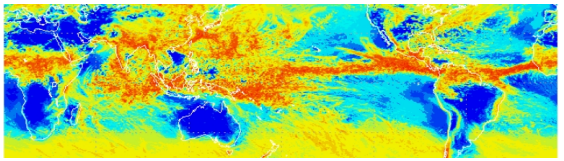
Cloud Feedback Model Inter-comparison Project Phase-2 (www.cfmip.net)

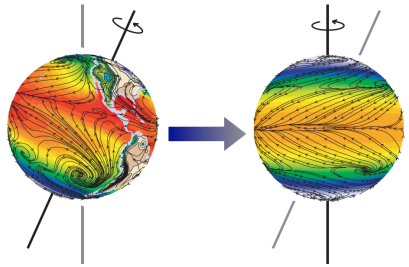
Co-Chairs :
Sandrine Bony & Mark Webb

Coordination Committee:
Chris Bretherton, Steve Klein, George Tselioudis,
Pier Siebesma & Minghua Zhang

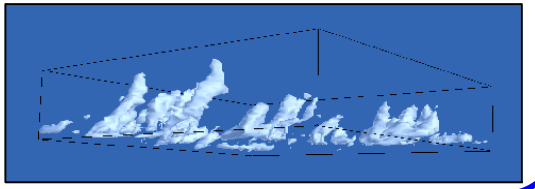
Cloud Feedback Model Inter-comparison Project Phase-2
CFMIP-2 (www.cfmip.net)

GCM analysis through a hierarchy of models

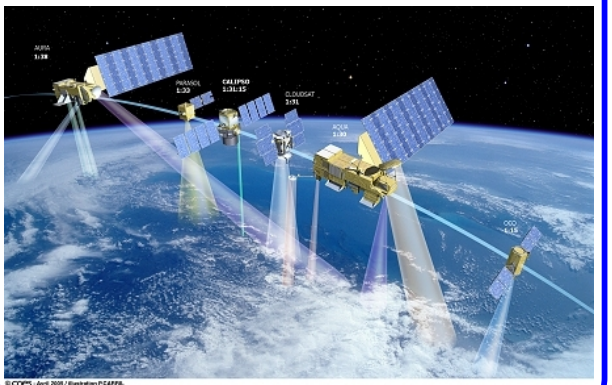




Process studies (in-situ obs, LES/CRMs)

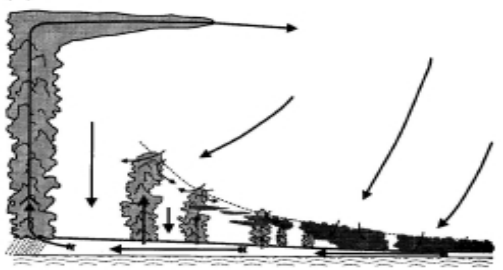


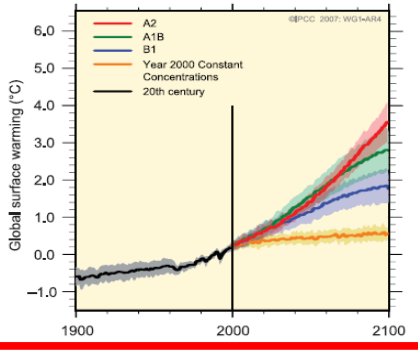
Satellite observations & simulators (COSP)



Understanding ····· **Evaluation**

Assessment of cloud-climate feedbacks





Spreadsheets showing plans for all of the CFMIP-2 models (available at http://www.cfmip.net -> Data Availability)

UKMO HadGEM2 82 available May '12

MPI ESM 63 planned by Mar '12, 63 available May '12

CCCma CanAM4/CanESM2 85 planned by Mar '12, 60 available Jan '12

IPSL CM5a-LR 79 planned by Mar 12, 58 available Jan '12

NCAR CAM4 (Worksheet 1) 67 planned by Jun '12, 41 May '12

MIROC5 75 planned by Dec '12, 53 available May '12

CNRM CM5 44 available Jan '12

MRI 58 planned by Aug '12, 49 planned by Jun, 34 available May '12

MIROC-ESM 20 planned by Dec '12, 8 available May '12

NCAR CAM5 (Worksheet 2) 48 planned by July '12, 0 available May '12

KNMI EC-EARTH 32 planned but not before Jun '12, 0 available Jan '12

ACCESS 23 planned by Dec '12, 0 available May '12

NICAM 18 planned, 0 available May '12

GFDL CM3 6 planned by Jun '12, 0 available May '12

CFMIP
Cloud Feedback Model Intercomparison Project

The role of cloud processes and feedbacks in the climate system

Joint EUCLIPSE-CFMIP meeting, May 29th – Jun 1st 2012, Paris

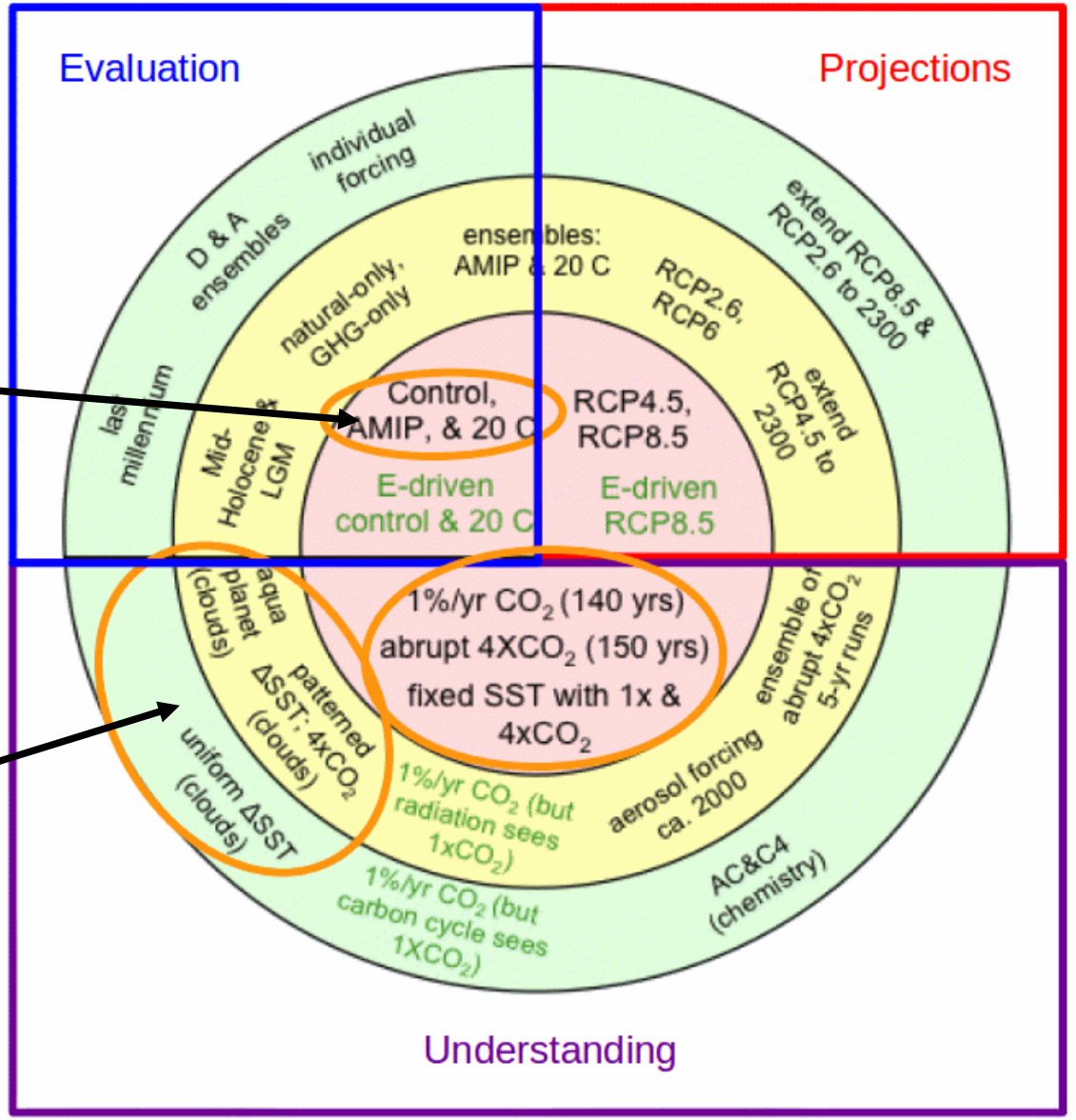
Three main topics :

