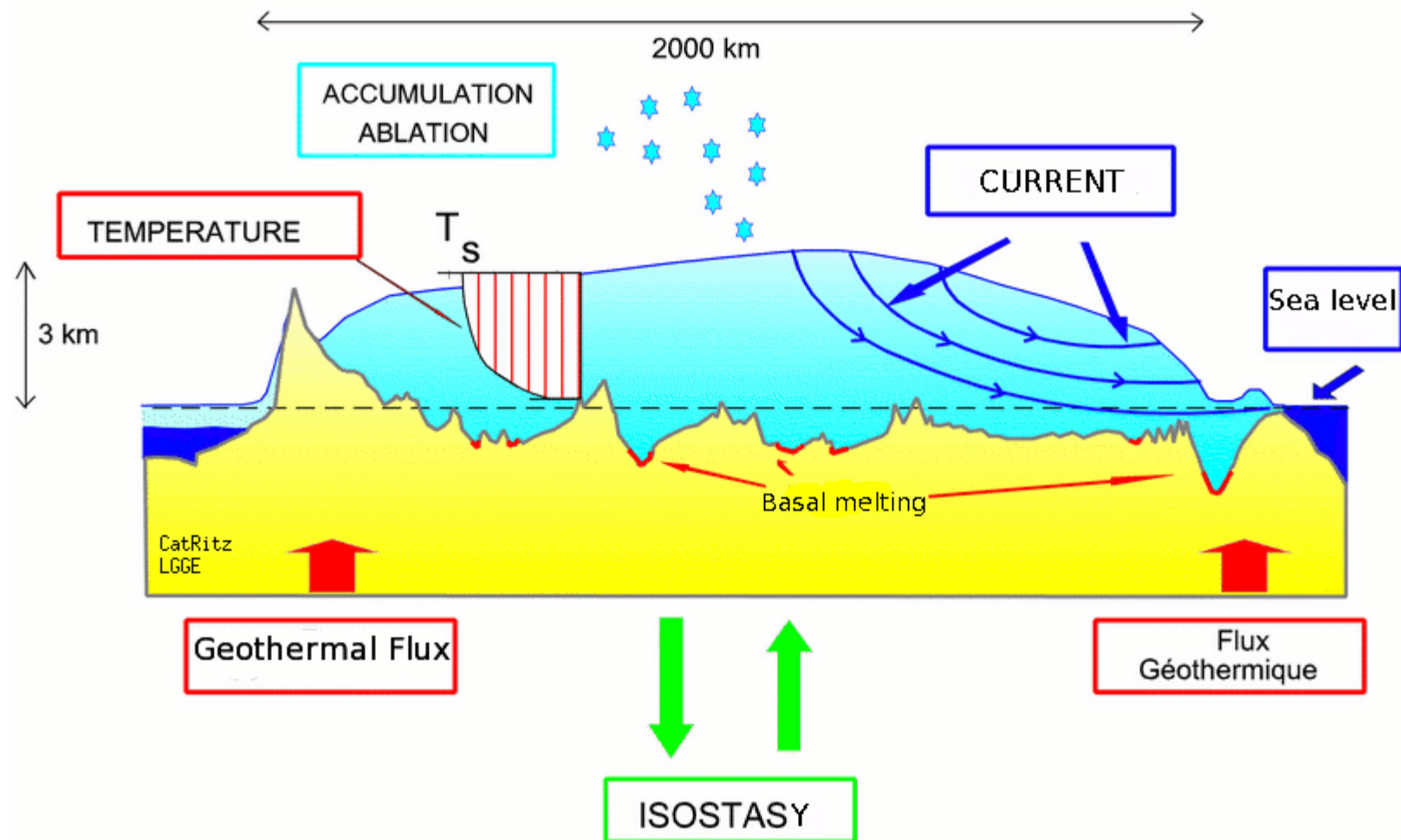


ESM development at IPSL

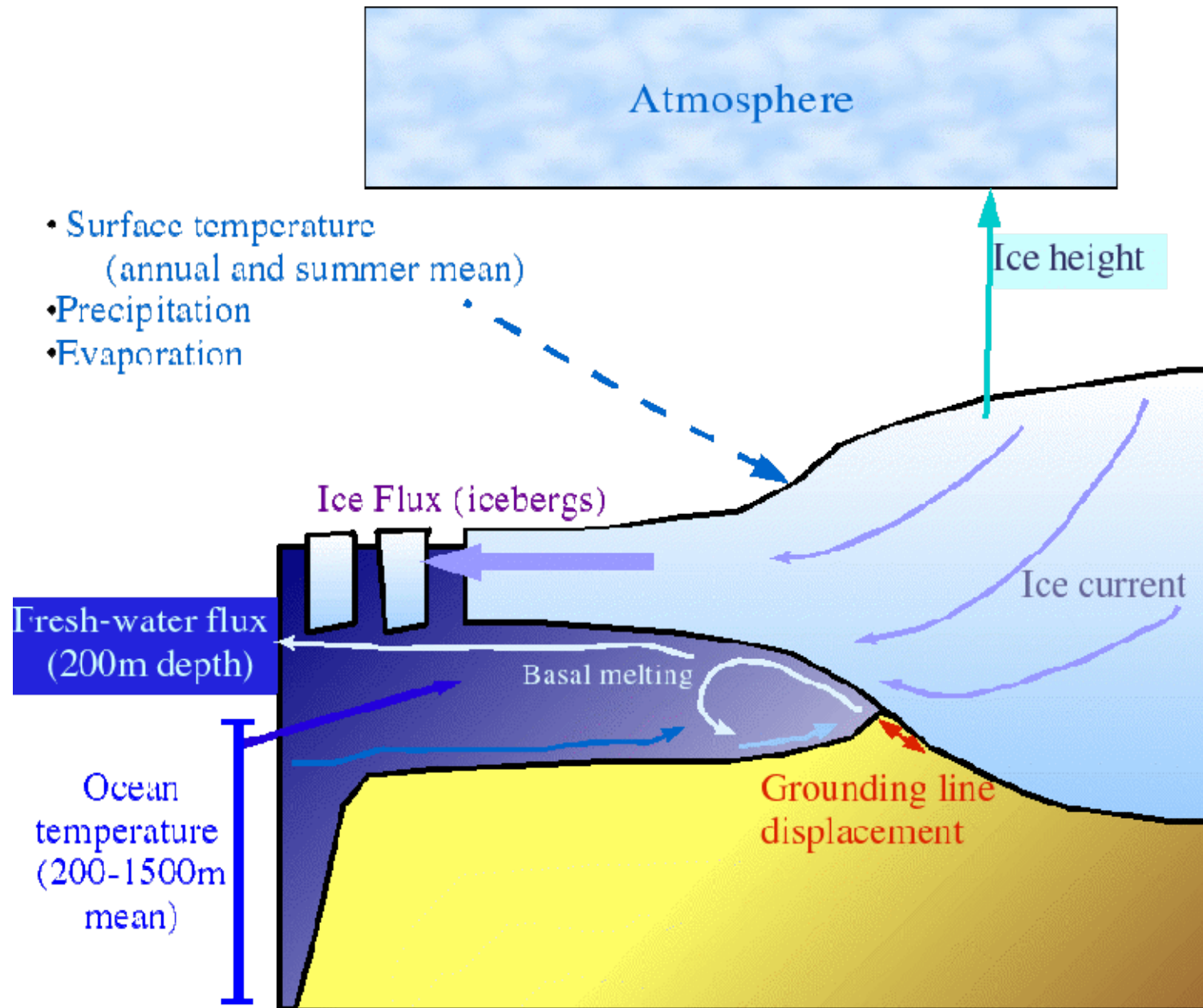
- Ice sheet coupling the OAGCM
- Carbon cycle and land-use
- Aerosols
- Chemistry

