Low cloud breakout

Brian Medeiros & Matt Wyant
(standing in for Bjorn and Chris)

Agenda

Brian Medeiros, Aquaplanet Activities

Matt Wyant, SP-CAM low clouds

Anning Cheng, GCSS cases

Masaki Satoh, NICAM low clouds

BREAK

Zach Eitzen, Cloud Objects

Status Report

Characterizing climate (& cloud) response across aquaplanets: A progress report

Brian Medeiros

CMMAP Team Meeting '07b

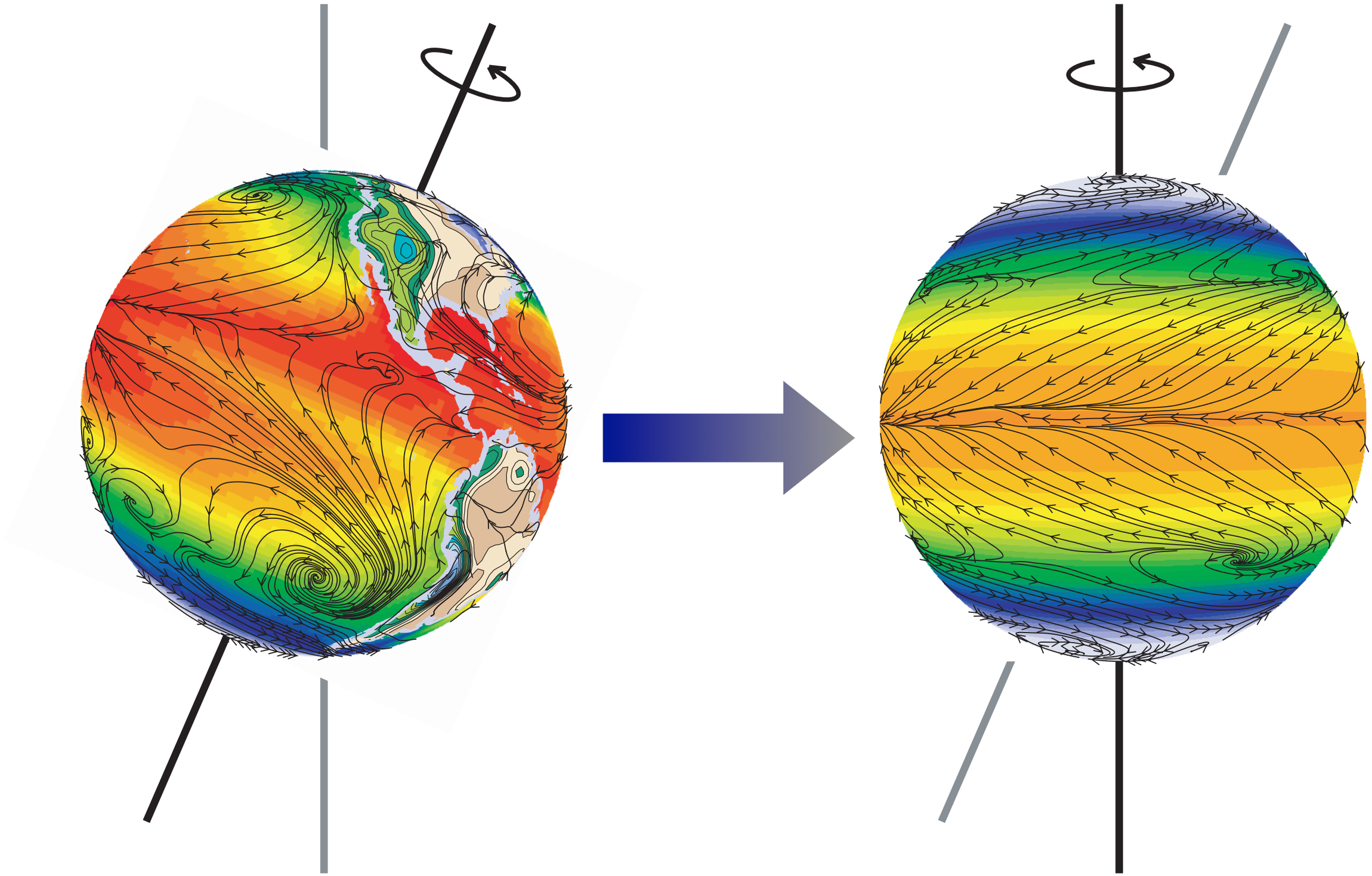
Overview

Review aquaplanet climate response results

Recent CMMAP-related developments

- Characterizing aquaplanet response (continued)
- SP-CAM aquaplanet
- development of forcing dataset

