Status and Overview of EUCLIPSE simulations for IPSL

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Outline :

(1) Models

(2) Simulations

(3) Diagnostics

4) A few illustrations

Two versions of the IPSL Climate Model will be used in CMIP5

IPSL-CM5A : Earth System Model

- *same physics package as in CMIP3* (LMDZ4, Hourdin et al. 2006)

- higher resolution in latitude
  → better jets, weaker T biases at mid-latitudes, better monsoons)

- higher vertical resolution (L39 instead of L19)
  → better stratosphere and PBL

- two resolutions used in CMIP5 :
  Atm: 3.75 deg x 1.85 deg x L39 (LR) ; Ocean: 2 deg
  Atm: 2.50 deg x 1.25 deg x L39 (MR); Ocean: 2 deg
  + systematic exploration of the impact of higher resolution in long/lat

- *coupled to carbon cycle, chemistry, aerosols*

- CMIP5:
  all CMIP5 simulations will be done with the LR version.
  some CMIP5 simulations will be done with the MR version
  many simulations done; some are still running....

Two versions of the IPSL Climate Model will be used in CMIP5

IPSL-CM5B : Coupled Ocean-Atmosphere GCM

- *new physics package (LMDZ5) :*
  revised convection + cold pools (Grandpeix & Lafore 2010)
  PBL thermals (Rio & Hourdin 2008)
  Statistical cloud scheme coupled to PBL thermals (Jam et al. 2010)
  Land-surface scheme with 11 soil layers (?)
  etc

  → good diurnal cycle of deep convection over Africa,
  more low-level and mid-level clouds,
  good comparisons to LES over cases, etc

- resolution : 2.5 deg x 1.25 deg x L39

- Few CMIP5 simulations :
  pre-indus, 1%CO2, atmospheric (AMIP, aquaplanet, idealized)

- CMIP5 simulations have not started yet
  expected completion: end of 2010

CFMIP2/CMIP5 Experiment Hierarchy

Pre-industrial	Historical/ present	CO_2 forcing / adjustments	Climate feedbacks
3.1 ESM pre-industrial control	3.2 ESM historical	6.3,6.3E ESM Abrupt $4CO_2$	6.1 ESM 1% per year CO_2
	3.3E AMIP SST		
6.2a ATM + control SST climatology	6.4a/b ATM + control SST, present aero	6.2b ATM + control SST $4CO_2$	CMIP5 Experiments with COSP
CFMIP /CMIP5 Expts with full CFMIP outputs	3.3 ATM AMIP SST	6.5 AMIP + $4CO_2$	6.8 AMIP uniform +4K
			6.6 AMIP +4K SST pattern
	6.7a ATM Aquaplanet control	6.7b ATM Aquaplanet + $4CO_2$	6.7c Aquaplanet Uniform+4K
			no carbon cycle or interactive vegetation
CGILS Experiments SCM & LES	3 GPCI points AMIP SST		3 GPCI points AMIP SST+2K

CFMIP2/CMIP5 Experiment Hierarchy

Atmospheric simulations done with the IPSL-CM5A model, LR (3.75 deg x 1.85 deg x L39)

AMIP series :

- 3.3: CMIP5 AMIP run (core)	Done (up to 1995 – waiting for O3)
- 6.5: AMIP + 4xCO2	Done
- 6.6: AMIP + patterned 4K	Done
- 6.8: AMIP + uniform 4K	Done
- 3.3E: AMIP ensembles	Done

Pre-industrial series :

- 6.2a: Pre-industrial Control SST	Done (50 yrs)
- 6.2b: Control SST + 4xCO2	Done (50 yrs)
- 6.4a: Control SST + all aerosols	To be redone
- 6.4b: Control SST + sulface aerosols	To be redone

Aquaplanet series:

- 6.7a: Aquaplanet Control	To be redone with CFMIP O3
- 6.7b: Aquaplanet + 4xCO2	idem
- 6.7c: Aquaplanet + 4K	idem

