LaRC Activities for the Global Modeling Initiative

or …

"I'm not just the president of the hair club for men,
I'm also a member"

or…

Just in case I don't drink the HQ kool-aid!

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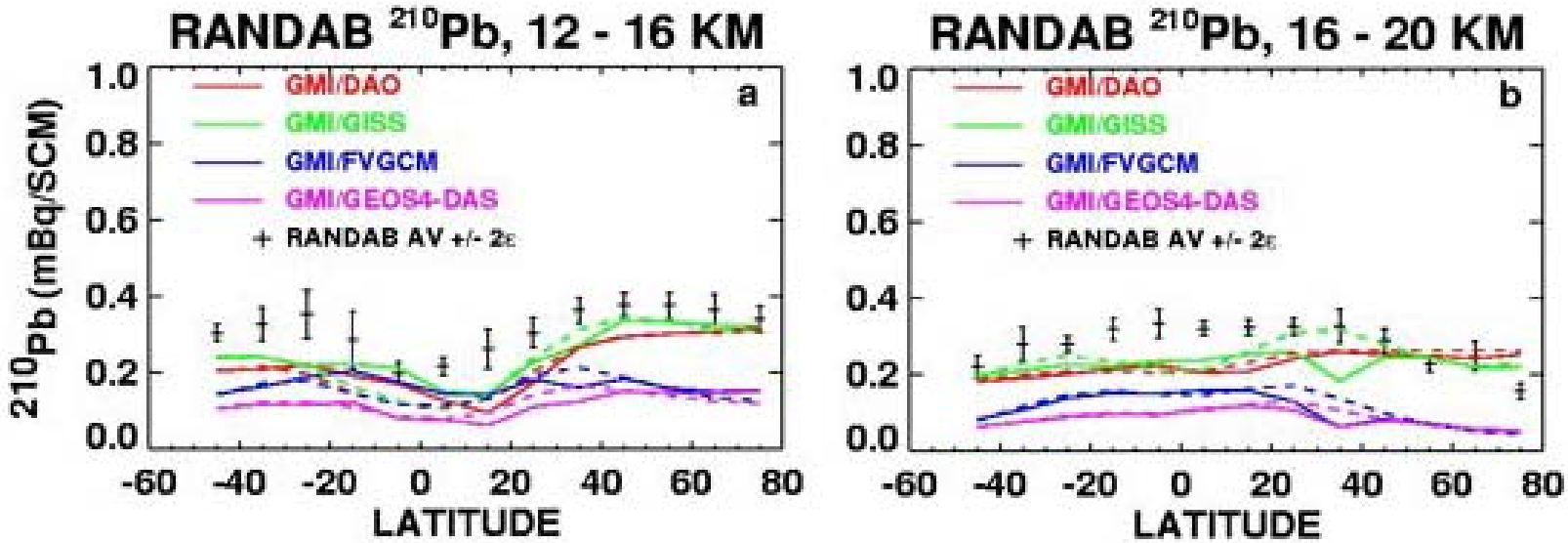
GMI Science Team Meeting
NASA Goddard Space Flight Center
May 11, 2009

Proposed Tasks

- Wet scavenging in GMI CTM/GEOS 5 CCM
- New Be-7 Source function and simulations
- UT/LS transport and tracer distributions
- Uncertainties in UT/LS RF calculations

1. Wet Scavenging in the GMI CTM/GEOS5 CCM



GMI simulations of UT/LS Pb-210 concentrations compared with Radionuclide Database (RANDAB) observations. Left panel: 12 - 16 km. Right panel: 16 - 20 km.

- Radionuclide simulations suggest insufficent scavenging in wet convective updrafts for GEOS 4.
- Convective scavenging not implemented in GEOS5 CCM
  - Colarco scheme in RAS for aerosols, but not implemented for other soluble species.
  - No scavenging diagnostic implemented.
  - Need scheme for testing.

