Geophysical Research Abstracts
Vol. 18, EGU2016-4863, 2016
EGU General Assembly 2016

Uncertainty and dispersion in air parcel trajectories near the tropical tropopause

John Bergman (1), Eric Jensen (2), Leonhard Pfister (2), and Thoapaul Bui (2)
(1) Bay Area Environmental Research Inst., Petalume CA USA, (2) NASA Ames Research Center, Moffett Field CA USA

The Tropical Tropopause Layer (TTL) is important as the gateway to the stratosphere for chemical constituents produced at the Earth's surface. As such, understanding the processes that transport air through the upper tropical troposphere is important for a number of current scientific issues such as the impact of stratospheric water vapor on the global radiative budget and the depletion of ozone by both anthropogenically- and naturally-produced halocarbons. Compared to the lower troposphere, transport in the TTL is relatively unaffected by turbulent motion. Consequently, Lagrangian particle models are thought to provide reasonable estimates of parcel pathways through the TTL. However, there are complications that make trajectory analyses difficult to interpret; uncertainty in the wind data used to drive these calculations and trajectory dispersion being among the most important.

These issues are examined using ensembles of backward air parcel trajectories that are initially tightly grouped near the tropical tropopause using three approaches: A Monte Carlo ensemble, in which different members use identical resolved wind fluctuations but different realizations of stochastic, multi-fractal simulations of unresolved winds, perturbed initial location ensembles, in which members use identical resolved wind fields but initial locations are displaced 2° in latitude and longitude, and a multi-model ensemble that uses identical initial conditions but different resolved wind fields and/or trajectory formulations. Comparisons among the approaches distinguish, to some degree, physical dispersion from that due to data uncertainty and the impact of unresolved wind fluctuations from that of resolved variability.