EUCLIPSE / CFMIP diagnostic package implementation

CFMIP/CMIP5 Diagnostic Package Implementation in IPSL-CM5A	Table	Status
CMIP5 standard output (Amon, Amon 2D etc)	aMon	DONE
CFMIP monthly 3D -- Clouds, temperature, humidity etc on model levels	cfMon	DONE*
CFMIP monthly inline -- monthly mean in line ISCCP/CALIPSO/PARASOL simulator output	cfMon	DONE
CFMIP daily 2D -- daily mean 2-D fields including inline ISCCP/CloudSat/CALIPSO/ PARASOL simulator output	cfda	DONE
CFMIP daily 3D -- daily mean 3-D fields on model levels plus CALIPSO and ISCCP cloud fractions	cfda	DONE*
CFMIP 3-hourly orbital offline -- CloudSat/CALIPSO /PARASOL simulator output in orbital curtain format	cf3hr	Later
CFMIP monthly offline -- monthly mean gridded simulator output based on 3-hrly orbital offline	cfOff	Later
CFMIP timestep station data -- 2-D and 3-D fields on model levels at 20 to 30 minute intervals at 119 point locations.	cfSites	Later
CFMIP monthly 3D -- Clouds, mass fluxes, internal radiative fluxes, tendencies temperature, humidity and cloud.	cfMon	DONE*
CFMIP 3-hrly inline -- Instantaneous 3 hourly global 'snapshots' for future COSP development	cf3hr	Later
CFMIP monthly 4CO2 2D -- monthly mean TOA radiative fluxes calculated by instantaneously quadrupling CO2.	cfMon	DONE
CFMIP monthly 4CO2 3D -- monthly mean 3-D radiative fluxes calculated by instantaneously quadrupling CO2.	cfMon	DONE*

