Multiple evaluations of the CCCMA GCM

Jason Cole

University of British Columbia/University of Toronto

12 Nov 2007

Overview

- Activities since Jan. meeting
  - Completed MPACE SCM15D runs for intercomparison
  - Completed CFMIP-1 contribution (NetCDF files from PCMDI)
  - Completed contribution for GPCI
  - New version of SCM (SCM15F) (multiple fixes)
  - Implemented McICA (and 1D) fully into next GCM version
  - Coupled CCCma radiation with SAM (solar MC)
  - Evaluate clouds and radiation in GCM
- Largely using CERES products, and ISCCP
- Some results from monthly mean data
  - Anomalies TOA radiation, cloud properties
  - Bony diagrams

CERES data and GCM configuration

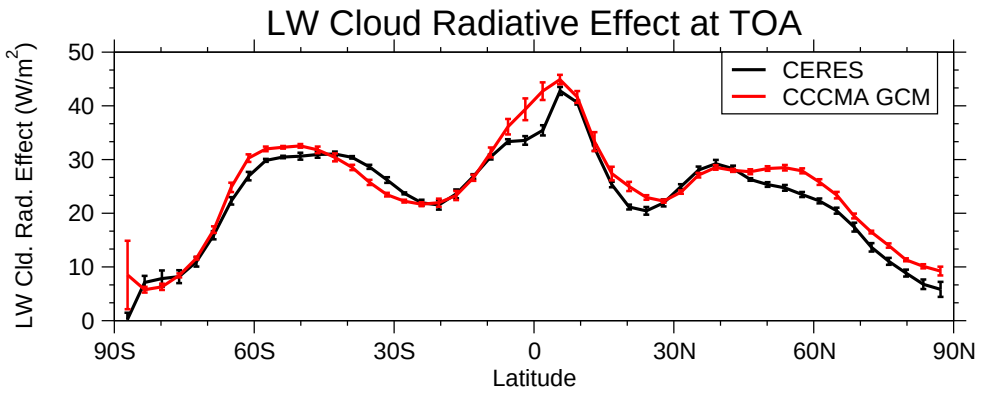
- Monthly CERES data
  - Radiation from Mar. 2000 - Oct. 2005
  - SRBAVG2 GEO cloud data Oct. 2000 - Oct. 2005
- GCM15F simulations
  - T47L35 using time varying SSTs, start Jan. 1999-Aug. 2005
  - ISCCP simulator turned on
- Averaged 1°x1° CERES data to T47 grid
- Set points on T47 grid to missing if $\leq$ 50% CERES data
- Generated month by month masks, applied to GCM fields

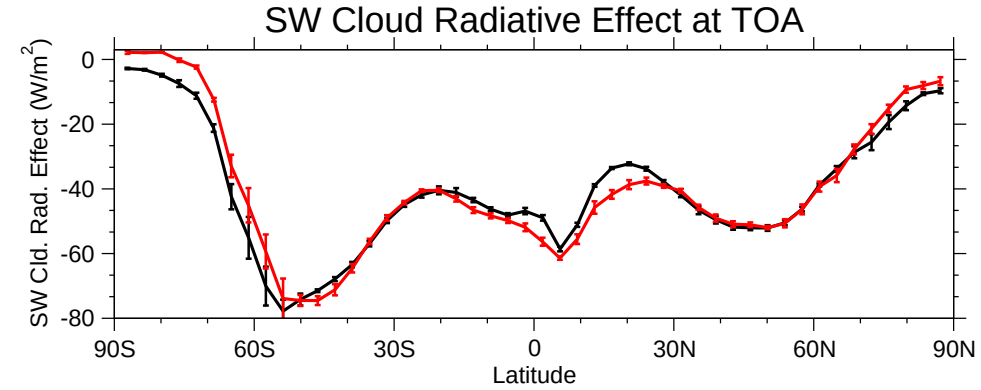
TOA cloud radiative effect (2000/08 - 2005/08)

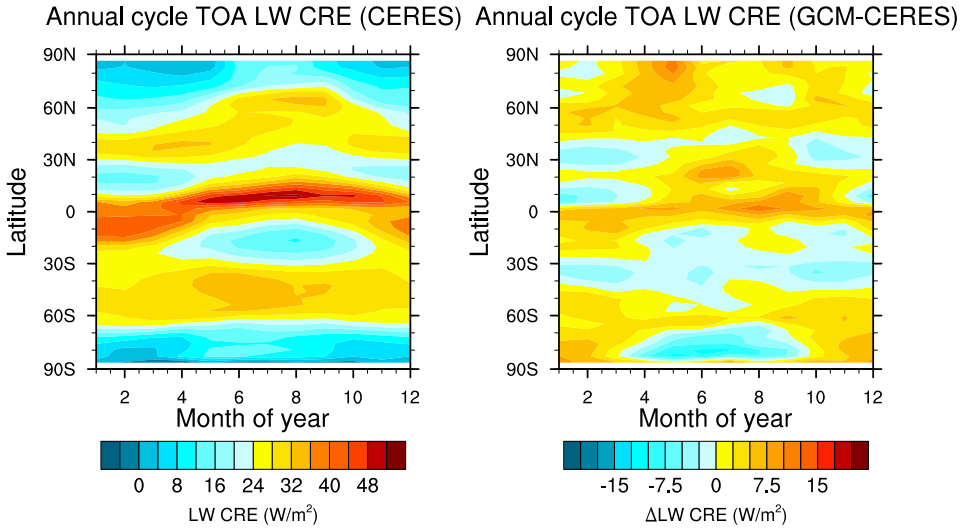
Global means

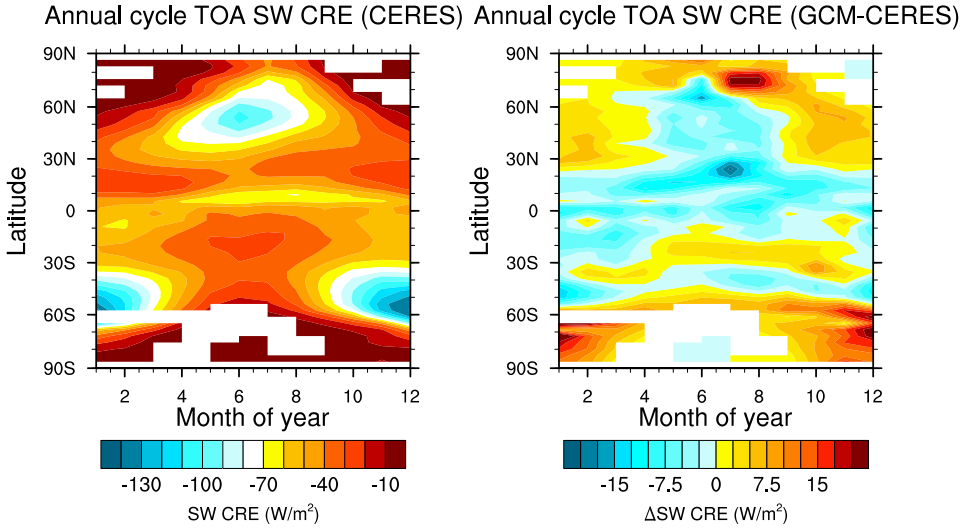
Variable	CERES	CCCMA GCM
SW CRE TOA	-45.87	-46.89
LW CRE TOA	26.75	27.98

CRE = F(all-sky)-F(clear-sky)



