Towards a model climatology of relative humidity in the upper troposphere for estimation of contrail and contrail-induced cirrus

Henry B. Selkirk[1], M. Manyin[2], L. Ott[1,3], L. Oman[3], C. Benson[1], S. Pawson[3], A.R. Douglass[3] and R. S. Stolarski[4]

The formation of contrails and contrail cirrus is very sensitive to the relative humidity of the upper troposphere. To reduce uncertainty in an estimate of the radiative impact of aviation-induced cirrus, a model must therefore be able to reproduce the observed background moisture fields with reasonable and quantifiable fidelity. Here we present an upper tropospheric moisture climatology from a 26-year ensemble of simulations using the GEOS CCM. We compare this free-running model's moisture fields to those obtained from the MLS and AIRS satellite instruments, our most comprehensive observational databases for upper tropopsheric water vapor. Published comparisons have shown a substantial wet bias in GEOS-5 assimilated fields with respect to MLS water vapor and ice water content. This tendency is clear as well in the GEOS CCM simulations. The GEOS-5 moist physics in the GEOS CCM uses a saturation adjustment that prevents supersaturation, which is unrealistic when compared to *in situ* moisture observations from MOZAIC aircraft and balloon sondes as we will show. Further, the large-scale satellite datasets also consistently underestimate super-saturation when compared to the in-situ observations. We place these results in the context of estimates of contrail and contrail cirrus frequency.

[1]Goddard Earth Sciences and Technology Center, University of Maryland, Baltimore County, Baltimore, MD
[2]System Sciences and Applications, Inc., Columbia, MD
[3]NASA Goddard Space Flight Center, Greenbelt, MD
[4]Johns Hopkins University, Baltimore, MD

Abstract submitted to the 16th Middle Atmosphere Conference of the American Meteorological Society, Seattle, WA, January 23-27, 2011