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Isentropic transport and mixing in the sub-tropical UTLS over Brazil: Analysis of airborne tracer measurements during Troccinox II

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Transport processes between the extra-tropical stratosphere and the tropical UTLS region critically control the chemical composition of the TTL and the tropical lower stratosphere and thus the composition of air masses transported further upward into the stratosphere. We present evidence of frequent quasi-horizontal transport and mixing in the sub-tropical UTLS, both across and above the tropopause, from in-situ measurements of long-lived trace gases over southern Brazil. The observations were obtained with the M55 Geophysica aircraft operating from Araçatuba (21˚ S, 50˚ W) during the "Tropical Convection, Cirrus and Nitrogen Oxides Experiment II" (Troccinox II) aircraft campaign in January / February 2005. Among other species the High Altitude Gas AnalyzeR (HAGAR) measured N_2O, CH_4, CFC-12, CFC-11, H-1211 and SF_6. Ozone was obtained by the Fast Ozone ANalyzer (FOZAN), CO by the Cryogenically Operated Laser Diode (COLD), and NO_y by the chemiluminescence instrument SIOUX.

Below the tropical tropopause we find layers exhibiting significant anti-correlations between long-lived tracers and ozone, indicating air of stratospheric origin within the TTL. Above the tropopause, tracer mixing ratios ranging from typical tropical to typical mid-latitude values, often over short flight distances, indicate active isentropic mixing. Events of isentropic mixing are also apparent as mixing lines in the tracer-

tracer correlations. Numerical simulations with the Chemical Lagrangian Model of the Stratosphere (CLaMS) reproduce such events fairly well. CLaMS simulations with artificial origin-of-air tracers are used to quantify the fraction of air mixed into the observation region from different source regions. Furthermore, results from a long-term run of the CLaMS model are presented in order to place our observations into a climatological context.