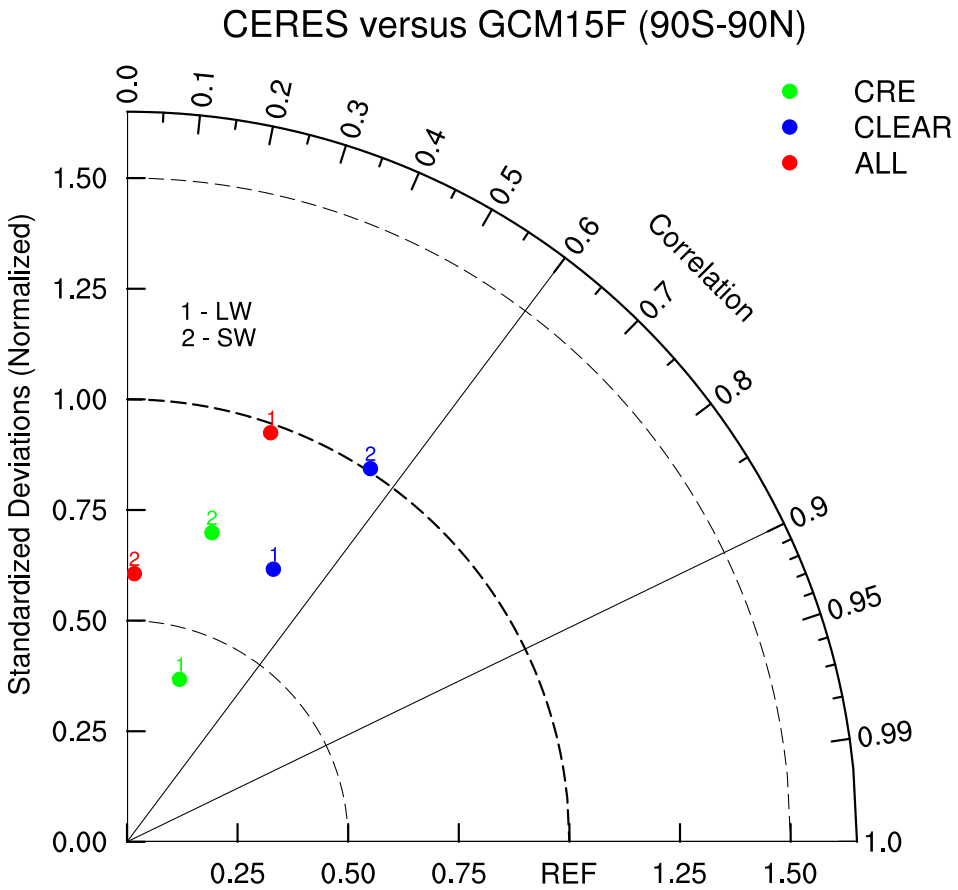


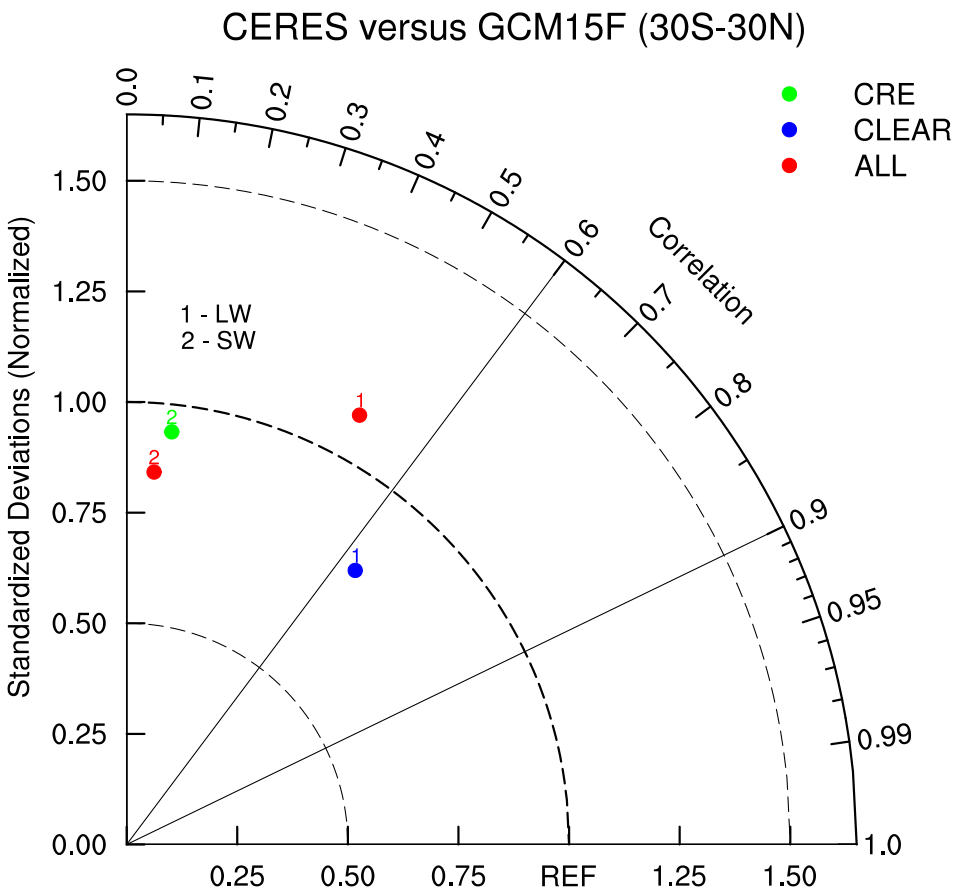




Monthly anomalies (2000/08 - 2005/08)

$$\text{Radius} = \sigma_{GCM}/\sigma_{CERES}$$
$$\text{Angle} = \text{Correlation}$$





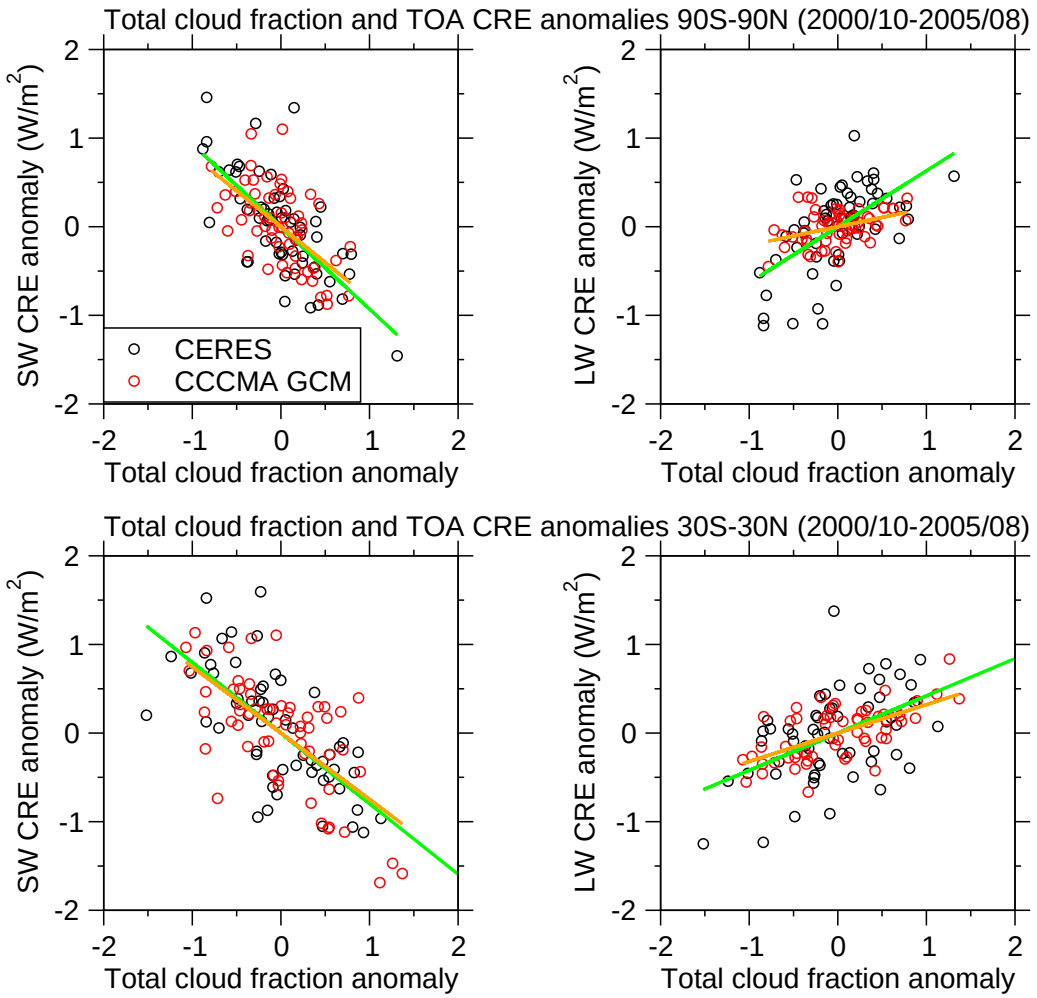
ISCCP (90°S-90°N), Ratio=1.96, Corr.=0.19