1. The evaluation of (CMIP5) model clouds using observations and process models
2. The role of cloud processes in large-scale atmospheric dynamics
3. The role of cloud processes in climate adjustments and feedbacks

CMIP5 long-term set of experiments

COSP outputs, process and radiative diagnostics, cfSites outputs

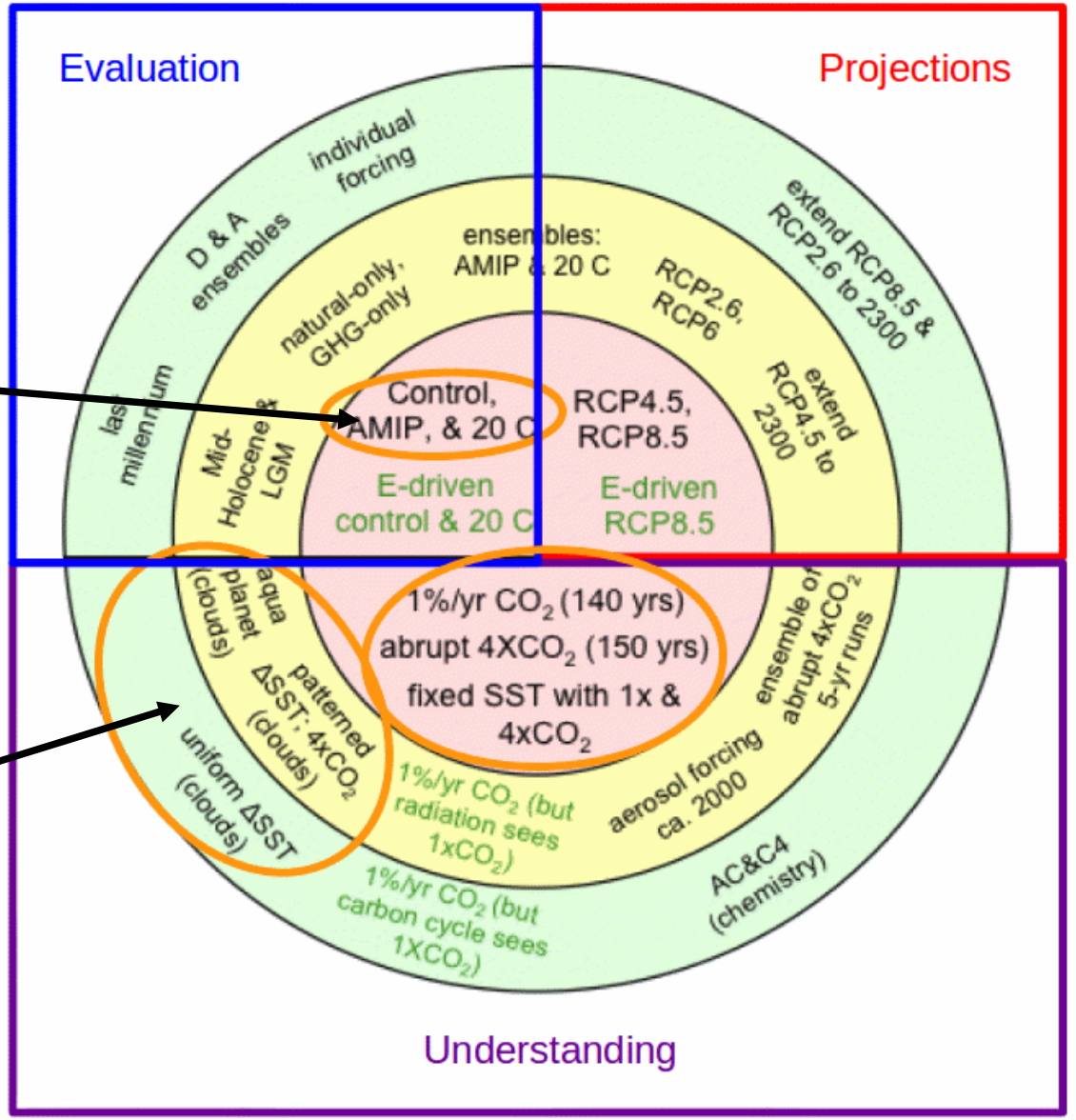
Idealized experiments (amip4xCO2, amipFuture, amip4K, aquaControl, aqua4xCO2, aqua4K)



