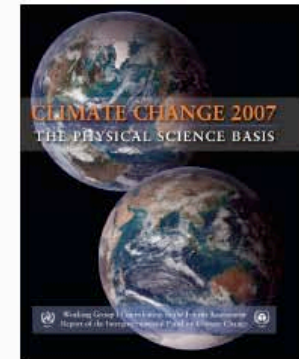
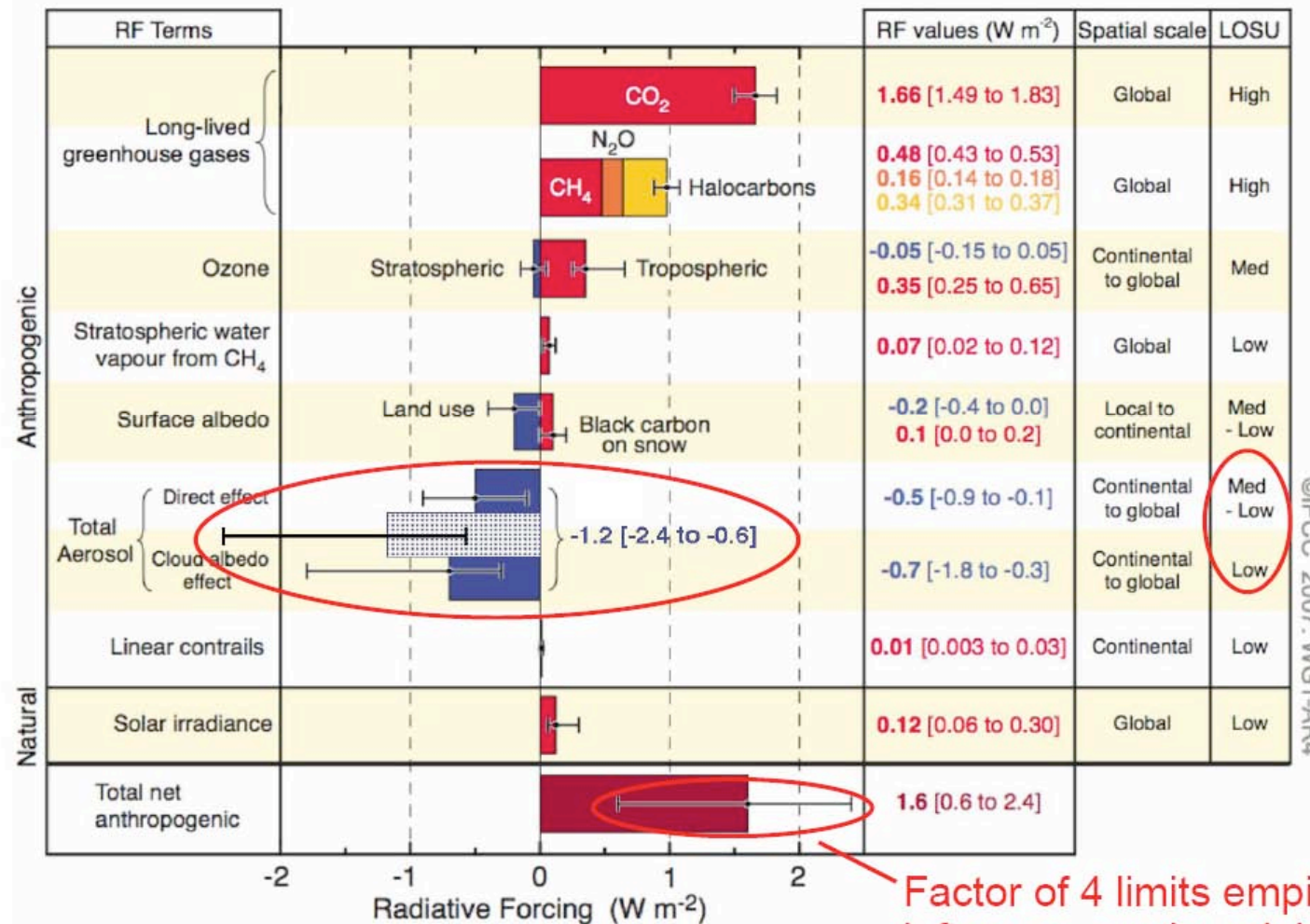


# Les aerosols dans le modèle couplé (offline et online)

Anne Cozic, Yves Balkanski, Michael  
Schulz, Celine Deandreis, Nicolas Yan,  
Nicolas Huneeus et Jan Griesfeller

# GLOBAL-MEAN RADIATIVE FORCINGS (RF)

Pre-industrial to present (Intergovernmental Panel on Climate Change, 2007)

