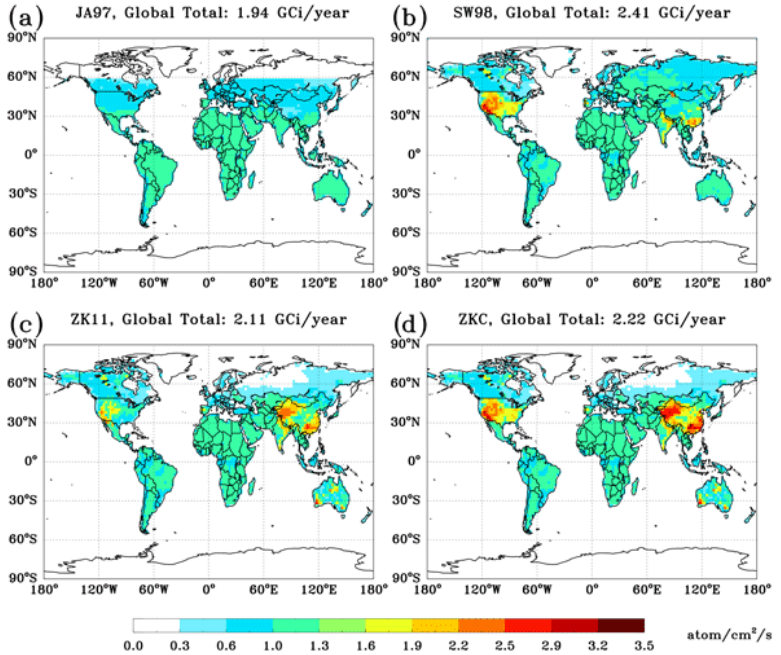
Transport WG update

Andrea / Hongyu, 2/24/2021

1) improved wet scavenging from SUNY group's Luo et al. (GMD 2020)
   - https://gmd.copernicus.org/articles/13/2879/2020/
   - as option, in Version 13.2, to replace Luo et al. (GMD 2019)

2) GEOS-Chem Rn-222 paper published (Zhang, B. et al. ACP 2021)
   - https://acp.copernicus.org/articles/21/1861/2021/
   - implement new Rn-222 emissions (panel d) as option in GC?



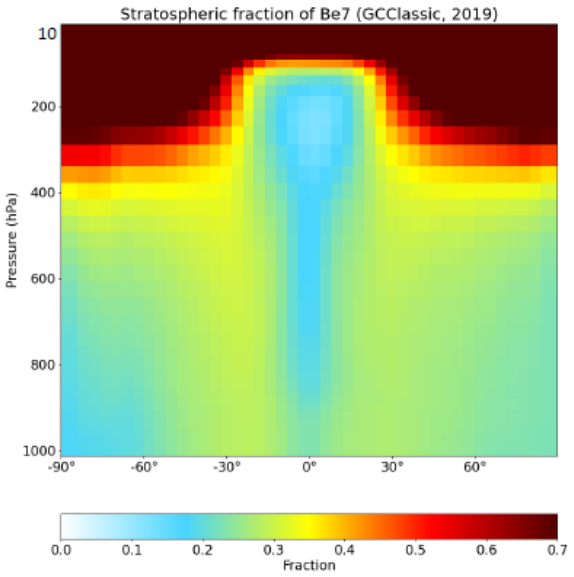
3) stratosphere-troposphere exchange (STE) in GEOS-Chem (Daniel/GCST, Andrea, Hongyu, Emma)

- 7Be obs constraint: annually 23-27% of the 7Be in surface air at NH mid-latitudes is of stratospheric origin
- STE in GC / MERRA2 looks OK in the mean (diff between GCC vs GCHP)

- sensitivity of strat 7Be fraction to the location of tropopause (Liu et al., ACP 2016)
- GC starts archiving TROPPB (instead of TROPPT) for stratospheric tracer definition
  (to be consistent with the GEOS transport tracer)

