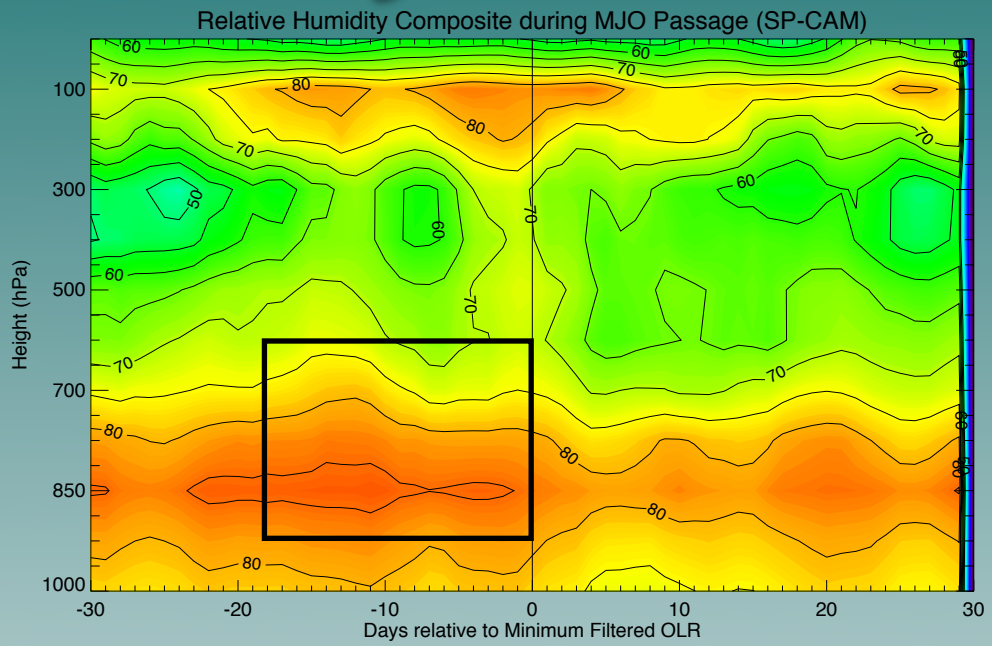
Basic Differences

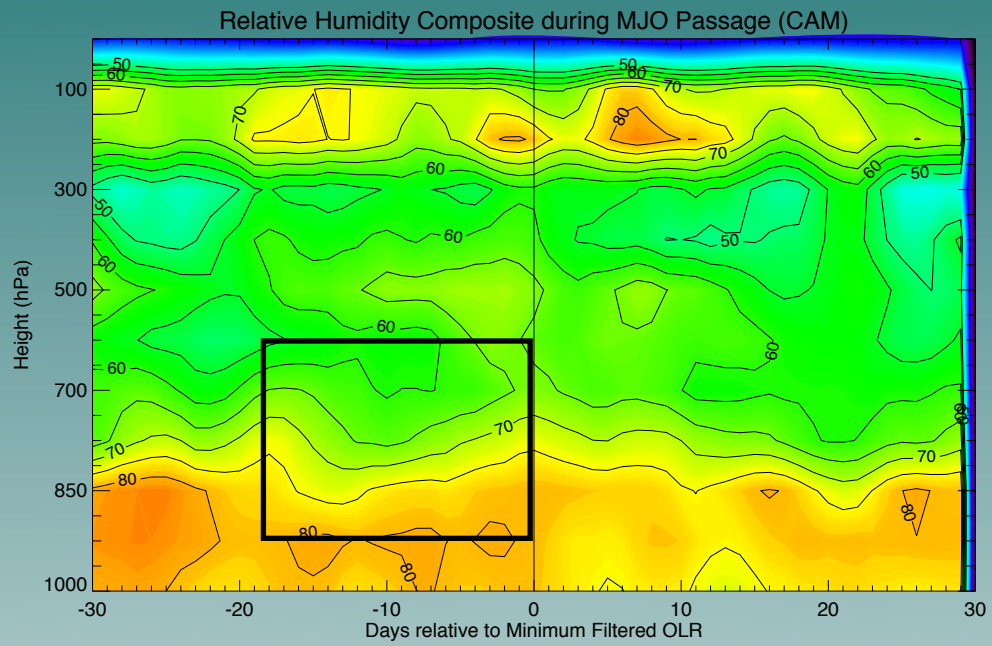
MJO Spatial Structures





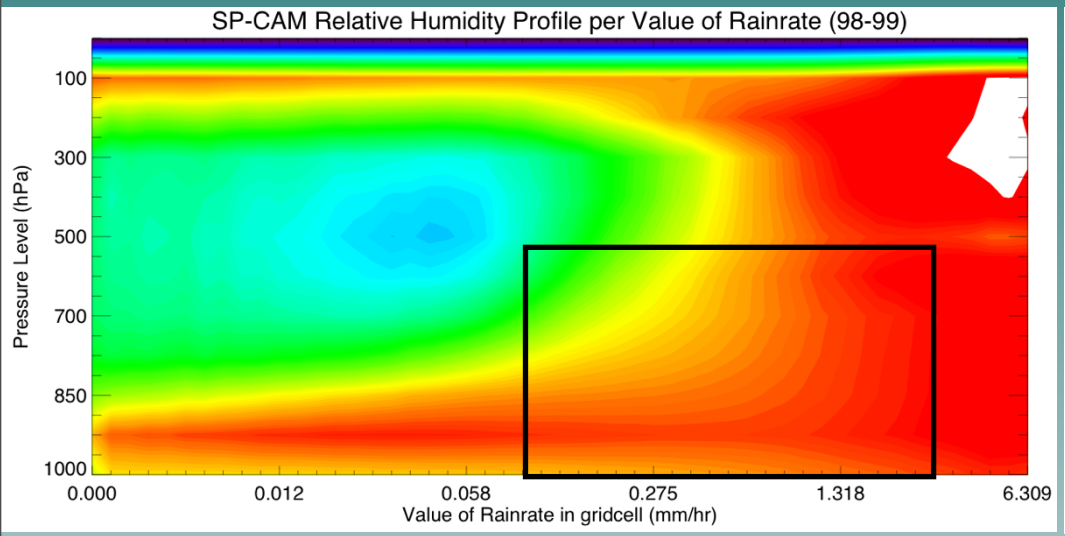
MJO Moisture Profiles