ISCCP (30°S-30°N), Ratio=1.41, Corr.=0.43

Clr SW - Ratio=1.04, Corr.=-0.01

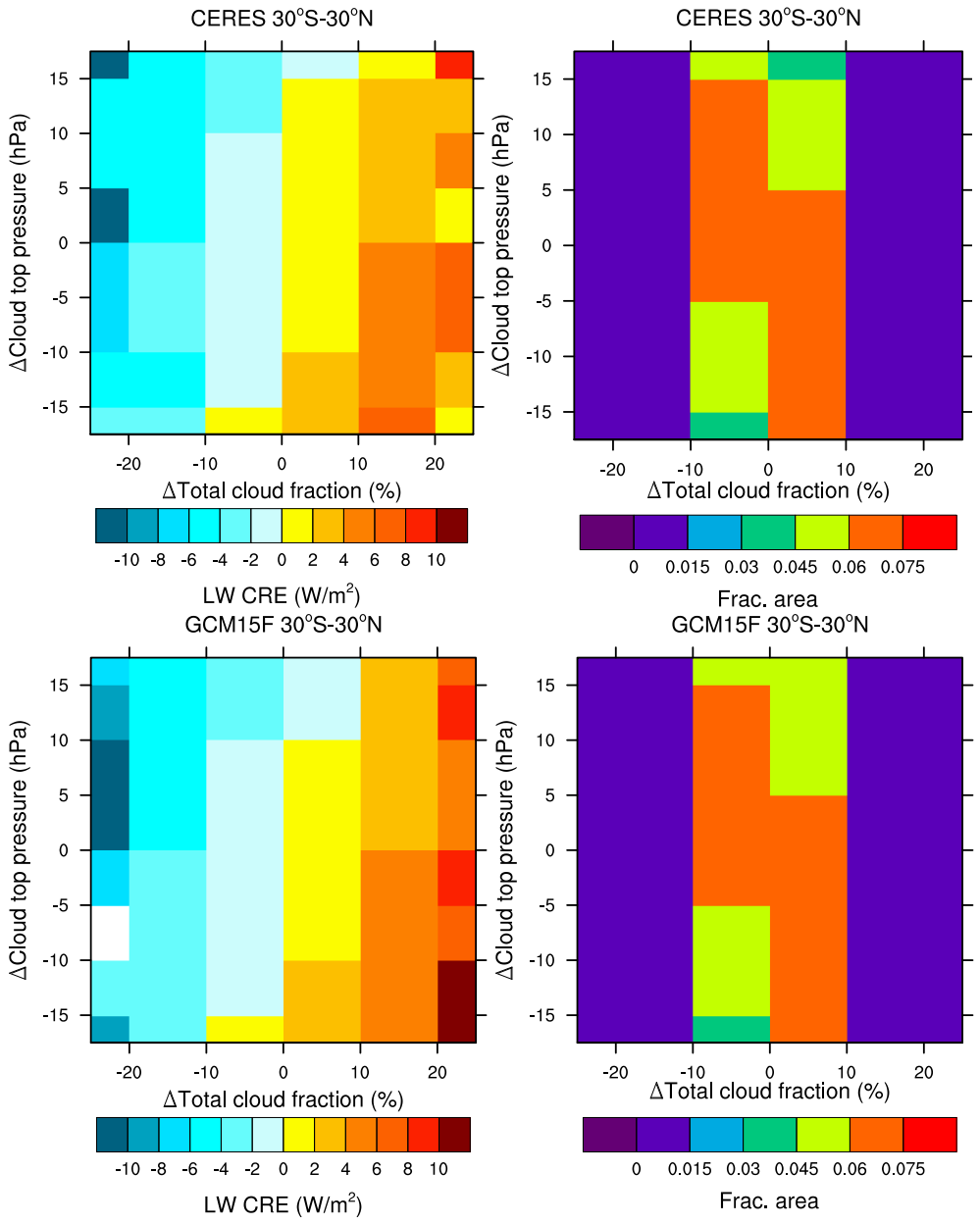
LW CRE - Ratio=0.573, Corr.=-0.149

Monthly

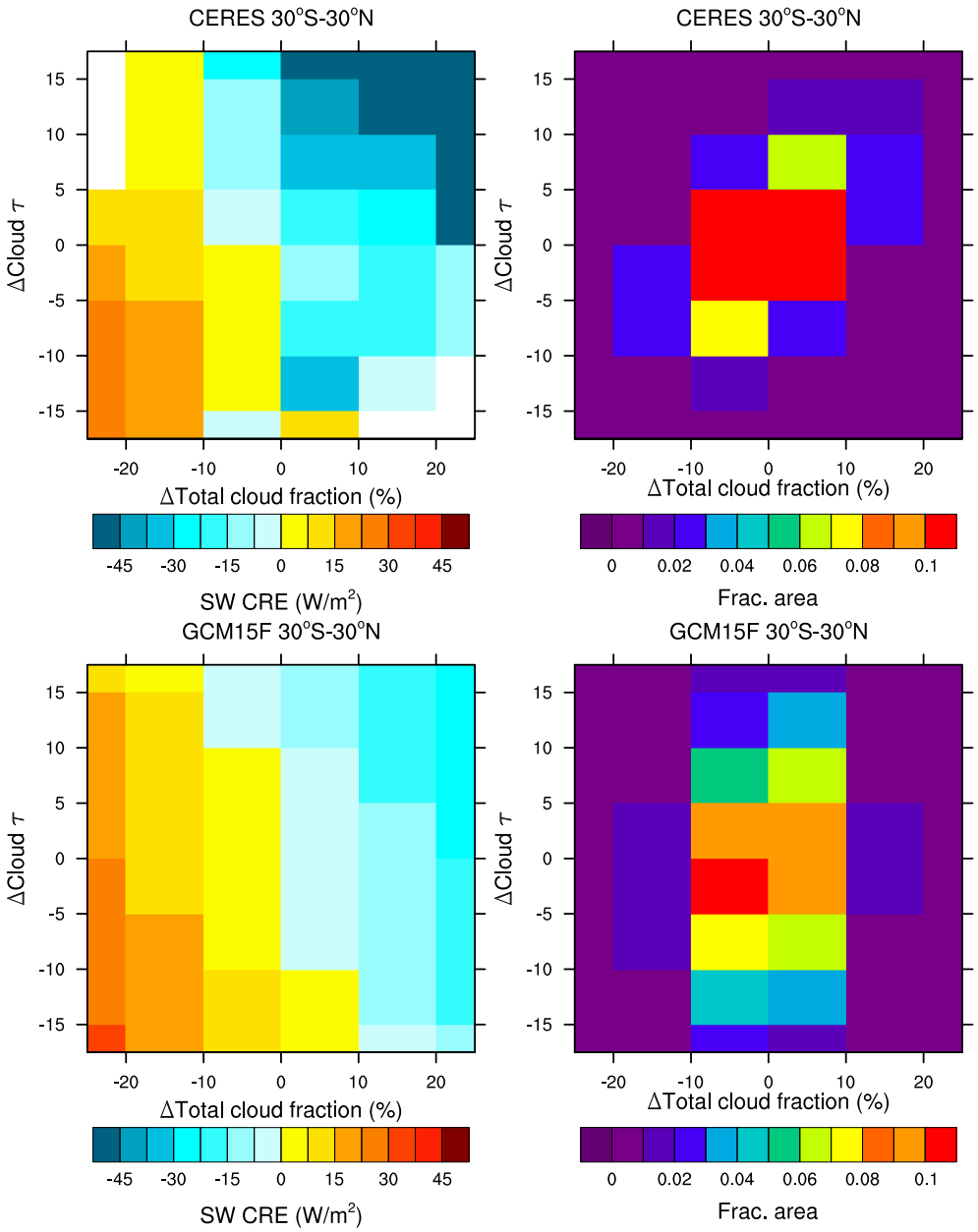


