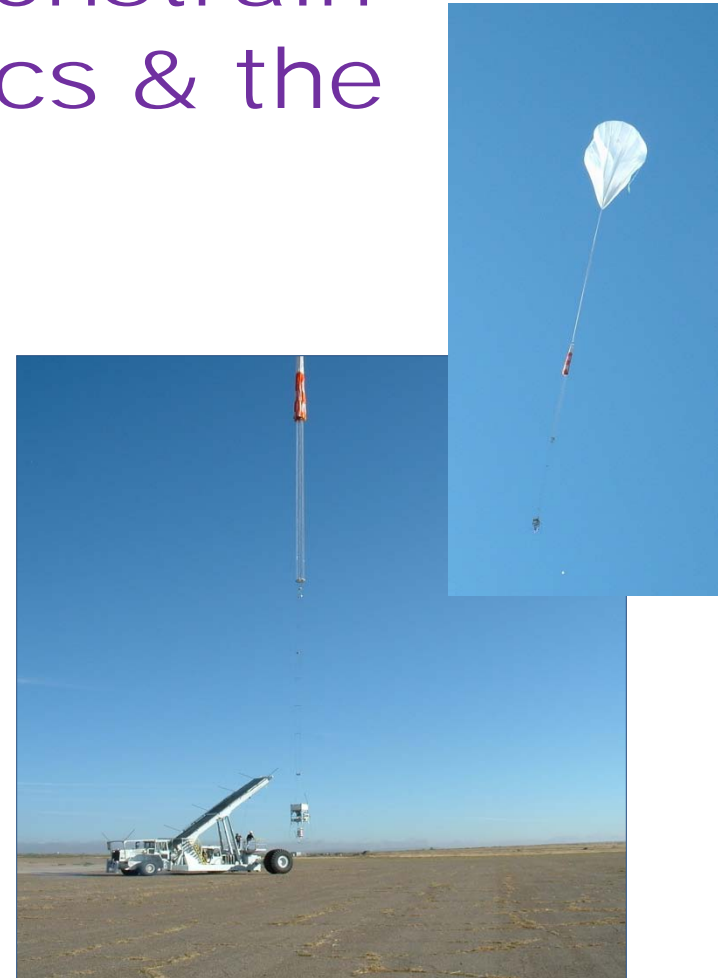


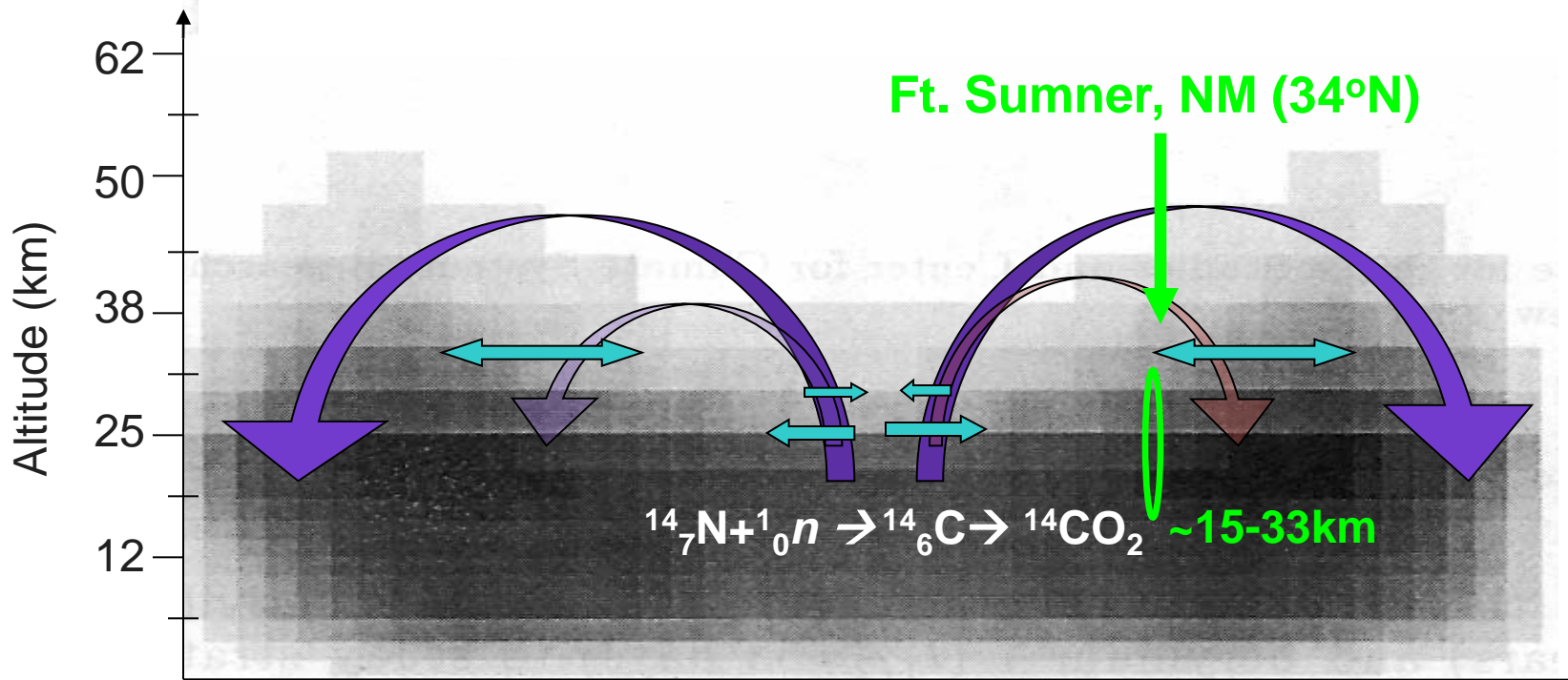
Measurements and Modeling of Contemporary Carbon-14 Levels in the Stratosphere to Constrain Stratospheric Dynamics & the Global Carbon Cycle