Aquaplanets



Aquaplanets

aquaplanet advantages:

excellent statistics

fast equilibration

reduced dimensionality

helps close gap between simple and sophisticated

[e.g., Miller (1997), Larson et al. (1999)]

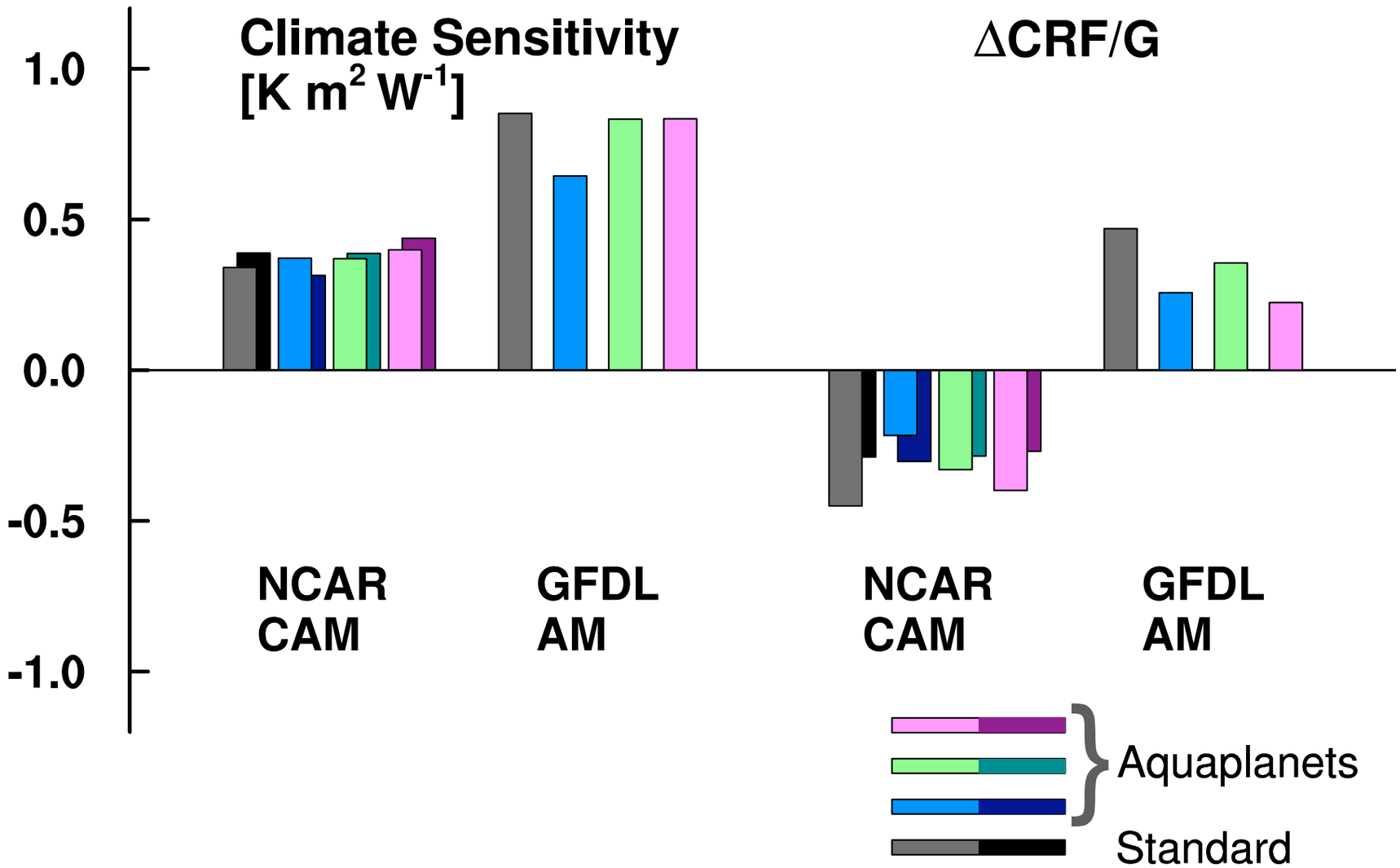
experimental strategy:

GCM frameworks: NCAR CAM (T42,T85), spCAM, uwCAM, & GFDL AM

Variety of aquaplanets (SST, samples different large-scale circulations)

FANGIO experiments (aka Cess, SST+2)

Climate sensitivity

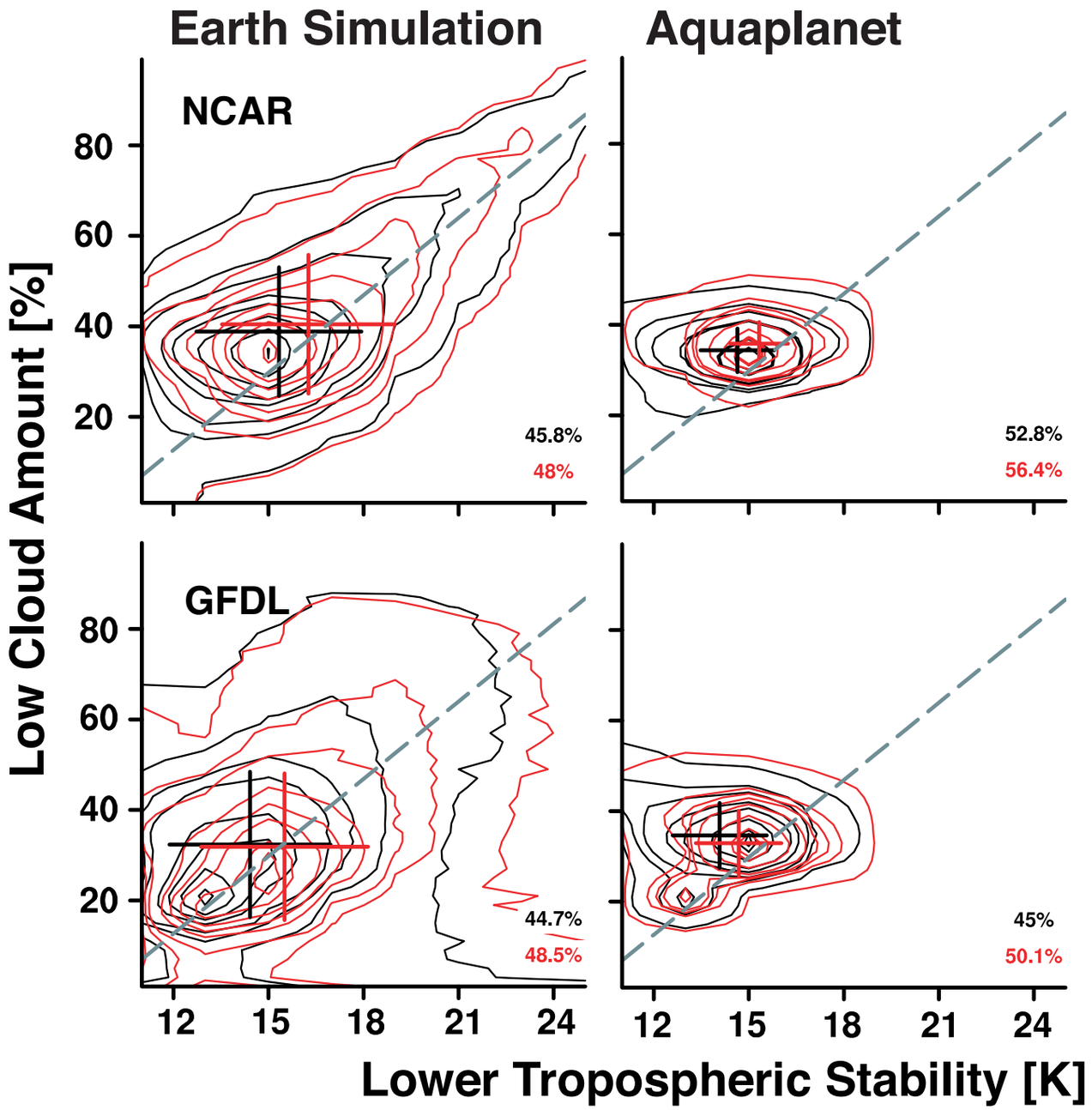


Low cloud distributions

Joint pdfs of low cloud amount and lower tropospheric stability, conditioned on "weak subsidence" (i.e., $0<w_{500}<30$ hPa/d)

Earth simulations show extended "stratocumulus" feature, roughly following empirical relationship from Klein & Hartmann.

