

**GEOS-Chem Steering Committee Telecon  
06 December 2018**

**Attending/Missing:**

Becky Alexander, **Kevin Bowman**, **Sebastian Eastham**, Mathew Evans, **Emily Fischer**, **Jenny Fisher**, **Jeff Geddes**, Colette Heald, **Barron Henderson**, **Daven Henze**, **Chris Holmes**, **Lu Hu**, **Daniel Jacob**, Dylan Jones, **Prasad Kasibhatla**, **Christoph Keller**, Hong Liao, **Jintai Lin**, **Hongyu Liu**, Jingqiu Mao, Eloise Marais, **Randall Martin**, **Dylan Millet**, **Andrea Molod**, **Lee Murray**, **Jeff Pierce**, **Amos Tai**, **Jun Wang**, **Yuxuan Wang**, **Bob Yantosca**, **Fangqun Yu**, **Lin Zhang**, **Lizzie Lundgren**, **Melissa Sulprizio**

**1. General update (Daniel)**

- v12.1 approved, working on v12.2, v12.3
- Coupling GEOS-Chem module with earth systems models (Daniel + Seb have NSF proposal for CESM); several other efforts: Beijing Climate Center (Lin), WRF (May), GEOS mature (Lu, GMD paper published, Christoph is using)

**2. Engineer's report (Bob)**

- v12.1.0: big update is new budget diagnostics to see how each operation is changing mass (PBL, trop, full column)
  - anthropogenic dust emissions
  - CEDS ship emissions
  - fix for non-local PBL mixing
  - and more – see newsletter
- v12.2: working on NOAA ObsPack for. saving model time series output at surface stations and along aircraft tracks for comparison to observations
- v12.3: some emission updates
- under the hood continuing to get rid of binary punch (bpch) format
- Support: wiki page with checklist of information needed to provide to GCST for diagnosing bugs
- Trying to cull obsolete information on wiki, centralize important information
- Working on updating benchmarks, porting from IDL to Python in the process

**3. Working Group Reports**

- **Aerosols (Colette, Jeff P., Becky, Fangqun)**
  - Importance of updating N2O5 hydrolysis gamma
- **Emissions and Deposition (Emily, Jintai, Eloise, Dylan M.)**
  - Jintai has global native resolution biogenic and soil NOx emissions (more in item #7 below)
- **Chemistry (Mat, Barron, Lu, Jingqiu)**
  - Jintai's student has developed aromatic chemistry scheme based on SAPRC11; paper accepted in GMD, code has been prepared to be implemented in upcoming version (first item in ready to go in)
  - Mat to hold telecon in new year to discuss chemistry updates (aromatics, halogens, alkyl nitrates, other organics)
- **Carbon Cycle (Kevin, Dylan J.)**
  - Some ongoing issues with wet/dry fixes in adjoint

- Starting to look into adjoint for GCHP for passive tracers. Key element is being able to save out timeseries data consistent with where observations are (e.g. only along satellite track). GMAO conversations, interest in using MAPL, some resource issues (see more in item #4).
- **Hg and POPs (Jenny, Chris)**
  - Jenny will have student working on migrating Hg benchmark into Python
- **Chemistry-Ecosystems-Climate (Amos, Hong, Lee, Jeff G.)**
  - Lee working on coupling with GISS; planning to archive and make available CMIP6 runs (just future & past meteorology)
  - Amos has student working on alternative ways to calculate stomatal conductance; will remain a separate module, working on how to link to dry deposition module
- **Transport (Hongyu, Andrea)**
  - Status update on re-diagnosing convection in GEOS-Chem. In some cases, new code improves agreement with radionuclide observations but in other cases no change or worse. Working on determining which parameters to optimize.
  - Should comparisons be to observations or to online model? Should keep both in mind.
- **Adjoint model and data assimilation (Daven, Jun)**
  - Dry and wet pressure fix from JPL
  - MERRA full chemistry adjoint has not been developed yet but people are interested
  - 0.25° model in development, expected to come online next year
  - JPL supporting GCHP adjoint model development

#### 4. GMAO Update (Andrea, Christoph)

- Andrea has been asking about timing of getting GEOS-FP output on the cubed-sphere to drive GCHP. Expense involved in generating an additional output.
- Some discussion about generating cubed sphere output at coarser resolution to make it affordable. Seb has established which fields need to be archived on cubed sphere (transport-related, 6 fields). C360 is good enough resolution for GCHP, saves factor of 4 relative to native C720. Andrea will get the message back to the folks at GMAO and ask about feasibility of C360 archive.
- Christoph has developed PCA-based method to compress and re-construct GEOS fields to 99.99% accuracy. Possibly use cubed-sphere output as a test case. We would want to see what effect it has on eventual mass fluxes and transport. Simpler compression algorithms exist (e.g. scale/offset with integer data).
- Christoph: basic comparison of stratospheric GEOS-Chem with GMI successful, now doing 10-year stratosphere simulations for further testing. Would be good to have GMI folks engaged in evaluating/developing GEOS-Chem stratospheric chemistry as we don't have much expertise there in the GEOS-Chem community. Christoph to organize a telecon on this in the new year (Daniel, Seb, Dylan J., Christoph, anyone else who is interested).
- Aerosol evaluation comparison with GOCART. 1-2 year simulation shows they are reasonably close, probably not worth spending time on differences. Plan is to develop version where GOCART framework can be used with GEOS-Chem chemistry; Lizzie working with Goddard team on this.

