GCHP adjoint
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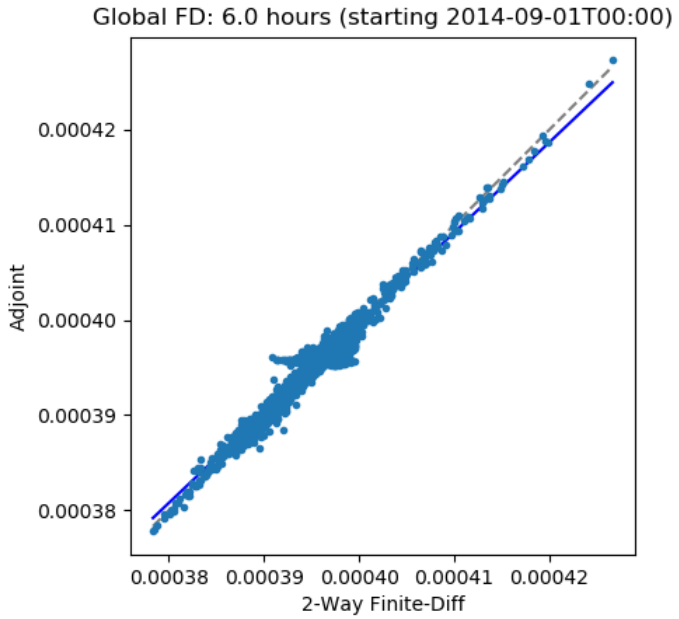
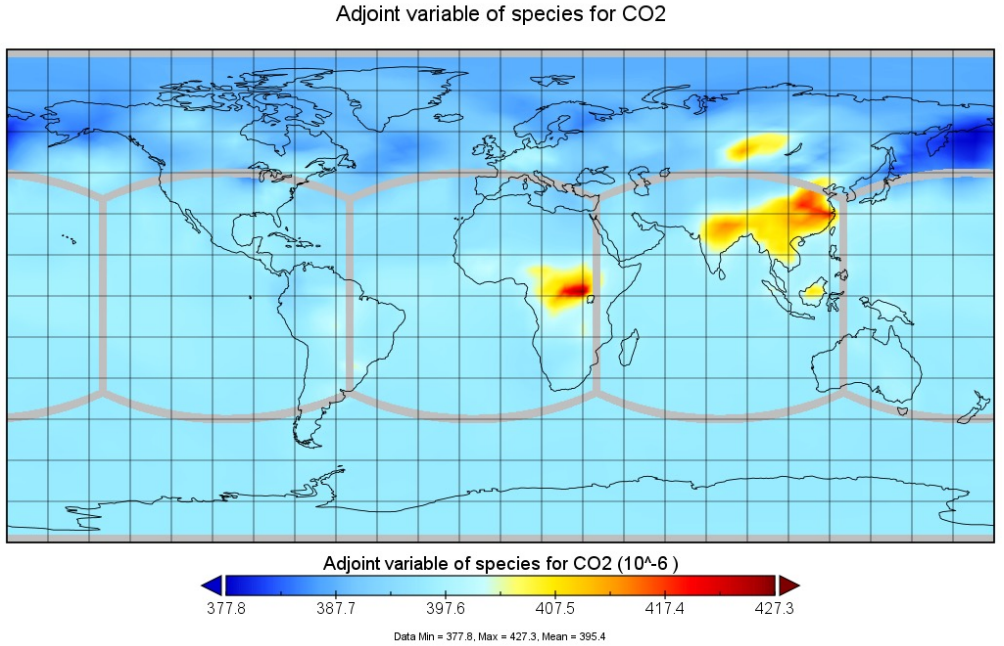
6 hr adjoint vs FD evaluation



6 hr initial condition sensitivity



Detailed instructions for installation and running (on NAS Pleiades): https://tinyurl.com/3ayyy8ez

Obtaining and running the code

- Adjoint code is now part of the main GEOS-Chem model code repository
  - The dev version hosted by Colin (see instructions) is more up-to-date
  - `git clone git@github.com:TerribleNews/GCHPctm_adj.git ./GCHP-adj`

- See detailed instructions for setup of run directory, build/make/install

- Adjoint code enabled at compile time with the following options:
  `-DADJOINT=yes -DREVERSE_OPERATORS=yes`

- Execute GCHP adjoint using runConfig_adj.sh

- Adjoint simulation is selected using the MODEL_PHASE option in GCHP.rc
  - runConfig.sh will set MODEL_PHASE to FORWARD
  - runConfig_adj.sh will set MODEL_PHASE to ADJ

- Adjoint results:
  `OutputDir/GEOSChem.Adjoint.20140901.nc4` (initial condition sensitivities)
  `OutputDir/GEOSChem.SFEmissions.20140901.nc4` (emission sensitivities)

GCHP results

Show in Panoply

Key differences from GC classic adjoint

- Adjoint code is now part of the main GEOS-Chem model code repository

- Adjoint is run entirely separately from the forward model
  - GC adjoint classic exec default behavior was forward + adjoint, (although as of v36 there is the option to run adjoint only)
  - GCHP is compiled to run either forward, or adjoint

- GCHP adjoint is currently just initial condition and emission sensitivities for CO_2
  - no full chem
  - no inversion capabilities

GCHP adjoint: what is included, what is needed

- Included
  - CO_2 horizontal transport
  - Initial condition sensitivities
  - Emissions sensitivities
  - Finite difference tests
    - for IC sensitivities (automated)
    - for emissions sensitivities (manually, using HEMCO)

- Needed
  - Volunteers!!
  - PBL mixing, convection
  - chemistry and deposition
  - Interface with inverse / DA framework – JEDI?