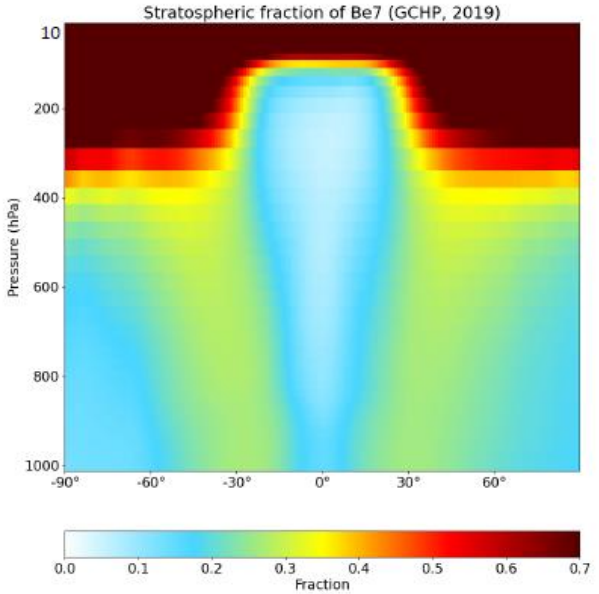
TROPPB: tropopause pressure based on blended estimate **(used in GEOS; not archived in GC)**
TROPPT: tropopause pressure based on thermal estimate **(currently used in GC)**
TROPPV: tropopause pressure based on EPV estimate

Annal mean strat 7Be fraction



Taken from the last year of the GEOS-Chem Classic 10-year benchmark with MERRA-2 meteorology(2019)

