

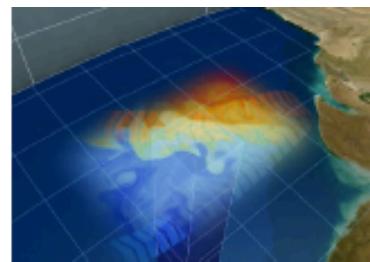


Institut
Pierre
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Institut de recherche en sciences de l'environnement

Développements chimie et aérosols pour IPSLCM6

Model Components

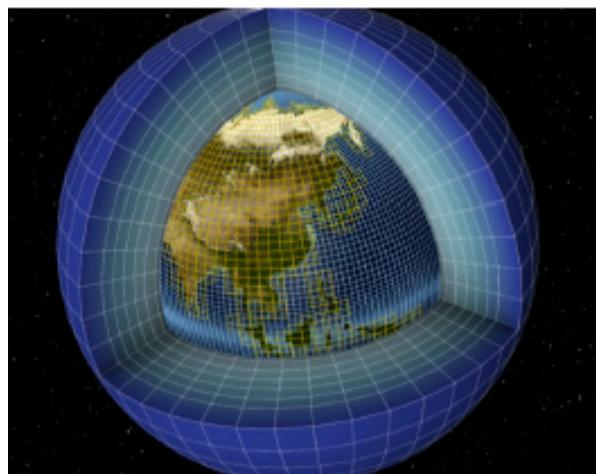


INCA / REPROBUS
(chimie atmosphérique)
(aérosol)

ORCHIDEE
(surfaces continentales)
(végétation)

LMDZ
(atmosphère)

OASIS
(coupleur)



OPA
(océan)

LIM

NEMO

PISCES
(biogéochimie marine)

All components developed in-house,
apart from
-LIM : at Louvain & IPSL
-OASIS : at CERFACS



IPSL-ESM : IPSL-CM6.1 (beta version since summer 2015 – ready mid2016)

Physical Components :

- Atmosphere : Improved Version of IPSL-CM5B used in CMIP5
- Ocean : from NEMO-v3.2 to NEMO-v3.6
- Sea-ice : from LIM2 to LIM3

ESM Configurations

- Standard : physical + carbon cycle (ORCHIDEE, PISCES)
- Standard w/ (1) interactive aerosol incl. nitrate, (2) full chemistry

Standard Resolution : IPSL-CM6.1-LR (similar to MR for IPSL-CM5)

- Atmosphere : 144x144 ($2.5^\circ \times 1.5^\circ$) L79 & Ocean : ORCA1 ($\sim 1^\circ$) L75

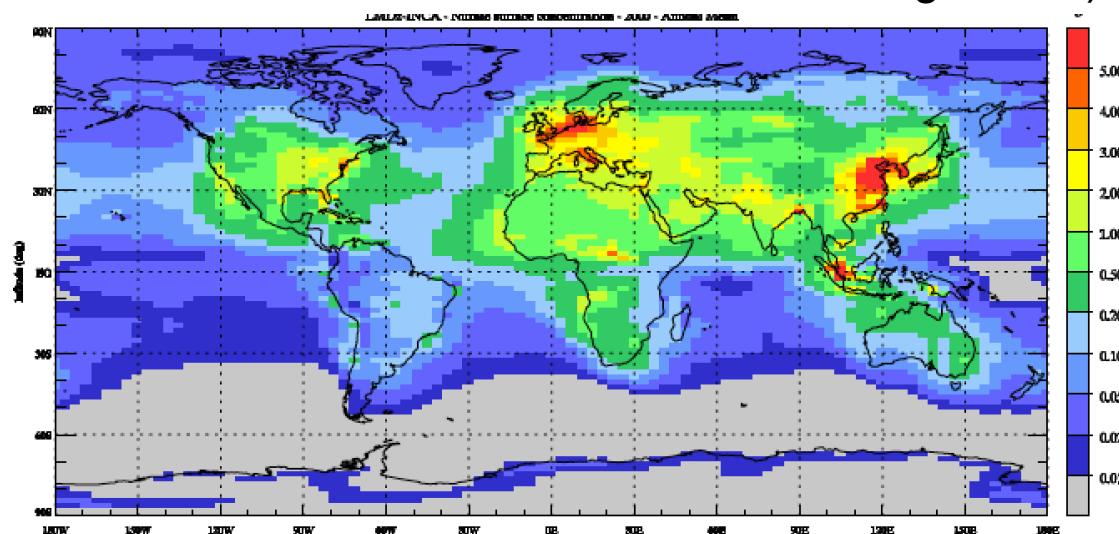
**IPSL-ESM : IPSL-CM6.2 (improved components – from CRESCENDO
not before 2018...)**



INCA in IPSL-CM6.1

- New radiative code RRTM
- N-cycle (Hauglustaine et al. 2014)
- Aerosols : major developments on dust mineralogy / iron content

(Journet, Balkanski, Harrison
Wang et al.,)



Nitrate Aerosols – Present Day (Hauglustaine et al.)