CMIP5 long-term set of experiments

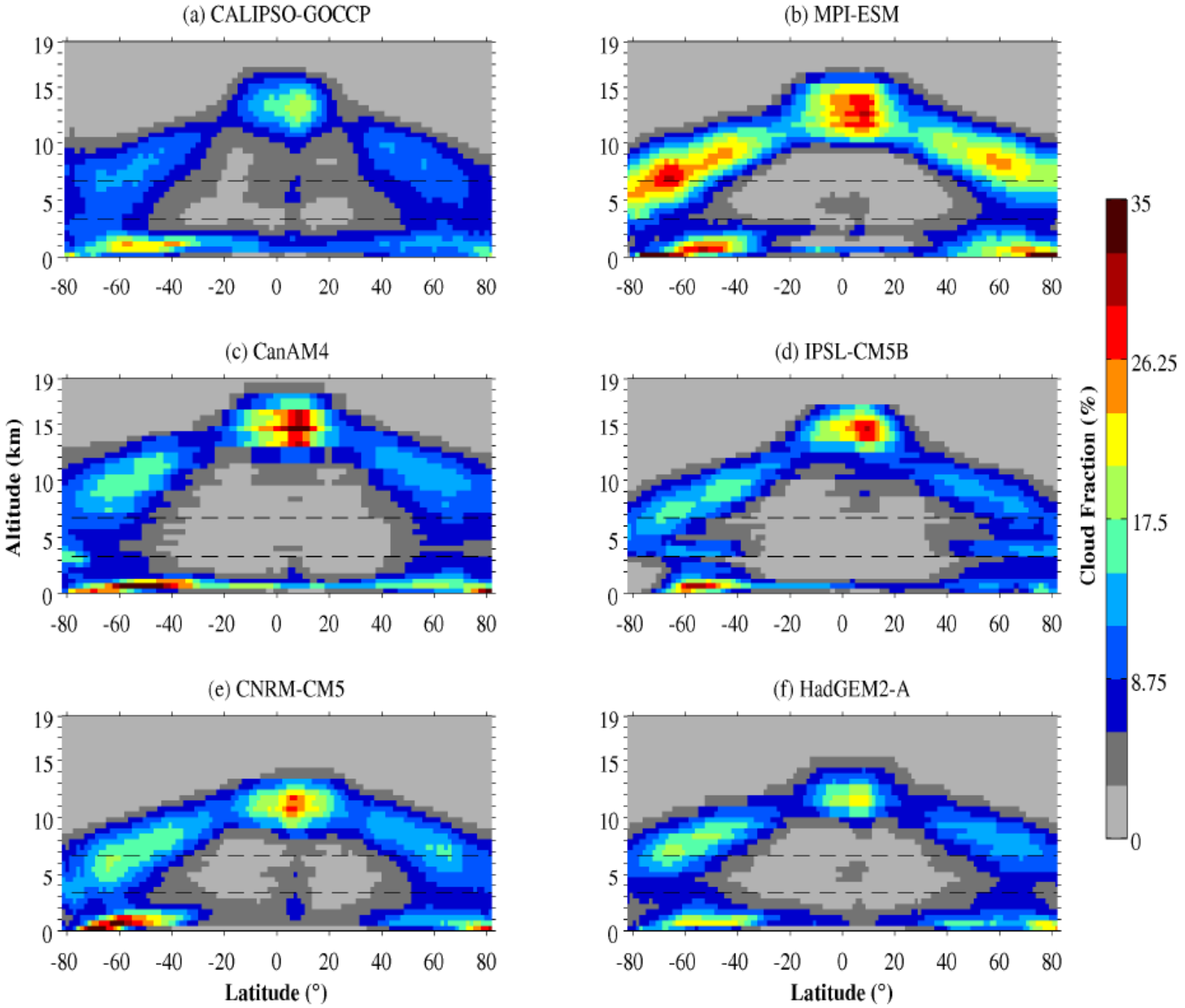
COSP outputs, process and radiative diagnostics, cfSites outputs

Idealized experiments (amip4xCO2, amipFuture, amip4K, aquaControl, aqua4xCO2, aqua4K)



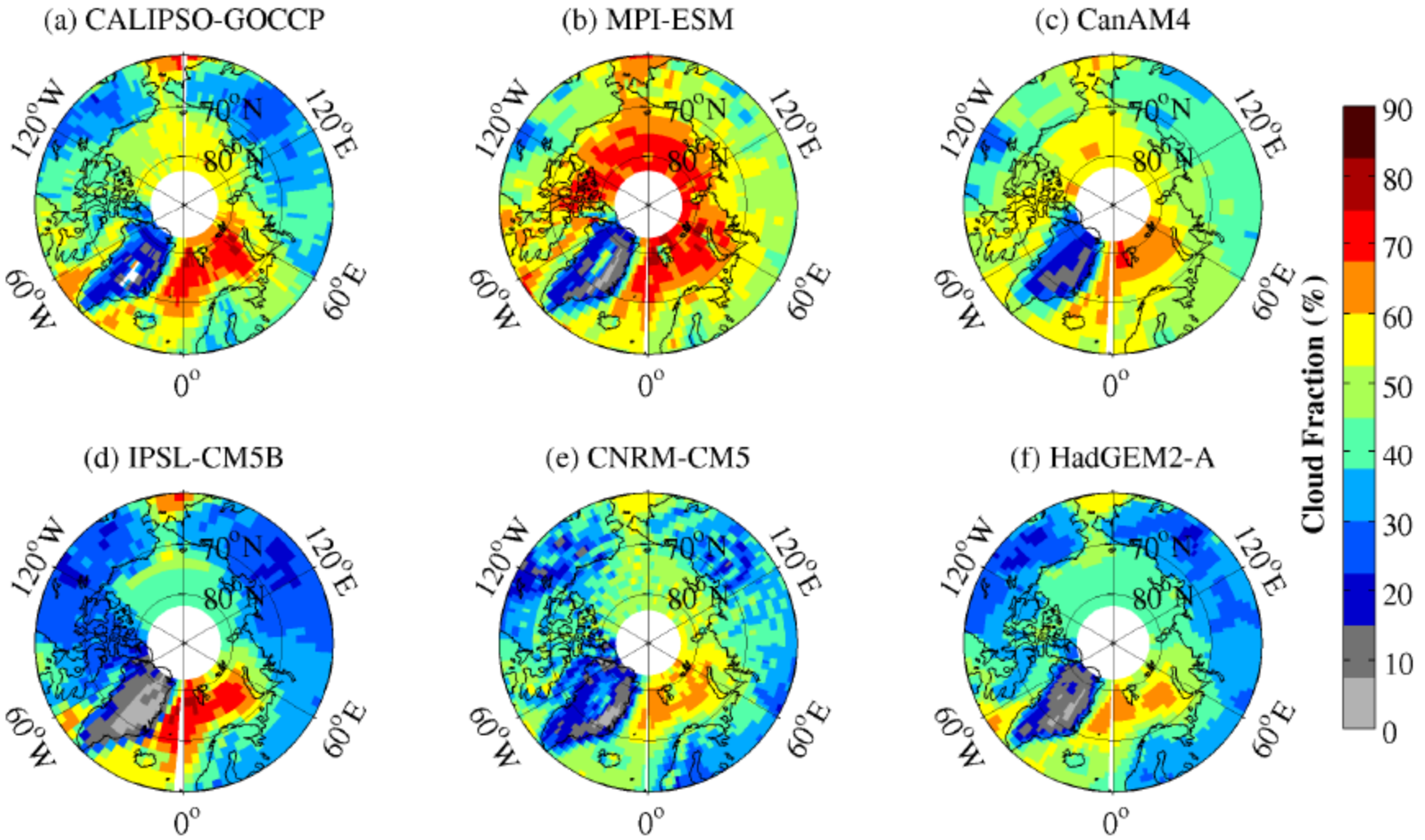
CFMIP outputs (as of Sept 2012) :
cfMon, cfDay (COSP) : 10 models
cfSites (processes, high freq): 7 models

