A Perspective on the Low-Latitude Cloud Feedbacks Climate Process Team (CPT)

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What is CPT?

- A multi-institutional effort (university + climate modeling labs) with two goals:

- Better understanding of oceanic low-latitude [boundary-layer] cloud feedbacks to climate change

- Better simulation of low-latitude [boundary-layer] clouds

- NOTE: LIMITED FOCI

Constitution of CPT

- Models: global models of NCAR, GFDL, GMAO + CAM3 SP
- 8 funded PIs (Bretherton, Khairoutdinov, Lappen, Mapes, Pincus, B. Stevens, Xu, M. Zhang) + NCAR (Kiehl), GFDL (Held), GMAO participation (Suarez + Bacmeister)
- 2 CPT “Liaisons” at the modeling centers of NCAR (C. Hannay) + GFDL (M. Zhao)
- Funded from October 2003 to September 2006; currently applying for a 2-year extension

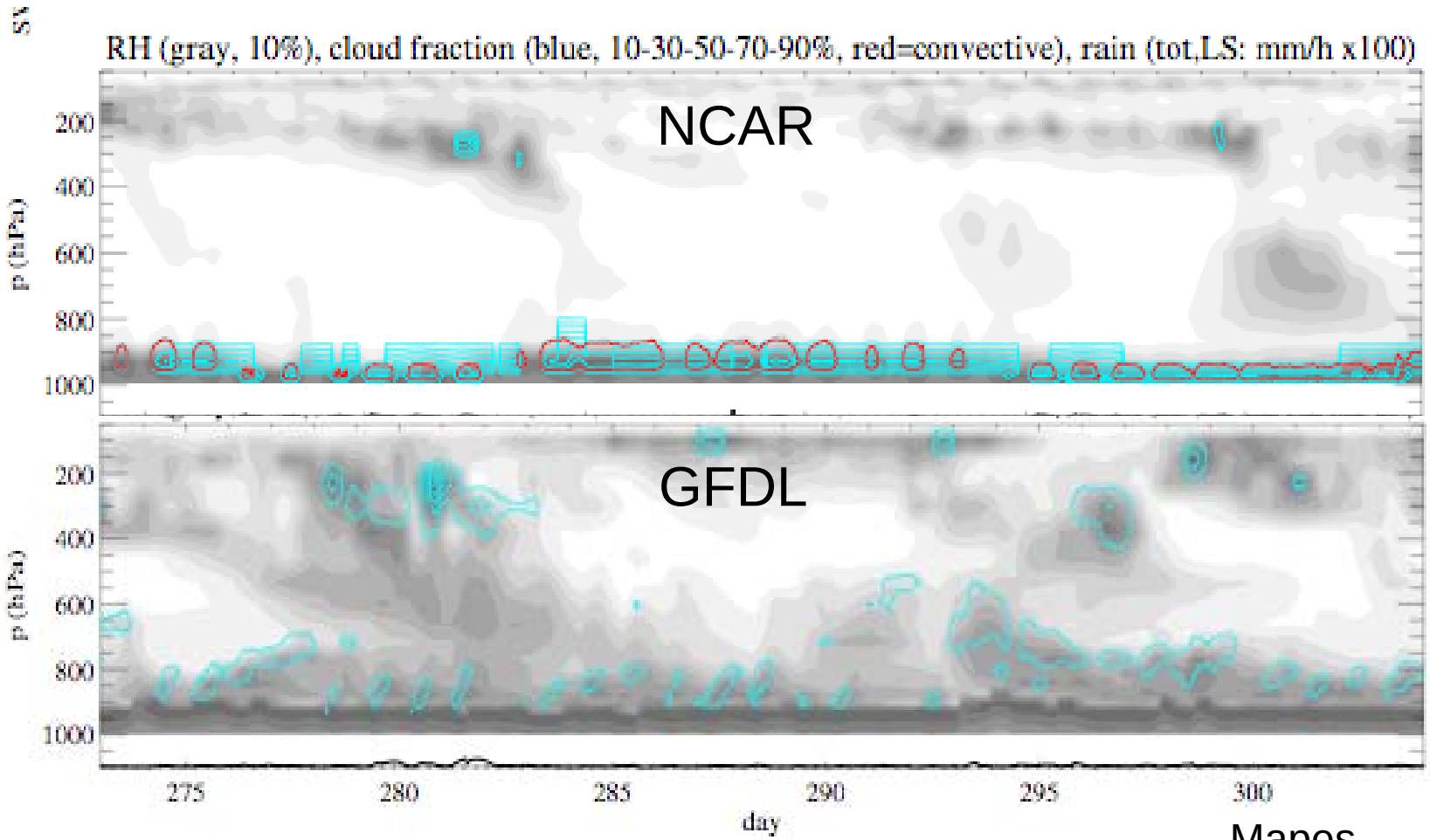
What is working well?