Reasonably good relationships between cloud radiative effect and total cloud fraction

LW TOA CRE and cloud properties anomalies



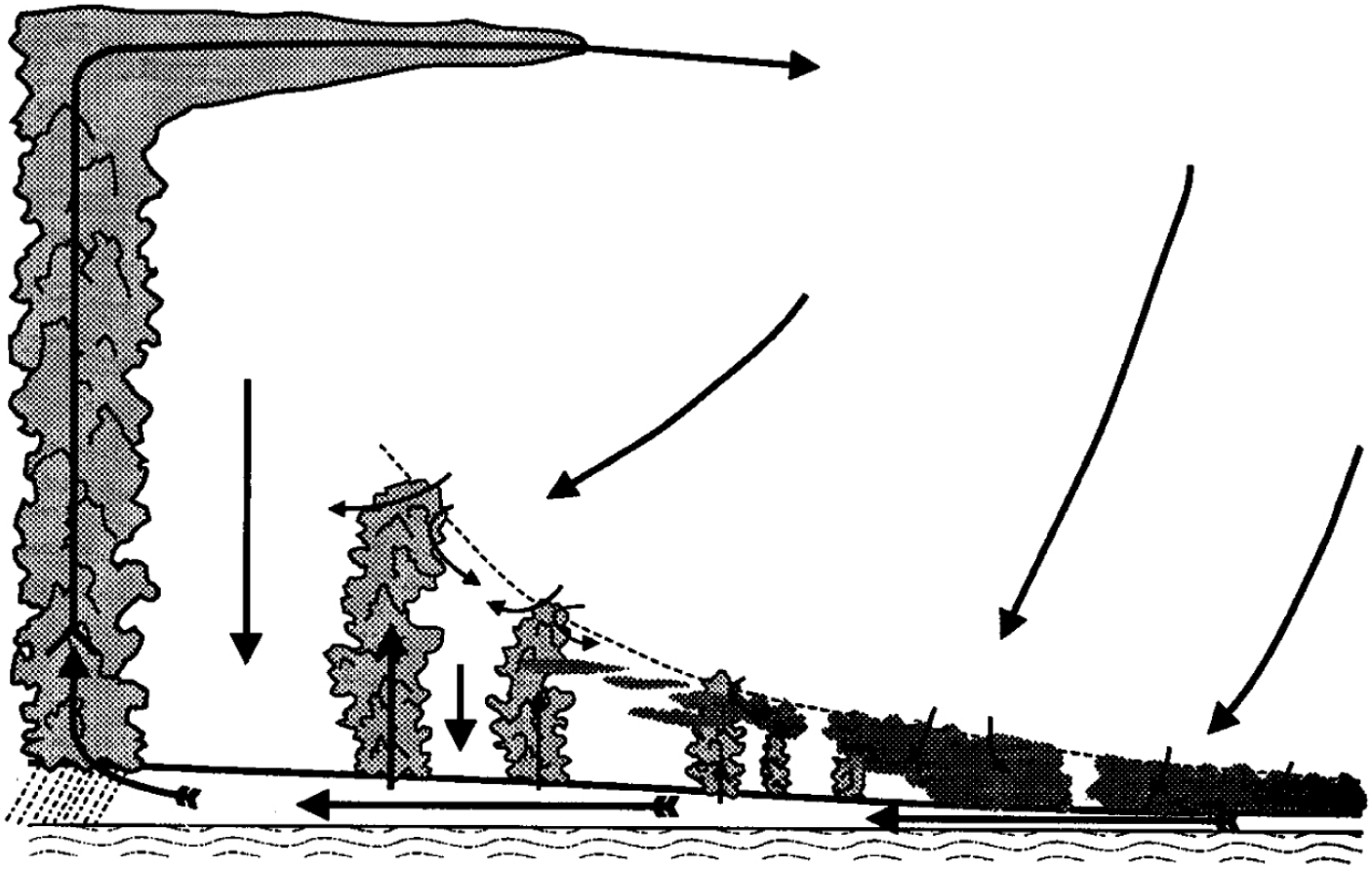
SW TOA CRE and cloud properties anomalies