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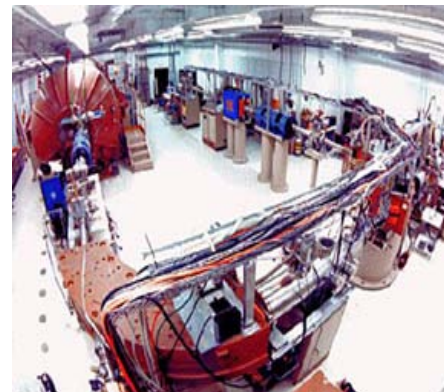
$^{14}\text{CO}_2$ as a Tracer in the Stratosphere



Background is ^7Be production from Koch & Rind 1998



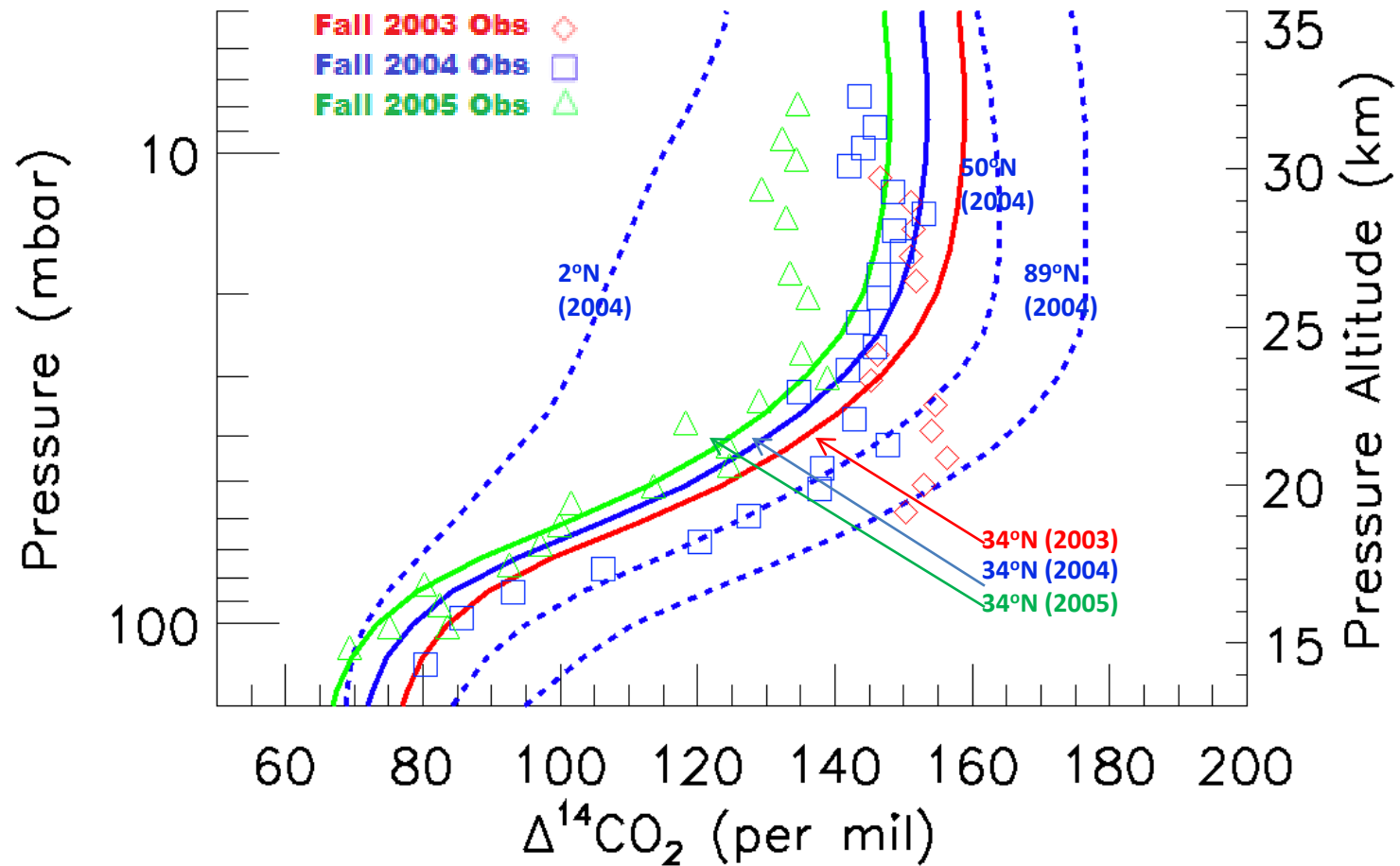
Balloon Sampling
Fall 2003, 2004, &
2005



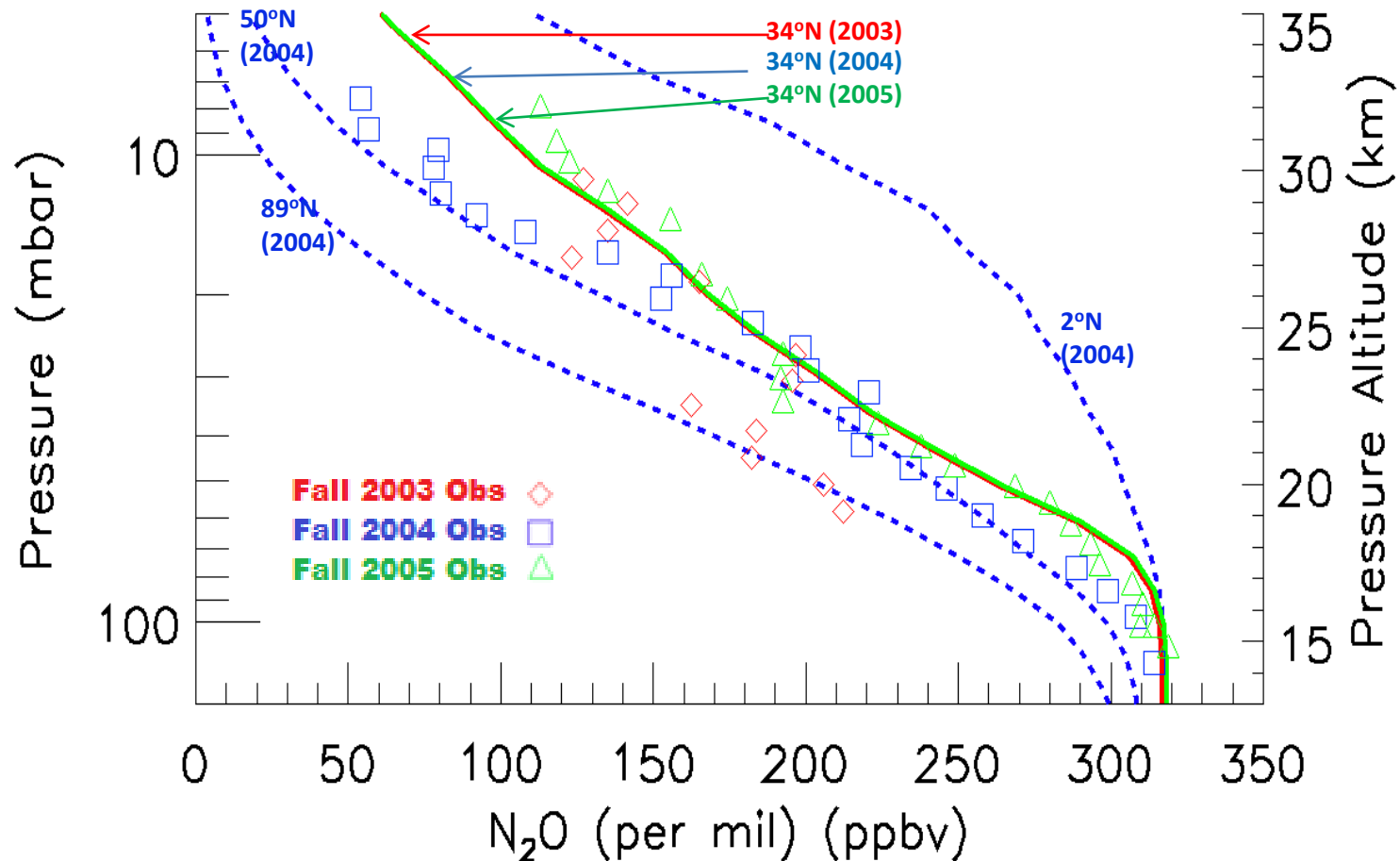
**Accelerator
Mass
Spectrometry
(LLNL CAMS)**