3D distribution of clouds



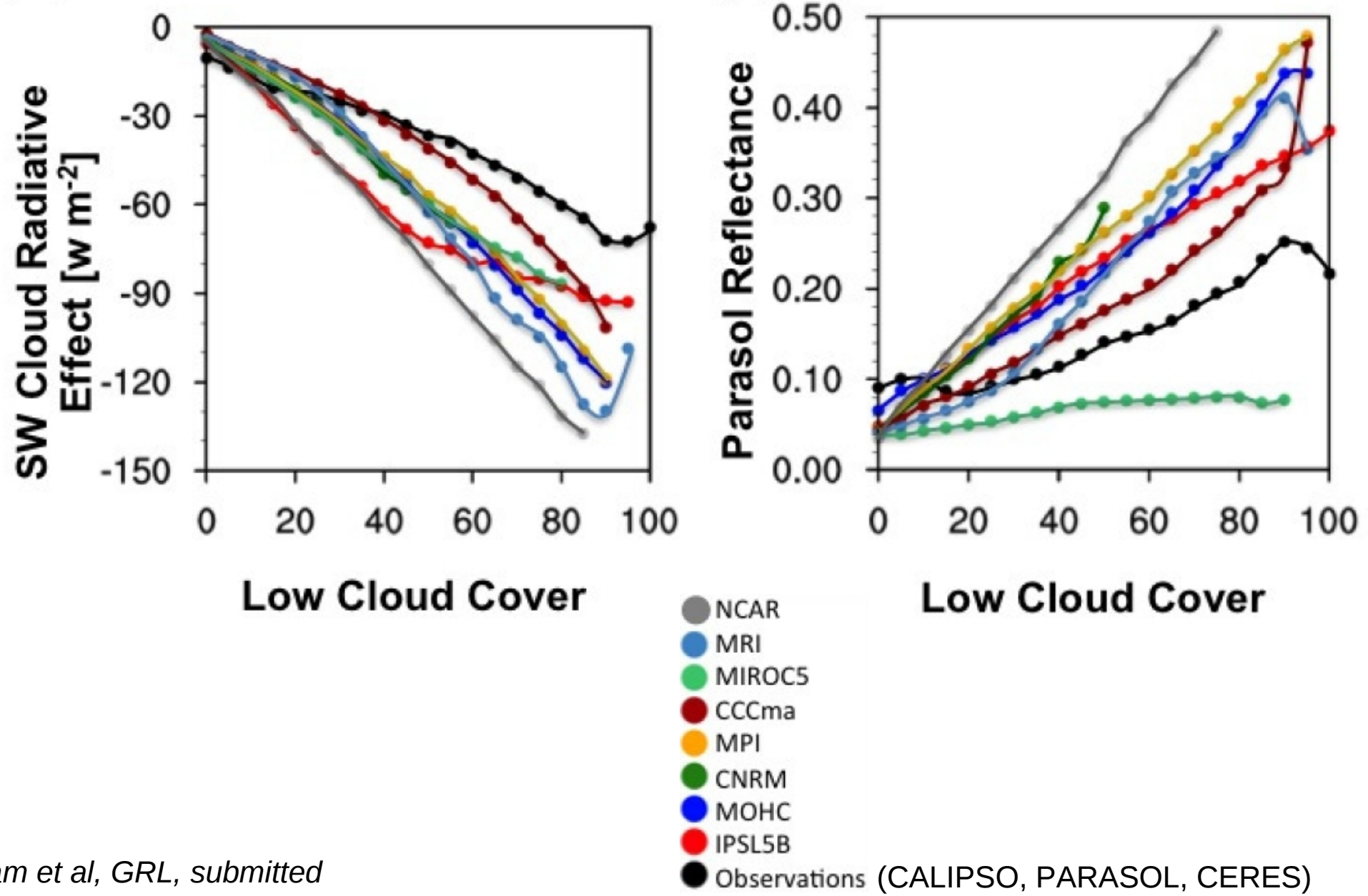
Cesana & Chepfer, GRL, submitted

Arctic low cloud cover



Cesana & Chepfer, GRL, submitted

Too few, too bright low-cloud problem



Nam et al, GRL, submitted

(CALIPSO, PARASOL, CERES)

CFMIP Observations for Model Evaluation

http://climserv.ipsl.polytechnique.fr/cfmip-obs.html

now part of Obs4MIPs

CLIMSERV
SERVICE DE DONNEES ET DE CALCUL DE L'IPSL

Institut Pierre Simon Laplace

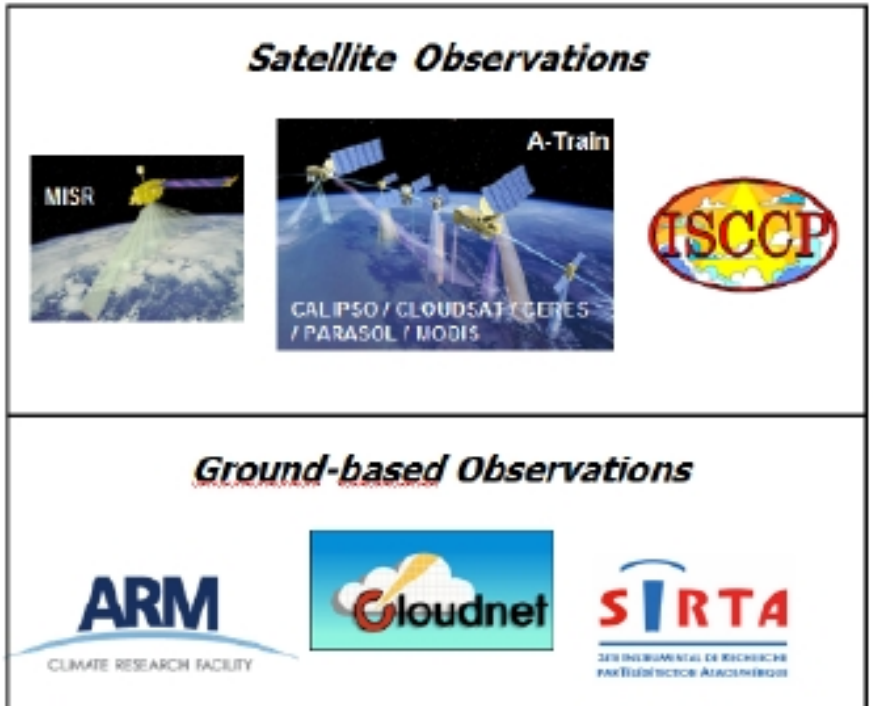
CFMIP Observations for Model evaluation

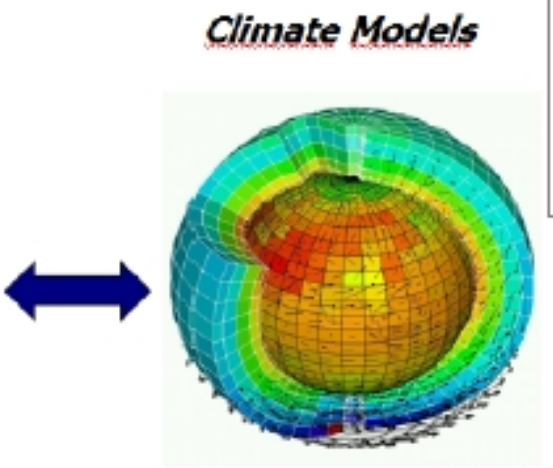
Page 1 sur 13

CFMIP Observations for Model evaluation

The Cloud Feedback Model Intercomparison Program has designed a protocol to evaluate clouds in climate and weather prediction models based on satellite observations (http://cfmip.metoffice.com/CFMIP2_experiments_March20th2009.pdf)