** some variables are not yet in model outputs (will be fixed soon)*

A few illustrations

ISCCP simulator

CALIPSO simulator

CloudSat simulator

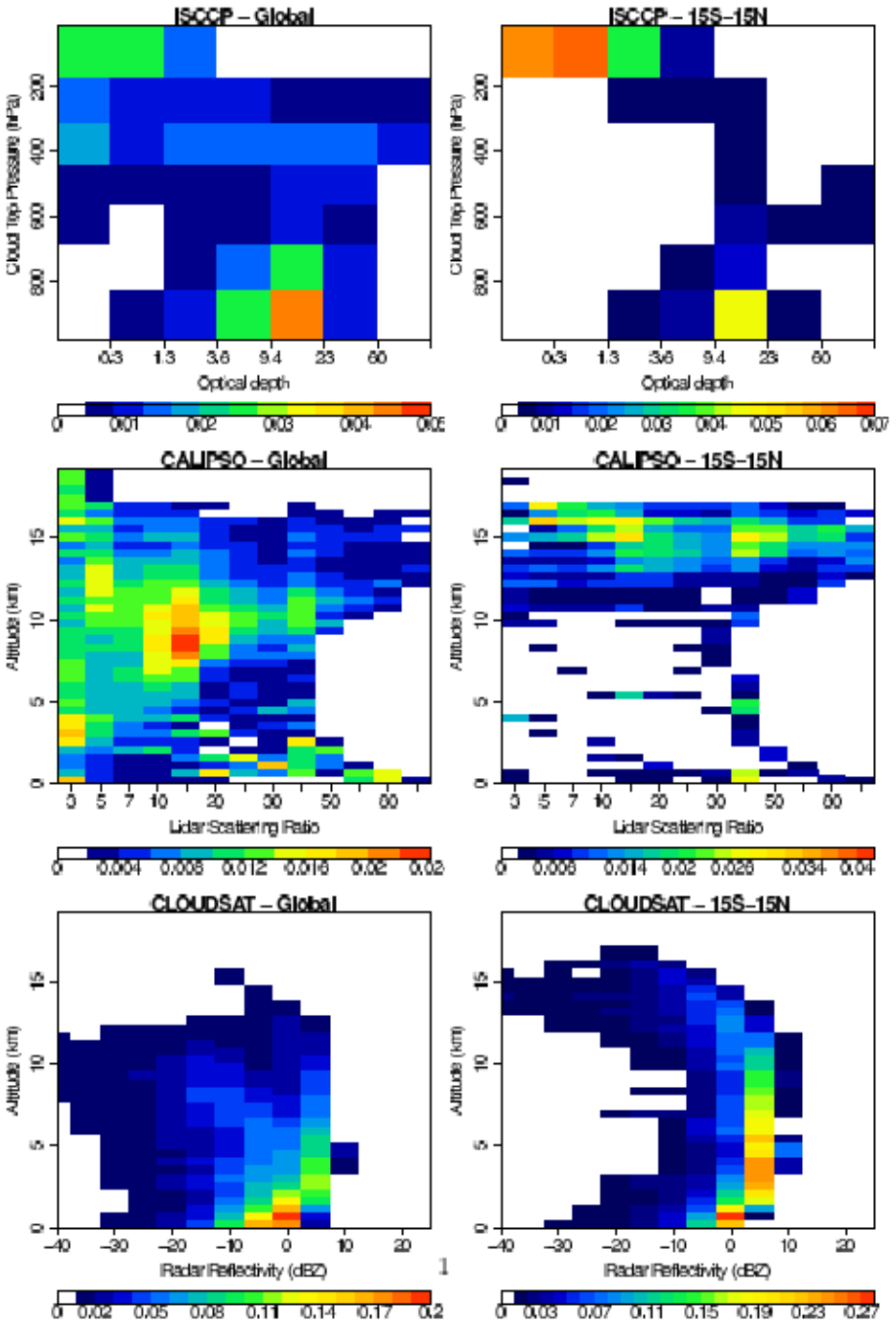
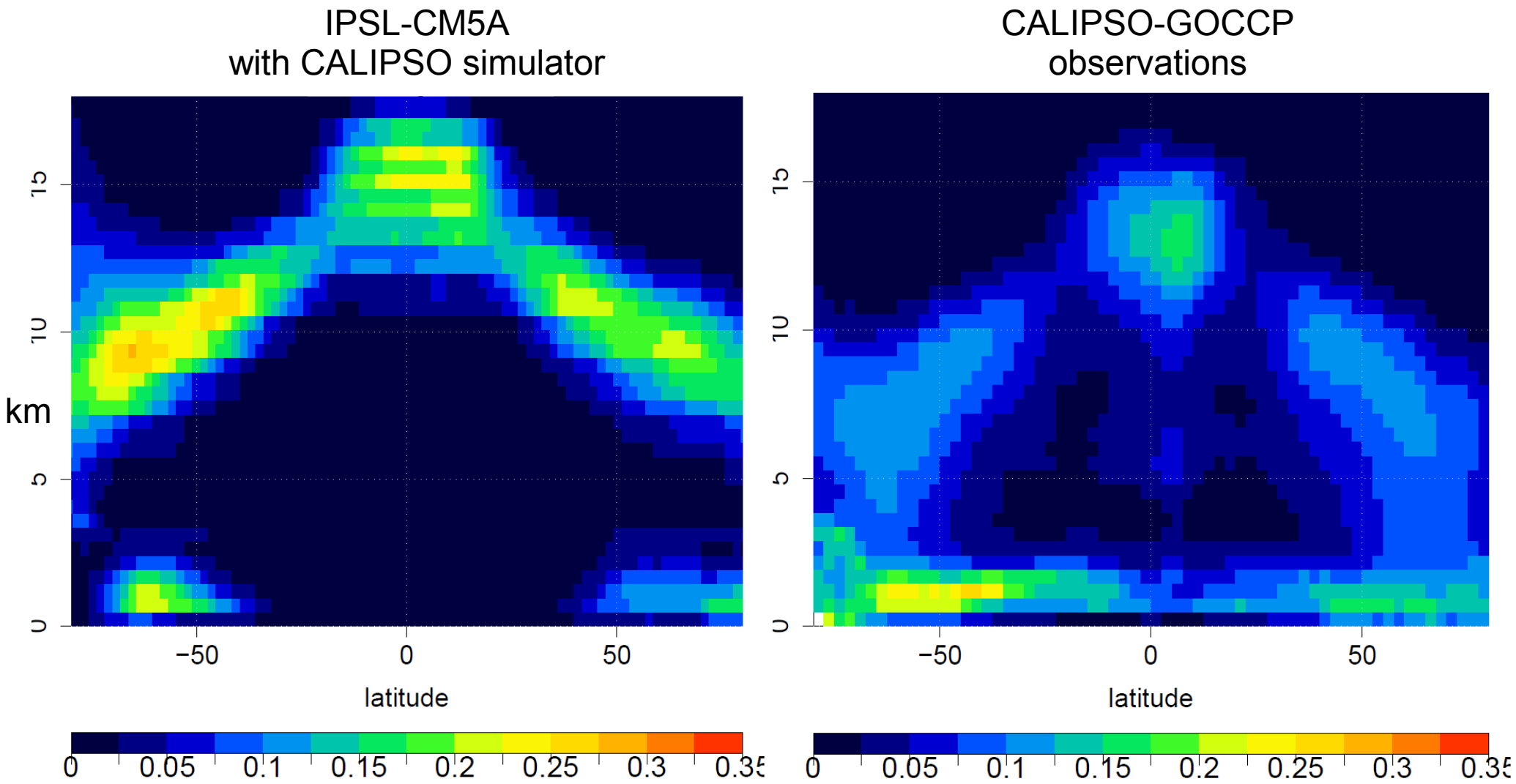


Figure 2. As Fig. 1, but for one month (August) of a climatological atmospheric simulation with a development version of LMDZ5.