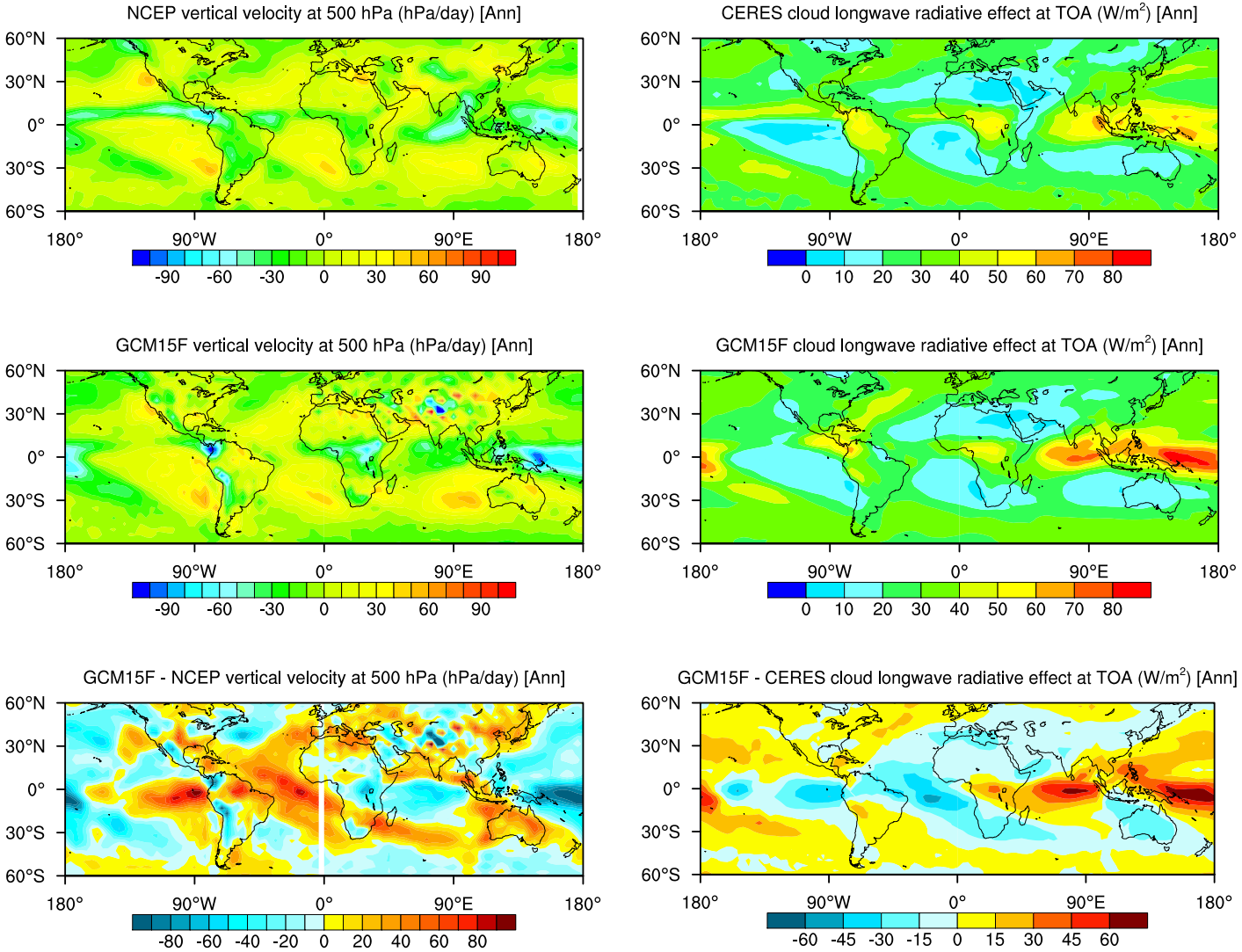
Compositing by dynamical state (Bony diagrams)

- "Bony" diagrams (Bony et.al., 2004, Climate Dynamics)
- Composite tropical (30°S-30°N) means using ω at 500 hPa

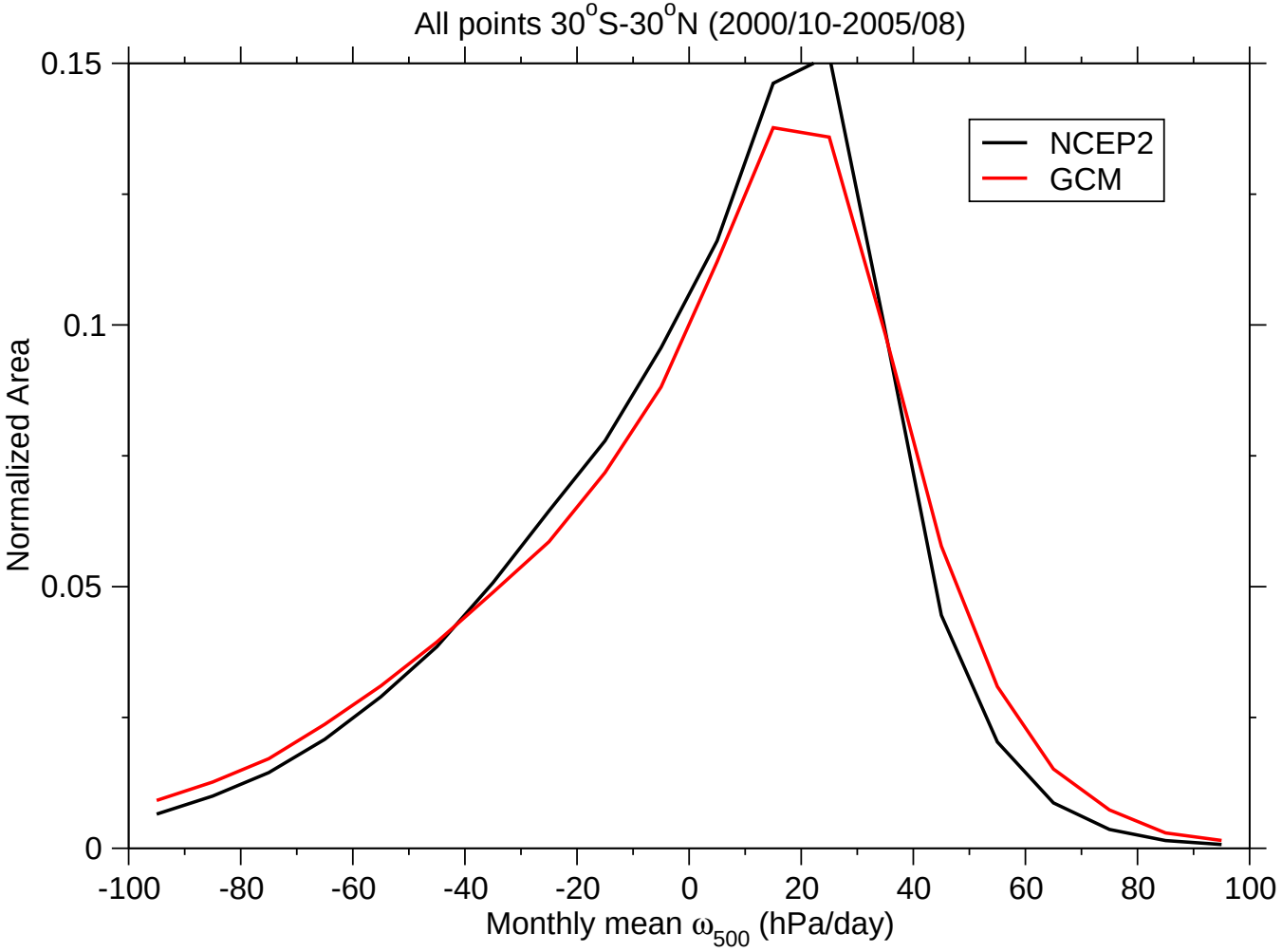
$$\overline{C} = \int_{-\infty}^{\infty} P_\omega C_\omega d\omega$$