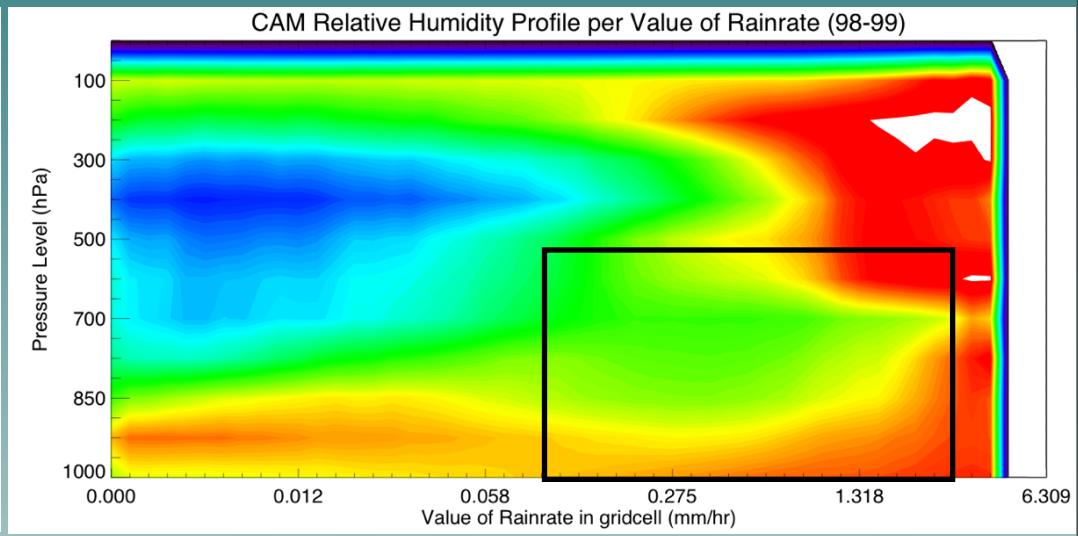




- Much less moisture in the mid Troposphere in the CAM.
- SP-CAM Builds up a deeply moistened column as the wave passes, and then a dryer column after.

