Chemistry-Climate Working Group

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Mission

The Community Earth System Model chemistry-climate working group is formed to focus on the coupling between the climate system, aerosols, atmospheric composition and chemistry.

Focus on CAM5

- Understand chemistry differences between CAM4/BAM and CAM5/MAM
- Bring ammonium nitrate in MAM (MAM3 or MAM4)
- Integrate diagnostics from AeroCOM into released version
- Start testing online photolysis (collaboration with LLNL and U. C. Irvine)

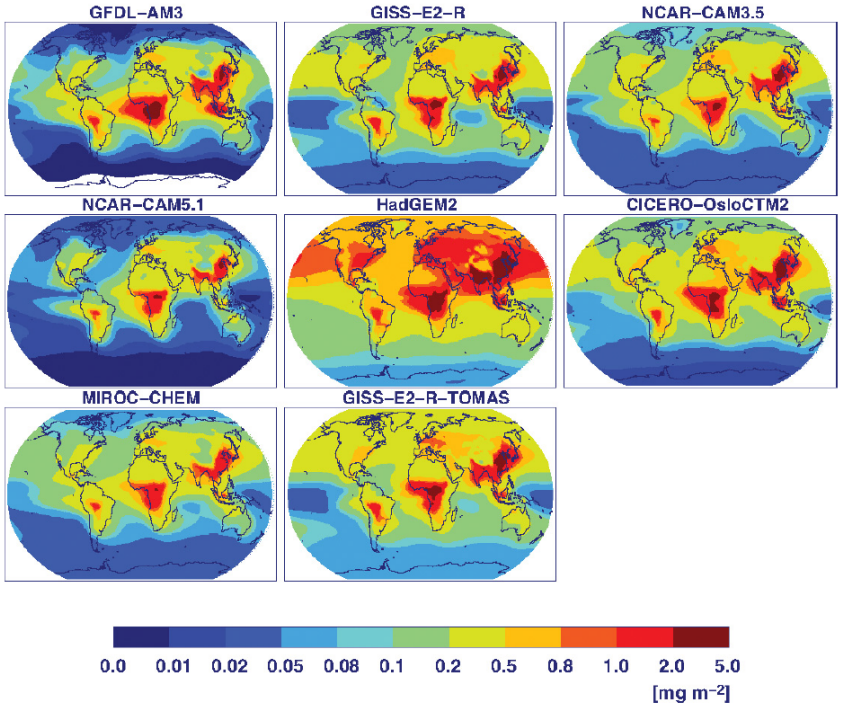
Recent release: new features

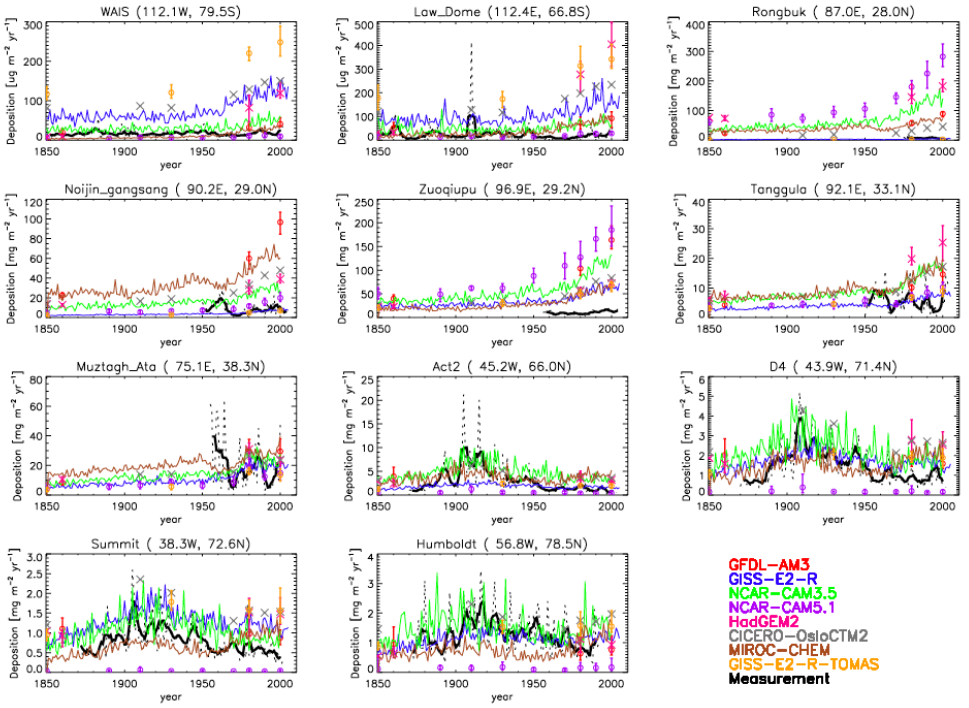
- Implementation of full chemistry with MAM3/MAM7 (new compsets)
- Expanded representation of secondary organic aerosols (in BAM), including a more speciated representation of biogenic emissions (MEGAN2.1)

