Objective: to highlight the role of GEOS-Chem chemistry in the GMAO’s GEOS Earth System Model, with progress from “research” to “production” capability
Progress of Two Applications of GEOS, Beginning in ~2004

Online implementation of tagged tropospheric tracers to support Intex-NA (Jacob-Pawson; Eric Nielsen)
Set a precedent of GEOS generating custom products for NASA’s field missions
Scrutiny of transport in analyses and forecasts – features; emissions
Presently transporting about 10 idealized tracers and 29 aerosols (with assimilation) in GEOS FP system

Newest analysis and forecasting system, GEOS CF, is based on GEOS-Chem

Emergence of the first version of the GEOS CCM (Chemistry-Climate Model) (Stolarski-Pawson; Eric Nielsen)
Set a precedent of GEOS applications to multi-decadal ozone change studies
Scrutiny of transport in multi-decadal simulations
Presently transporting stratospheric and tropospheric constituents in GEOS CCM system
GEOS CCM is considering a future that will be based on GEOS-Chem
Realism of Total Column Ozone in the GEOS CCM

- Successive changes in GEOS CCM have led to very realistic representation of total global ozone evolution.
- Only sparse investment in development of the GMI strato-trop chemistry mechanism.
- GEOS-Chem mechanism is under continual development by a huge team!
- The bar is already set quite high when it comes to the total column ozone.

Figure by Luke Oman and Qing Liang

- GEOS-4 -> GEOS-5 (improved circulation)
- Very short-lived bromine compounds;
- Volcanic aerosols;
- Quasi Biennial Oscillation (QBO)
- Tropospheric chemistry;
- 11-yr Solar cycle
GEOS CF (Composition Forecasting) System

Real-time analysis and forecasting system for atmospheric composition:

- Based on GEOS meteorological analyses, using REPLAY technique
- Emissions and reactive chemistry based on GEOS-Chem
- No assimilation of constituents (at least for now)
- Resolution: c360L72, or ~25km globally
- One five-day forecast each day
Example output: GEOS-CF surface ozone “analysis”
Summary

GEOS-Chem provides a pathway to sustainable modeling of atmospheric composition in GMAO’s GEOS systems:

- GEOS CF already exploits this capability
- Central repository allows for easy code sharing
- Pathway from “research” to “production” systems (and beyond?)

Hope to use a GEOS CF system for a 20-year REANALYSIS of atmospheric composition, using EOS observations and more

Examining the possibility of using GEOS-Chem in the GEOS CCM – stringent demands on the stratosphere
Reactions (not very chemical)

Any questions?

Who else is here from the GMAO:

Andrea Molod: the speaker who will begin once I leave the podium
Christoph Keller: the Chair, who’s to blame if Andrea starts late
Pamela Wales: who joined GMAO too recently to blame for anything; she will present poster B.18
Emma Knowland: who is blameless because she has a PhD from Edinburgh; she will talk about GEOS CF on Wednesday
Susan Strahan: who is not from GMAO, but is a leading light of the GMI and GEOS CCM projects