Toward an aircraft in situ data based chemical tracer climatology for model evaluation in the UTLS
S. Tilmes, L. L. Pan, D. E. Kinnison, A. Gettelman NCAR, USA

Abstract: The representation of chemical transport processes that couple the upper troposphere (UT) and lower stratosphere (LS) in CCMs is a key component for the models to simulate future climate scenarios. To constrain and evaluate CTMs and CCMs, we establish a climatology based on aircraft data from a set of northern hemisphere campaigns. Data are grouped into regimes that are based on the underlying transport characteristics. Diagnostics using CO, H$_2$O and Ozone for three regimes are presented.

How do we use sparse aircraft observations to establish a climatology in the UTLS?
- Exchange processes and mixing between UT and LS differ with location and season [e.g., Holton 1995].
- Characteristics of different tracers depend on background transport processes.
⇒ Sparse observations need to be grouped in a physically meaningful way to describe the characteristics of tracers in different regimes.

The jet streams are important boundaries for transport regimes in the UTLS:

Altitude and Latitude location of various aircraft campaigns in the Northern Hemisphere between 1995 and 2008:
- STRAT/POLARIS, ACCENT, SOLVE, CRYSTAL_FACE, ARCTAS, START08

Relative altitude with regard to the Tropopause (TP) to describe the chemical discontinuity across the TP

Different Regimes (Fall):
- Aircraft observations are grouped with regard to the location of the STJ and the PJ using NCEP meteorological data.
- Significant differences between different regimes and seasons for Ozone (top), CO (middle) and H$_2$O (bottom).
- Comparison with model results can identify shortcomings of the models.

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