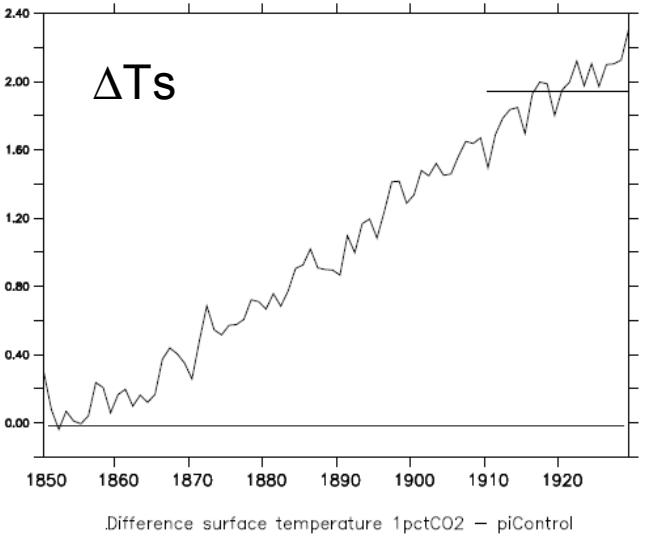
COSP implementation

EUCLIPSE Deliverable 1.3
(Aug 2010)