Index de l'article

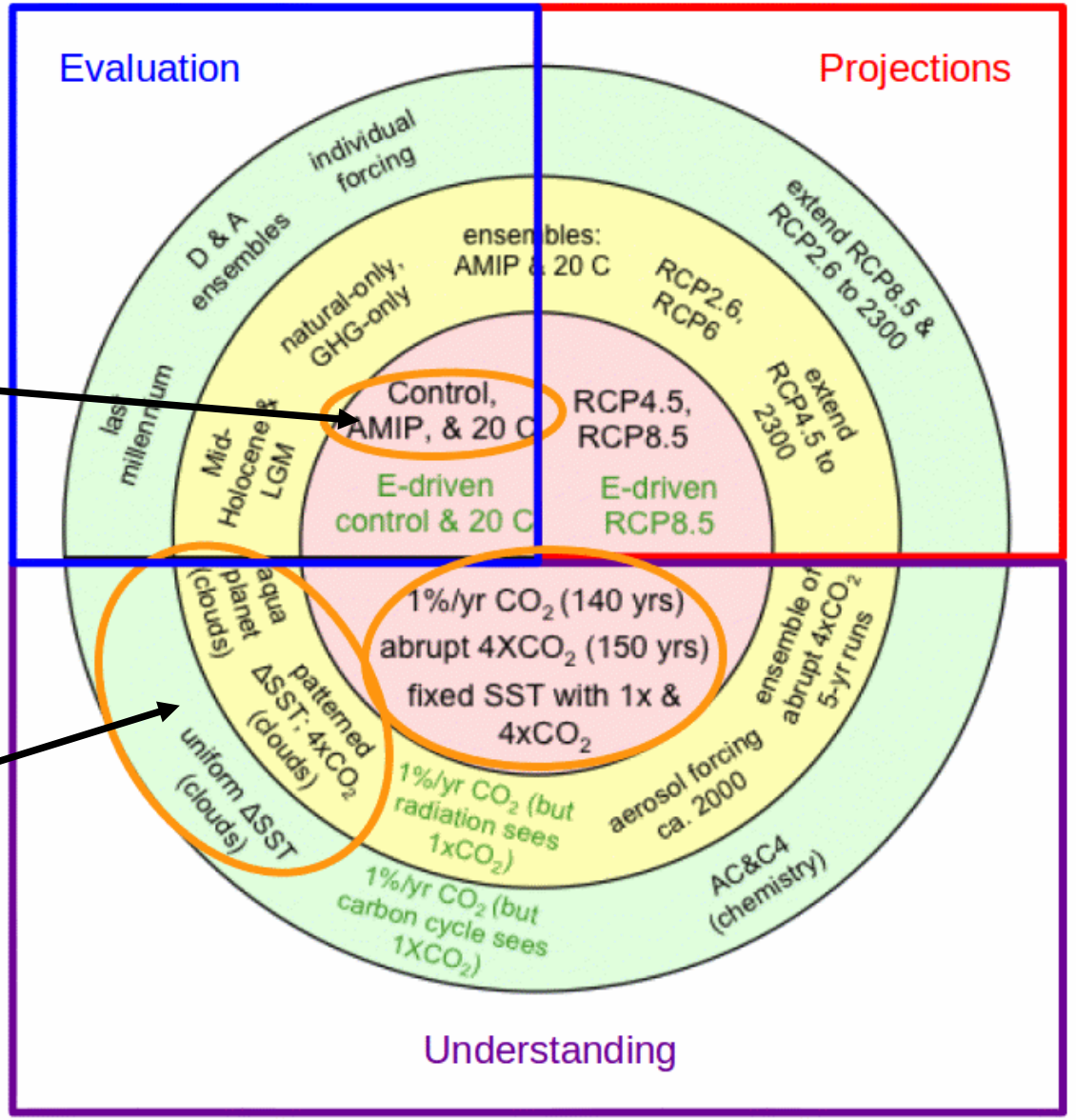




CMIP5 long-term set of experiments

COSP outputs, process and radiative diagnostics, cfSites outputs

Idealized experiments (amip4xCO2, amipFuture, amip4K, aquaControl, aqua4xCO2, aqua4K)



CFMIP2/CMIP5 experiments (as of Sept 2012) :

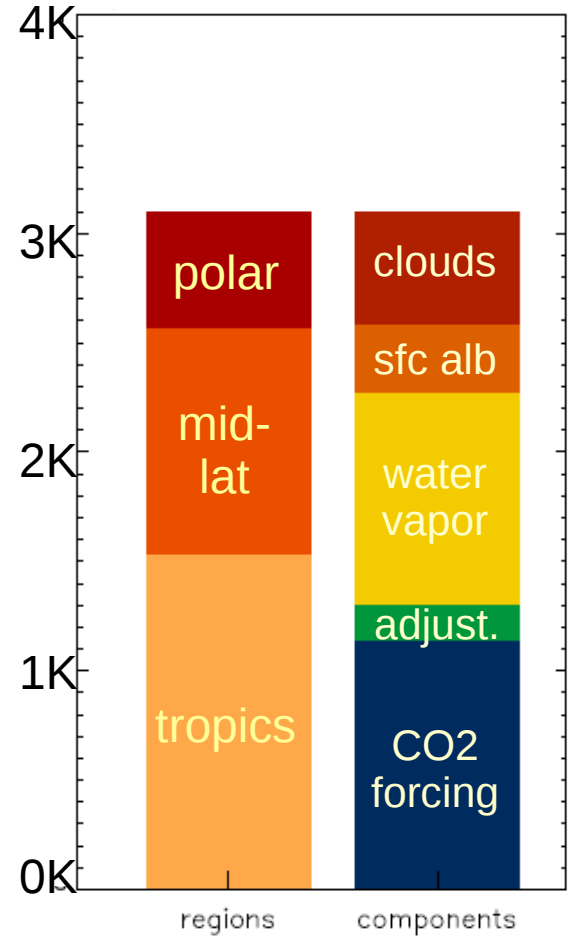
amip4xCO2, amip4K : 12 models ; aqua-planets : 11 models