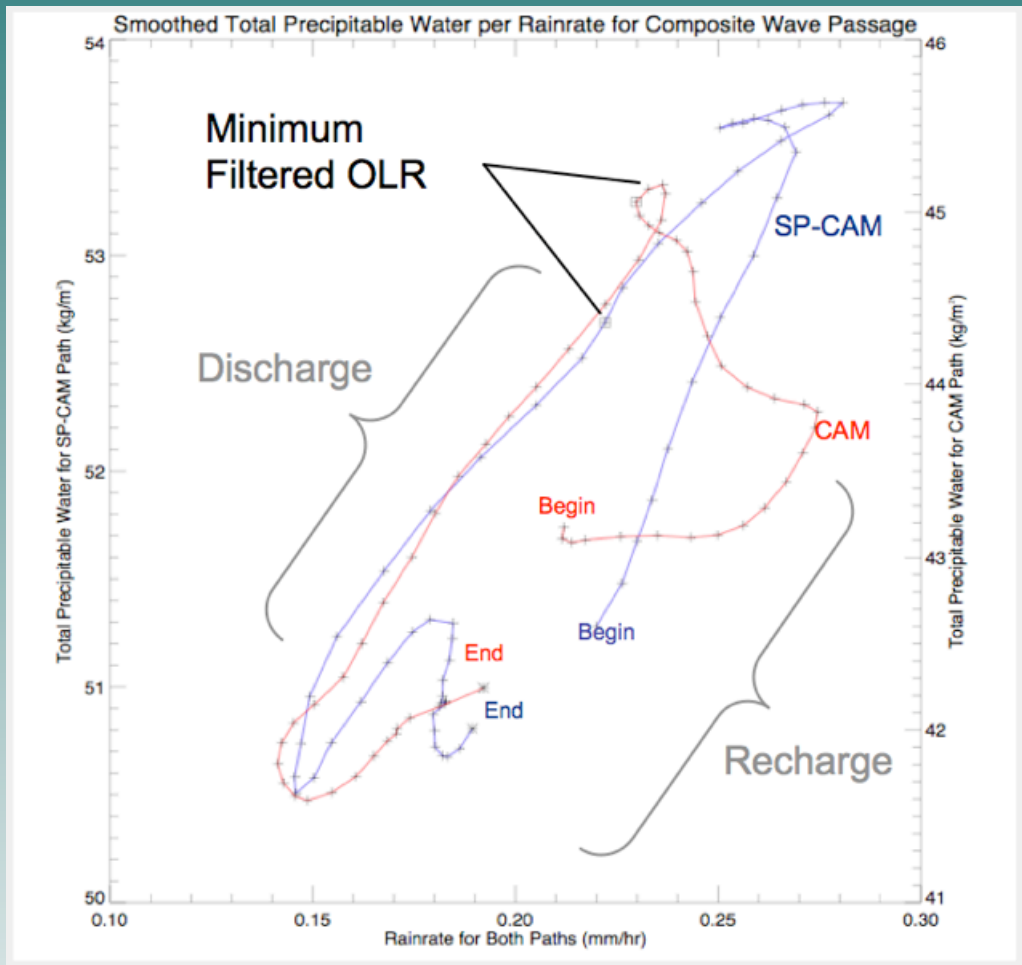
Composite Tropical RH Profile per Rain-rate

