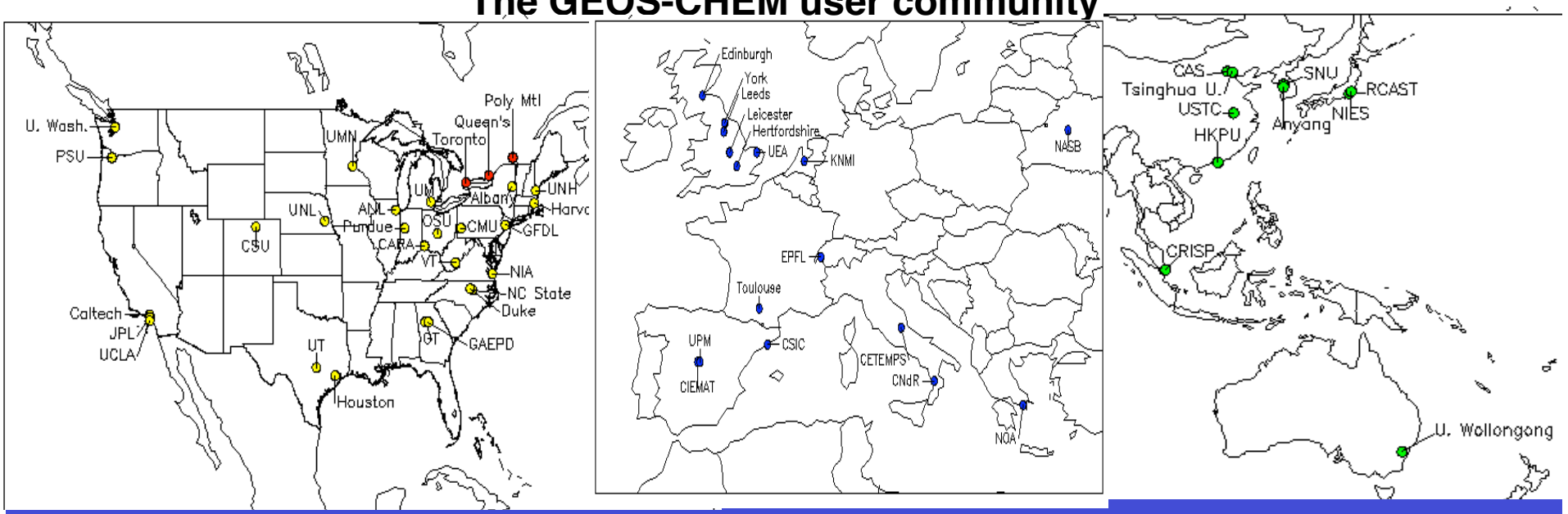
Welcome to the 4th GEOS-Chem Scientific and Users' Meeting!

The GEOS-CHEM user community



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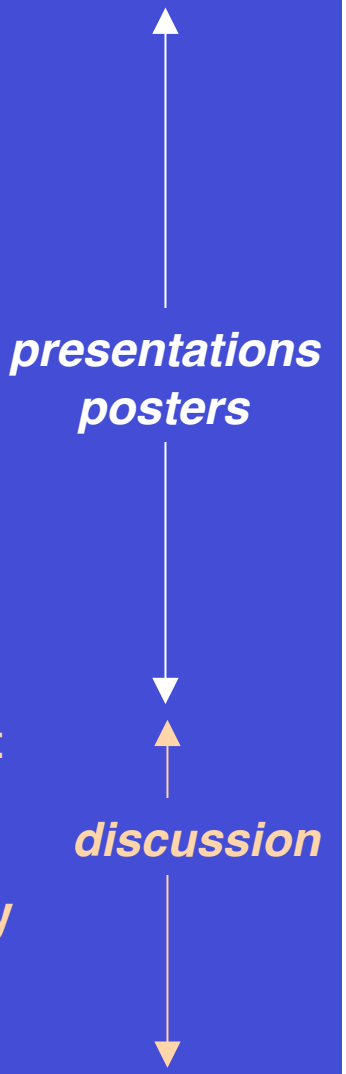
to Harvard School of Engineeering & Applied Science for facilities;
to Brenda Mathieu, Jacob graduate students for logistics**

MEETING AGENDA

- *Tues Apr. 7*
  - Model overview and development
  - Chemical transport
  - Aerosol sources and chemistry
  - Aerosol microphysics and radiation
  - Biomass burning
- *Wed. Apr. 8*
  - Tropospheric ozone
  - Photochemistry
  - Regional air quality (2)
  - Mercury
  - Carbon gases: CO_2, CO, methane
- *Thurs. Apr. 9*
  - Chemistry/climate/land interactions
  - Model software engineering, code development, user support
  - WG 1: Emission inventories, Adjoint model clinic
  - WG 2: Aerosol processes, Carbon gases, Chemistry-climate
  - WG 3: Adjoint model, Regional modeling, Oxidants/chemistry
- *Fri. Apr. 10*
  - Working Group reports
  - Future directions

  - Model clinic (afternoon)

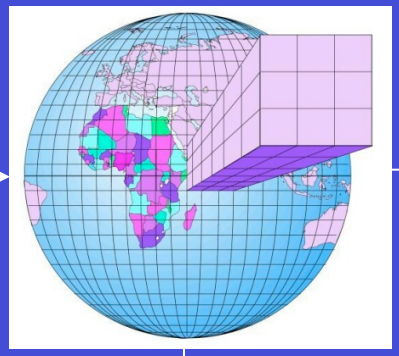


GEOS-Chem Chemical Transport Model (CTM)