GC/MERRA2
4x5, TPCORE

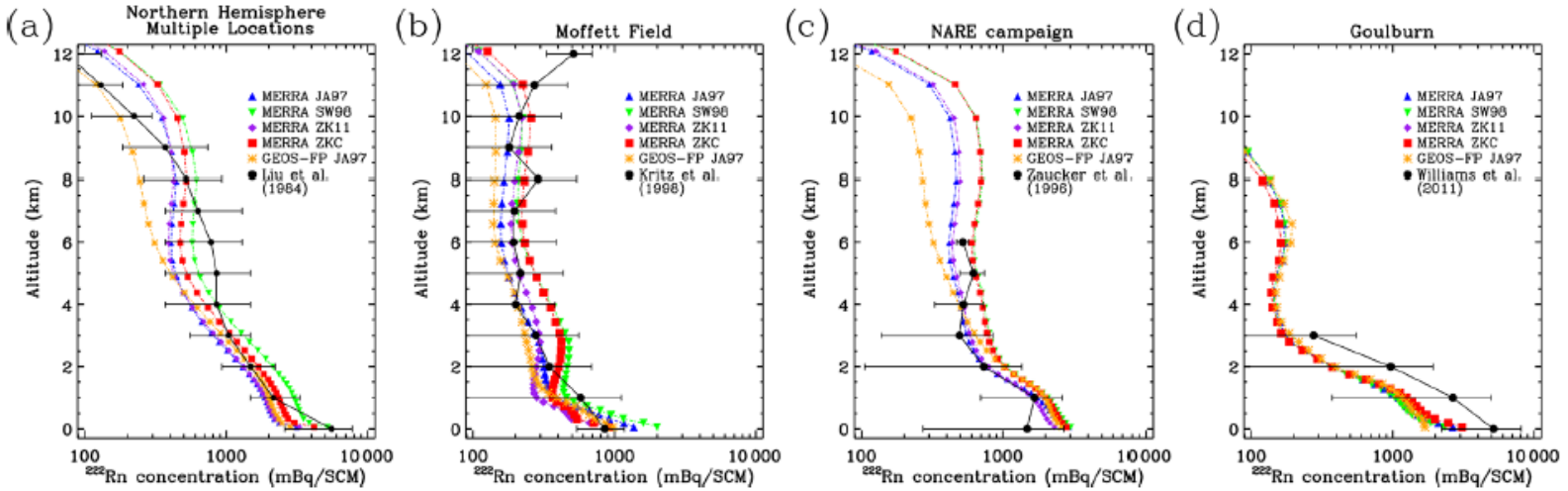


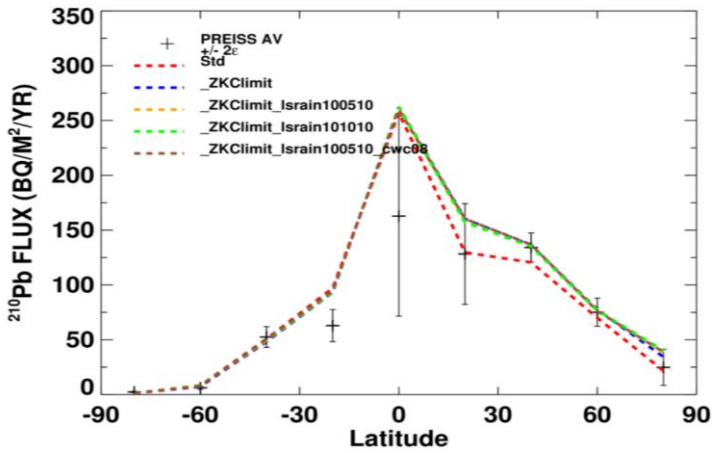
Taken from the last year of the GCHP Classic 10-year benchmark with MERRA-2 meteorology (2019)

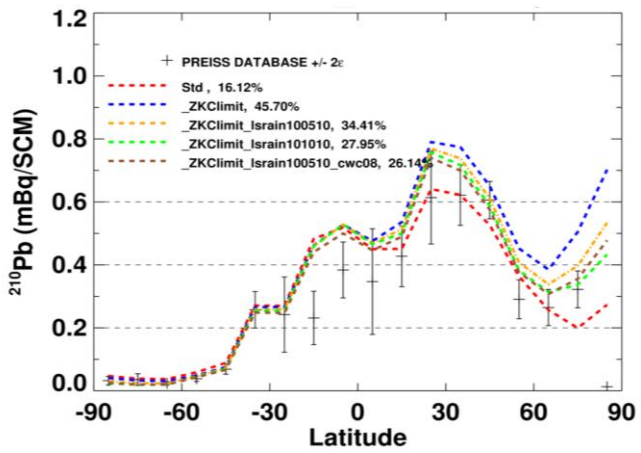
GCHP/MERRA2
c48, FV3

4) Evaluation of benchmark radionuclide tracers with observations

- Rn-Pb observational datasets & IDL code for model-obs comparison sent to GCST & GMAO.
- Code for 7Be not ready, but strat 7Be fraction is a more useful diagnostic







5) Rediagnosis of RAS convection in GEOS-Chem (Dylan J., Tailong, Andrea)

- work is finished and a manuscript is being finalized

6) A few things brought up by Daniel:

a) Now that we have the full GEOS suite of transport tracers in the GEOS-Chem benchmarks, how can we set up a procedure to compare these benchmarks to the on-line GEOS and to the GEOS-CTM?

GCST will look into installing the transport tracers as a gridded component in GCHP so that results can be exactly compared to GEOS and GEOS-CTM.

b) One issue that has come up in these benchmarks is that GCC and GCHP have substantial differences in vertical transport, as indicated by PBL venting of 222Rn (more venting in GCHP) and STE of 7Be and ozone (less leakage from stratosphere and downwelling in GCHP). Some of that could reflect differences in resolution (4x5 GCC vs c48 GCHP) but the advection schemes are also different. It would be nice to understand this, or at least to know if GCHP is more consistent with on-line GEOS.

c) Our model comparisons to ozonesonde vertical profiles over land suggest that PBL mixing in the model is too fast. Midday ozone profiles in the PBL are flat in the model but not in observations. The CMAQ scheme has the same problem, it doesn't seem to be GC-specific. This might have to do with top-down vs. bottom-up mixing. We're going to be working at Harvard to come up with an alternative scheme but wondering if that's a known problem in GEOS. We plan to compare to the GEOS-CF sonde comparisons.