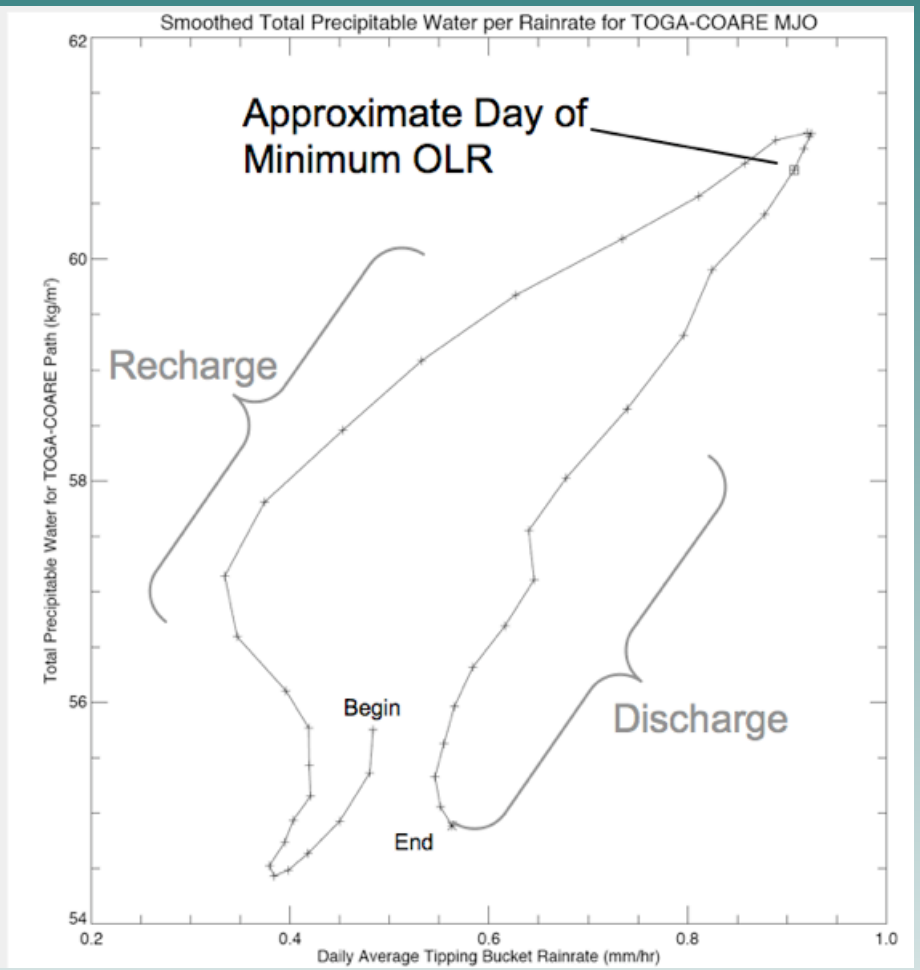




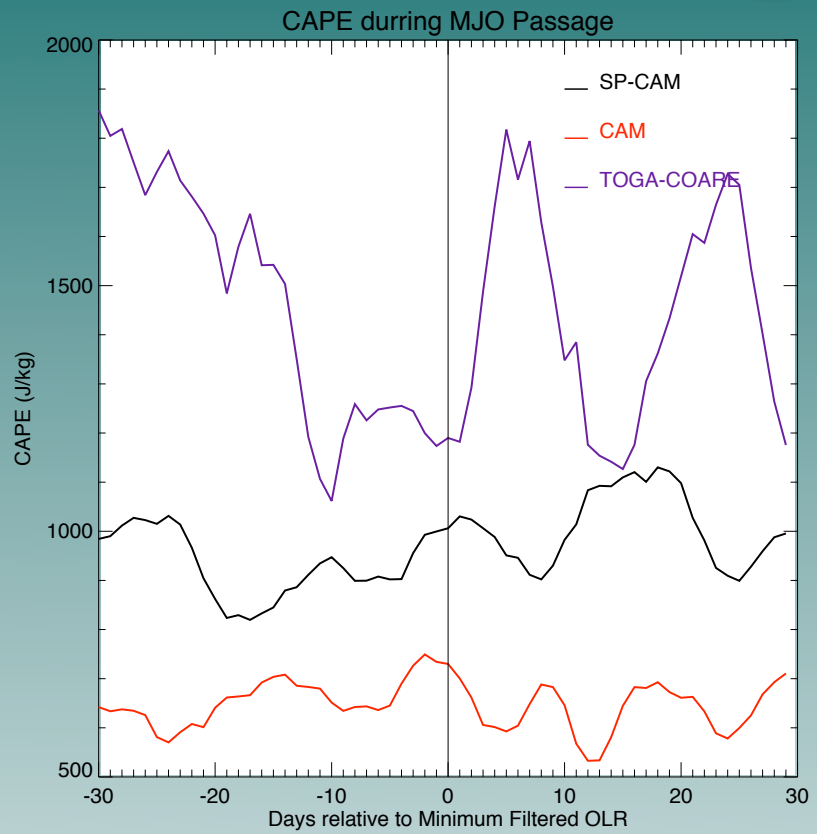
- SP-CAM has much higher values of rain-rates than the CAM
- Higher RH profiles above heavy rain indicate that SP-CAM does not rain as easily as CAM
- 'Critical Value' of Relative Humidity higher in SP-CAM
- Analysis of TOGA-COARE soundings support SP-CAM (see poster)