abrupt4xCO2 : 28 models ; sstClim with 1x and 4xCO2 : 15 models

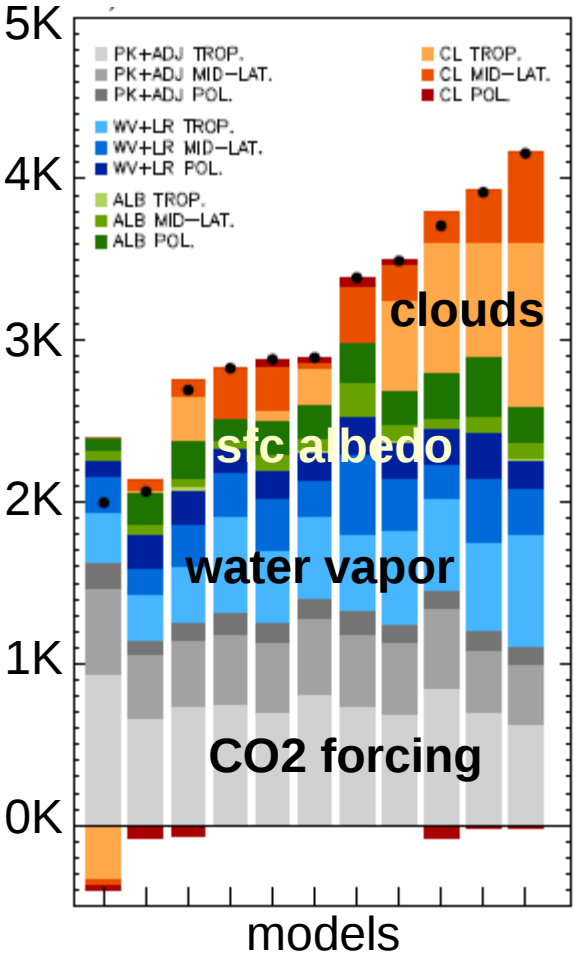
Climate Sensitivity

Still a large spread among CMIP5 models : 2.1 – 4.7 K (Andrews et al. GRL, 2012)

Decomposition of CMIP5 MMM Climate Sensitivity



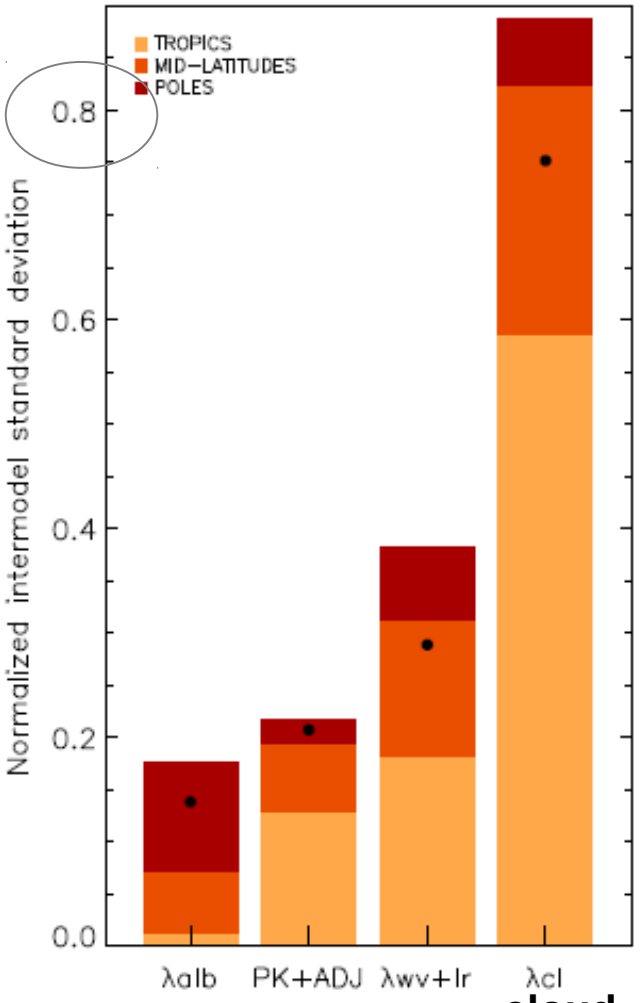
Climate Sensitivity of each CMIP5 model



Vial et al., Clim. Dyn., submitted

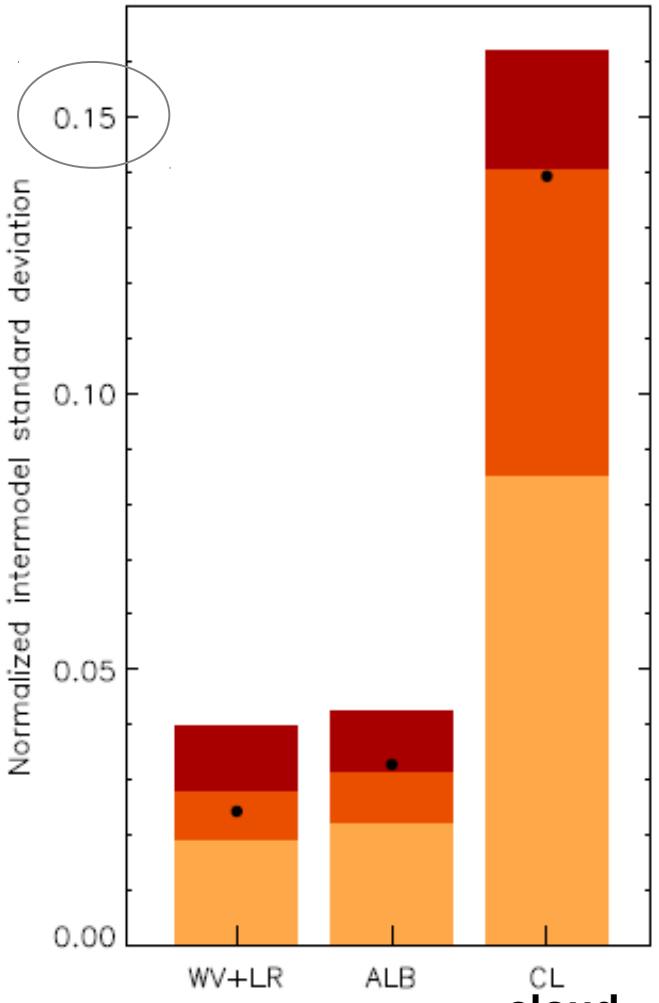
Analysis of the spread of Climate Sensitivity estimates