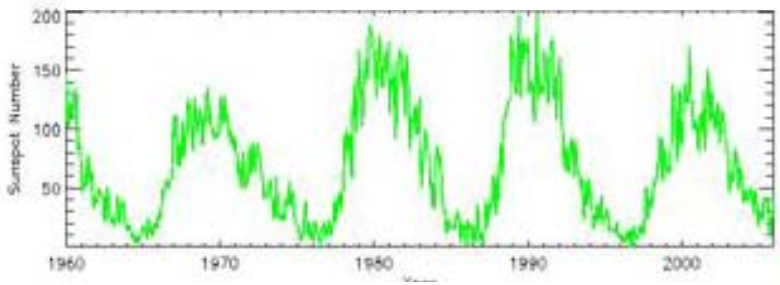
Proposed Wet Scavenging Tasks:

- Optimize wet scavenging in the GMI CTM for each met data set.
  - GEOS4, GEOS4 DAS, GEOS5, GEOS5 DAS, ECMWF?, GFDL
  - Development path uncertain

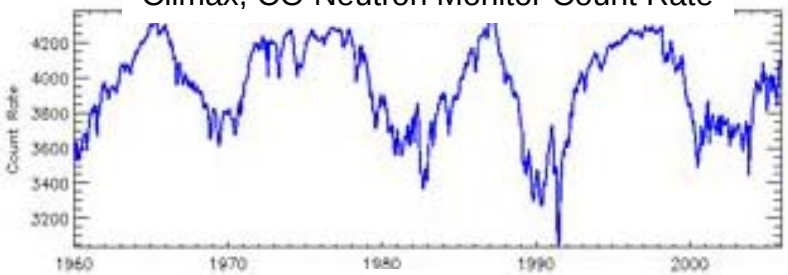
- Optimize online scavenging in the GEOS 5 CCM.
  - Add scavenging diagnostic
  - Implement radionuclide tracers (Rn-222, Pb-210, Be-7, Be-10 for testing).
  - Test multiple scavenging methodologies (e.g. explore utilizing RAS-calculated updraft velocities and autoconversion).
  - Test coupling GEOS5 prognostic cloud scheme with scavenging (large scale).
  - Compare on-line and off-line calculations.

2. Develop new time-dependent Beryllium-7 source function

Monthly Averaged Sunspot Number

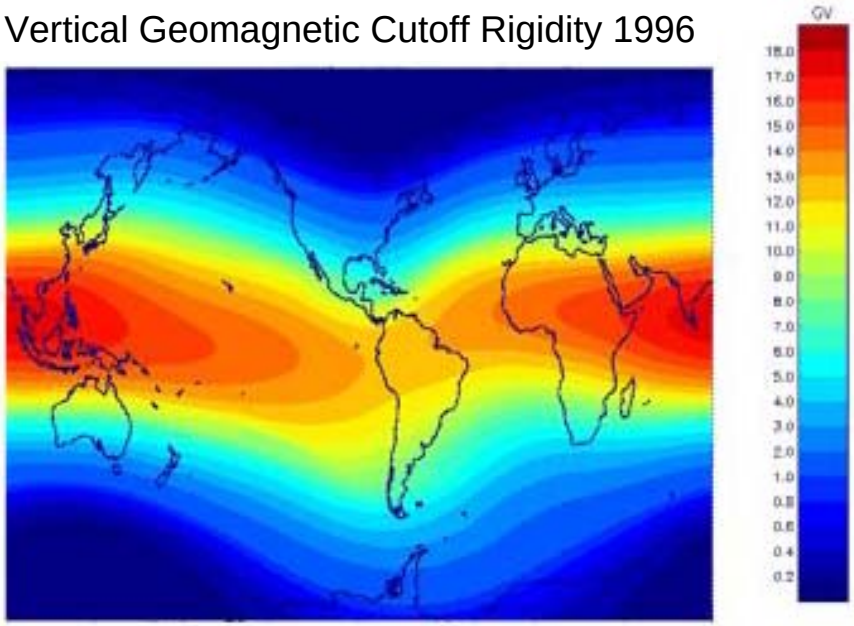


Climax, CO Neutron Monitor Count Rate



Year

Vertical Geomagnetic Cutoff Rigidity 1996



- Be-7 has temporal and longitudinal variability which is not represented in current source function.
- Variability confuses interpretation of modeled surface Be-7 with obs.
- Exploit variability to better understand propagation of stratospheric influence to surface.