GRISLI: Greenland Ice Sheet Model



C. Ritz et al, JGR 2001

Ocean – Ice sheet – Atmosphere

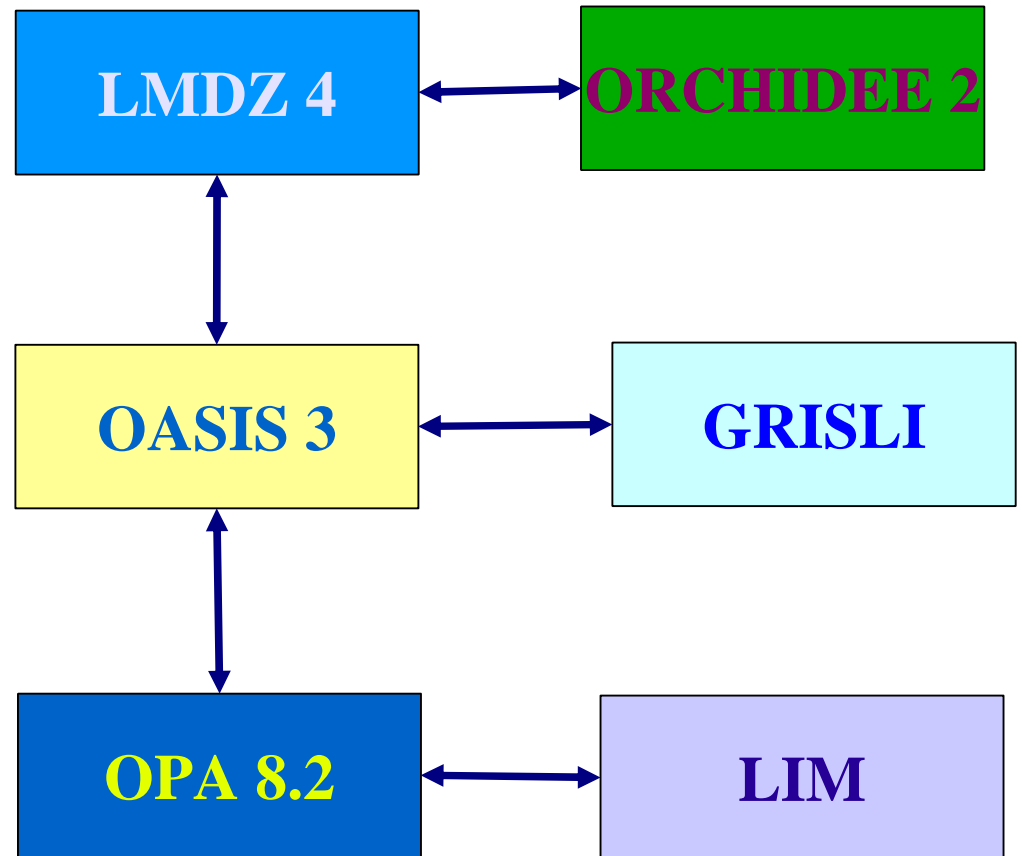


1st stage: no changes of oceanic nor atmospheric domains

exchanges only by the heat and mass fluxes: ocean – ice sheet

GRISLI – OAGCM coupling

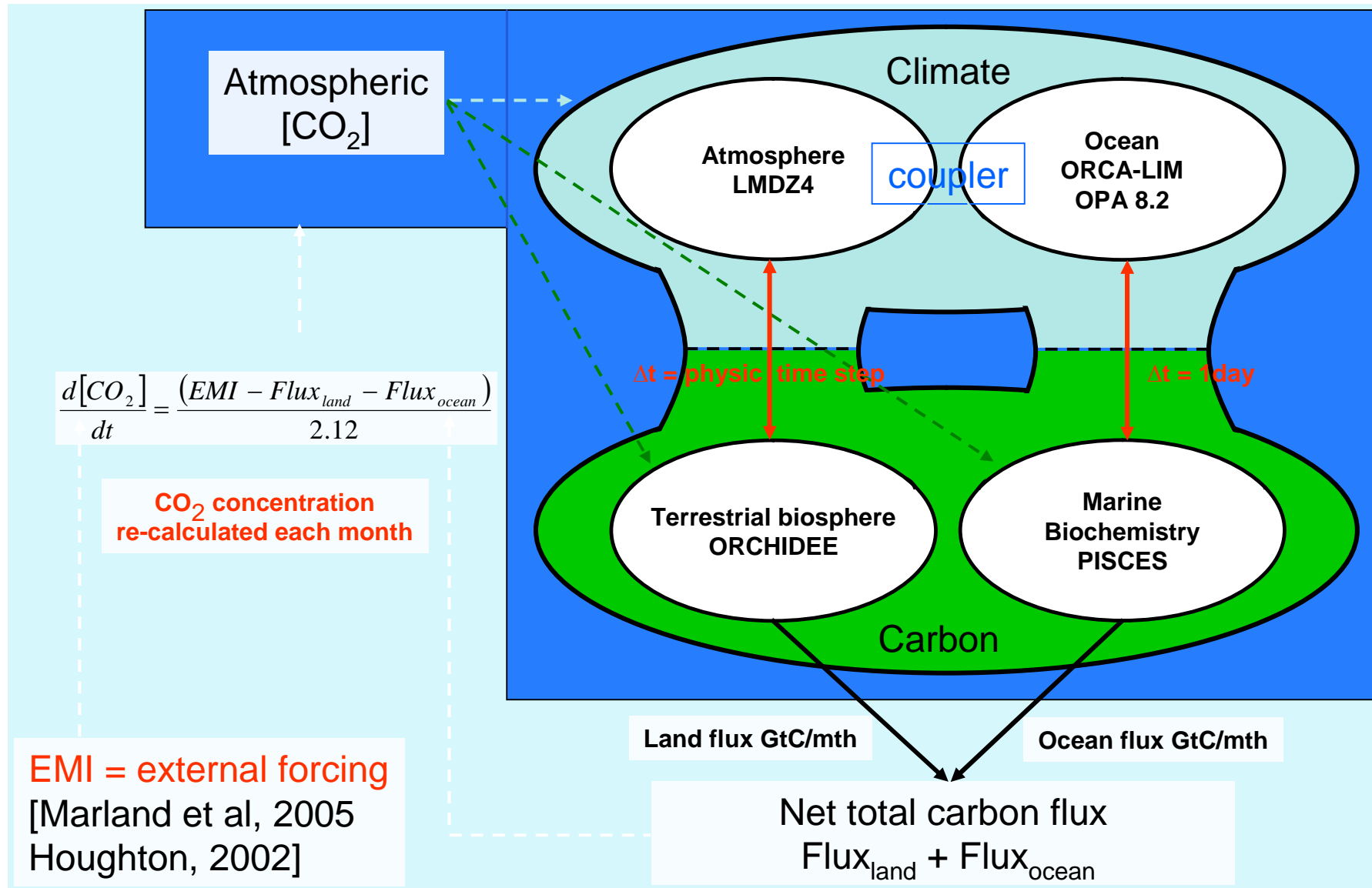
Coupling with the atmosphere done
(through OASIS)
Coupling with the ocean to be done