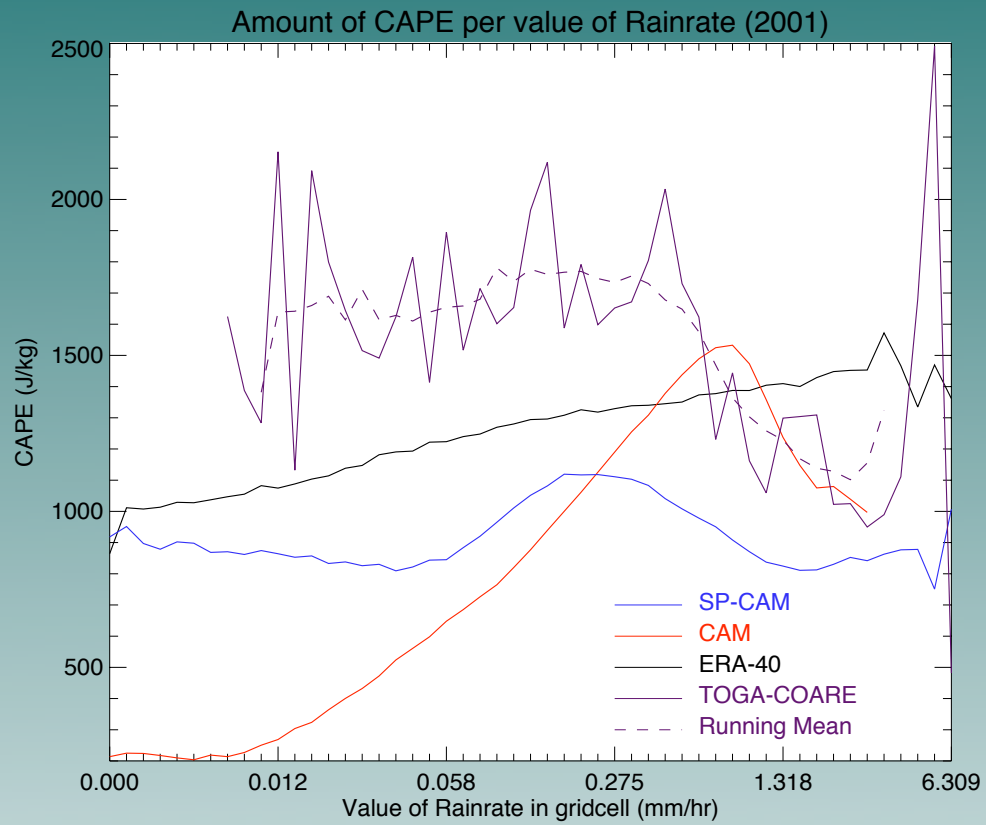
Moistening Processes





CAPE

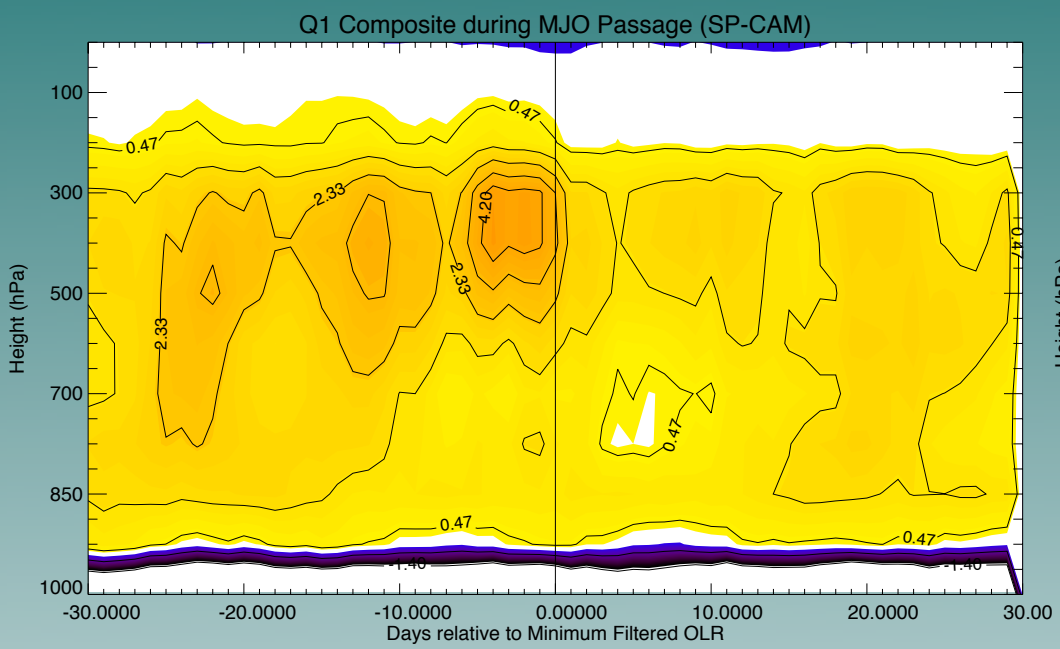


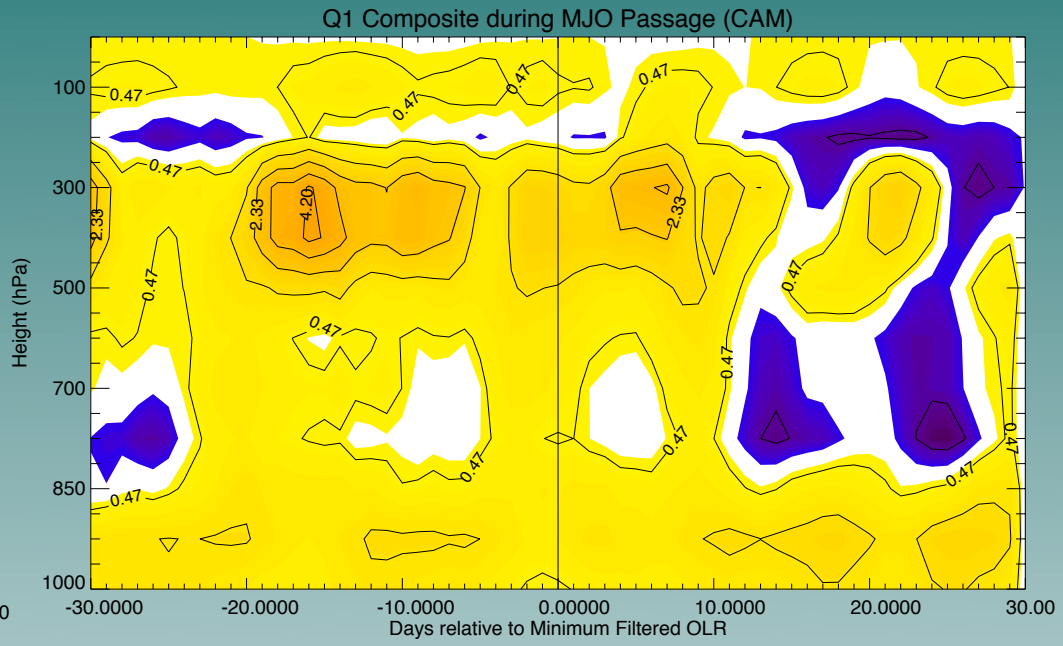


- Started looking at CAPE, but LHS not particularly statistically significant.

- Drop in CAPE with high rainrates good for all but ERA-40 (against TRMM rain)