Source Function Methodology

- Neutron count rates from Climax, CO define temporal variation.

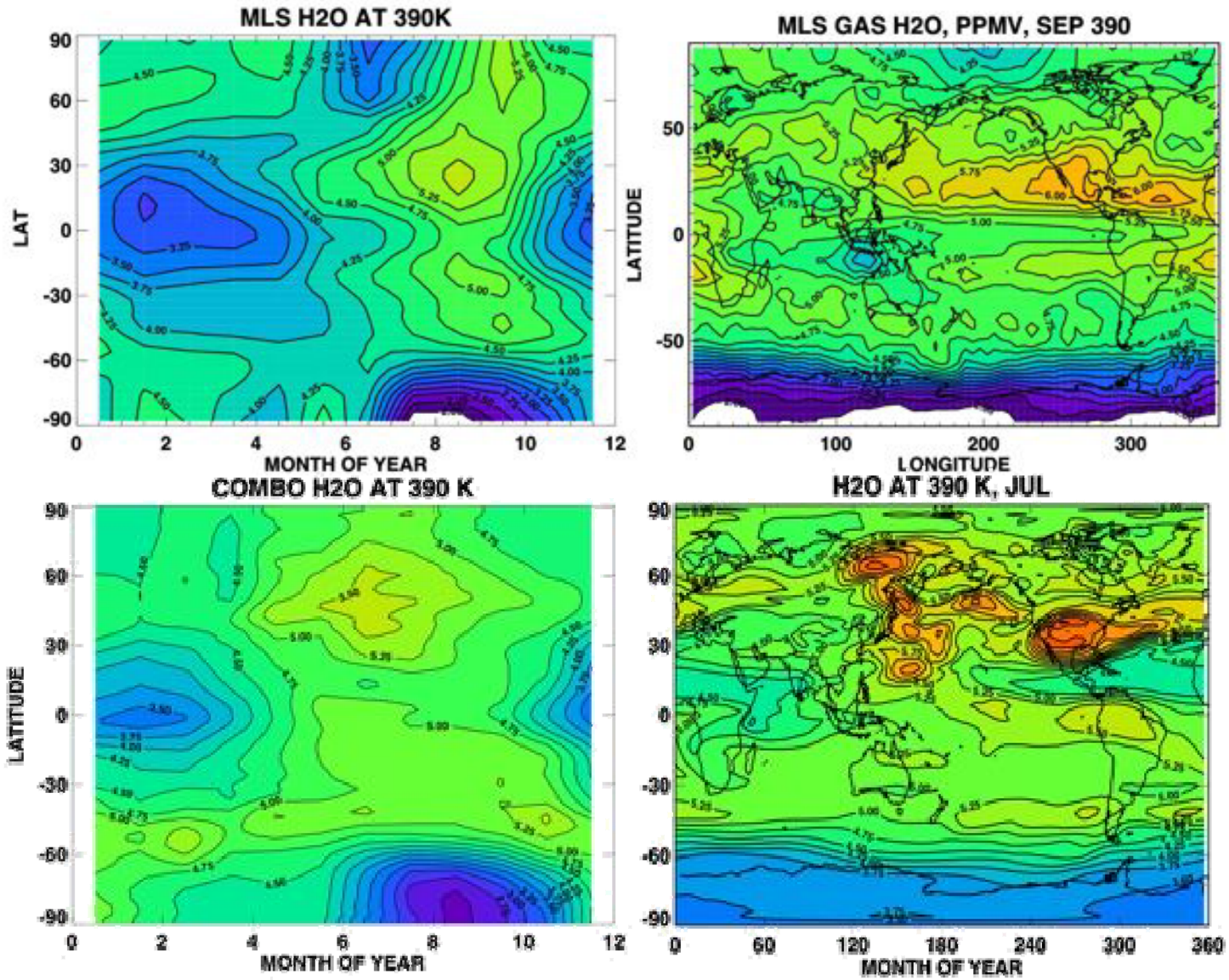
- Combine with cosmic ray spectral measurements from NASA Advanced Composition Explorer and High Energy Astrophysical Observatory data to infer full cosmic ray spectrum.