Carbon cycle coupling

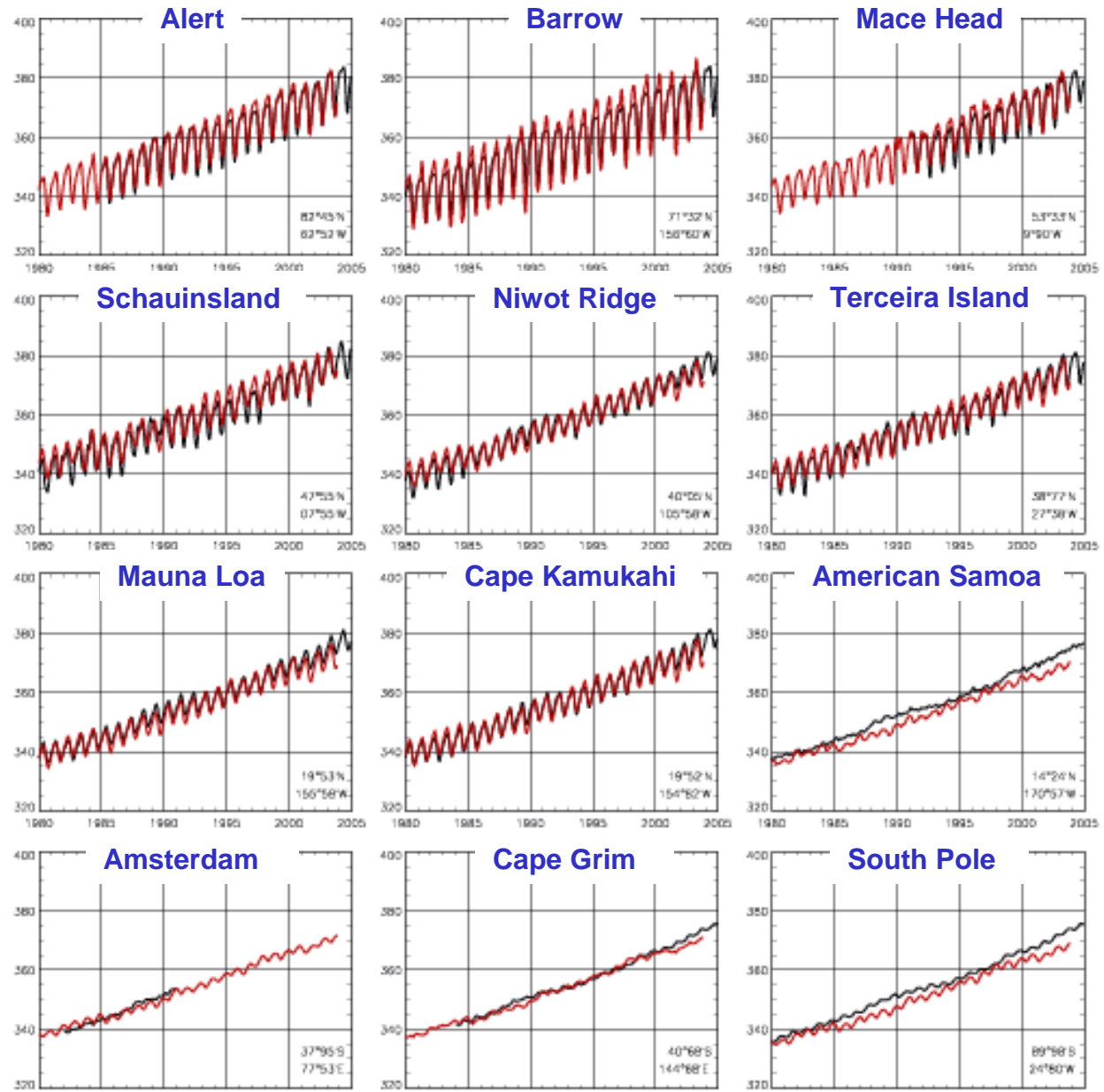
- IPSL_CM4 (IPCC version) +
 - ORCHIDEE (land carbon cycle) (done)
 - PISCES (ocean carbon cycle) (done)
- + inclusion of land use in orchidee (time evolving land cover map)
 - Biophysical impact (done)
 - *Biogeochemical impact (to be done)*