Aquaplanets have no stratocumulus, BUT are otherwise similar (both dynamically and thermodynamically)



Aquaplanet low cloud questions

What cloud regimes populate the aquaplanet pdfs?

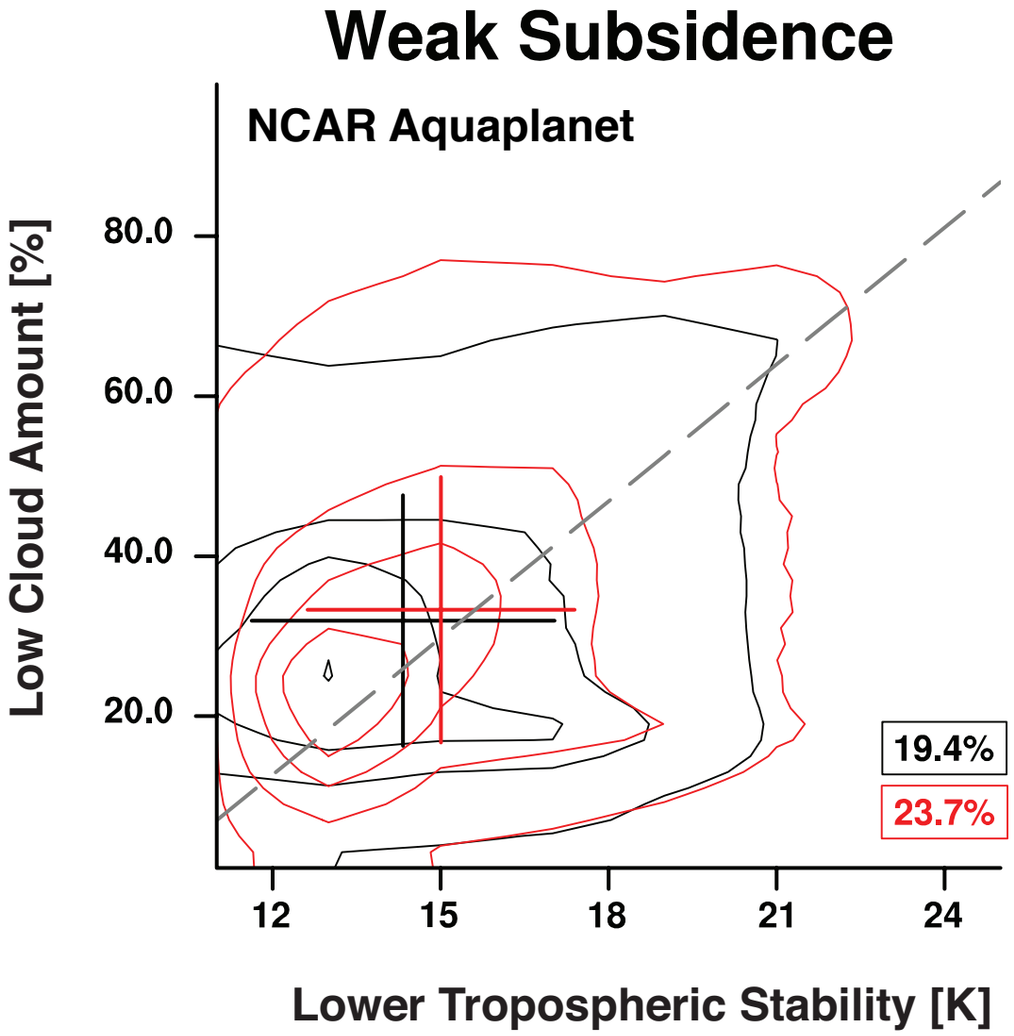
i.e., stratocumulus or trade cumulus? [neither?]