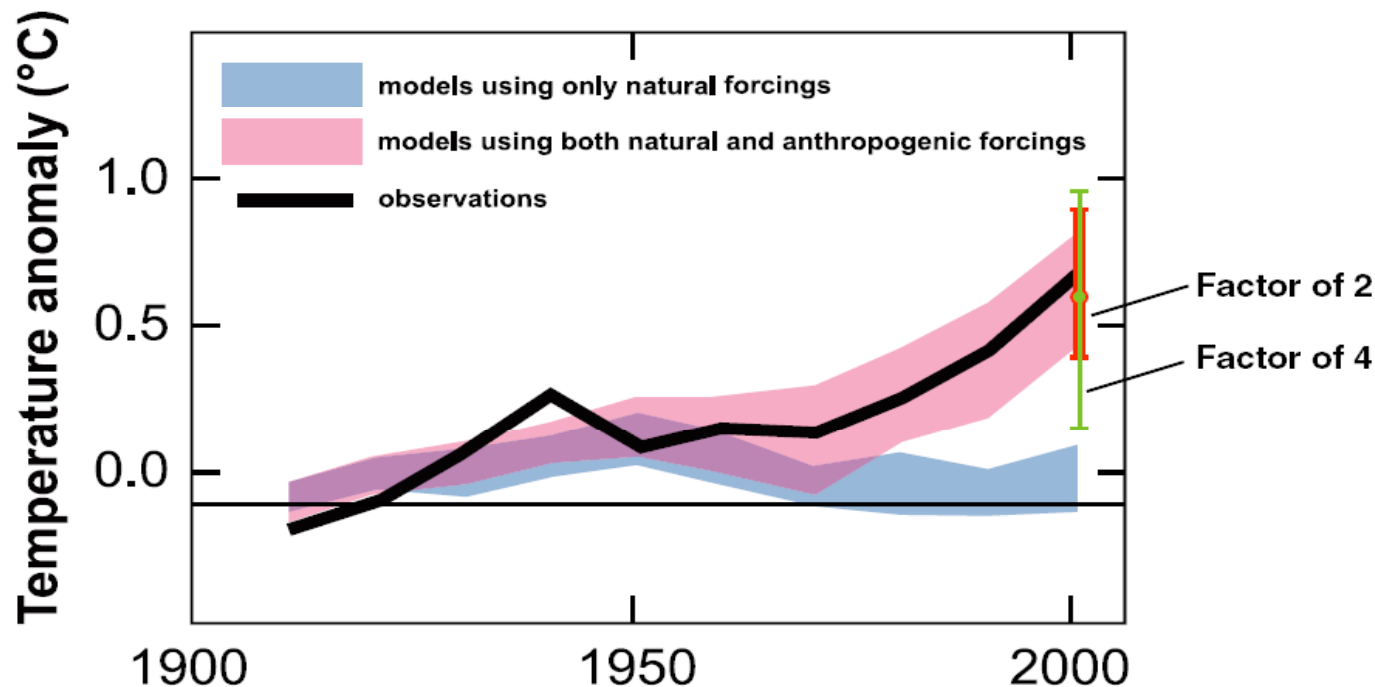


©IPCC 2007: WG1-AR4

LOSU denotes level of scientific understanding.