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Planned Developments w/ CRESCENDO

- Focus 1 : Secondary Organic Aerosols (w/ K. Tsigaridis)
- Focus 2 : N-cycle and deposition
- Focus 3 : Dust emissions and soluble Fe deposition

Who ? : Y. Balkanski, D. Hauglustaine, J. Lathière, O. Boucher, S. Szopa
A. Cozic
Post-Doc CRESCENDO



1- Coupled / integrated Carbon & Nitrogen cycle (2016)

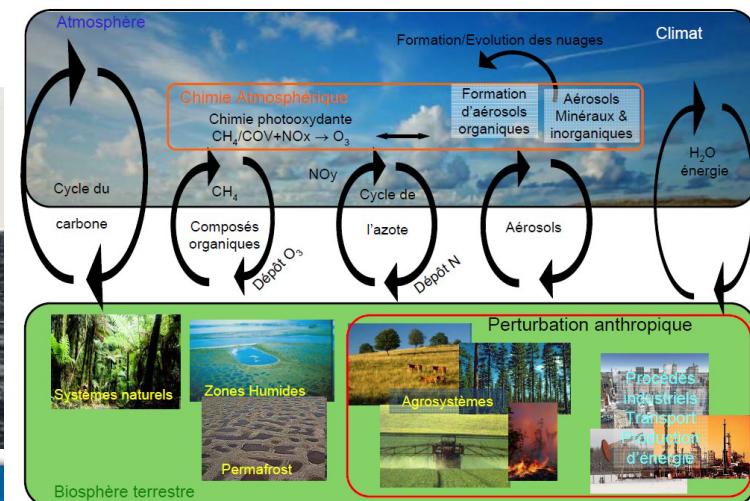
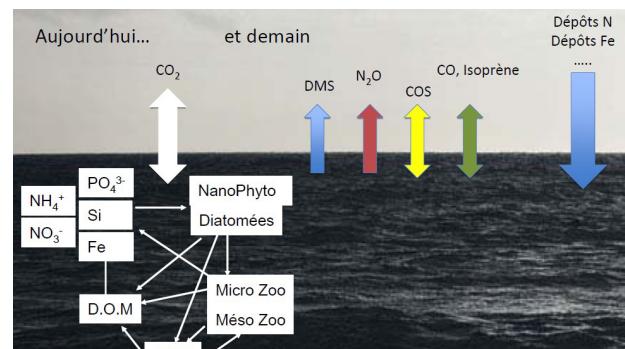
- N-cycle in ORCHIDEE (+ N₂O)
- Variable Stoichiometry C-N-P in PISCES (+N₂O)
- Atm. nitrogen cycle + deposition in INCA

2. VOCs and secondary aerosols (SOA) (2016-2017)

- Formation of SOA in INCA
- Emissions (marine + terrestrial of BVOCs)

3. Others...

- Land use + Forest management
 - carbon liability (soil, ocean)
 - high-lat process
- w/ ORCHIDEE



Overview AerChemMIP

Co-chairs:

Bill Collins(UK), Jean-François Lamarque (USA), Michael Schulz (Norway)

AerChemMIP will quantify **forcings**, **feedbacks** and global-to-regional climate **response** ($\Delta T, \Delta P$) from changes to:

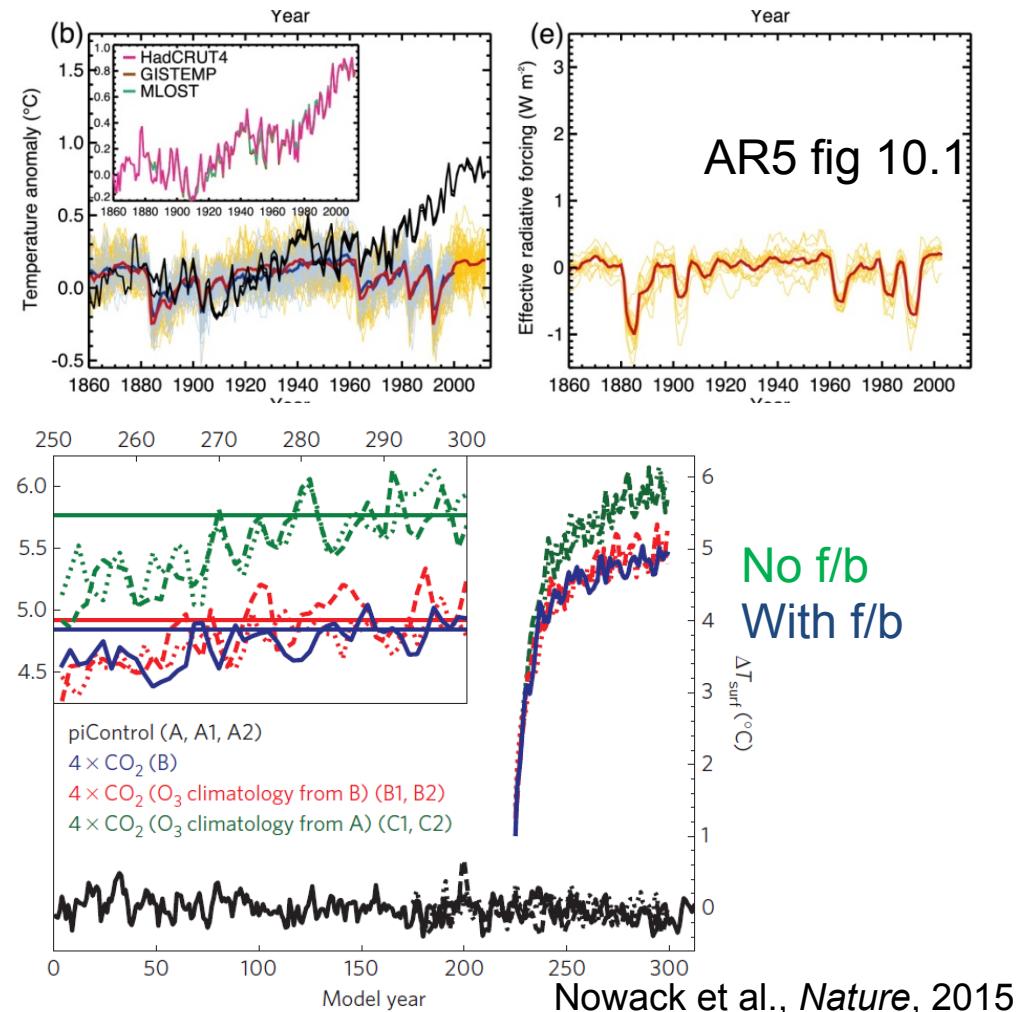
- NTCF emissions (aerosols, O₃ precursors)
- Reactive GHGs concentrations (N₂O, CH₄, ODSs)

