Discussion

Whole Atmosphere and Chemistry-Climate WGs
MUSICA

MUSICA: MUlti-Scale Infrastructure for Chemistry & Aerosols
https://www2.acom.ucar.edu/sections/multi-scale-chemistry-modeling-musica

Vision: Within five years develop, jointly with the community, a computationally feasible global modeling framework that allows for simulation of large-scale atmospheric phenomena, while still resolving chemistry at emission and exposure relevant scales.

MUSICA is being built on

SIMA: System for Integrated Modeling of the Atmosphere

SIMA Vision: An integrated global & regional atmospheric modeling system capable of simulating cloud to global scales in a community earth system model

- Encompass Climate, Weather, Chemistry & Geospace Applications
- Prediction (Initialized and Forecast) capabilities
- Complement & extend existing applications (CESM/WRF/MPAS)
- One community system: shared infrastructure and components
MUlti-Scale Infrastructure for Chemistry & Aerosols

MUSICA

Configuration

System for Integrated Modeling of the Atmosphere (SIMA)

Atmosphere Model
(global, regional, LES, box,…)

Common Physics Framework

Unified physics

Chem. Solv.  TUV  Deposition  Etc.

MICM

Model Independent Chemistry Module
Model-Independent Chemistry Module (MICM)

Same infrastructure for box models, regional-scale models, and global models

Chemistry Café Databases:
Versioned, traceable data storage

- Reactions and Reaction Rates
- Properties of Trace Gases
- Data for Photolysis Rates

Configurator

Atmosphere Model
(CAM, WRF, MPAS or box model)

Common Physics Framework (CPF)

Chemistry Driver

Kinetics Definitions
Solve Chemistry ODE
Other Chemistry/Physics Packages

Host Model Characterization

Community involvement in development of MICM and MUSICA is needed!
Discussion questions

• What are the primary applications for CESM, and its “niche”?  
• What should CESM do / focus on for the next five years?  
• What are the needs of WACCM & CAM-chem?  
• What should the format of the summer workshop and winter WG meetings be?
Specific Topics

• Chemical Mechanisms
  – More complex: terpenes, higher alkanes, fire compounds and their oxidation (Becky Schwantes)
  – Simpler: Troposphere-only (T1)? Improve “Reduced HC” scheme (trop&strat)?

• Model configurations
  – 2-degree
  – finer horiz. resolutions?
  – Vertical resolution (110L – needs development) & MOPED (more BL levels)
  – Spectral Element with CSLAM: ~1 deg, ~0.25deg?
  – SE with regional refinement
  – CTM (no interaction between chemistry and climate, i.e., aerosols on clouds) to study differences in chemistry, emissions, etc.
Development Activities and Plans
(from Chem. WG meeting Feb 2019)

• Specified Dynamics at 32 Levels - MERRA2 interpolated to 32L, investigating nudging factors, fields to constrain, etc.

• Inorganic nitrate aerosols and MOSAIC (Zaveri et al., Zheng Lu, Duseong Jo)

• Brown carbon (published in CAM5.4, need to move to CAM6)

• Improved wet scavenging in convective clouds (Pengfei Yu, Yunpeng Shan)

• Improved dust representation (Xiaohong Liu et al.)

• Online ocean emissions of VOCs, DMS, NO (Siyuan Wang)

• Updated chemistry: terpenes, higher alkanes, fire compounds and their oxidation (Becky Schwantes)

• VSL halogen chemistry (Doug Kinnison, Alfonso Saiz-Lopez, Siyuan Wang, et al.)

• Spectral Element/refined grid with chemistry (Forrest Lacey, Becky Schwantes, et al.)

• CAM-chem-SE-RR with meteorology nudging (Simone)

• Online TUV and/or Fast-J

• Update MEGAN biogenic emissions (in CLM) (Alex Guenther, UCI)

• CARMA implementation (Pengfei and NCAR)

• VBS improvement: add high NOx environment (especially for higher horiz. resolution)

• Updated SOA from Isoprene/IEPOX & Terpenes (Duseong Jo)