# TOO ROSY A PICTURE?

Ensemble of 58 model runs with 14 global climate models



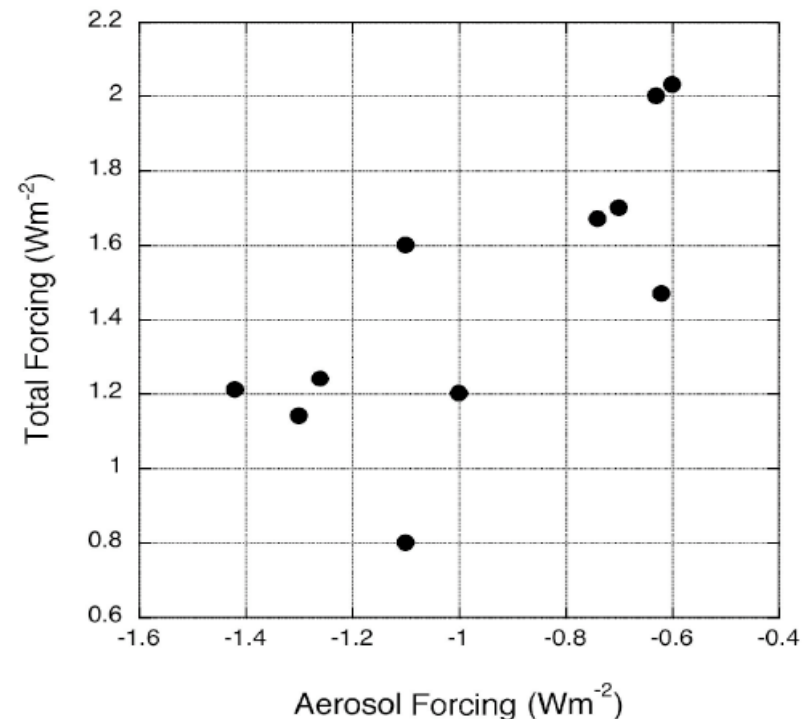
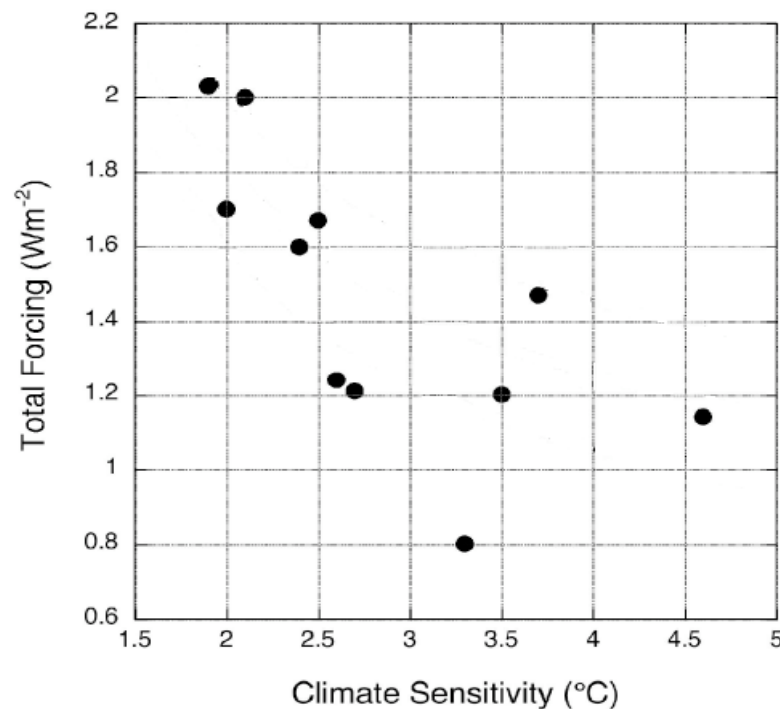
*Schwartz, Charlson & Rodhe, Nature Reports – Climate Change, 2007*

The models *did not span the full range of the uncertainty* and/or . . .

The forcings used in the model runs were *anticorrelated with the sensitivities of the models*.