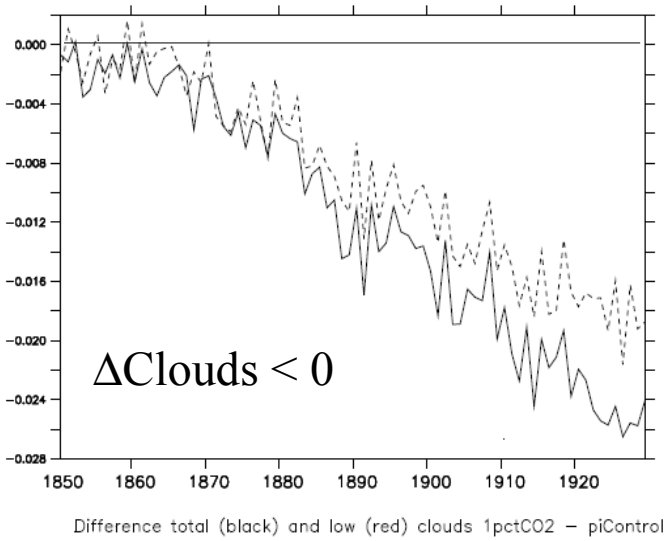
IPSL-CM5A
AMIP simulation

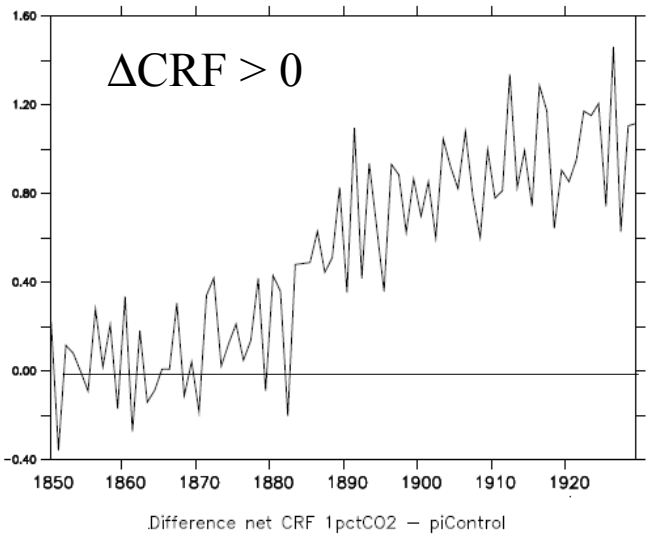


IPSL-CM5A coupled model : Simulation in which CO2 increases by 1%/year



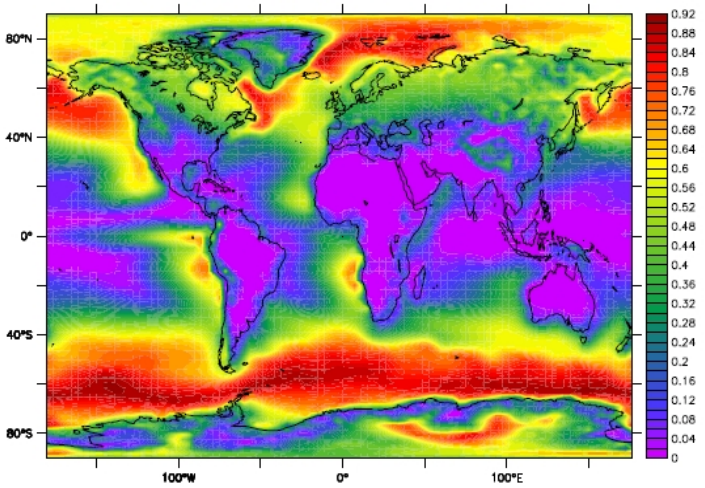
TCR ≈ 1.95 K





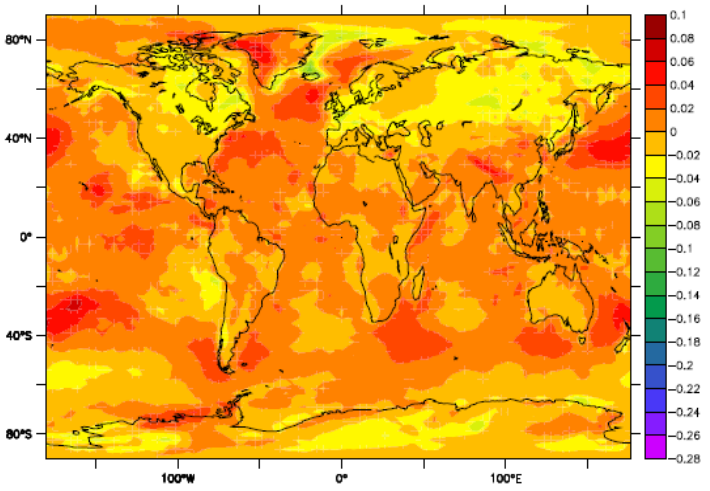
IPSL-CM5A
AMIP and perturbed AMIP simulations
Low-level clouds