Model Setup

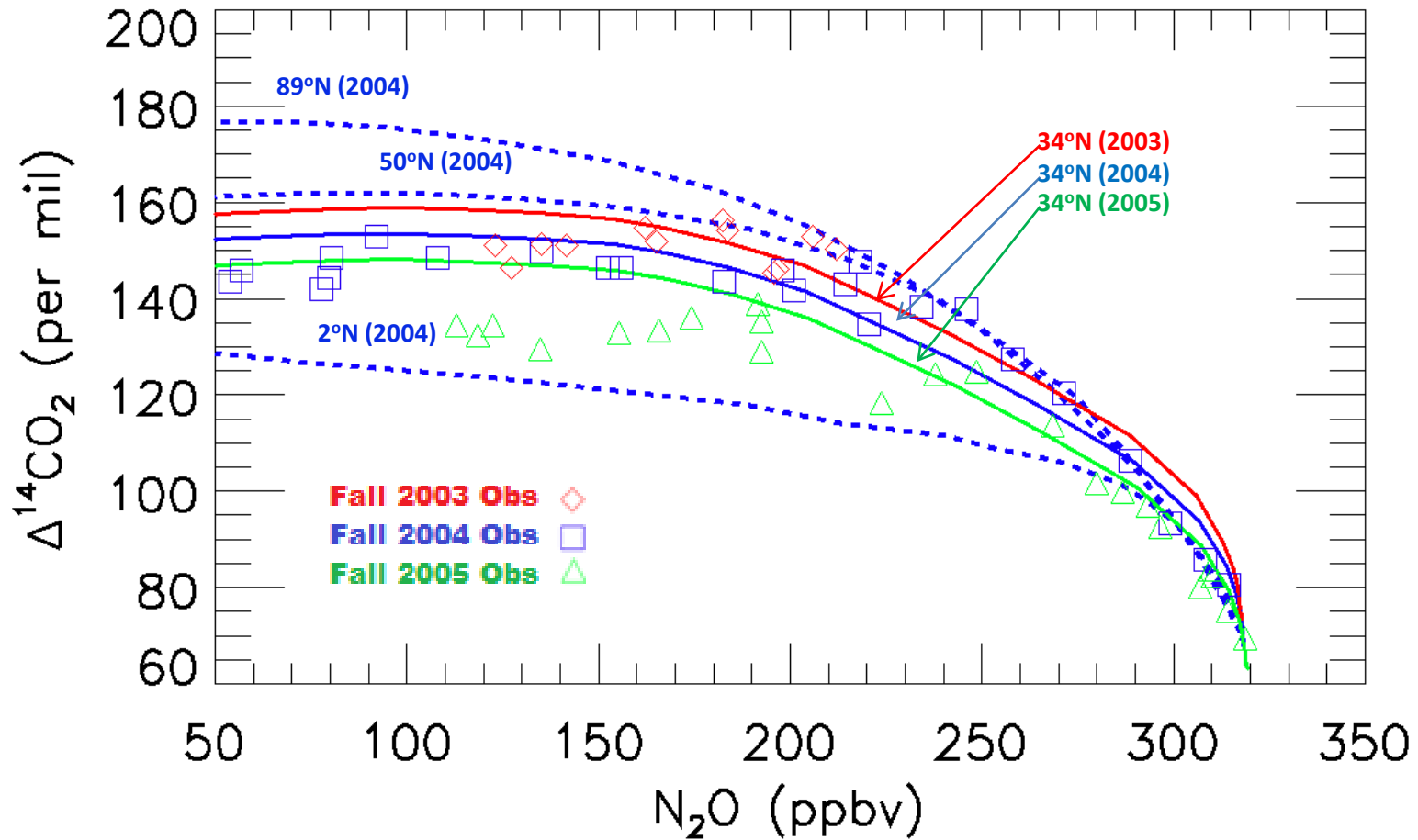
- ❖ IMPACT: LLNL chemistry transport model,
- ❖ 1960-2006 simulations,
 - (many e-fold times needed for spinup),
- ❖ 3 different GCM metadata.
- ❖ 3 tracers:
 - ^{14}C -trop (historical surface concentrations),
 - ^{14}C -strat (cosmogenic prod. in strat; zero in trop),
 - N_2O (historical surface concentrations + strat loss).