Do aquaplanets represent Earth-like regimes?

Can aquaplanets be compared with observations?

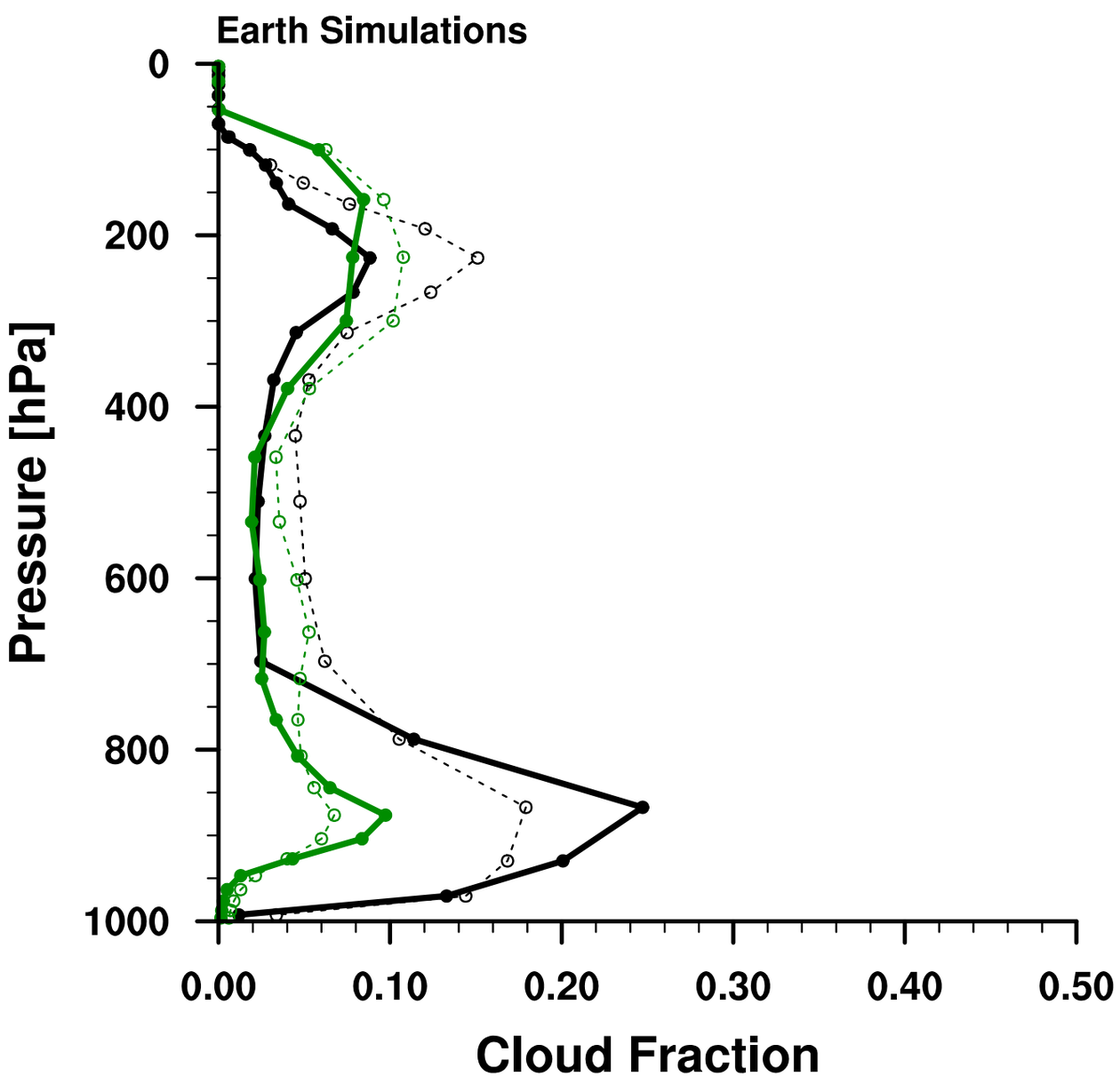
Are they stratocumulus?