Recent achievements

- Support of CMIP5 simulations
  - Concentrations of radiatively-active aerosols and gases for CCSM4
  - Oxidants for MAM/CAM5
  - Nitrogen deposition for CLM-CN
  - Black carbon deposition on snow and ice
- All aspects are now discussed in ACP/GMD special issue: ACCMIP

BC deposition





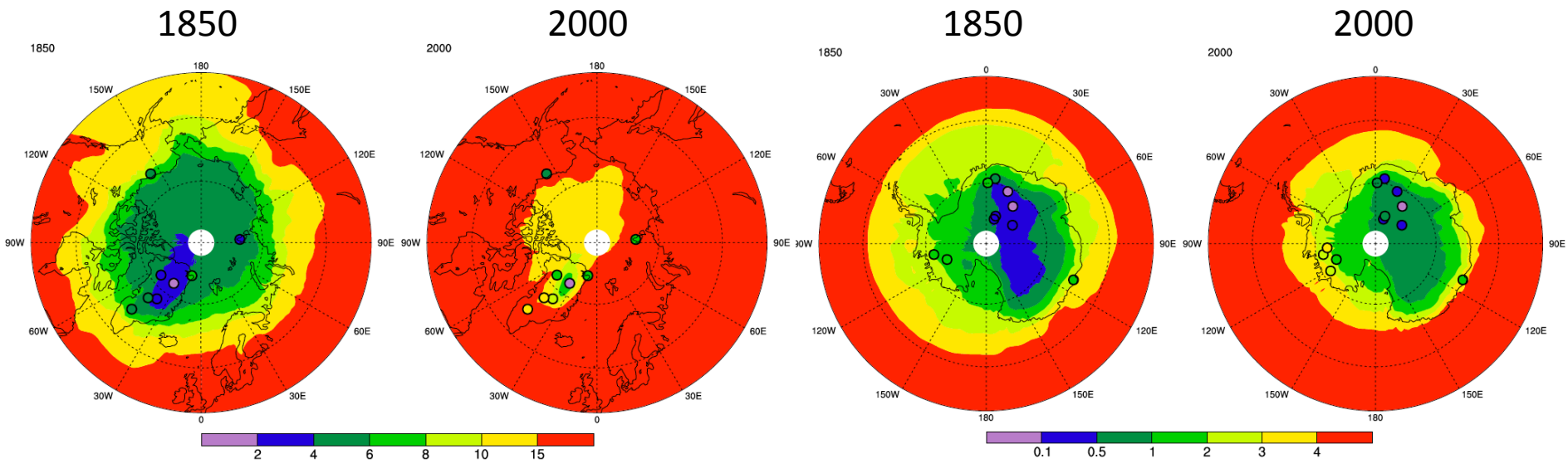
Fixes for underestimate in CAM5.1 is now available (scavenging) and upcoming implementation of MAM4 (Xiaohong's talk)

Lee et al., ACPD, 2012

Nitrogen deposition: pre-industrial to present-day

Arctic

Antarctic



mg(n)/m2/yr

Lamarque et al., submitted, 2013

Link with WACCM WG

- Very strong collaboration to
  1. eliminate code duplications cross-use approaches (e. g. SAD from WACCM; aerosols from CAM-chem)
  2. Complete integration of stratospheric (and above) chemistry within a singleframework (e.g. CCMI simulations with WACCM and CAM-chem)