# CORRELATION OF SENSITIVITY, TOTAL FORCING, AND AEROSOL FORCING IN CLIMATE MODELS

Eleven models used in 2007 IPCC analysis



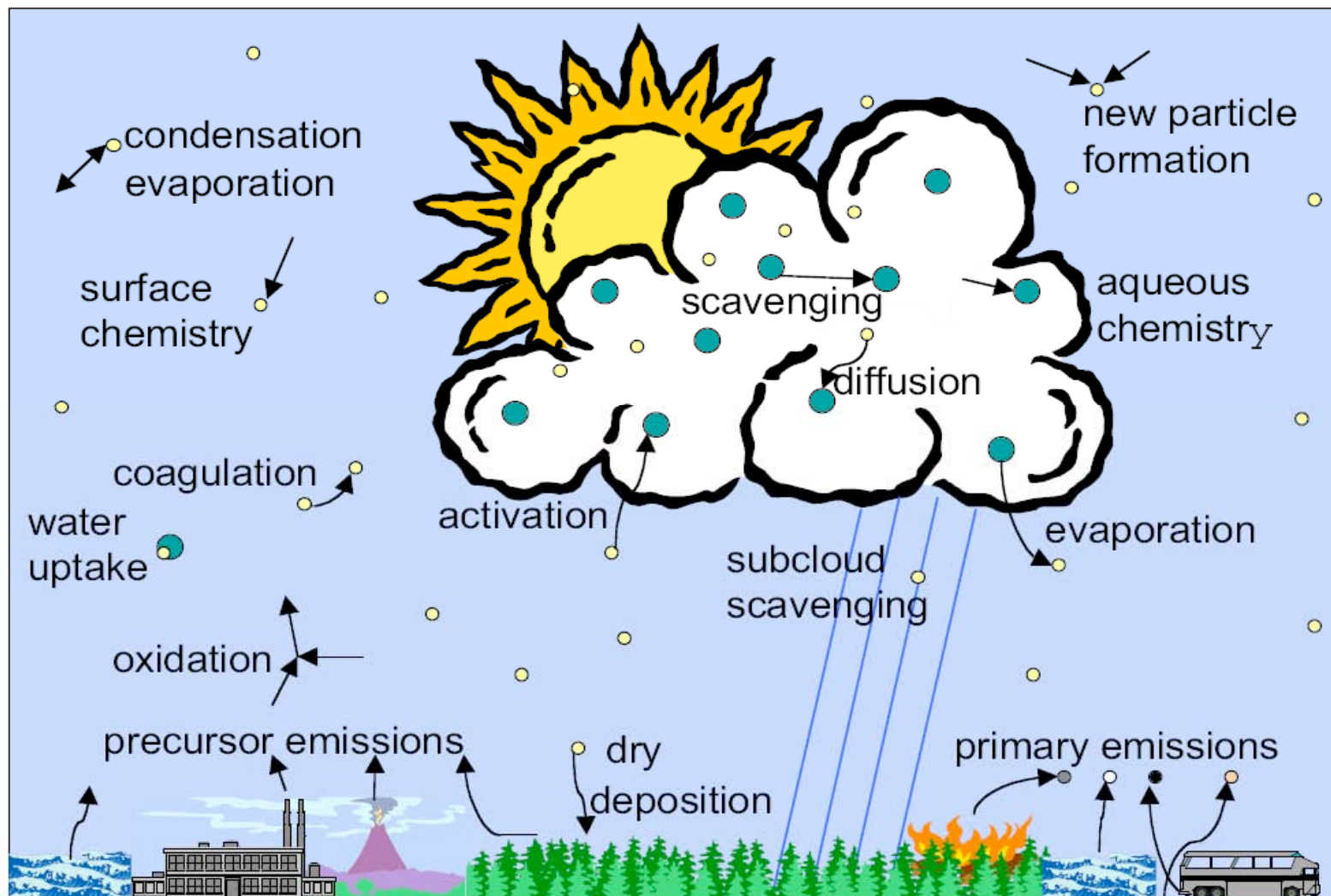
*J. Kiehl, GRL, 2007*

Climate models with higher sensitivity have lower total forcing.

***Total forcing increases with decreasing (negative) aerosol forcing.***

***These models cannot all be correct.***

# AEROSOL PROCESSES THAT MUST BE UNDERSTOOD AND REPRESENTED IN MODELS



*Ghan and Schwartz, BAMS, 2007*

# Existant

- **ISPLCM5** → couplage **offline** SO4 / lecture des masses dans un fichier de forçage
  - Rappel : IPSLCM5
    - NEMO (rev 1340)
    - LMDZ (branche LMDZ4-dev rev 1143)
    - ORCHIDEE (orchidee\_1\_9\_2)
- **IPSL\_ESM\_v1** → couplage **online** BC – SO4 – POM – DUST – SS / calcul des masses avec le modèle INCA

# Nouveau modèle IPSL\_ESM\_v2

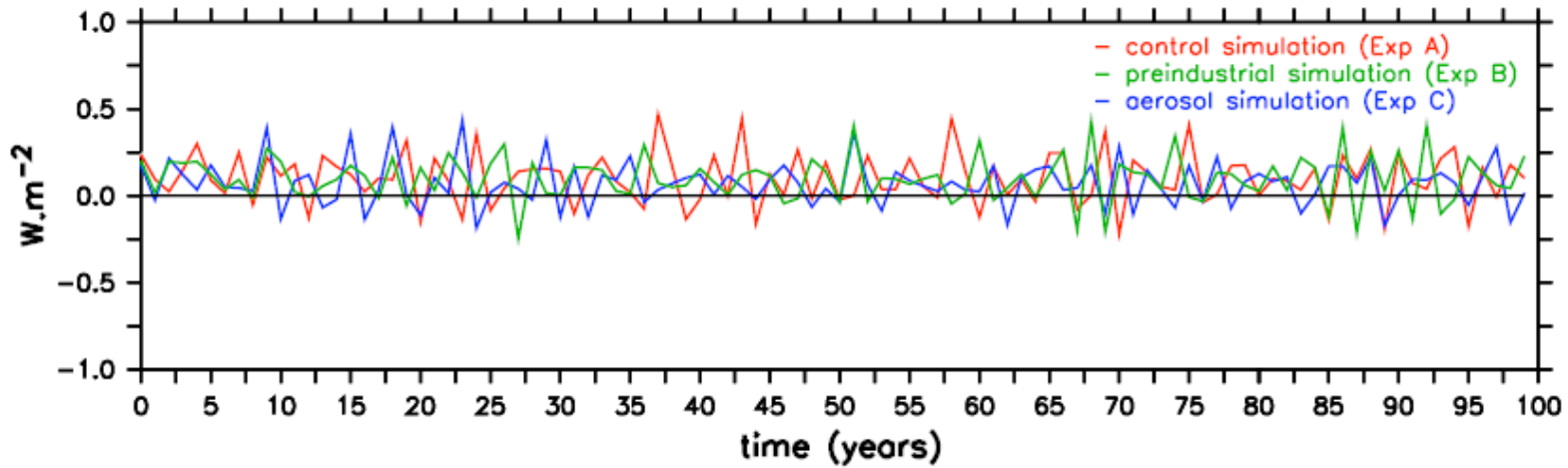
- **IPSL\_ESM\_v2** → couplage **offline/online**  
BC – SO4 – POM – DUST – SS / lecture  
des masses dans des fichiers de forçages
  - Options possibles
    - Choix des aérosols
    - Possibilité de passer du **online** au **offline**  
avec le même exécutable
- Possibilité de retrouver les résultats de  
IPSLCM5 (dans le cas du SO4)