#### 5. Nested model updates (Yuxuan, Lin)

- Nothing to report.

## 6. GCHP updates (Seb, Randall)

- Growing GCHP community
- Broad-standing requests: everyone on GCSC working on GCHP to share successes and challenges on GCHP mailing list, and please join GCHP working group mailing list and wiki page
- Working on update to build system to make it easier for new users; has successfully implemented for GC Classic
- GCHP 12.1.0 currently being evaluated via comparison to GCC; some differences but think we understand these as related to resolution dependence of emissions.
- A minor transport fix has been implemented to reduce spurious redistribution between troposphere and stratosphere caused by lack of true pressure fixer; effect is small but worth evaluating. Does not affect GCC.
- MAPL2.0 will have more parallelized I/O, currently being implemented by Lizzie, planning testing by start of 2019
- Looking at feasibility for 1D timeseries output to come from GCHP (satellite track, ObsPack style time/location info). Goes against current GCHP outputs (everything gridded); GMAO suggests it is doable with roughly 2 weeks of dedicated work
- 12.1.0 removes GCHP dependence on unit tester for creating run directories; improves usability. Now create run directory from source code, can specify through interactive scripts which met source you want to use. Also gives option of putting new run directory under version control with git. Also means that updates in new version will be committed in same history as source code. Hoping to eventually do the same for GEOS-Chem Classic.

## 7. Including grid-independent emissions in version 12.4.0 (Randall)

- Very close to realizing these, benefits for GCHP and for GEOS-Chem classic (Jintai's group has manuscript, data to be developed within weeks for seasalt, biogenics, soil NO<sub>x</sub>; Lee has provided lightning NO<sub>x</sub>; Dave Ridley has provided dust)
- Propose putting into v12.4.0 (would be major update for this version)
- Q: other processes are very resolution dependent (e.g. BL mixing, convection) – how will this affect concentrations if we are only making emissions grid-independent? Is that what we want?
  - At present, there are issues not only in magnitudes, but also spatial patterns change
  - This is a problem especially for GCHP, which switches between resolutions
  - This change will provide more consistency between resolutions
  - Not clear that the science will actually be better served...
- Q: are these option or default?
  - Had been thinking default
  - But there are scientific questions of using grid-independent emissions that need to be investigated
  - Should be an option until these are investigated?
  - This is definitely best option for lightning (already heavily parameterized, somewhat unlinked to convection); dust is canonical example where we need this change
- Q: how would updates be handled? e.g. MEGAN3 coming
  - Would probably become a responsibility of GCST (not necessarily the group that publishes the process-level updates)
  - Need to do anyway with new met fields
  - Parameterisations don't change all that often...
  - Could GMAO incorporate this into the assimilation?
- Consensus: definitely need to keep both grid-independent and online emissions for community. Will continue to think about the details of implementation and which one becomes default.

## 8. Benchmarking update (Mat, Lizzie)

- Reorganizing 1-month and 1-year benchmark output, starting with 1-month
- Primary changes are putting all plots together to a single page for each species, breaking up PDFs into sets of related species
- Adding bookmarks to jump to specific species
- Looking for feedback, will have an example soon
- How much observational data do we bring in 1-year benchmark? Wary of trying to include too much... Keep more minimalist for now.
- Benchmarks are useful as research tool. Should think about which observations to include to represent different environments (e.g. remote, near source). Some duplication in current observations. ATom should probably be included, as it is defining for the community. We'll need to come up with some specific diagnostics for this comparison.
- Will have a broader discussion about what observations to include when we get to the 1-year benchmark.

## 9. IGC9 planning (Daniel)

- Daniel has received all funds for logistics, coffee breaks, food, drinks, travel funds (NASA, NSF, NOAA, EPRI, Harvard, MIT)
- Registration page to be set up this month, need meeting agenda
- Feeling that clinics (cloud computing, WRF-GC) should not happen Sunday afternoon as may discourage attendance. Instead either Monday morning (meeting start Monday afternoon) or Thursday afternoon. Monday morning preferable. Would still be good to have some science Monday. Also means people can travel Monday morning, save hotel costs... Could we go to 3pm on Thursday? Might work with flights...
- Opposition to parallel sessions, should stay plenary in terms of unity of community and for logistics. Requires moving a lot of people to posters but that's OK.
- Need nominations for keynote speakers

## 10. GEOS-Chem logo (Jeff G.)

- General consensus for last versions (slide 18 onwards)
- Scalability won't be an issue as we will get the vector graphics version (or possibly even original file)
- Jeff will wrap up with the designer.