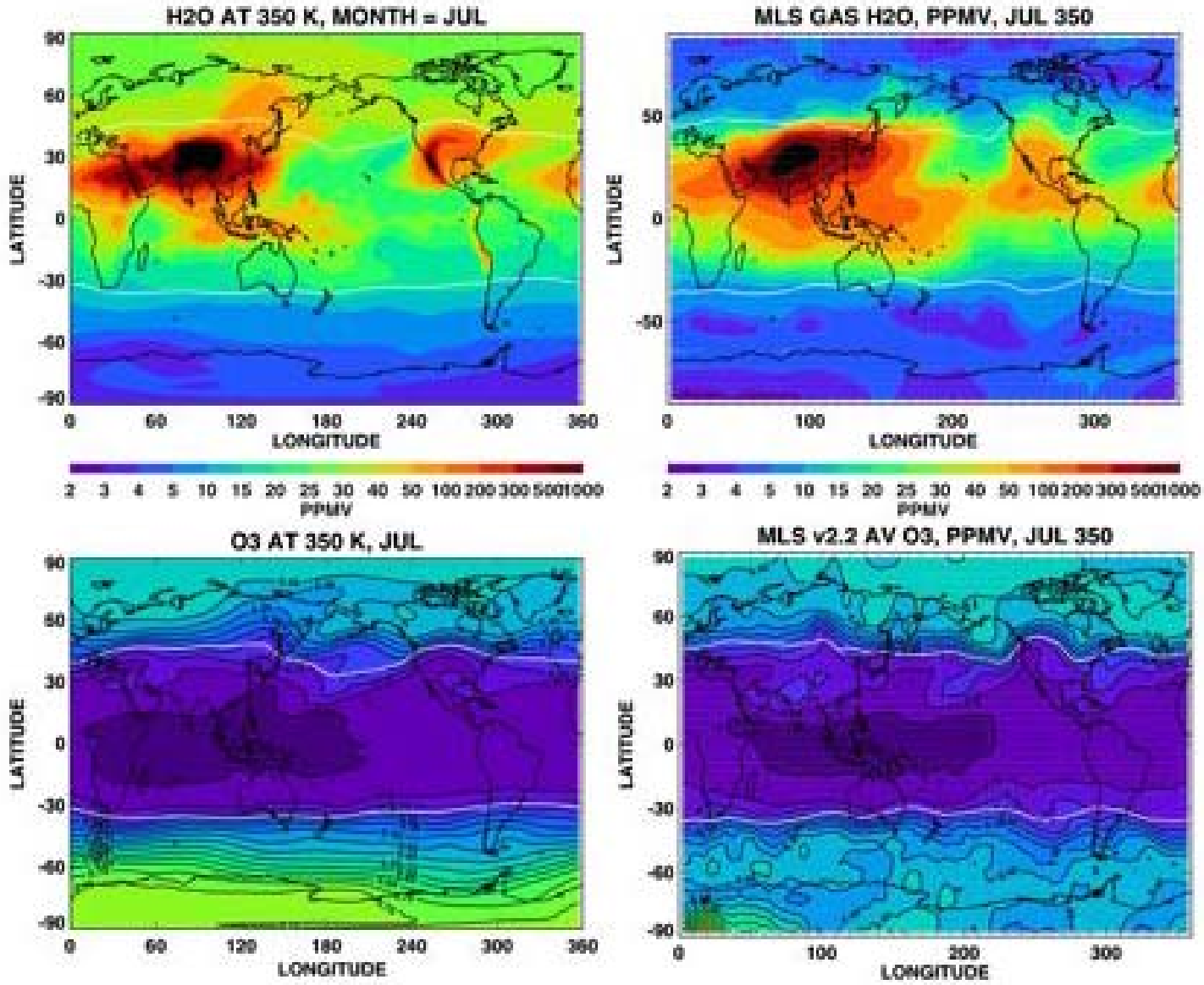
- Cutoff rigidity calculations to determine penetration depth.