Forcing, feedbacks and adjustments



cloud feedbacks

Tropospheric adjustments



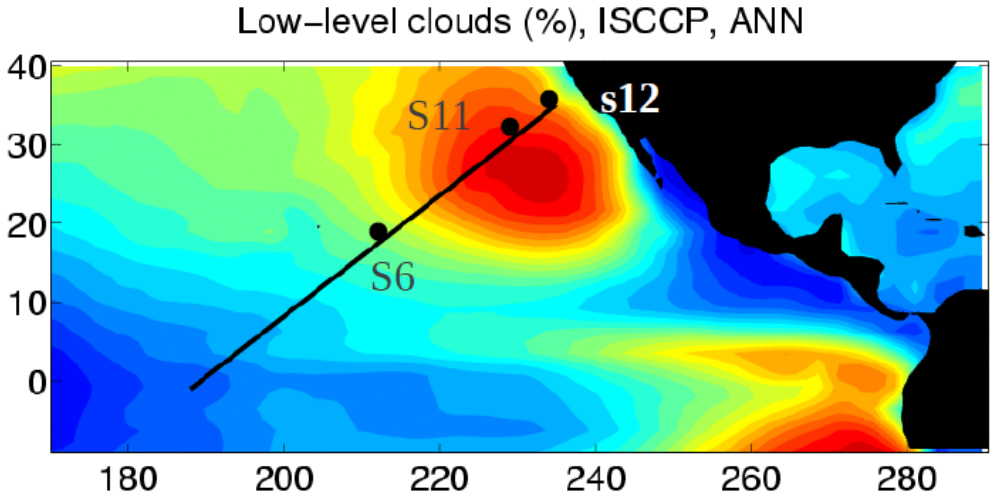
cloud adjustments

Vial et al., Clim. Dyn., submitted

CGILS project

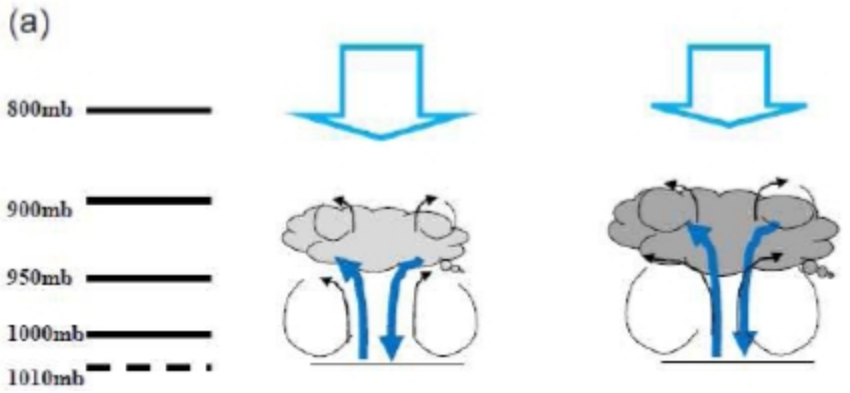
(WGCM/CFMIP & GEWEX/GASS)

Comparison of marine low-cloud feedbacks predicted by LES models and single-column versions of GCMs



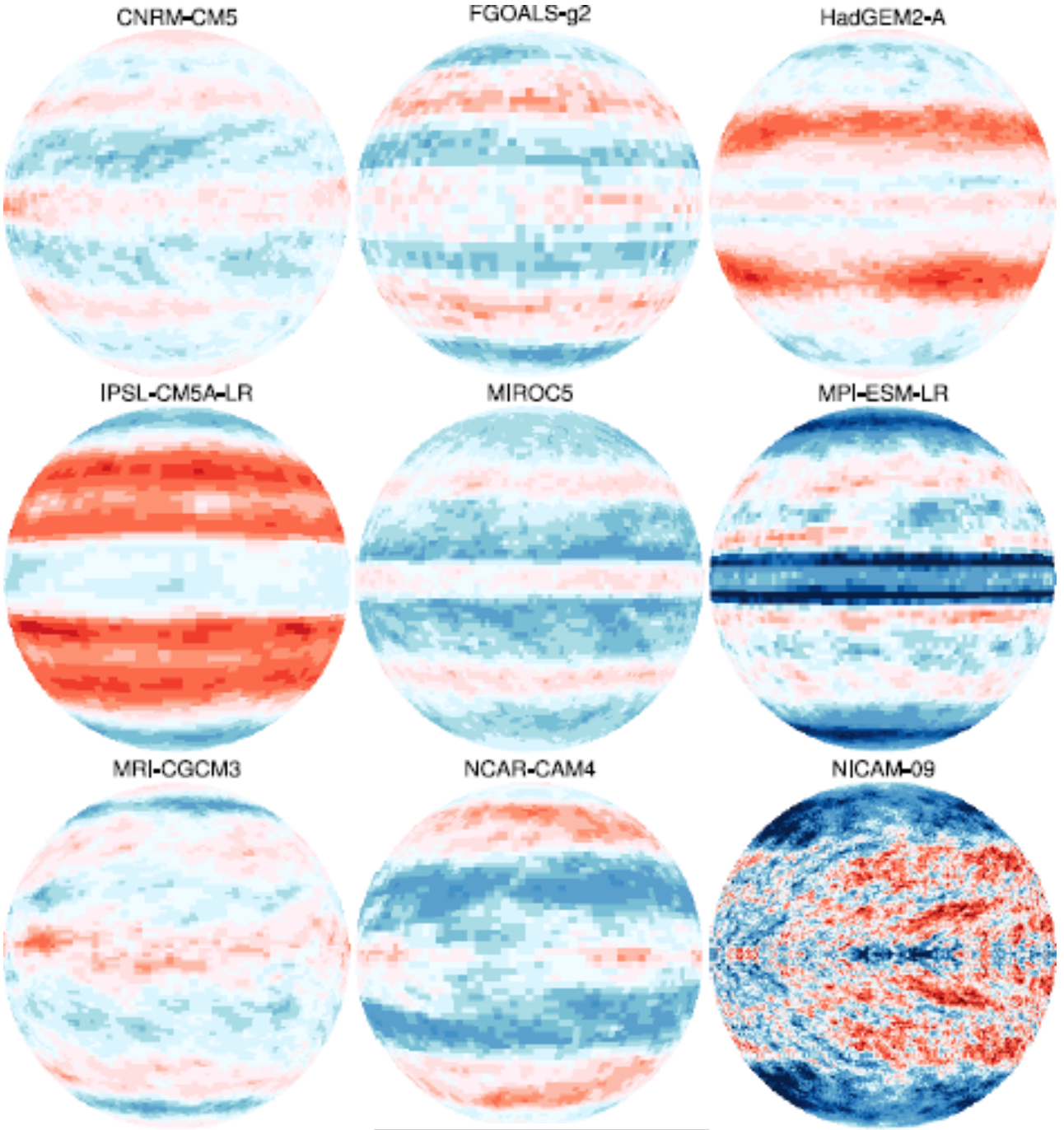
LES : - neutral or positive low-cloud feedback in shallow Cu and StrCu regimes (S6, S11) ;
- negative cloud feedback in S12 (but very dependent on the forcing)

SCMs : larger spread.



Zhang et al., BAMS, submitted
Blossey et al., JAMES, submitted
Zhang et al., JAMES, submitted
Bretherton et al., JAMES, submitted