IPSL_CM4_LOOP



Validation with CO2 data

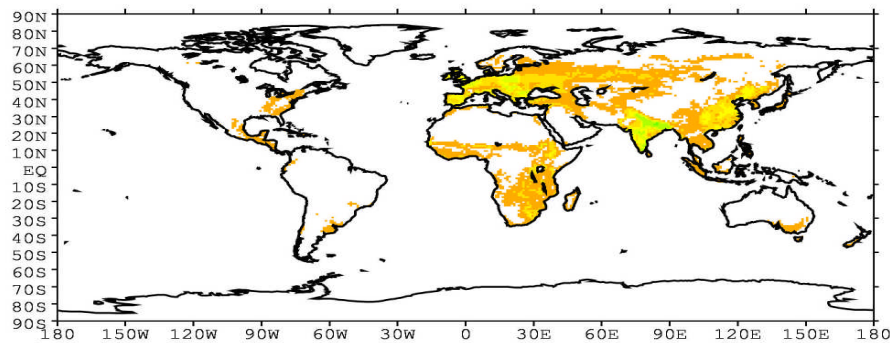
— NOAA/CMDL
— IPSL Model



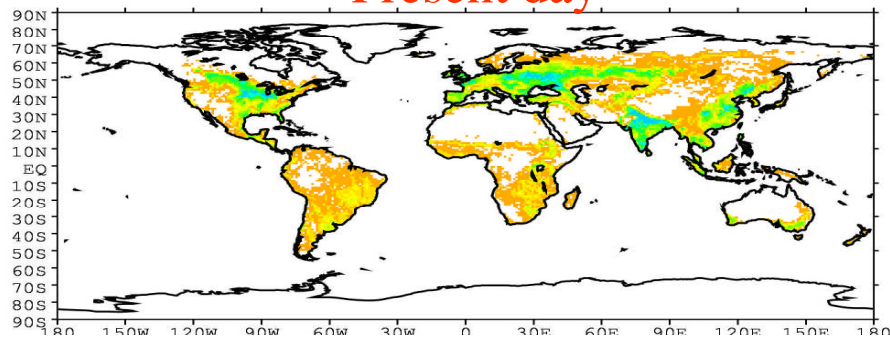
1979-2003 Period

Land cover change in IPSL_CM4

Pre industrial

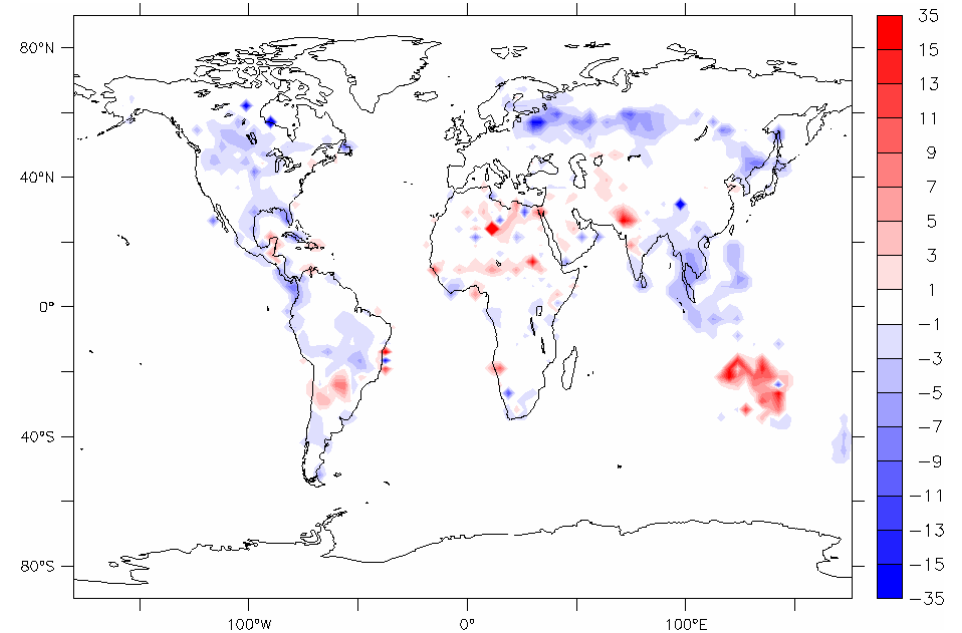


Present day



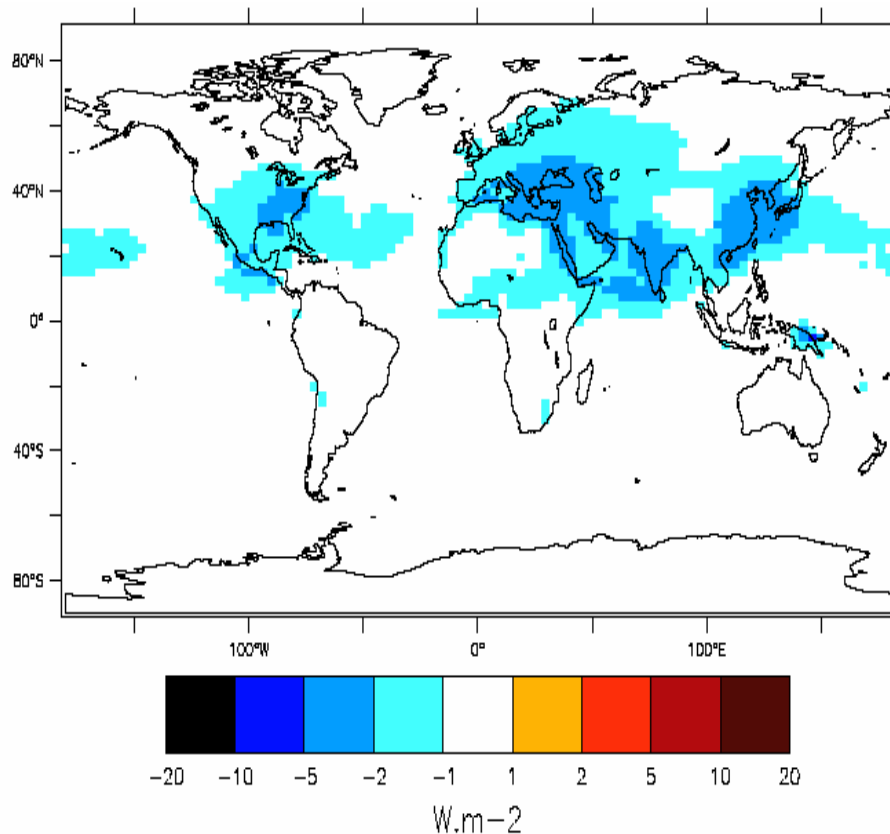
Fraction of gridcell covered by crops and pasture

Radiative Forcing (W/m^2)
(present day land use - no land use)