Input data
- meteorological fields
- other

Solve 3-D chemical continuity equations on global Eulerian grid

Modules
- emissions
- transport
- chemistry
- aerosols
- deposition



Model adjoint

Applications
- chemical transport
- chemical budgets
- flux inversions
- climate forcing
- air quality
- ecosystem exchange
- satellite retrievals
- diagnostic studies…

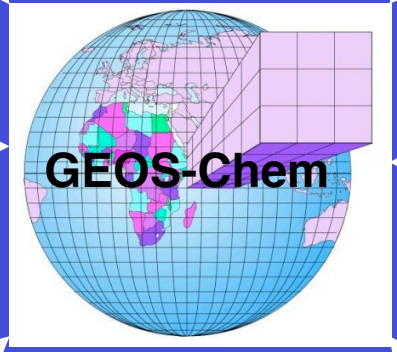
Meteorological input is from NASA/GMAO/GEOS data system: 1/2°x2/3° horizontal resolution (GEOS-5)

GEOS-Chem contributes to broader activities

Outer nest for regional air quality models (CMAQ, CHIMERE)

Chemistry-climate interactions (GISS GCM)

Interface with radiative transfer models (LIDORT)



Module exchange w/other CTMs (GMI)

Modules for Earth system models (GMAO)

Chemical data assimilation (GMAO)

GEOS-Chem model capabilities

- Driven by GEOS-3/4/5 meteorological data (1985-present), also GISS GCM for different climates
- 1/2°x2/3° to 4°x5° horizontal resolution, up to 72 vertical levels
- Tropospheric oxidant-aerosol chemistry, carbon gases, mercury, hydrogen…
- Model adjoint

Major updates to standard model since 3rd Users' Meeting (April 2007):

- Interface with GEOS-5 meteorological data
- Nested capability for GEOS-5
- Improved advection scheme
- Variable tropopause
- Cloud overlap schemes for photolysis
- Emission updates
- Chemical updates
- Hydrogen/HD simulation
- Mercury land-ocean-atmosphere coupling

Also GEOS-Chem wiki page, newsletter to improve communications

…and parallel development of model adjoint for GEOS-4 incl. chemistry, aerosols

GEOS-Chem developments over the horizon

Mature and (almost) ready to go in standard model:

- Linoz for stratospheric ozone (Dylan Jones)
- Improved boundary layer mixing (Jintai Lin)
- Interannual lightning (Lee Murray)
- Soil NO_x emissions (Randall Martin)
- Interface with LIDORT radative model (Daven Henze, Easan Drury, Jun Wang)
- Aerosol microphysics (Fangqun Yu)
- Aerosol phase transitions (Jun Wang)
- Methane update (Jerome Drevet, Kevin Wecht)
- C_2H_2/C_2H_6 (Yaping Xiao)

Currently in development:

- Tropospheric bromine chemistry (Justin Parrella)
- Carbonyl sulfide (Parvadha Suntharalingam)
- ESMF/MPI capability (Bob Yantosca, Philippe LeSager)
- GEOS-Chem 1-D column version (Bob Yantosca, Philippe LeSager)
- Numerical improvements (Mauricio Santillana, Scott Norris)
- GISS Model E interface (Loretta Mickley, Lee Murray)
- Terrestrial and deep ocean mercury (Nicole Smith-Downey, Elsie Sunderland)

along with continued updates to existing modules,
bracing for 1/4°x1/4° version of GEOS-5, move to GEOS-6…

Functioning of the GEOS-Chem community

- GEOS-Chem is a grass-roots community model
  - Code is open-access
  - Development is user-initiated
  - Central resource is large user community with broad interests

- Model management is presently based at Harvard (Yantosca, LeSager, Carouge)
  - Emphasis is on rapid infusion of new developments, model traceability, version control, user support
  - Financing is enabled by large local user base
  - As model grows, management base will need to extend outside Harvard

- The model is owned by its users, and with ownership comes responsibilities:
  - Keep up with the model (newsletters, wiki, e-mail list, users' meeting)
  - Contribute to the community: help with requests, report bugs
  - Share mature model developments for incorporation into standard model
  - Update regularly to latest standard version of model
  - Provide due credit to developers

Where are we headed over the longer term?

- **The need for global CTMs will only grow**
  - **best tools for understanding global atmospheric composition and implications for air quality, satellite data interpretation, source inversions, climate forcing, persistent pollutants, etc.**
  - **As large national labs move towards more integrated Earth models, maintaining a strong grass-roots CTM capability will be critical**

  GEOS-Chem has a bright future
- **Integrating CTM capabilities in other models will be increasingly important**
  - **with GCMs/ESMs for climate studies and biogeochemistry; with regional air quality models for intercontinental transport; with meterorological data assimilation systems; swapping modules with other CTMs for community assessments; etc.**
  - **View GEOS-Chem as collection of modules to serve other models**

  GEOS-Chem is headed in that direction
- **As model complicates, management becomes more challenging**
  - **Need to keep grass-roots perspective and community involvement that are key to the success of the model**
  - **Get groups outside Harvard to become involved in GEOS-Chem management**

  GEOS-Chem will remain as strong as its community of users