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

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 single framework (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