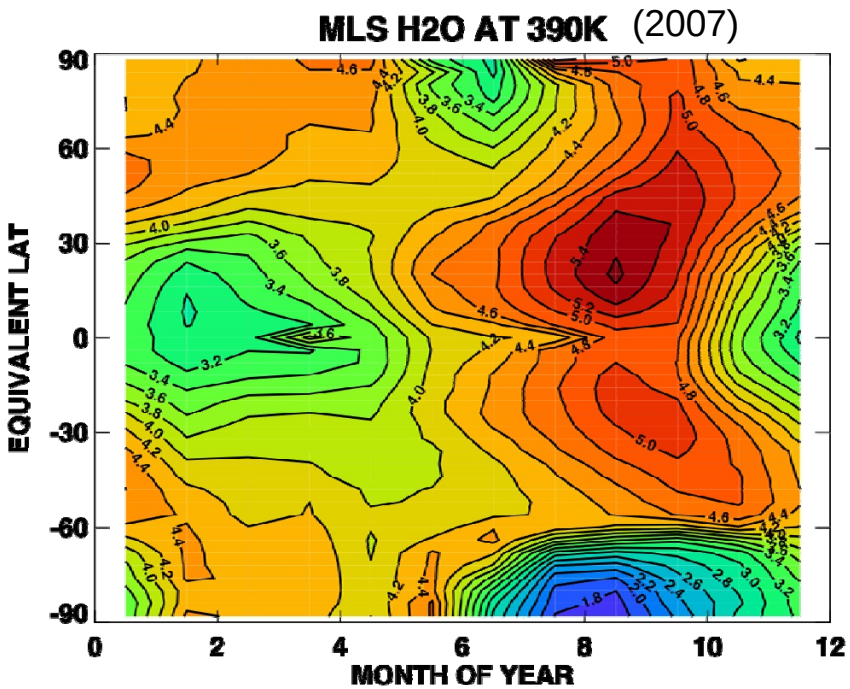
Tasks

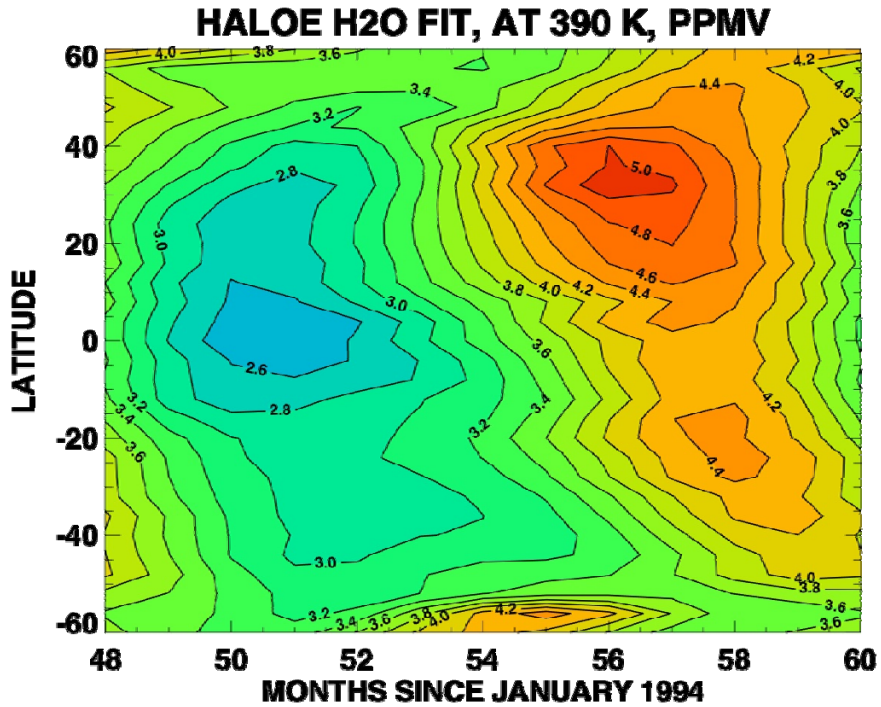
- Generate source function.
- Intercompare with others (e.g., Lal and Peters).
- Investigate impact on surface concentrations and deposition fluxes.
- Compare with historical data.
- Utilize source function in wet scavenging testing.