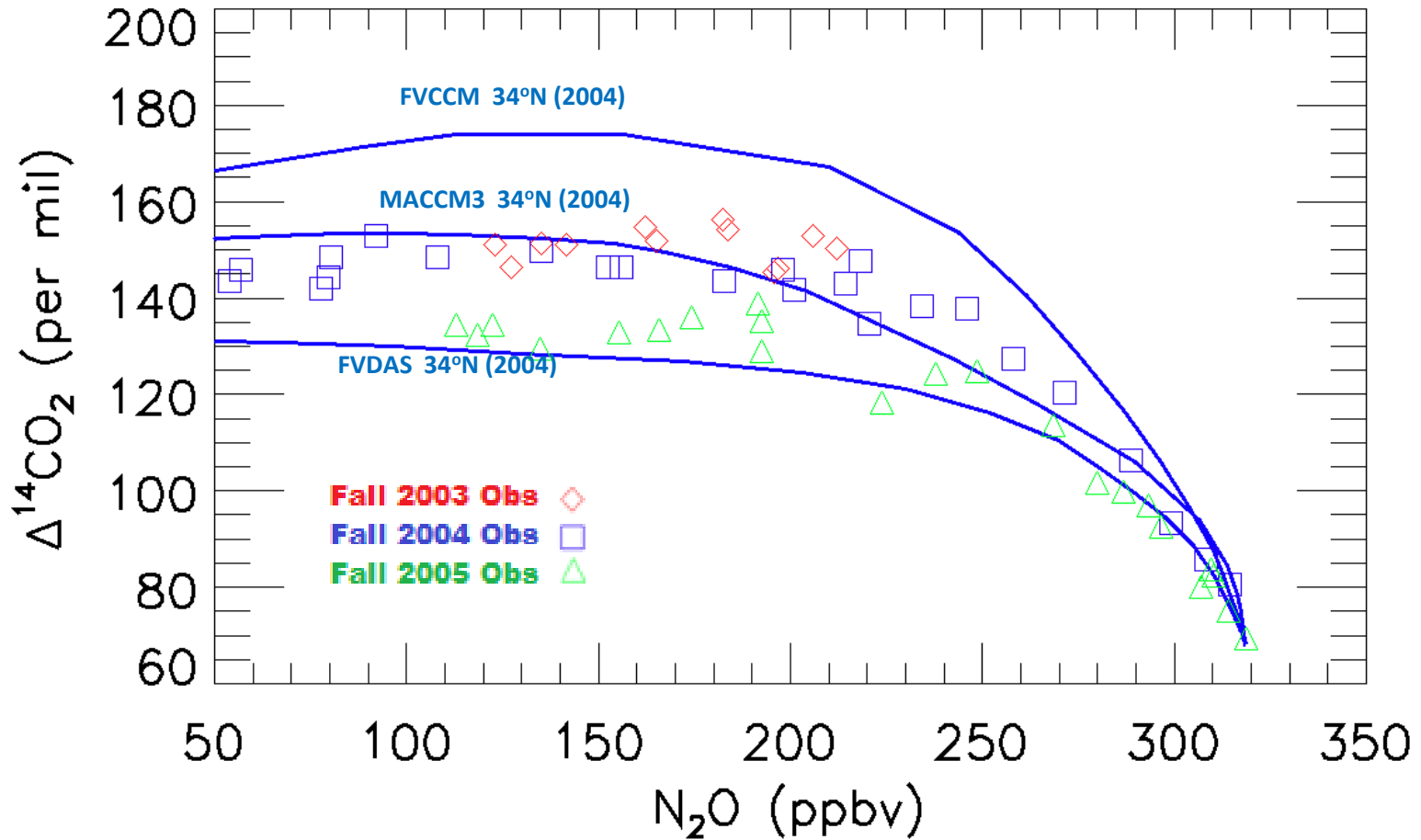
- ❖ Model vertical profiles generally match obs.
- ❖ Note Seuss effect (2003->2004->2005).
- ❖ Deviations from model could be described by transport from other latitudes.



