

## **TTL cooling and drying during the January 2013 Stratospheric Sudden Warming.**

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Extremely low water vapor concentrations (as low as 1.5 ppmv) in the tropical tropopause layer (TTL) were observed by in-situ measurements during the Airborne Tropical TRopopause Experiment (ATTREX) winter 2013 deployment in February 2013. The January 2013 tropical (15°N-15°S) mean value of Microwave Limb Sounder (MLS) water vapor satellite data at 82 hPa (2.3 ppmv) was one of the lowest during the instrument record (2004-2013). The relationship between a cooling of the tropical tropopause, a Sudden Stratospheric Warming (SSW) event and convective activity in Western Pacific is investigated using satellite data and reanalysis meteorological products to elucidate the likely origin of those extremely low water vapor concentrations.

A major mid winter SSW developed on January 6, 2013. Stratospheric polar temperatures increased by ~30 K in a matter of days and temperatures in the tropical upper troposphere and lower stratosphere (UTLS) dropped at the same time. As a result of the easterly shear phase of the quasi-biennial oscillation and the SSW, the tropical tropopause in January 2013 was anomalously cold (zonal mean of 187 K) and elevated (85 hPa). The tropical cold point tropopause (CPT) temperature and water vapor concentration at 82 hPa decreased by about 2 K and 1.5 ppmv respectively within the first 15 days of January; the water vapor change was likely a result of dehydration associated with the rapid cooling of the tropical CPT during that period.

### **Reference**

Evan, S., Rosenlof, K. H., Thornberry, T., Rollins, A., Khaykin, S., *Q. J. Roy. Meteorol.* 2015, *accepted.*