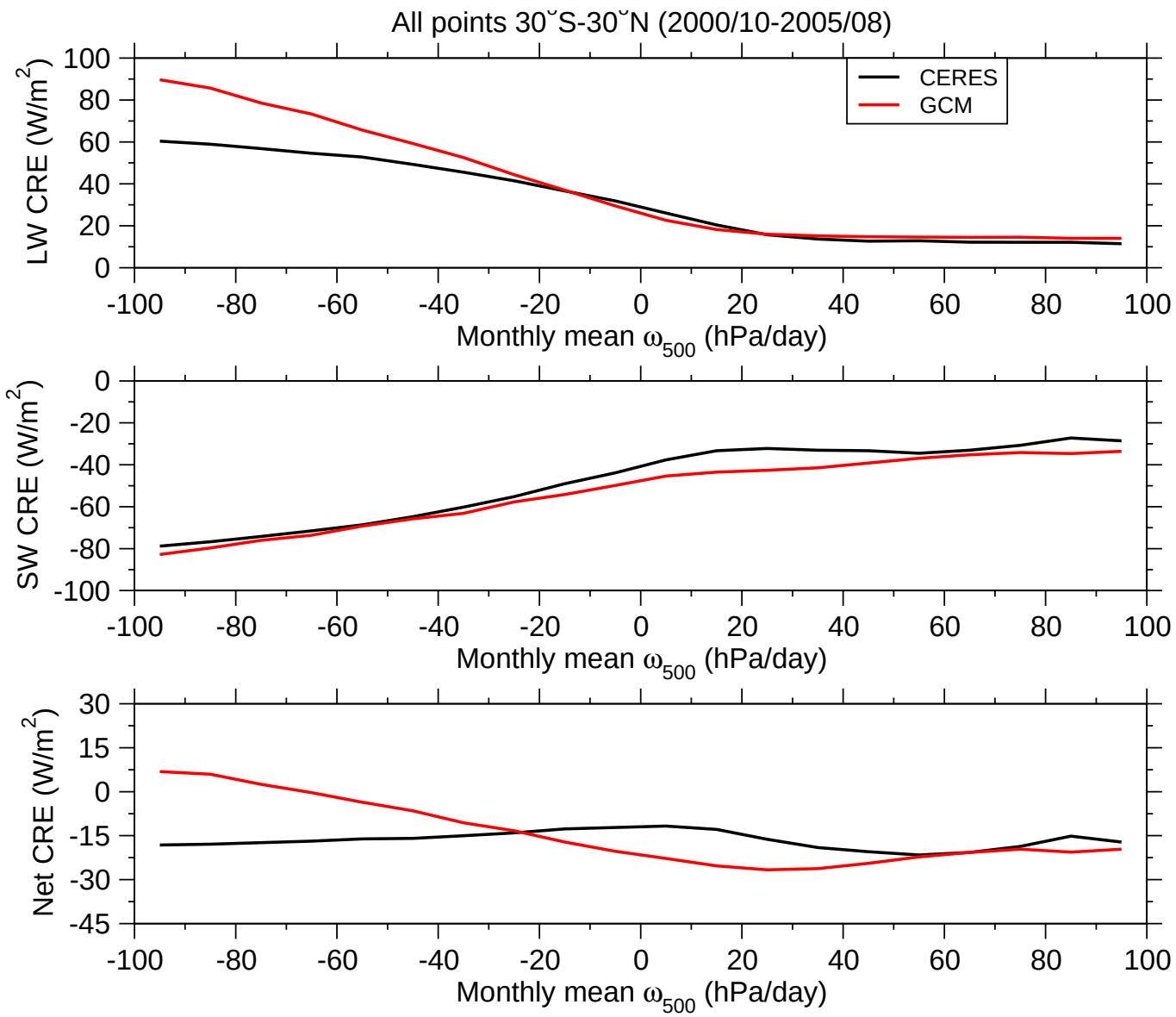
Vertical velocity and TOA LW CRE (2001/01-2004/12)