- Diagnosis of new problems in climate models by experts outside of the modeling centers

- The Liaisons play an essential role
  - They provide diagnostic output to the scientific team
    - Standard global monthly mean diagnostics
    - Saved every time step output from selected global points (state + processes)
  - They perform standard experiments needed by the CPT
    - AMIP runs, AQUA planet runs, Cess experiments (+/- 2K SST)

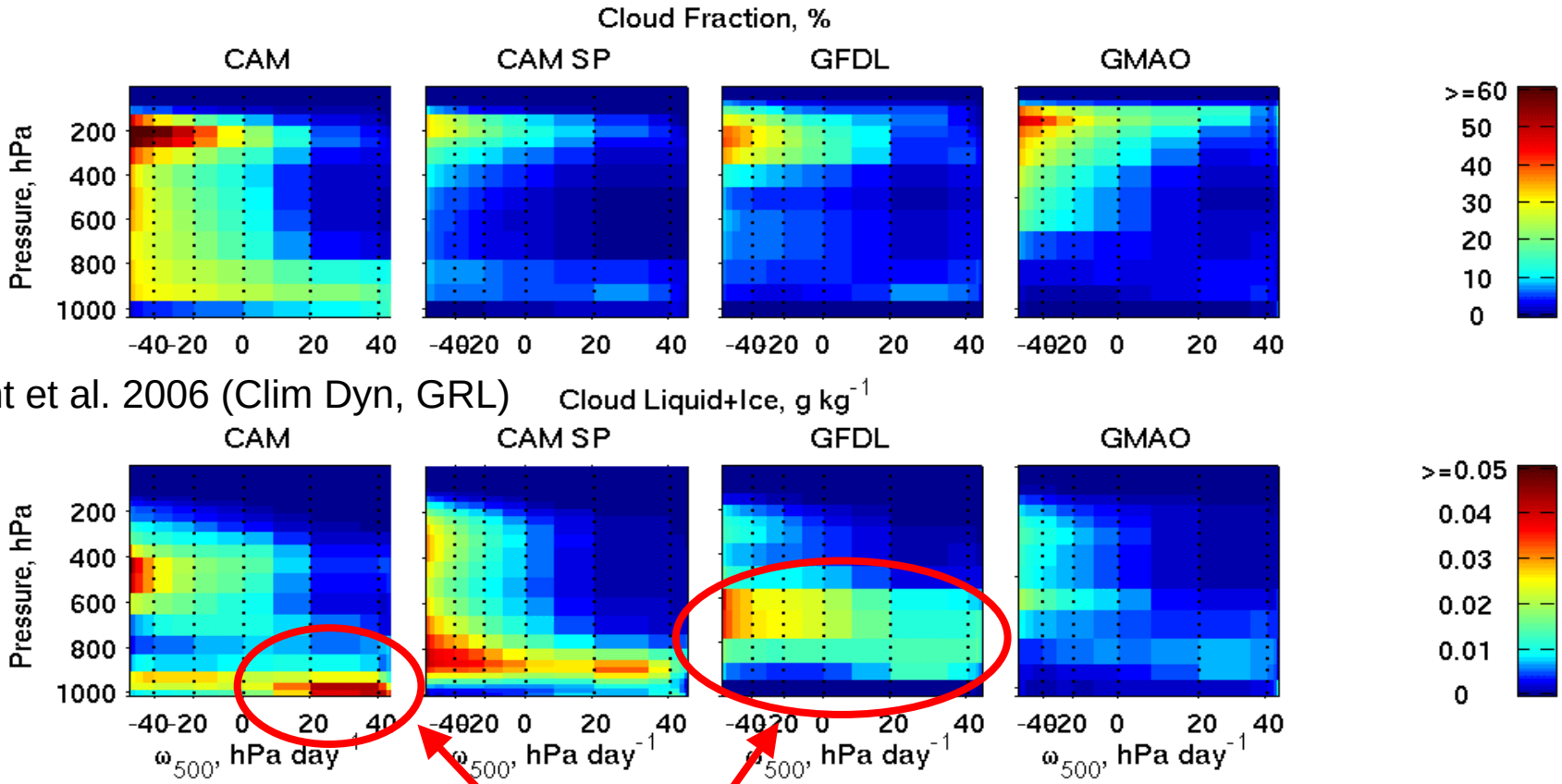
Single-column analysis

SE Pac Sc (85W 20S), October, every timestep



Mapes

Regime-binned cloud climatology



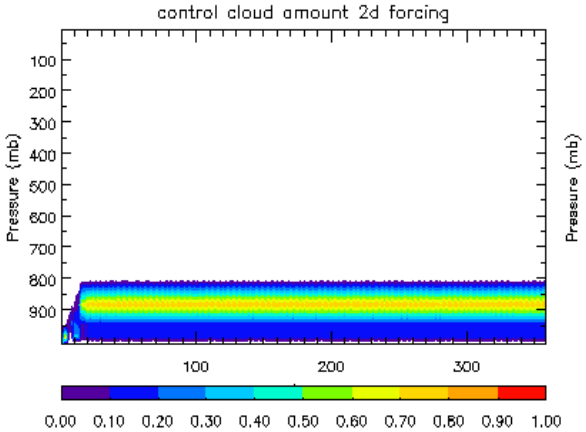
Wyant et al. 2006 (Clim Dyn, GRL)

Identification of
“new” problems

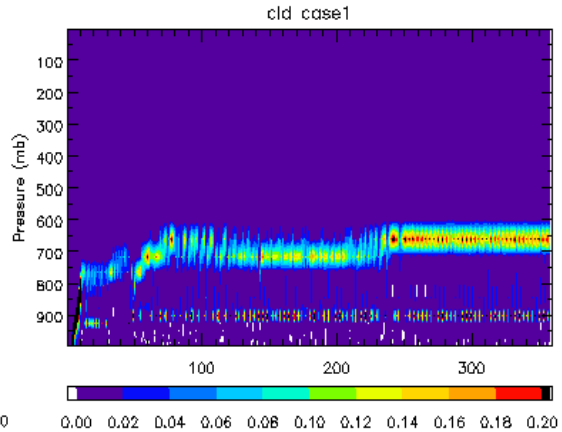
What is working well?

- Detailed diagnosis of boundary-layer cloud feedbacks
  SCM study led by Minghua Zhang