Aqua-Planets

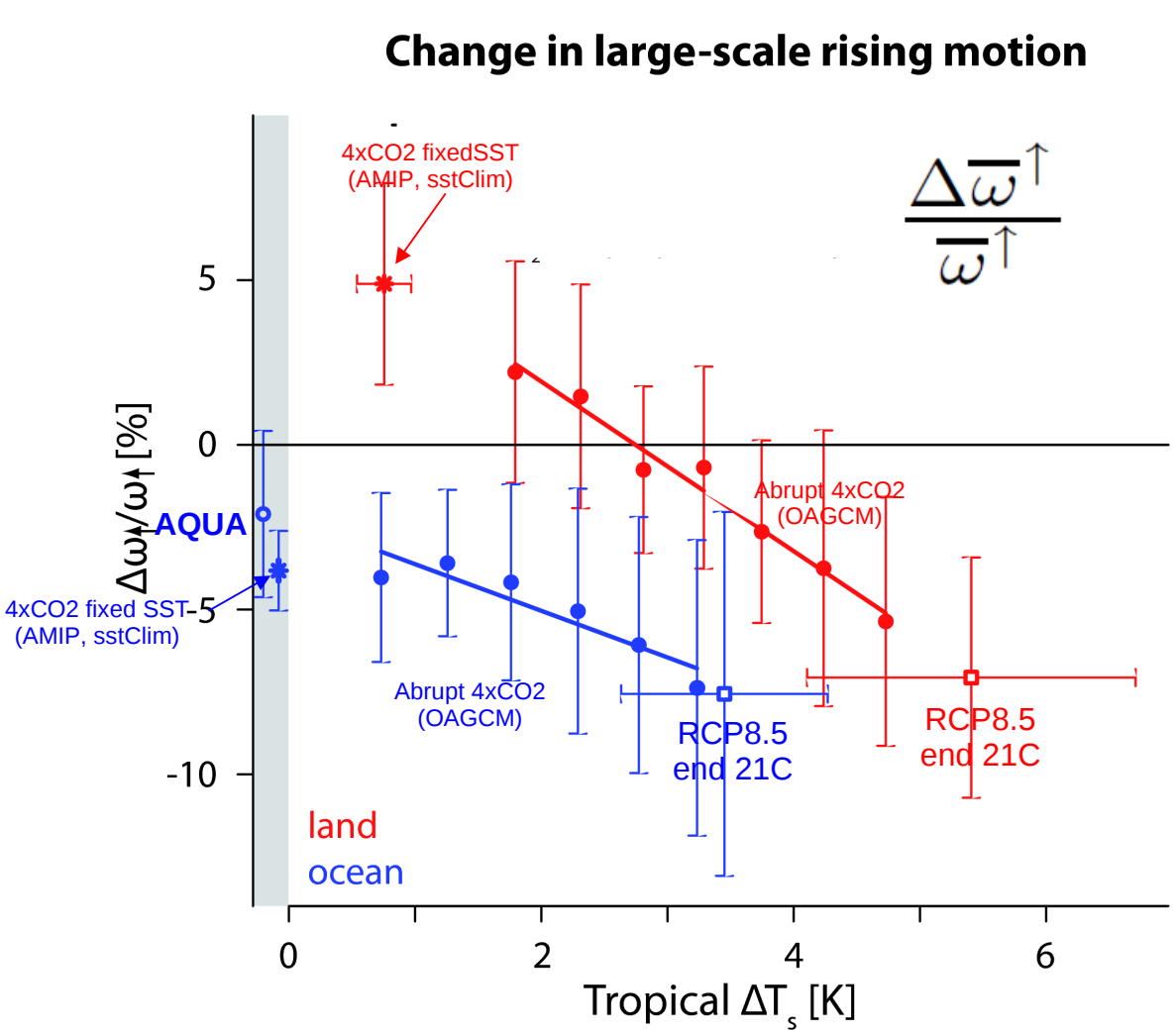


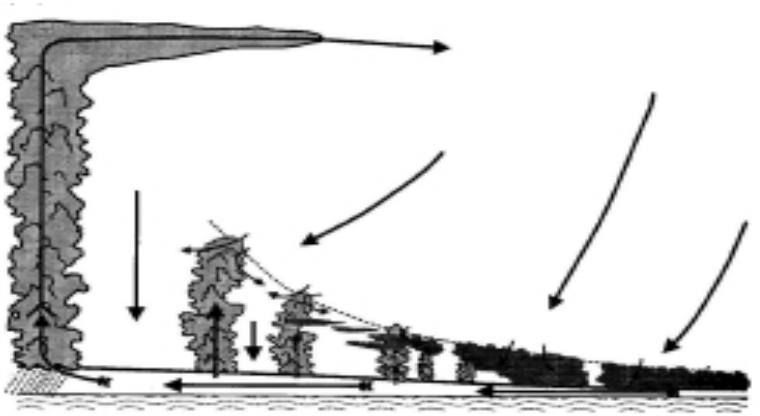
NICAM (9 km)

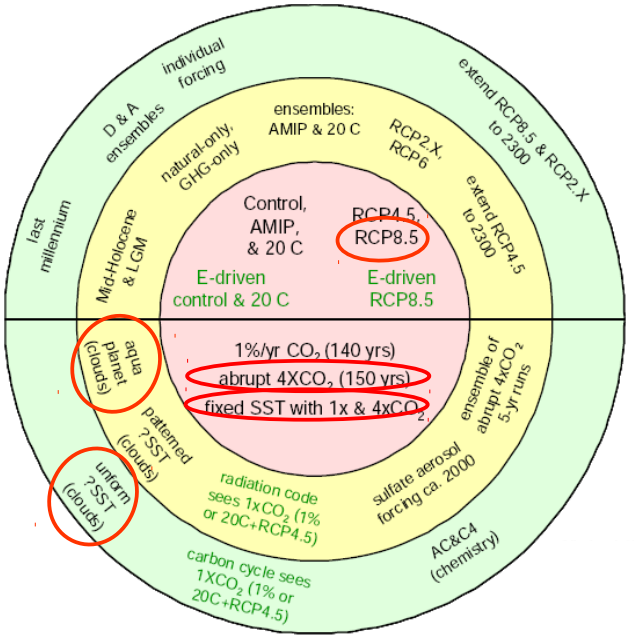
Courtesy Brian Medeiros

Change in circulation predicted by CMIP5 models

... in multiple models, experiments and configurations







Bony et al., submitted

Clouds ON-OFF Klimate Intercomparison Experiment (COOKIE)

Bjorn Stevens, Sandrine Bony, Mark Webb

Motivation :

* Identify robust effects of cloud-radiative interactions in climate (climate change, atmospheric circulation, climate variability)

* how do the atmospheric response to ENSO, the structure of the ITCZ and the MJO depend on cloud-radiation interactions ?

* to what extent do predictions of climate changes become more robust in the absence of cloud-radiative feedbacks ?

Coordinated experiments proposed :

Extension of the AMIP and aqua-planet CFMIP/CMIP5 atmosphere-only experiments ;
Involves 6 simulations (totaling 100 years) *with* cloud-radiative effects switched off.

TABLE 2. CLOUDS-ON component of COOKIE

Name	SST	CO_2	Time Period	Minimum Output
AMIP	AMIP	observed	1979-2008	AMON
AMIP4xCO2	”	4×observed	”	”
AMIP4K	AMIP+4K	observed	”	”
aqua	QOBS	348 ppmv	5yr	”
aqua4xCO2	”	1372 ppmv	”	”
aqua4K	QOBS+4K	348 ppmv	”	”

More information on :
http://www.euclipse.eu/wp4/wp4.html
http://www.cfmip.net

Conclusion

1. CFMIP2/CMIP5 experiments and outputs have already proved to be useful.

... model outputs are still welcome !

... much work remains to be done to exploit them fully.

2. CFMIP interests progressively broaden

... in addition to climate sensitivity, role of clouds in large-scale dynamics and climate variability ?

... new coordinated experiments proposed (COOKIE)

3. CFMIP collaborations with GEWEX/GASS and WGNE are developing well

... e.g. CGILS, analysis of the new generation of climate models, Transpose-AMIP

... cloud research community (GCM, processes, obs) is getting increasingly interconnected

4. WRCP Grand Challenge on « Clouds and Climate Sensitivity » : a great opportunity !