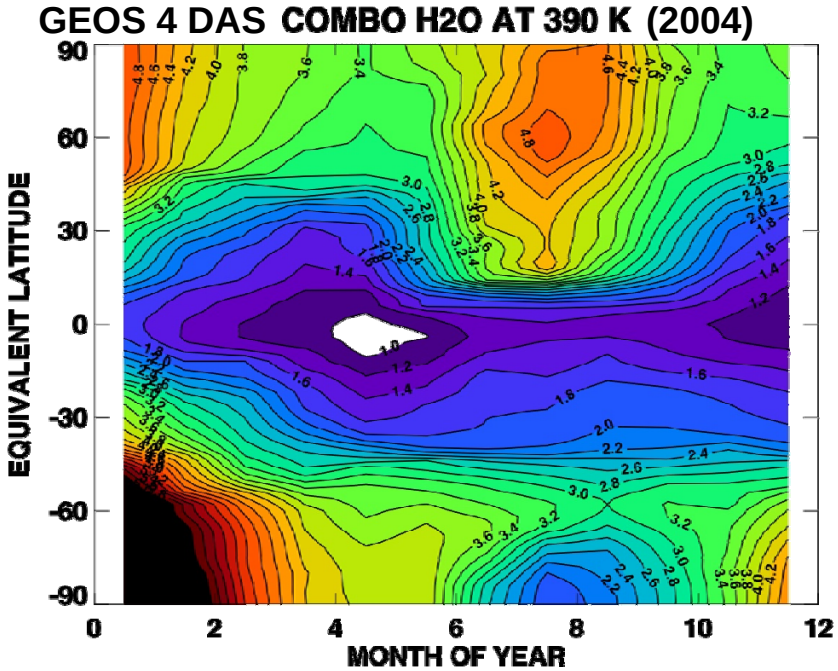
3. Transport processes controlling (UT/LS) trace species




H2O AT 350 K, MONTH = JUL
LATITUDE
LONGITUDE
PPMV
MLS GAS H2O, PPMV, JUL 350
LATITUDE
LONGITUDE
PPMV
O3 AT 350 K, JUL
LATITUDE
LONGITUDE
MLS v2.2 AV O3, PPMV, JUL 350
LATITUDE
LONGITUDE







EFFECTS OF GEOS 4 DAS MET DATA

When driven by the GEOS 4 DAS met data, annual cycle of H2O at base of overworld shows much lower than observed mixing ratios in the tropics due to the ~5 degree colder temperatures than seen in GEOS 4 AGCM. This degrades agreement with observations shown above.

Using H2O distributions to evaluate GMI meteorological data:

- Focus on 350K - 390K transition region.
- MLS/AIRS H2O comparisons with model results.
- Focus on explaining SH subtropical maximum, meridional cross-trop exchange, intercomparison of met data sets.
- Utilize Concurrent observations of CO and O3, other tracers for interpretation.

4. Meteorological uncertainty in the radiative characteristics of the UT/LS region.

- Motivated by sensitivity of O3 RF to UT distribution, plus UT high biases in O3.
- Goal is to understand error in RF calculations due to errors in UT O3 distributions.
- Also look at sensitivity of calculated RF to met data fields.