# 3 simulations

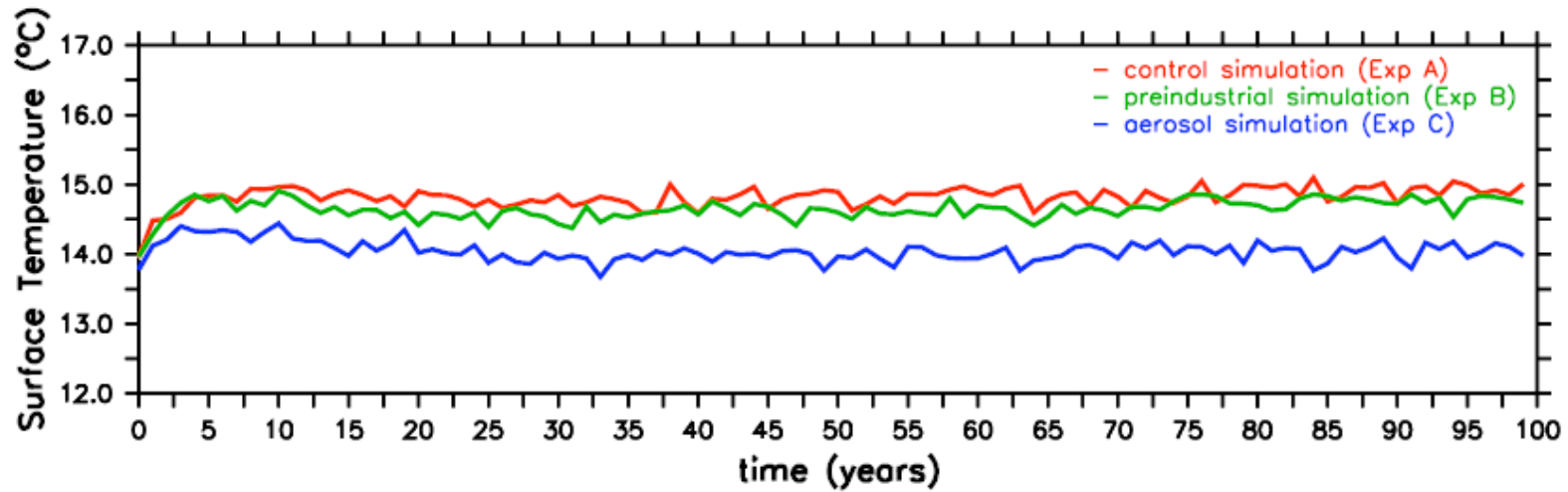
	<b>greenhouse gases</b>	<b>aerosols</b>
<b>Experiment A</b>	<b>CONTROL</b> constant CO <sub>2</sub> , CH <sub>4</sub> and other GHG (CO <sub>2</sub> = 286ppm, CH <sub>4</sub> = 700ppbv )	no aerosols
<b>Experiment B</b>	same as CONTROL	pre-industrial aerosols
<b>Experiment C</b>	same as CONTROL	present (2000) aerosols