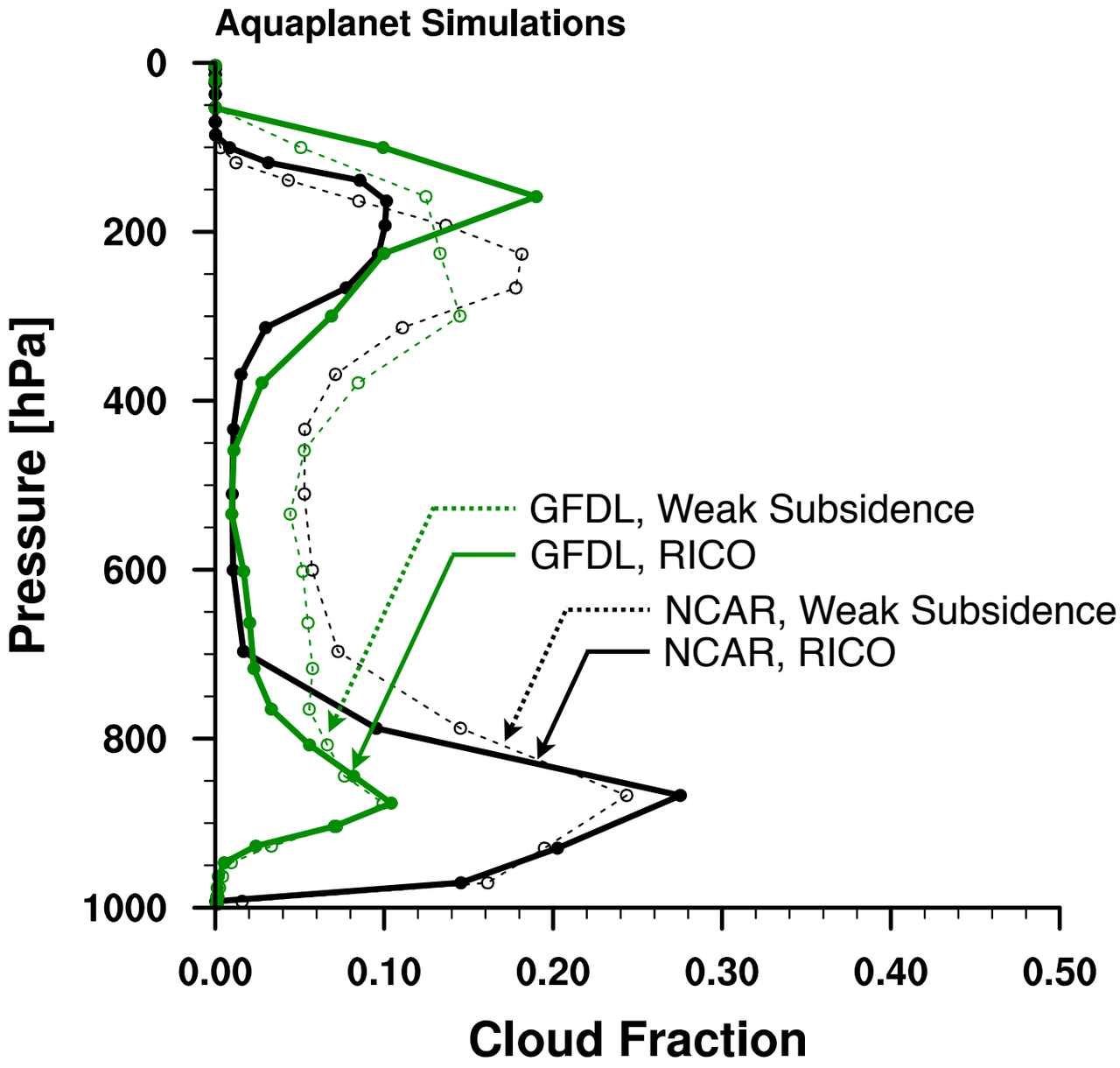
- Joint PDF from daily mean output shows little Sc.
- Vertical structure is ambiguous for CAM, cumulus-like for AM
- “Stratus incidence” is low in CAM, displaced from maximum cloud fraction.



Are they cumulus? Are they realistic?

