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Influence of convection on the TTL over Brazil: Analysis of airborne in situ trace gas measurements

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In this study we present in situ aircraft measurements from Aracatuba, Brazil (21˚S, 50˚W) during the Tropical Convection, Cirrus and Nitrogen OXides Experiment (TROCCINOX) in February/March 2005. The University of Frankfurt's High Altitude Gas Analyzer (HAGAR) instrument on board of the high-flying aircraft M55 Geophysica measured, among other tracers, carbon dioxide from the boundary layer up to 20 km. The COLD (Criogenically Operated Laser Diode) and Fast Ozone ANalyzer (FOZAN) instruments sampled carbon monoxide and ozone, respectively, on the same platform. Furthermore we examine carbon monoxide and ozone data of the DLR-Falcon (ceiling 12.5 km) and carbon dioxide as well as carbon monoxide of the INPE-Bandeirante aircraft sampling the planetary boundary layer.

We focus on the tropical tropopause layer (TTL) extending from $\sim$13 km to $\sim$18 km where a variety of meteorological conditions was sampled. Air recently influenced by deep convection from local thunderstorms was observed as well as aged tropical tropopause layer air. We evaluate the influence of convection on the TTL by examining profiles and correlations of CO_2, CO, and O_3. CO is mostly found to be elevated in the TTL, in some cases up to the tropopause. Apart from local convection long-range transport of remotely convected air contributes to the CO enhancement. CO_2 profiles

show a clear decrease in the TTL after fresh convection of CO_2-depleted local boundary layer air. Mixing of overshooting air within the TTL is analysed using correlations of CO and CO_2 with O_3. We also use Lagrangian simulations (FLEXPART; CLaMS) to track layers of uplifted air back to their source region for selected case studies.