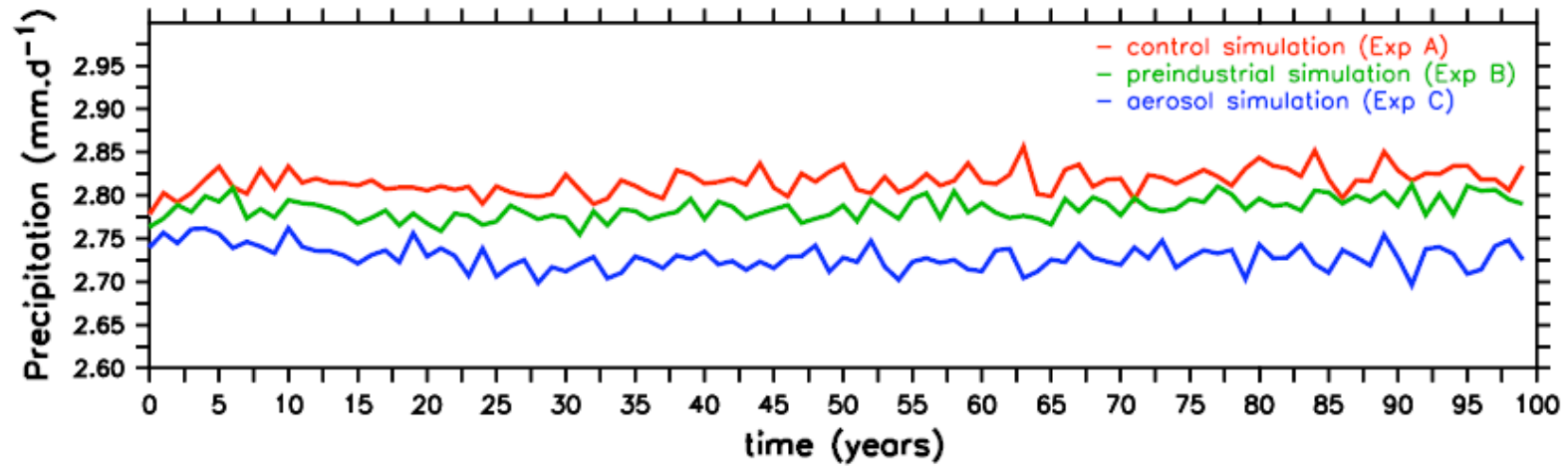
## Energy Budget



## Global Surface Air Temperature

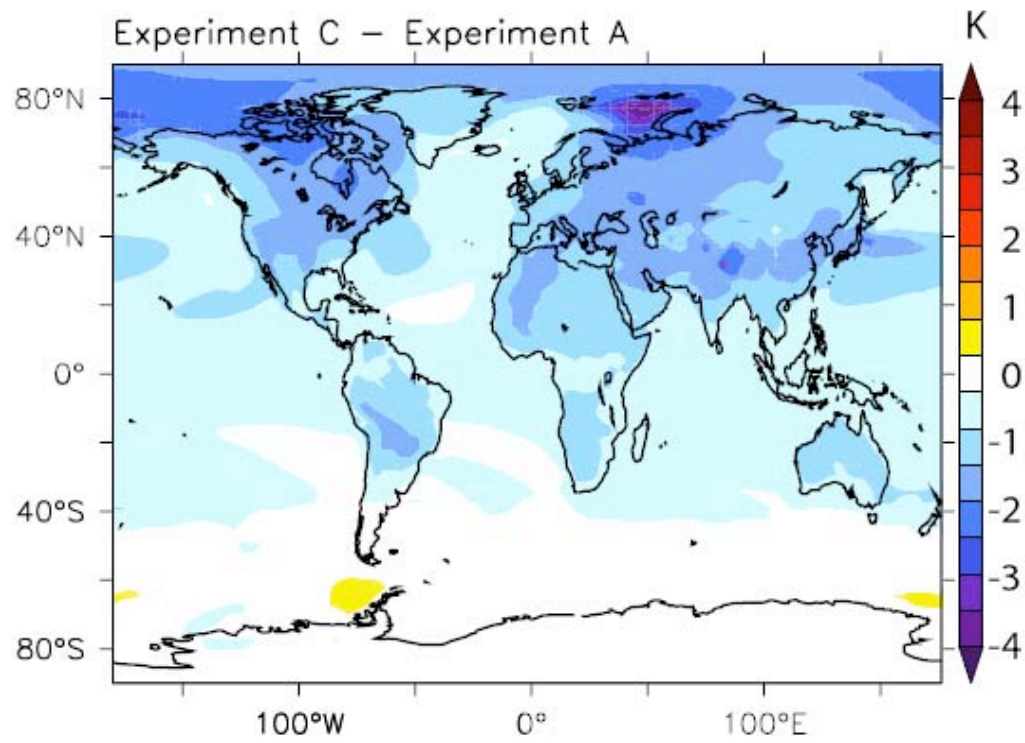


## Global Annual Precipitation



# Difference in Surface Air Temperature

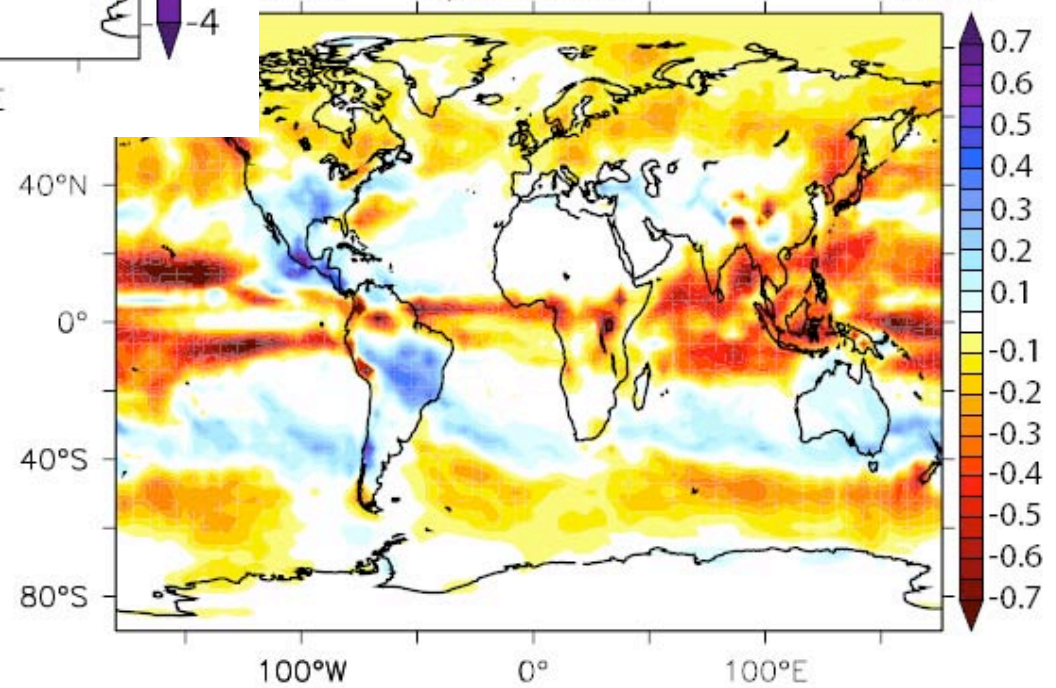
Experiment C – Experiment A