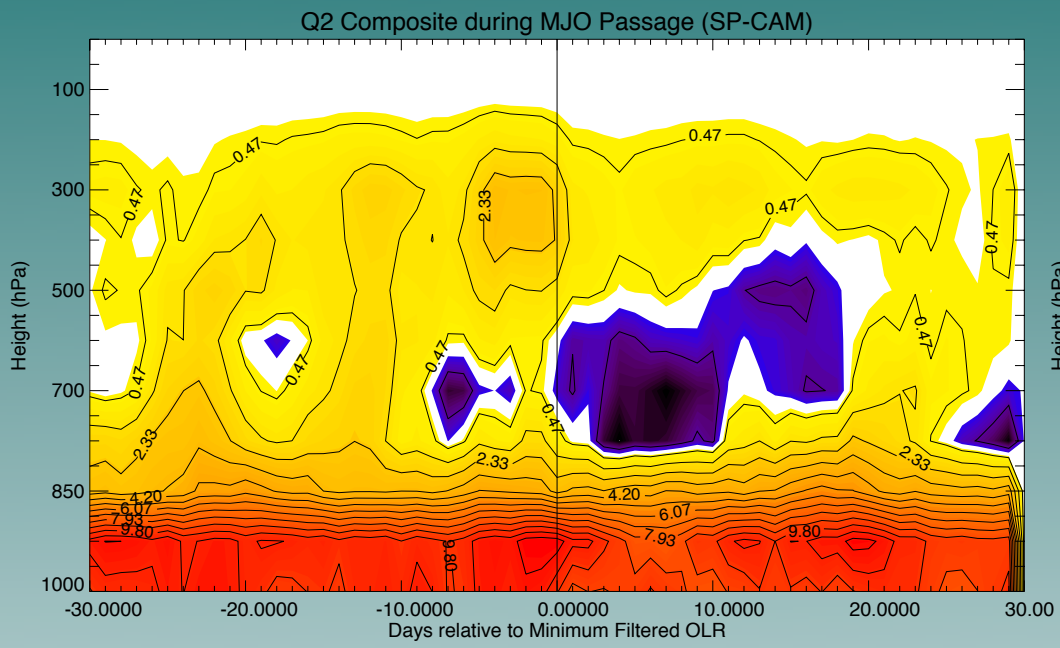
MJO Heating Profiles Q1

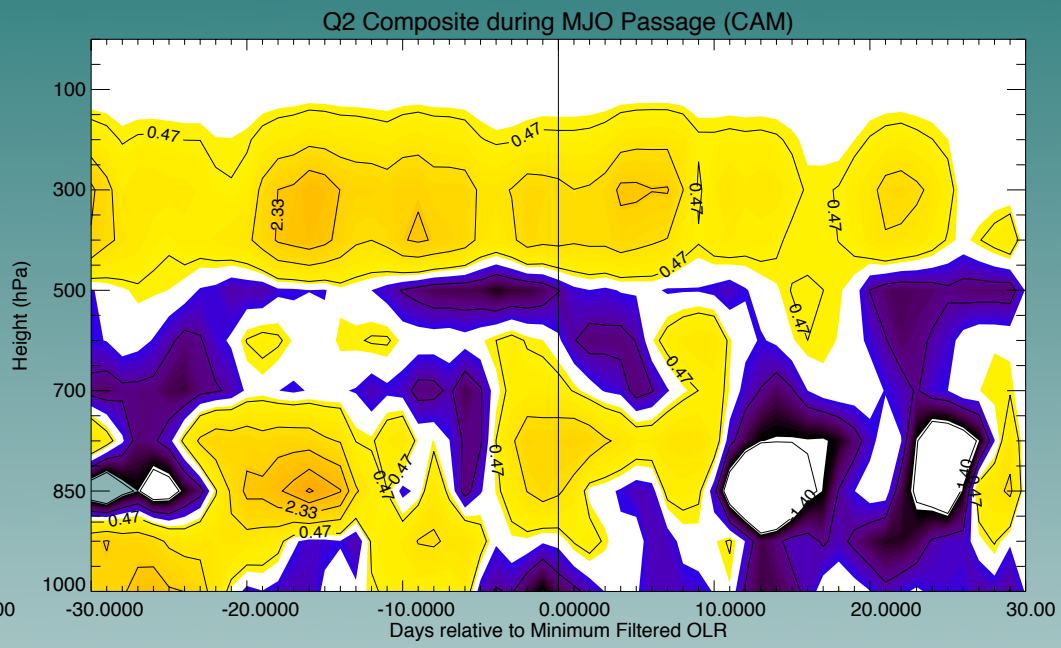




- SP-CAM builds up to intense heating at upper levels as the wave approaches. Much less heating afterwards.
- CAM never quite builds up a large area of heating in the upper levels.
- SP-CAM has constant intense cooling at lowest levels - downdrafts and evaporative cooling?