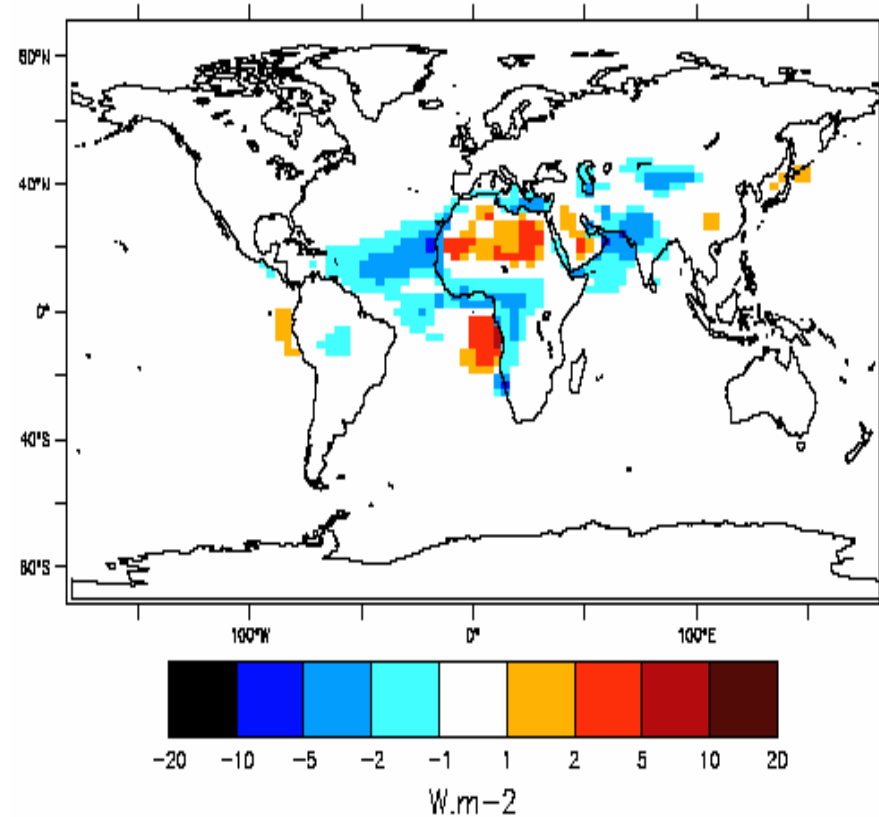


Aerosols : direct radiative effect

Sulfates only



Other anthropogenic aerosols*

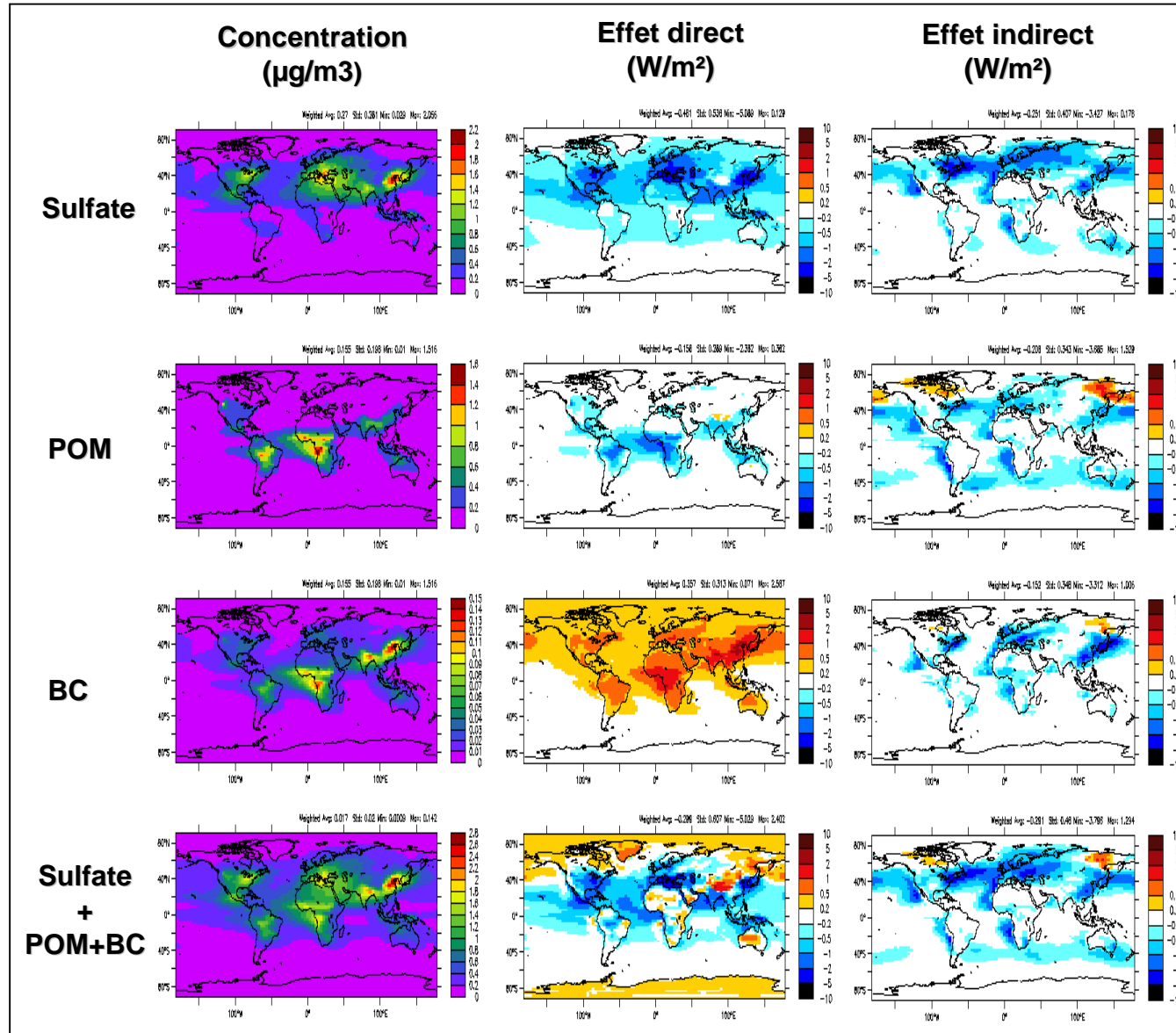


Min = -7.1 Max=+5.4 Mean=-0.15 W m⁻²

Aerosols chemical scheme (INCA)
Embedded in LMDz

*BC + organique + 0.5*poussières désertiques

Direct + Indirect (1st) radiative forcing present-day



Aerosols LMDz (done); aerosols in OAGCM (work in progress)