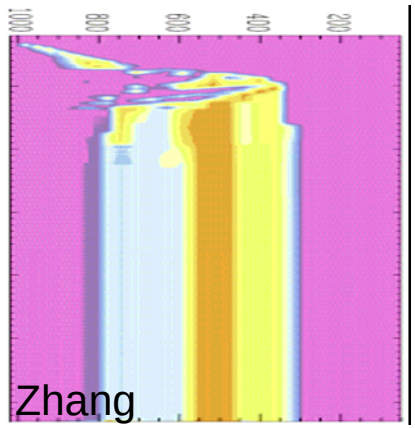
NCAR



GFDL

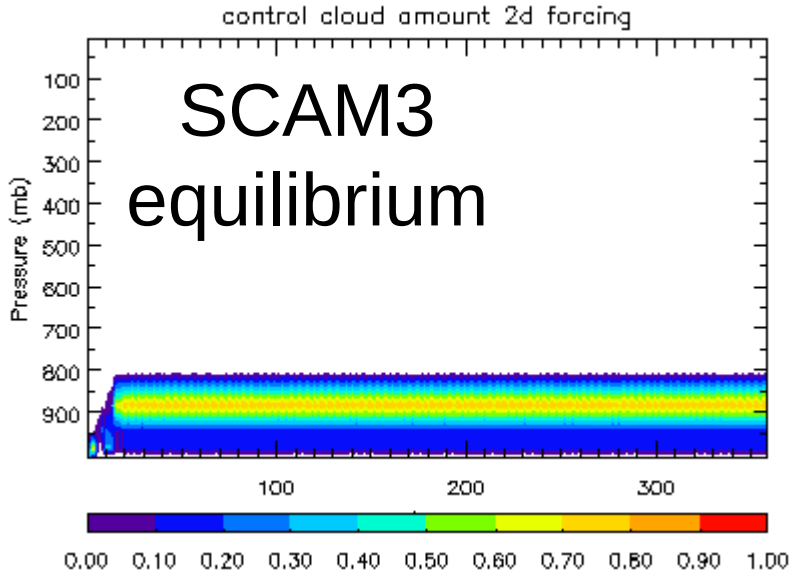


GMAO



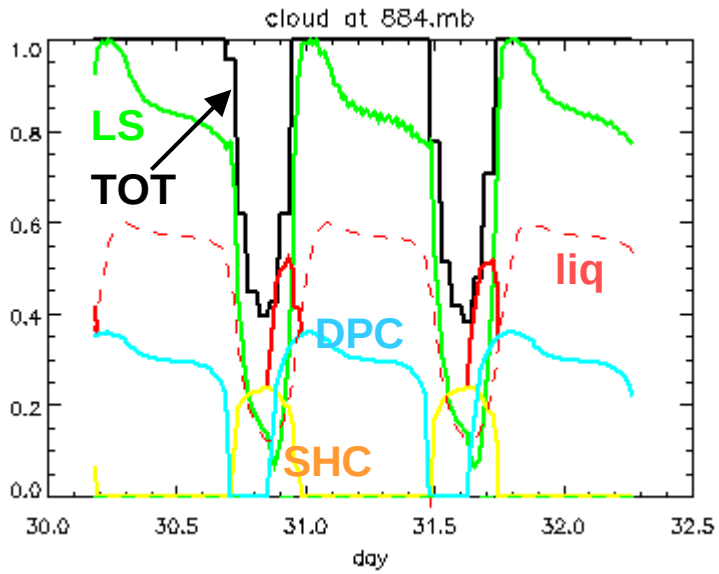
M. Zhang

  - Cloud profiles in the single-column versions of our 3 GCMs exhibit very similar biases to those seen in our Bony analysis of the full models
  - SCM +2K cloud feedbacks (not shown) also analogous to full GCMs. *(not a given)*



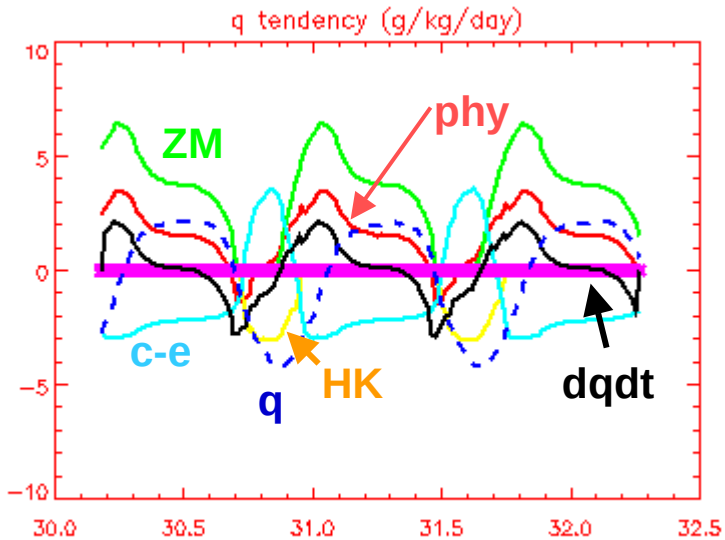
Detailed diagnostics on how the processes maintain the cloud in this simpler framework

Time Series of clouds at 900 mb



Days

Time Series of q tendency at 900 mb



Days

What is NOT working well?

Developed before CPT with separate funding

- Are the models better yet?
- GFDL Example:
  - excessive 600-800 hPa condensate
  - Cause: RAS is a bad shallow convection scheme
  - Potential solution: import an ***existing*** shallow convection scheme (Bretherton et al. 2004) in GFDL model (M. Zhao – GFDL CPT Liaison)
  - Current situation: it solves the tropical ocean excessive 600-800 hPa condensate problem BUT there is far too much mid-latitude oceanic low cloud (how to fix that? – currently playing with “free” parameters such as the precipitation efficiency)
  - Will it make it into the GFDL model at the end of the next 2 years?