- ❖ Model vertical profiles generally match obs.
- ❖ Note N₂O annual increase is small.
- ❖ Path of chemical loss is longer than from ¹⁴C production.



- ❖ N_2O relation to ^{14}C seems to be captured, except 2005 (signature of different transport?).



❖ N₂O relation to ¹⁴C seems to be captured by different metadata corresponding to an extreme stratospheric circulation year.

Conclusions

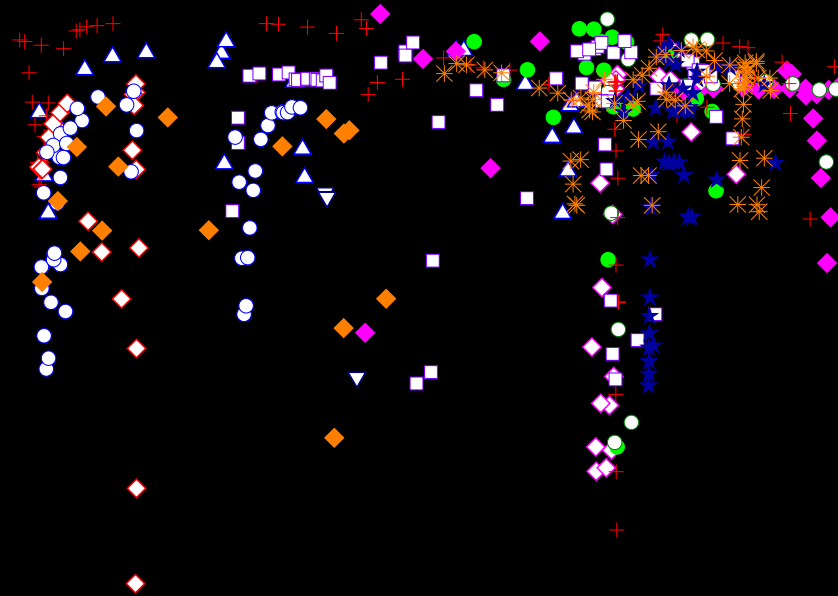
- ❖ IMPACT model seems to give reasonable simulation.
- ❖ ^{14}C observations give additional information about stratospheric dynamics.
- ❖ Results will help constrain natural ^{14}C production rate, with implications for carbon cycle studies.

Future

- ❖ Run with assimilated (observed) meteorology.
- ❖ Run with solar-cycle effect on ^{14}C production.