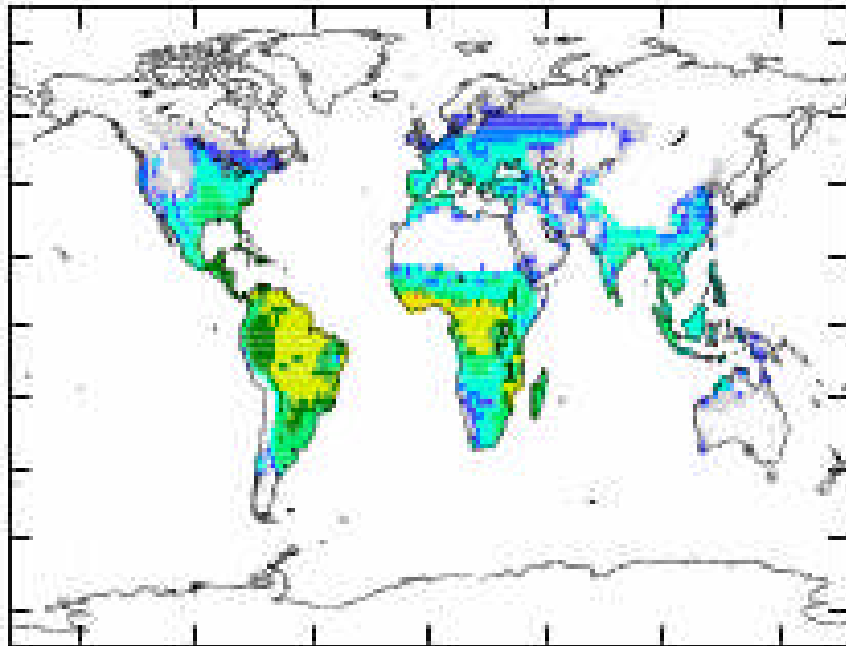
Coupling with chemistry

- INCA chemistry model coupled to LMDz
 - Different configurations (tracers, aerosols, methane chemistry, full chemistry)
 - Not yet coupled to the OAGCM
- Emission models
 - VOCs and N₂O from vegetation (ORCHIDEE)
 - DMS from ocean (PISCES)
- Impact of ozone on land productivity

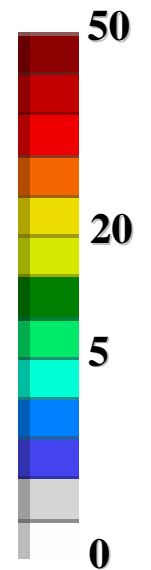
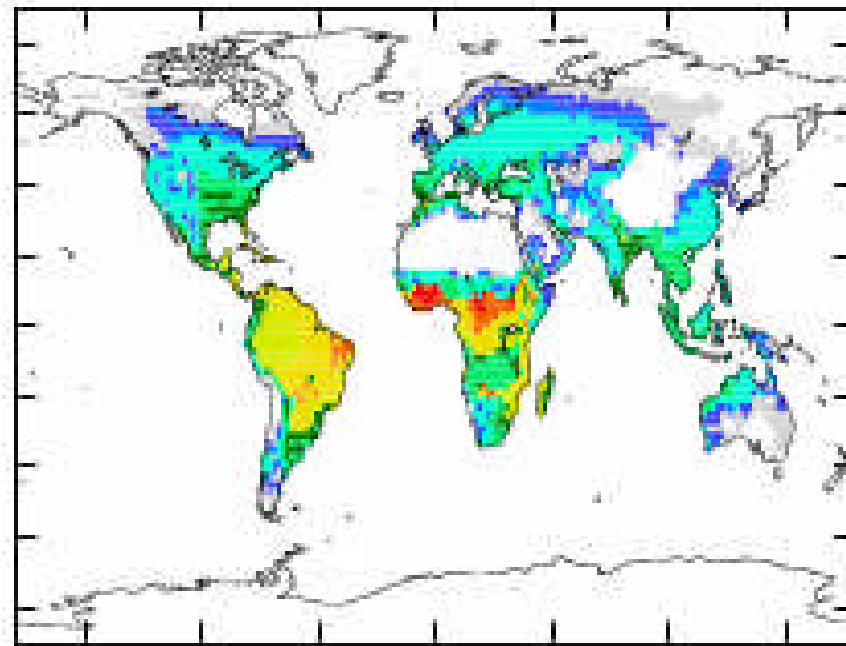
VOC emission in ORCHIDEE