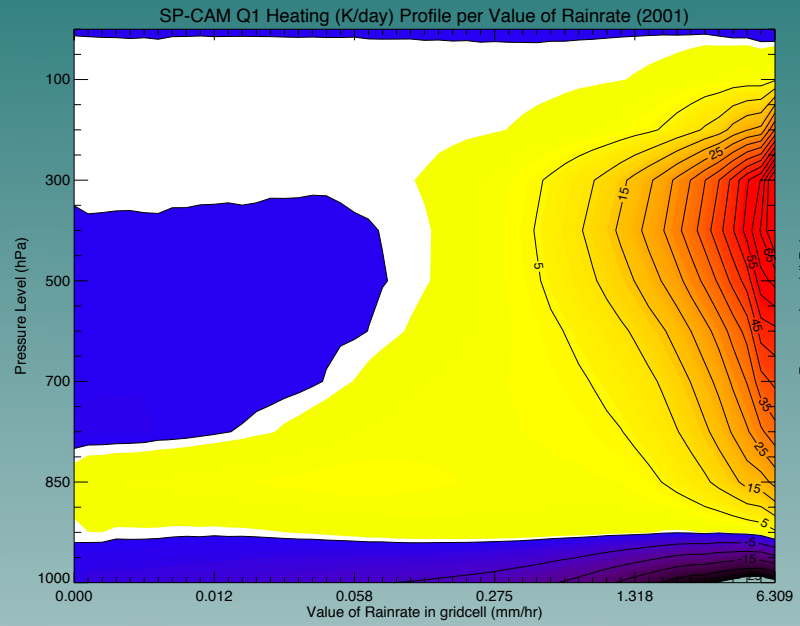
MJO Heating Profiles Q2

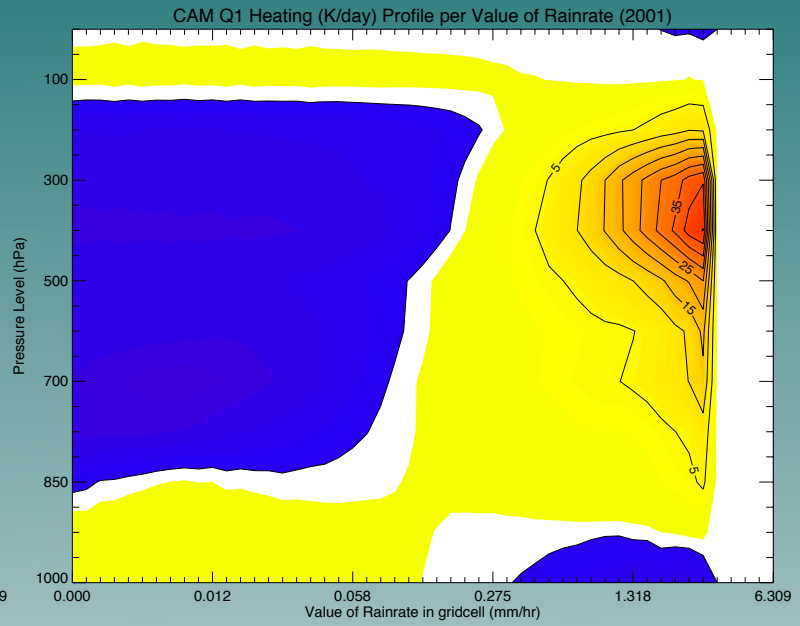


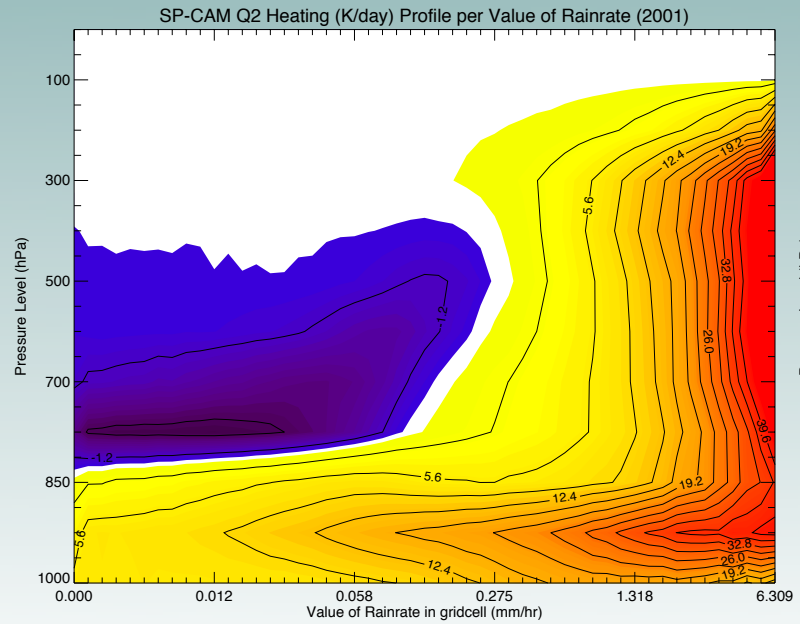


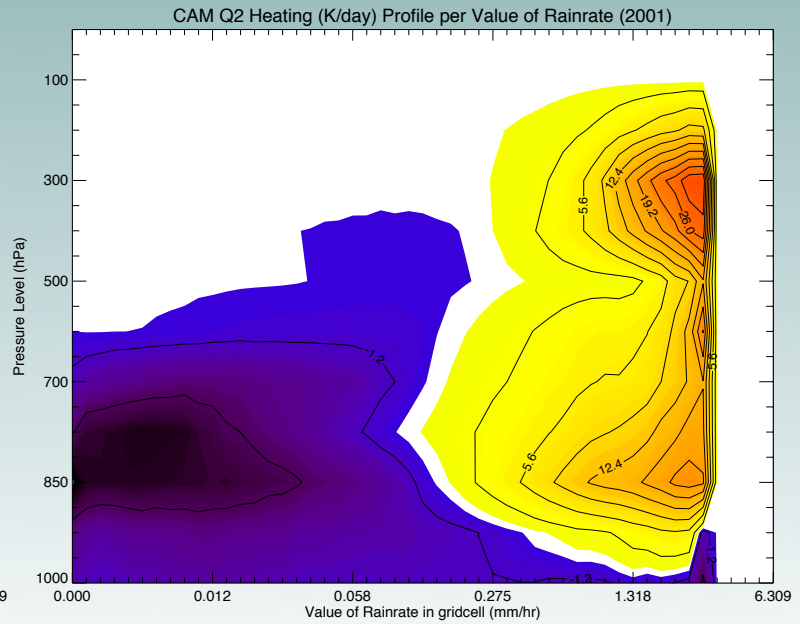
- Again, SP-CAM builds up to intense heating and drying at upper levels as the wave approaches. Cools and moistens midlevels after passage.
- CAM shows cooling and moistening at midlevels throughout wave.
- SP-CAM has constant intense drying at lowest levels - convective drying is extremely powerful.

Composite Tropical Heating Profiles per Rain-rate









Summary

- Distribution of waves and spatial structure in SP-CAM is ok.
- SP-CAM rains after column is much more moist than CAM
- SP-CAM and obs rain-tpw phase relationship similar
- SP-CAM heating in upper levels much more organized than CAM.
- Lowest level Q1 and Q2 in SP-CAM really intense

A Few Thoughts

- Results seem to indicate that Discharge-Recharge type mechanisms important for MJO initiation in the model.
- Convection occurring in a nearly saturated column releases a higher net heating.
- Physics need time to moisten before precipitation forms.
- Boundary layer drying and advection from subtropics just as important to wave organization as moistening.