Overview of the Airborne Tropical TRopopause EXperiment (ATTREX)

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Abstract Text:

The NASA Airborne Tropical TRopopause EXperiment (ATTREX) is a series of airborne campaigns focused on understanding physical processes in the Tropical Tropopause Layer (TTL) and their role in atmospheric chemistry and climate. ATTREX is using the high-altitude, long-duration NASA Global Hawk Unmanned Air System to make in situ and remote-sensing measurements spanning the Pacific. A particular ATTREX emphasis is to better understand the dehydration of air as it passes through the cold tropical tropopause region. The ATTREX payload contains 12 in situ and remote sensing instruments that measure water vapor, clouds, multiple gaseous tracers (CO, CO2, CH4, NMHC, SF6, CFCs, N2O), reactive chemical compounds (O3, BrO, NO2), meteorological parameters, and radiative fluxes.

ATTREX flight series have been conducted in the fall of 2011 from Armstrong Flight Research Center (AFRC) in California, in the winter of 2013 from AFRC, and in the winter/spring of 2014 from Guam. The first two flight series provided extensive sampling of the central and eastern Pacific, whereas the last flight series permitted sampling in the western Pacific. The sampling strategy has primarily involved repeated ascents and descents through the depth of the TTL (about 13-19 km). Over 100 TTL profiles were obtained on each flight series. The ATTREX dataset includes TTL water vapor measurements with unprecedented accuracy, ice crystal size distributions and habits. The cloud and water measurements provide unique information about TTL cloud formation, the persistence of supersaturation with respect to ice, and dehydration. The plethora of tracers measured on the Global Hawk flights are providing unique information about TTL transport pathways and time scales. The meteorological measurements are revealing dynamical phenomena controlling the TTL thermal structure, and the radiation measurements are providing information about heating rates associated with TTL clouds and water vapor.

This presentation will provide an overview of the ATTREX flights, examples of measurements from the flights, and plans for modeling/analysis of the ATTREX dataset.