Annual Isoprene emissions (gC/m²/yr)

ORCHIDEE - Present



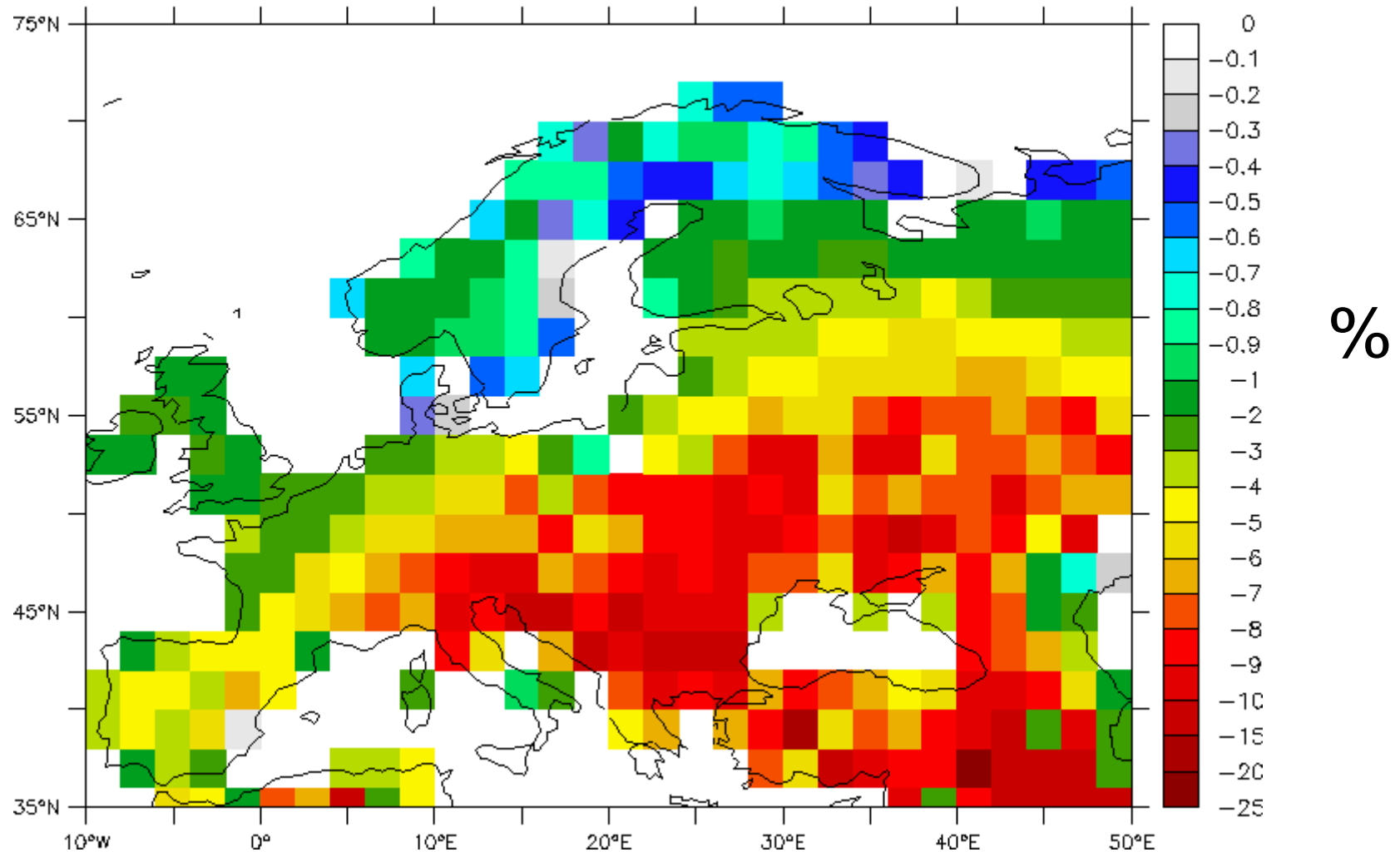
ORCHIDEE - 2050



Ozone deposition from LMDz INCA

Impact on Photosynthesis (ORCHIDEE)

– Impact of Ozone on NPP – SRES A2 scenario –



ENSEMBLES

Stream 2 simulations at IPSL

- Coupled climate-carbon cycle model
 - Transient runs driven by CO2 emissions (virtually certain)
- Scenario with land cover changes
 - Transient runs driven by land cover maps (very likely)
- Aerosols (all anthropogenic)
 - Snapshot runs driven by aerosols emissions (virtually certain)
 - Transient runs (unlikely, CPU limitation)
- Full Chemistry (very unlikely)