AMIP CTRL



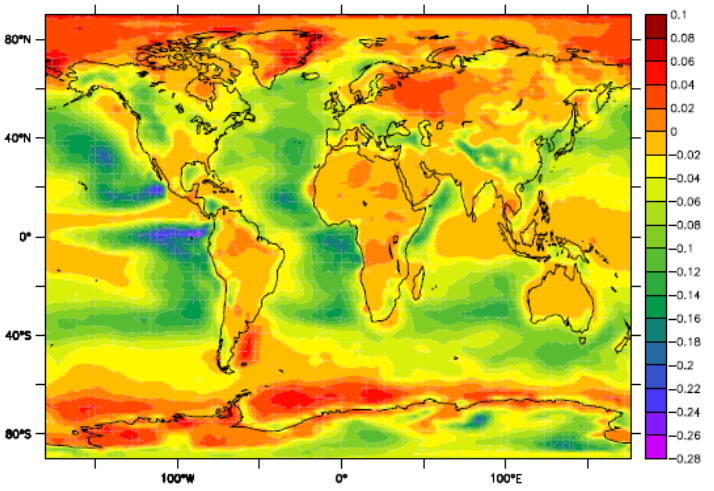
Low clouds amip1 : 1979–1995

AMIP 4xCO2 - CTRL



Low clouds amip4xCO2 – amip1 : 1979–1995

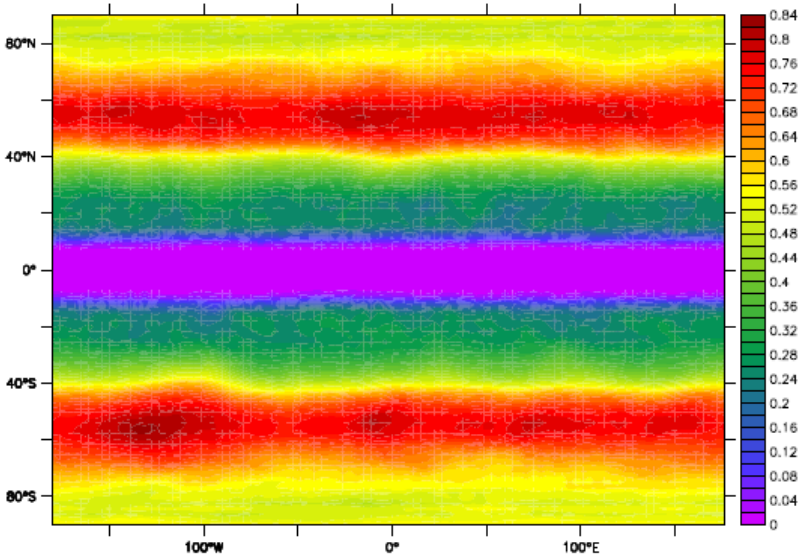
AMIP +4K - CTRL



Low clouds amip4K – amip1 : 1979–1995

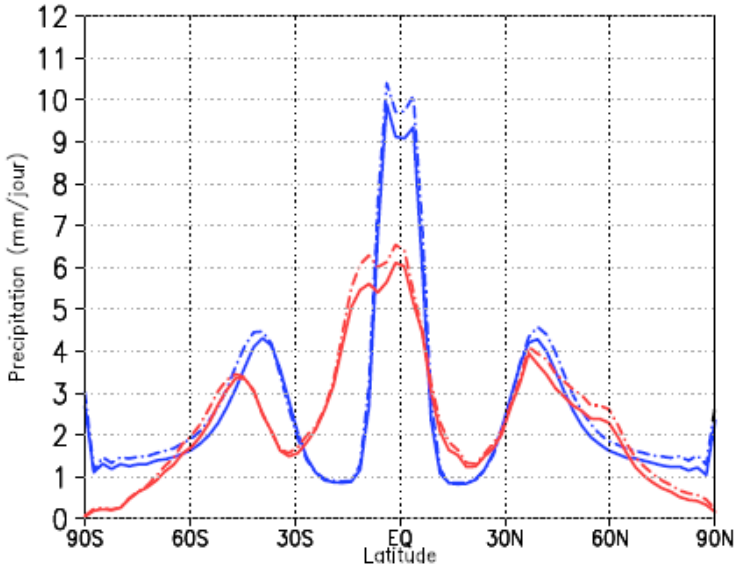
IPSL-CM5A
Aqua-planet Simulations

low-level cloudiness

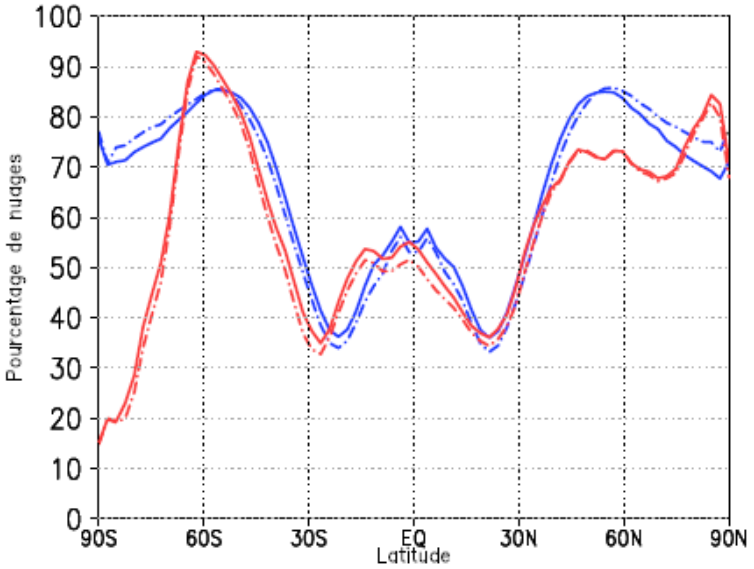


Low clouds aquaControl : 1979–1995

Zonal mean precipitation



Zonal mean total cloud cover



——— AMIP ctrl ------- AMIP + global warming

——— Aqua-planet ctrl ------- Aqua-planet + global warming

Summary of IPSL Status on EUCLIPSE experiments

CMIP5 /CFMIP :

- Most atmospheric experiments done with IPSL-CM5A (with COSP included)
- Experiments with IPSL-CM5B (new physics) expected in 2011
- All diagnostics implemented, except :
  - outputs at 119 point locations at every timestep
  - 3 hourly outputs (offline or inline)
  → expected by the end of 2010 / beginning of 2011
- Outputs are now being CMORized (Sebastien Denvil, IPSL).
- Data will be archived on the ESG by the end of 2010 (IPSL = data node).

In addition :

- CGILS simulations (SCM) : done by Florent Brient (PhD, LMD...talk on Thurs.)
- Transpose-AMIP : to be done in 2011 by Solange Fermepin (EUCLIPSE PhD)