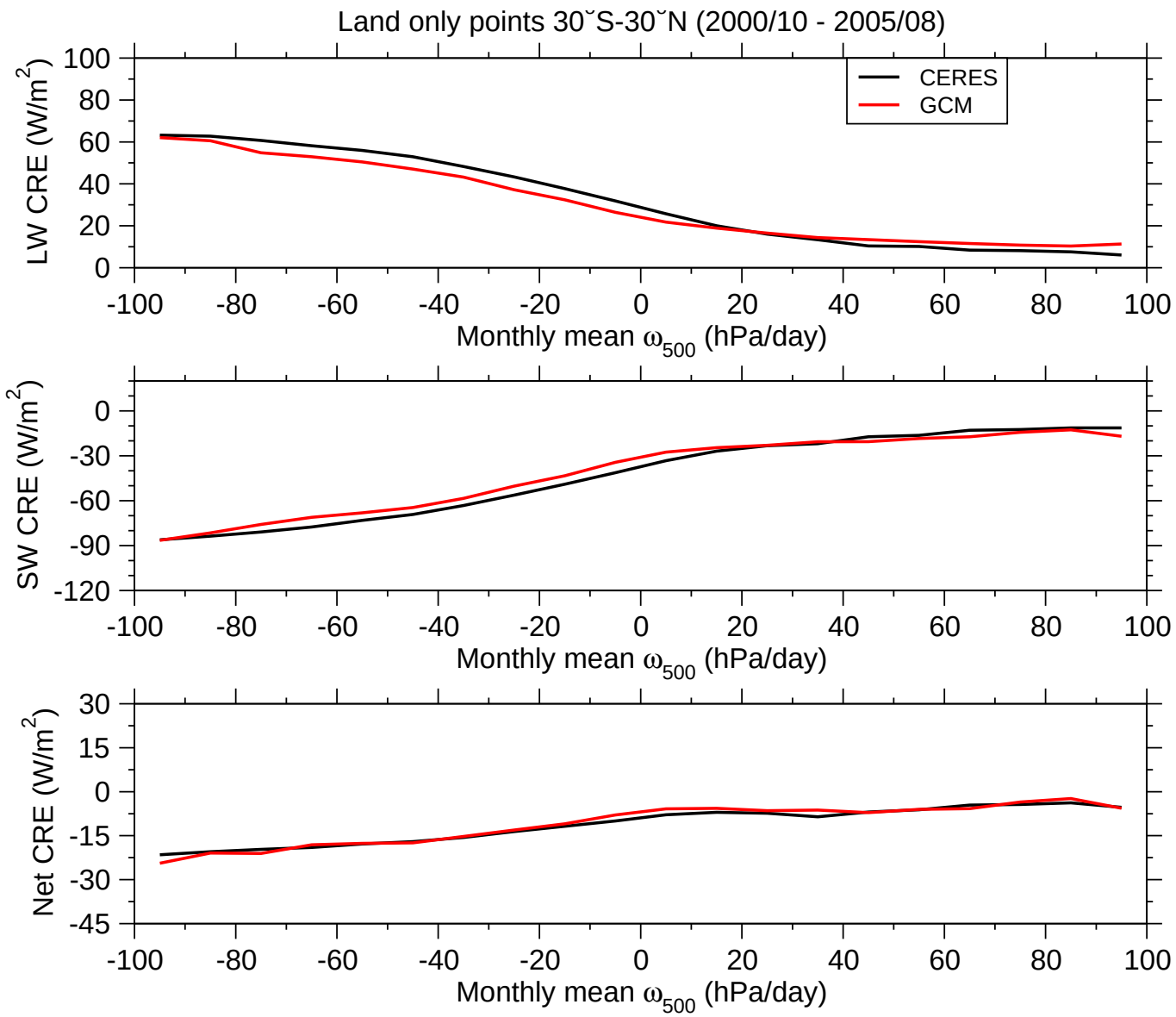
Fractional area of vertical velocity



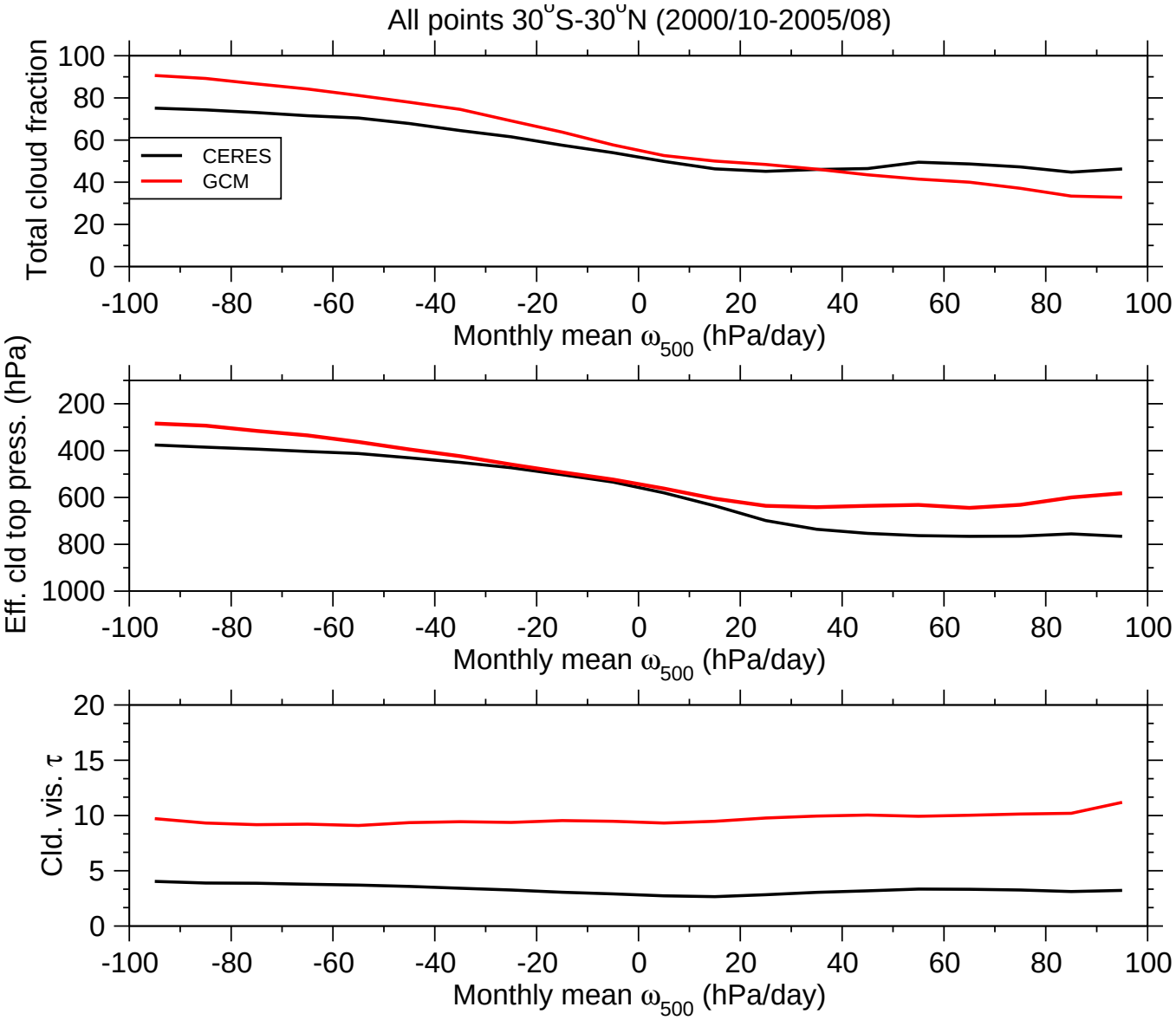
TOA CRE function ω (30°S-30°N)



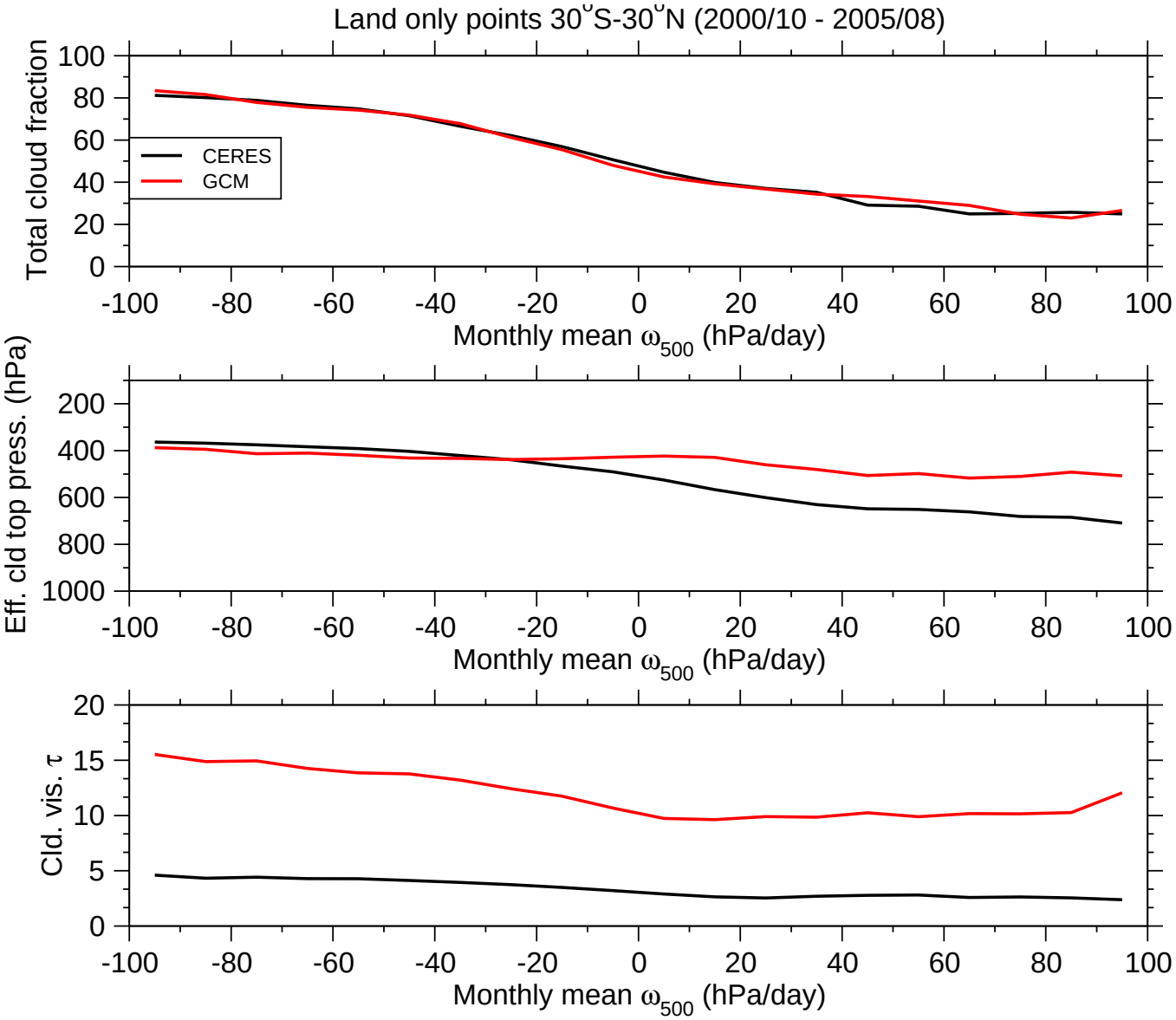
TOA CRE function ω over land (30°S-30°N)