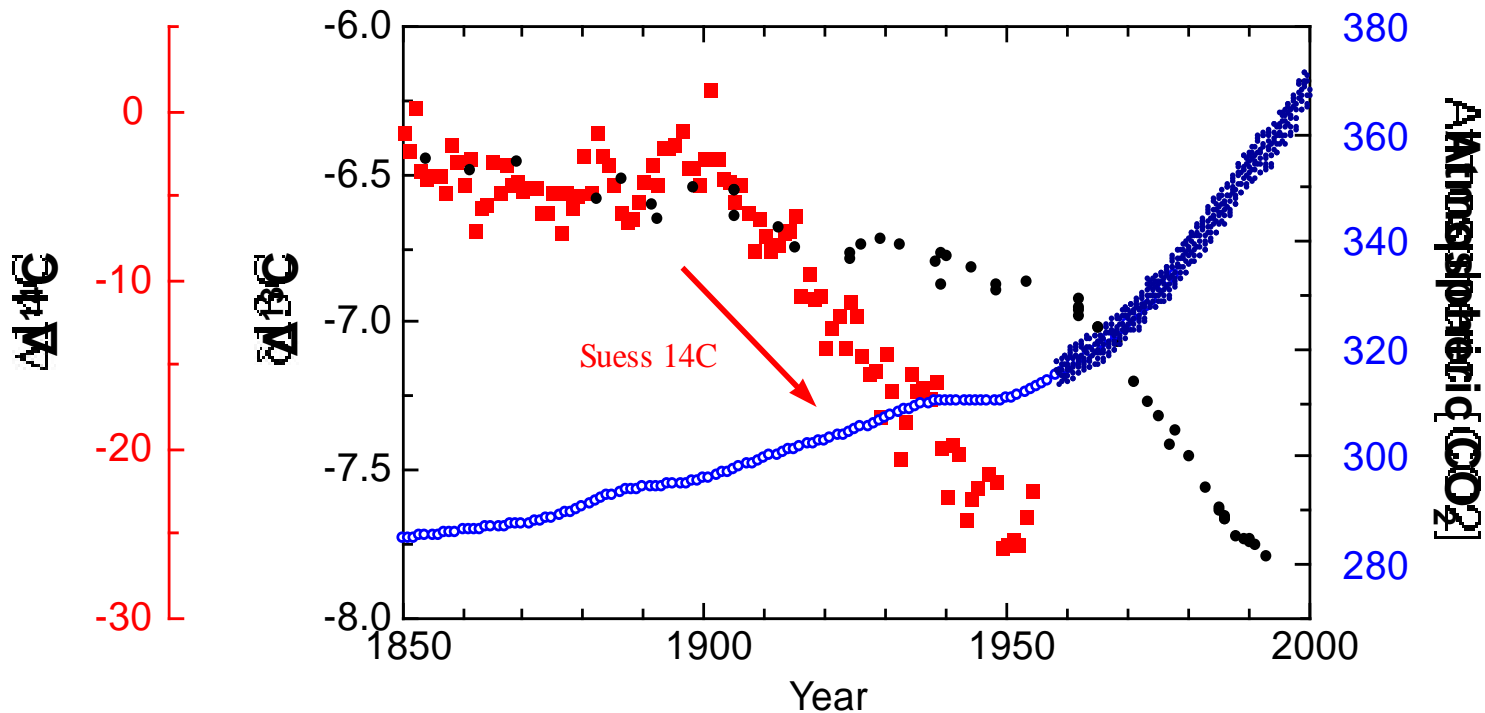
The End

Archived CO₂ Samples at UCB: Spatial (5S-88N) and Temporal (1996-2007) Distribution



- △ Dec 1996
- ◆ Apr 1997
- ◇ May 1997
- Jun 1997
- Jul 1997
- + Sep 1997
- ▽ Dec 1999
- Jan 2000
- ★ Feb 2000
- ✳ Mar 2000
- ◆ Jan 2004
- ◇ Jan 2006
- Feb 2006

$^{14}\text{CO}_2$ is a Fossil Fuel CO_2 Tracer



- Atmospheric CO_2 , $\Delta^{13}\text{C}$, and $\Delta^{14}\text{C}$ as reconstructed in tree-rings and ice cores for the pre-atmospheric weapons testing. The decrease in $\Delta^{14}\text{C}$ and $\Delta^{13}\text{C}$ is caused by the burning of fossil fuels.
- Present day atmospheric $^{14}\text{CO}_2$ has returned to near “pre-bomb” levels.

Carbon Cycle Partitioning of Bomb ^{14}C

