Variability of Ice Supersaturation, Nucleation, and Cirrus in TTL Vertical Layers

Joshua P. DiGangi[1], Glenn S. Diskin[1], James Podolske[2], Mario Rana[1,3], Thomas Slate[1,3], T. Paul Bui[2], Paul Lawson[4], Troy Thornberry[5,6], Andrew Rollins[5,6], David Fahey[5], and Eric Jensen[2]

[1]*NASA Langley Research Center, Hampton, VA, USA*
[2]*NASA Ames Research Center, Mountain View, CA, USA*
[3]*Science Systems and Applications Inc., Hampton, VA, USA*
[4]*SPEC Inc., Boulder, CO, USA*
[5]*NOAA Earth Systems Research Laboratory, Boulder, CO, USA*
[6]*Cooperative Institute for Research in Environmental Sciences, Boulder, CO, USA*

High altitude cirrus clouds strongly influence Earth's radiative balance, and thus climate. This effect is not due as much to the direct extinction of the clouds, but their ability to enhance water vapor concentrations in the stratosphere. Cirrus cloud formation is dependent on characteristics and composition of ice supersaturation (ISS) regions, or regions where the relative humidity with respect to ice exceeds 100%, as well as the availability and characteristics of cloud condensation nuclei. The Airborne Tropical TRopopause EXperiment (ATTREX) was a series of campaigns focused on improving our understanding of humidity in the TTL. Jensen et al. (2013) reported two classes of cirrus observed during 2011 ATTREX deployment. One class consisted of large ISS, low ice concentrations, and large vertical extents; the other class consisted of much smaller ISS and higher ice concentrations, and was present in very thin vertical layers. We will present analysis of these classes of cirrus using data from the more recent 2013 and 2014 ATTREX deployments, including further evidence of the existence of these thin, low ISS, and high ice concentration layers, as well as evidence of their horizontal extent. We will also discuss the relative frequencies of the two classes in the TTL.

References

Jensen, E.J, Diskin, G., Lawson, R.P., Lance, S., Bui, T.P., Hlavka, D., McGill, M., Pfister, L., Toon, O.B., Gao, R.S., *Proceedings of the National Academy of Sciences of the United States of America.* **2013**, 110, 2041-2046.