→ It will provide essential new data to answer CMPI6 Q1 “How does the Earth system respond to forcing?”. AerChemMIP will provide data on past and future changes in the chemical composition of the atmosphere and estimate the associated forcings

→ It will provide significant contributions to WCRP theme “Biogeochemical forcings and feedbacks” (Chemistry-climate feedbacks, uncertainty associated with natural emissions,...)

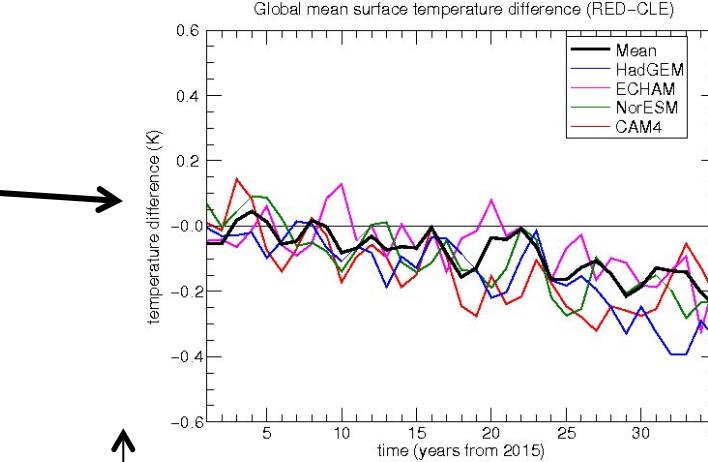
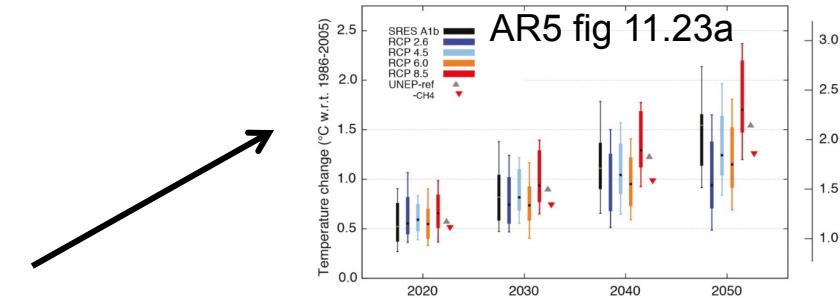
Motivation 1: Quantification of the transient Effective Radiative Forcing of Near-Term Climate Forcers

- Quantification of Effective Radiative Forcing of NTCFs for historical runs with interactive aerosol (+chemistry)
 - Needed for D&A
 - Improves on AR5 and Forster 2013
 - Includes tropospheric O₃
- Quantification of biogeochemical feedbacks
 - e.g., chemistry-climate feedback under a 4xCO₂ with (AerChemMIP) vs without (RFMIP) interactive aerosols and chemistry changes the climate sensitivity



Motivation 2: Quantifying the climate impacts of Near-Term Climate Forcers

- Importance of NTCFs in climate prediction scenarios
 - AR5: near term ΔT spread was due to Near-Term Climate Forcers
 - ECLIPSE (FP7): Mitigation of CH₄, BC compared to business as usual
- AerChemMIP will quantify the climate effects of NTCF mitigation based on a variant to ScenarioMIP Tier1 SSP3-7



Stohl et al. (2015)