- Conditioned on "weak subsidence" (dotted) and on RICO-like conditions (solid)
- Can be compared with observed conditions (RICO about 10% cloud fraction, inversion at about 800 hPa)

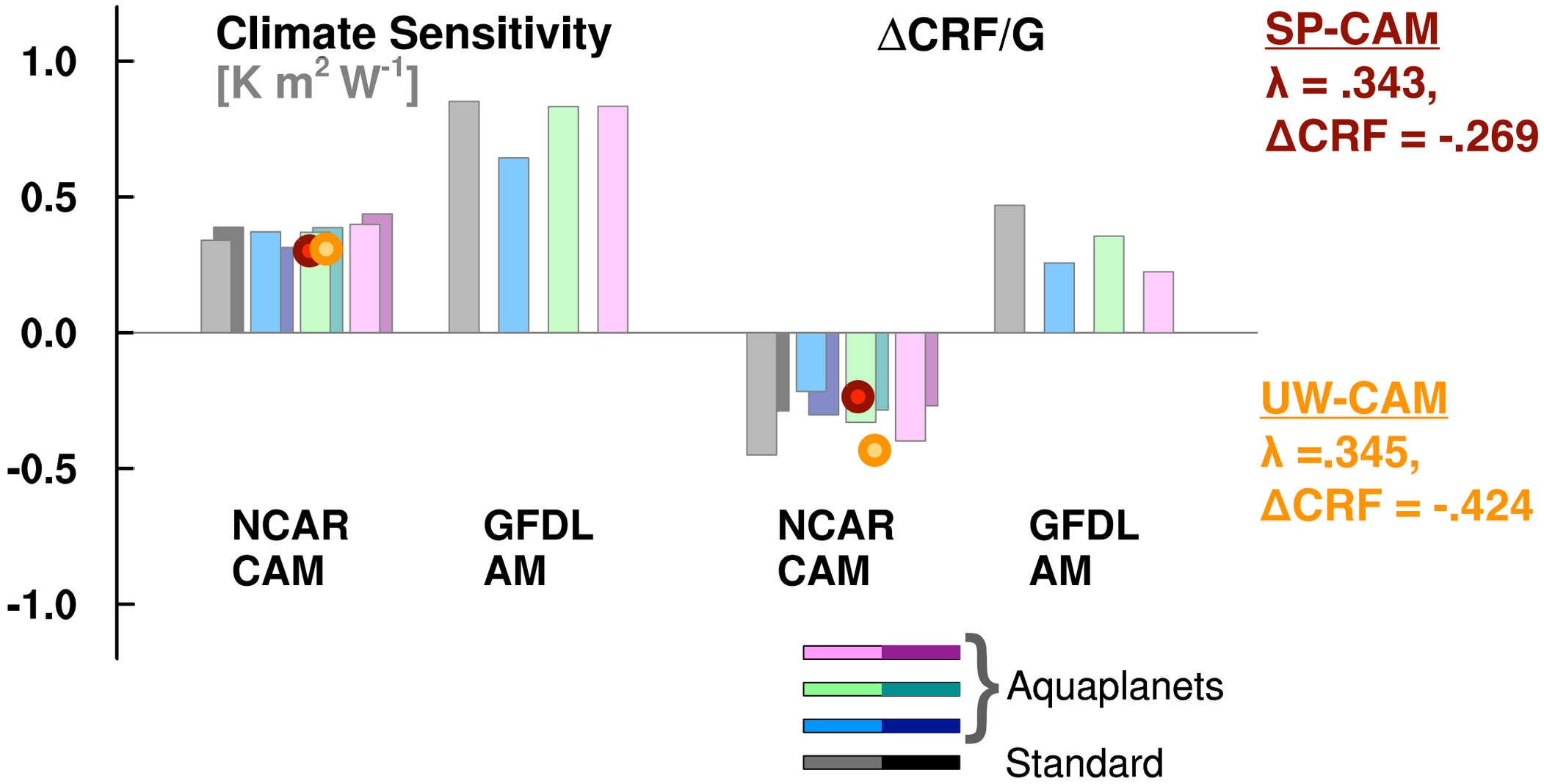




Preliminary Work

Climate sensitivity - more

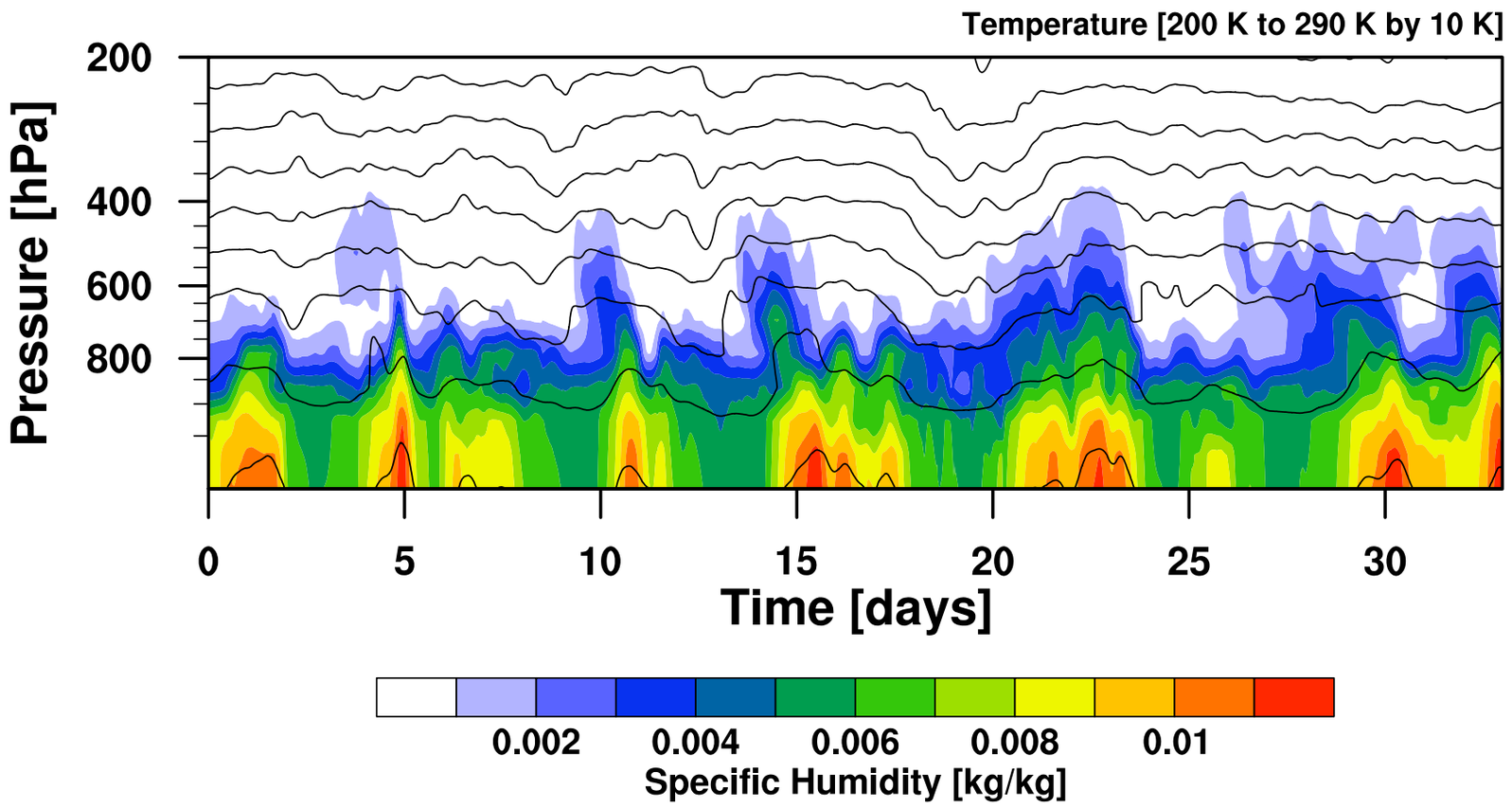
- Additional experiments using aquaplanet version of SP-CAM (Marat) and UW-CAM.



Aquaplanet forcing

- Develop a rich forcing dataset and timeseries to drive high resolution models (SCM, CRM, LES) and to compare with observations.

- Prototype dataset has been developed (below), and is being "alpha tested" by C-L Lappen. Additional forcing can be generated, depending on what is needed.



And from here?

How to best use this framework?

connections to SCM/CRM/LES

comparisons with observations

How to make use of MMF?

.... see also status report slide later.