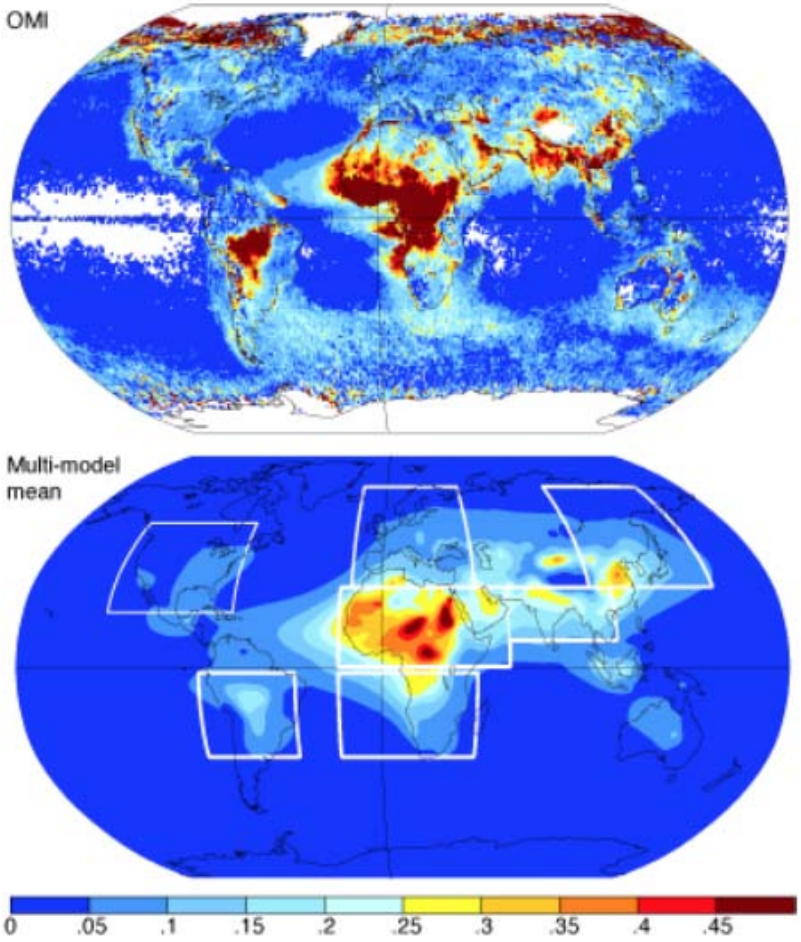
Upcoming participation to international activities

- GeoMIP: look at chemical impacts of Solar Radiation Management
- CCMI
  - Hindcast experiment (led by P. Hess): focus on 1960-present reconstruction of tropospheric and stratospheric changes in atmospheric composition
  - Forecast 1960-2100

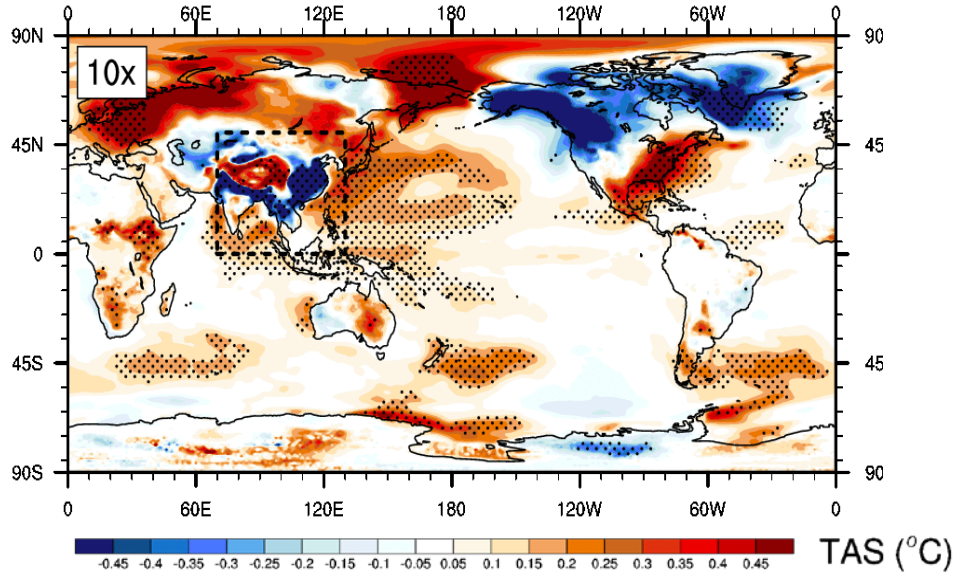
Upcoming topics of research

- Importance of natural aerosols:
  - Oceanic sources of organic aerosols (Primary and secondary)
  - Land sources of organic aerosols and interaction with anthropogenic emissions
  - Sea-ice sources of halogens/DMS
- Interaction with methane and fire emissions
- Remote impact of regional emissions

Absorbing aerosols



Shindell et al., ACPD, 2012



Teng et al., GRL, 2012

Topics of present development & research

testing the representation of chemistry and aerosols in CESM and evaluating existing and forthcoming CAM configurations, including:

- CAM5 physics, especially the coupling of interactive gas-phase chemistry and the modal aerosols and the impact of the new planetary-boundary layer parameterization
- improved modeling capabilities for new chemistry to allow for better process understanding (e.g., isoprene oxidation mechanisms and tropospheric halogen chemistry)
- improved modeling capabilities for different dynamical cores (SciDAC proposal) and horizontal resolutions