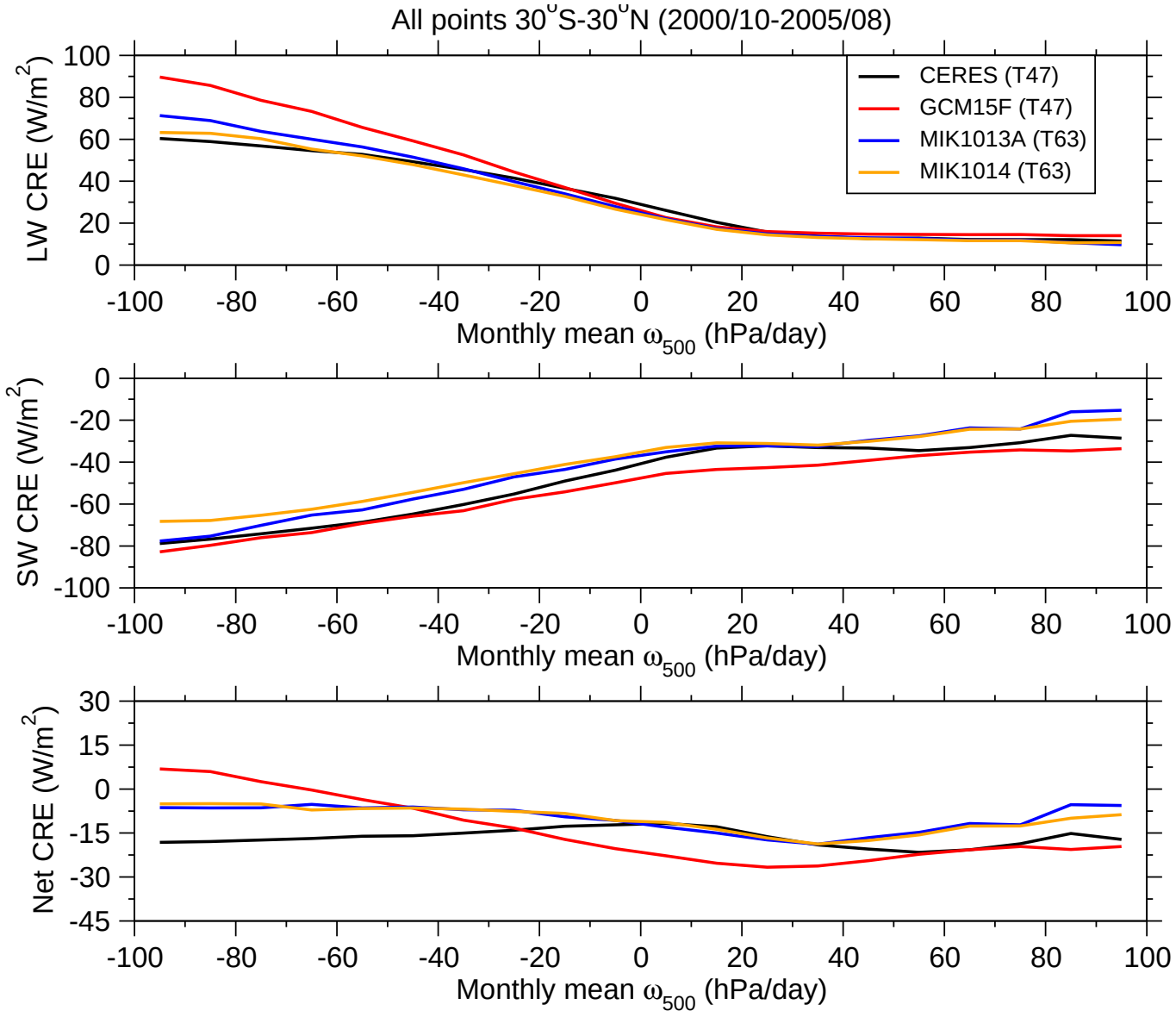
Cloud props. function ω (30°S-30°N)



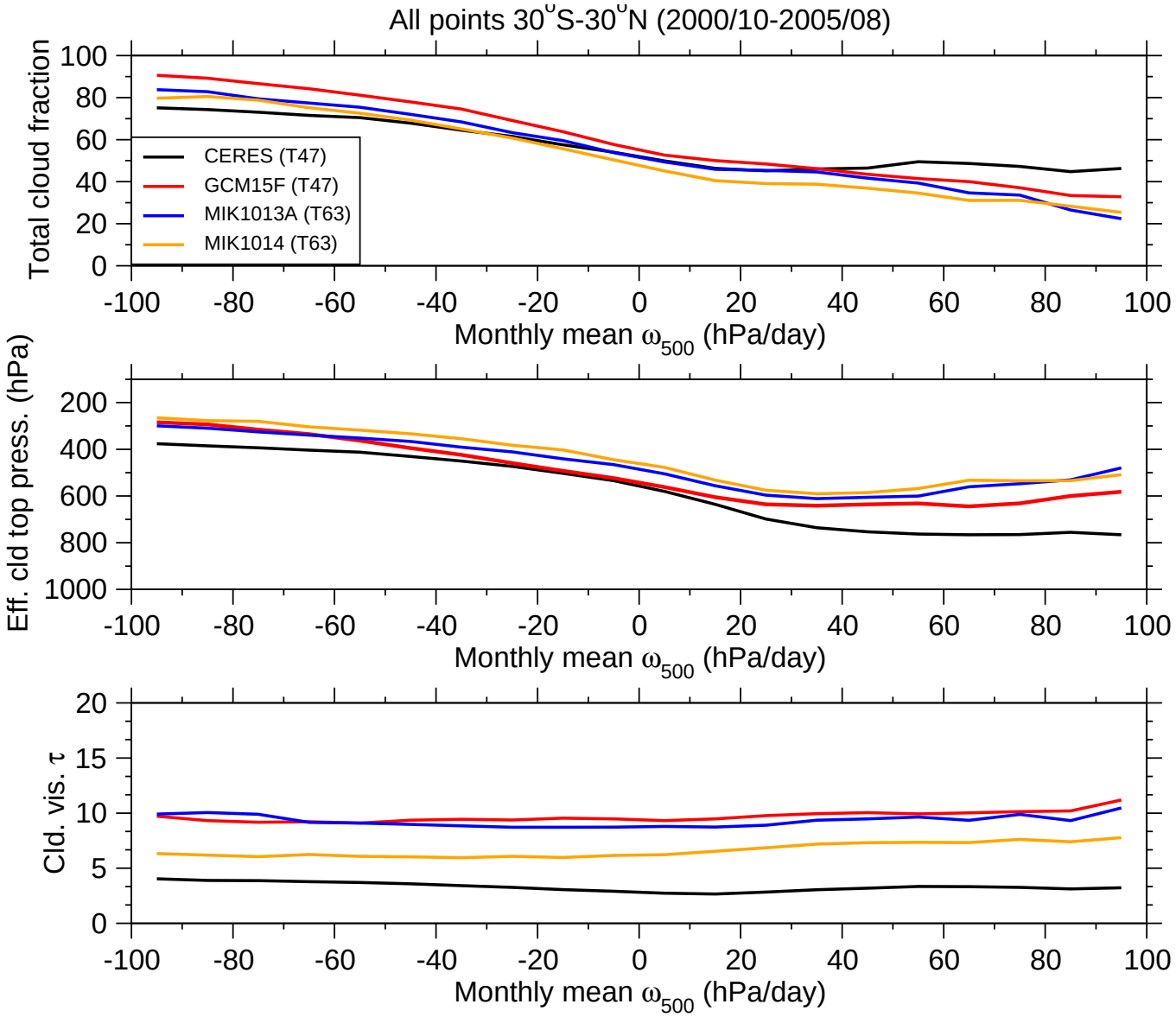
Cloud props. function over land ω (30°S-30°N)



Bony plots GCM test runs (PRELIMINARY!!)



Bony plots GCM test runs (PRELIMINARY!!)



Summary and the next 12 months

- Times-series of monthly anomalies not very similar
- Cld. rad. effect anomalies consistent with cld. prop. anomalies
- Differences in cld. properties and radiation fn dynamic state
  - Seems to improve with latest GCM version
- Analyse CFMIP-1 results
- Continue diagnostics (reproduce Wyant, 2006 paper)
- Look at sub-monthly fields (daily, diurnal cycle)
- Implement CloudSat/CALIPSO simulator
  - Precip. in stochastic cloud generator
- Involvement with CFMIP-2
- Use of the MMF

The End