Using COSP to evaluate clouds in the CanAM4 and CanESM2

Jason Cole c/o Phil Austin

Canadian Centre for Climate Modelling and Analysis



Models and CMIP5 experiments

Some basic evaluation of CCCma's contribution to CFMIP-II

CanAM4 - Canadian Atmospheric Model version 4

- Used for all AMIP type experiments requested for CMIP5
- T63 horizontal resolution, 35 vertical layers, top \sim 1 hPa

CanESM2 - Canadian Earth System Model version 2

CanAM4 coupled to ocean, sea-ice and carbon cycle models

Simulations

- Ran all CFMIP-II experiments except aqua-planet
- Ran AMIP type experiments 1950-2009

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Zonal-mean cloud fractions

Biases in GCM are consistent using ISCCP or CALIPSO



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Cloud fraction anomaly time-series (60°S-60°N) Trends in ISCCP observations not seen in simulations



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Change cloud fraction (60°S-60°N)

Preliminary results



Change cloud fraction

Preliminary results

Patterned SST change high cloud



4xCO₂ change high cloud



Patterned SST change low cloud

-2

6

10



4xCO₂ change low cloud





-10

-6

Cloud albedo (July 2000-2005) CERES+MODIS $\Rightarrow \alpha = \overline{F_{\uparrow}}/\overline{S_{\circ}}$

 $\rightsquigarrow \overline{X}$ is 24-hour average assuming constant atm. state



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Cole et. al., J. Climate, 2011

Cloud fraction albedo histogram

Constructed using daily-means between 60°S and 60°N



Summary

- For the period overlapping ISCCP and CALIPSO obs, CanAM4 and CanESM2 have similar biases
- There are no clear trends in the simulated cloud fractions over the ISCCP record
- Cloud changes are similar in sign for Cess-like and 4xCO₂ experiments
- Patterned SST experiments capture aspects of the cloud fraction changes in the coupled runs
- CanAM4 simulates cloud-mean albedo that is too large
 - Mainly due to low clouds with too large water paths
- · Histograms highlight issues with simulated clouds
- CERES team developing cloud-mean TOA flux dataset

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