# Difference in Precipitation

Experiment C – Experiment A

mm.d<sup>-1</sup>



MISSTI

# ESM-IPSL-INCA aerosol model configurations for 5<sup>th</sup> IPCC report

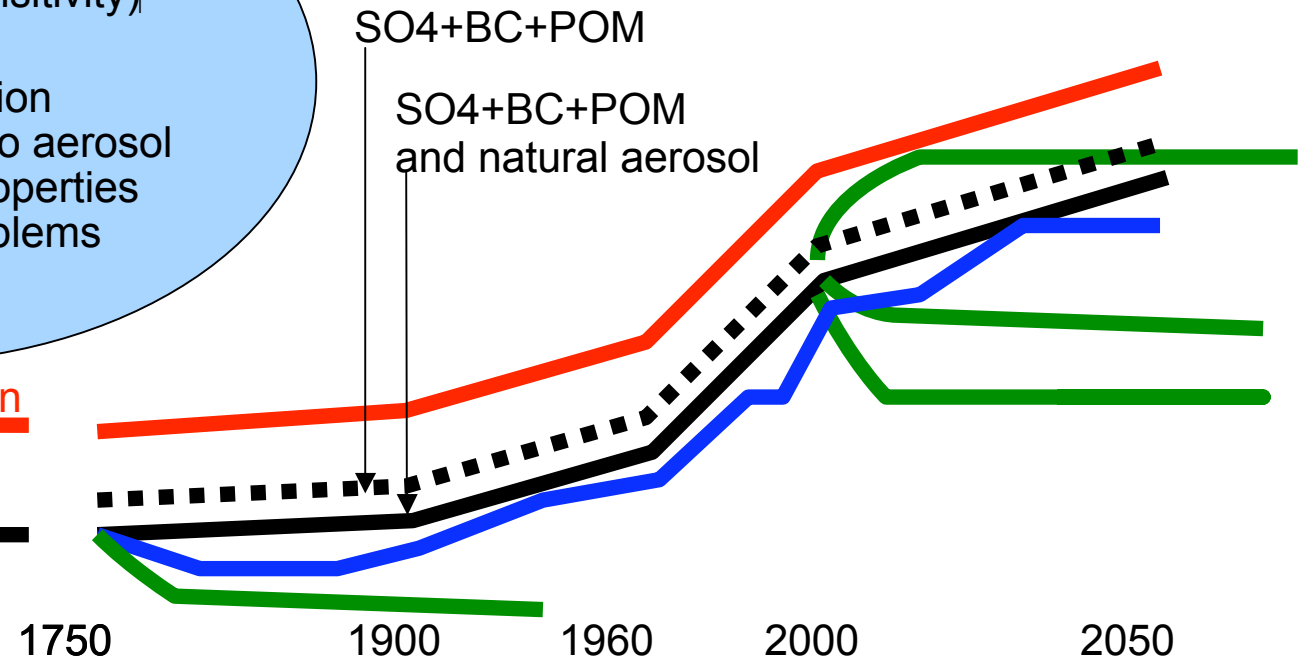
Preindustrial Control Climate state  
 $T=f(\text{Forcing and Sensitivity})$   
 function of:

- Model Resolution
- Degree of coupling to aerosol
- Natural aerosol properties
- ...and other problems

144x142 IPSL standard run

96x95

1 Control run  
 300 years

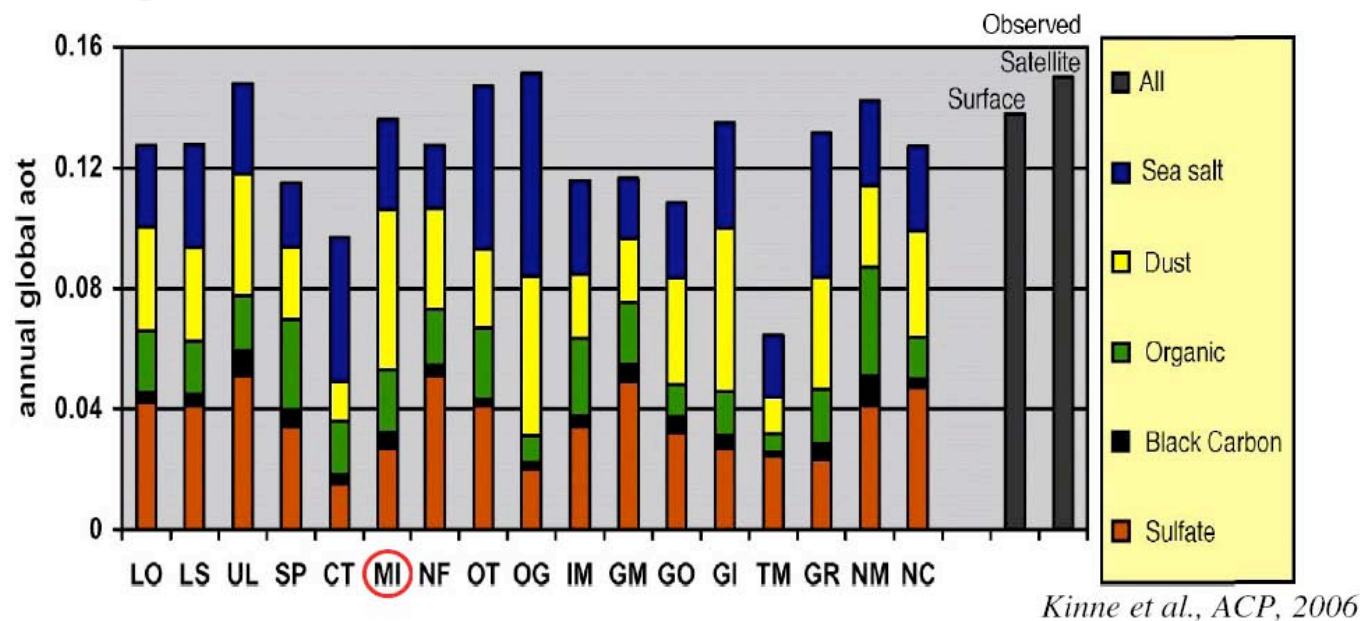


Preindustrial aerosol with precalculated natural aerosol

- Decoupled runs**
- Reading in every 10-20 years precalculated aerosol mass and optical properties, based on IPCC emissions, INCA-NMHC-AER
  -
- Interactive coupled aerosol runs**
- Transient aerosol-climate simulation
  - Snapshot simulations with different emissions
  - Hindcast run with SST forcing

# AEROSOL OPTICAL DEPTH IN 17 MODELS (AEROCOM)

Comparison also with surface and satellite observations



Surface measurements: AERONET network.

Satellite measurements: composite from multiple instruments/platforms.

Are the models getting the “right” answer for the wrong reason?

Are the models getting the “right” answer because the answer is known?

Are the satellites getting the “right” answer because the answer is known?