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Composition of the TTL over Darwin: local mixing or long-range transport?

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Abstract. We present ozone and carbon monoxide measurements taken in Darwin, Australia, during the wet season of 2005/2006, to examine whether the composition of the Tropical Tropopause Layer (TTL) reflects that of the local boundary layer or is influenced more by advection from distant sources. We find that the latter predominates in the upper TTL, and is also the major influence in the lower TTL, except during an active monsoon phase. The day-to-day variability of ozone in the TTL is far greater than that in the lower troposphere, and correlates closely with air mass origin deduced from trajectory calculations based on standard ECMWF wind analyses. Although clear evidence of recent local uplift was found in carbon monoxide tracer measurements recorded inside convective anvils, no such signal was found out-of-cloud in the background TTL, where the measured variability correlated well with air mass origin deduced from back-trajectories. This study suggests that the composition of the TTL is ultimately determined by vertical mixing in certain "hot spot" regions of the tropics, with advection from these regions dominating the composition elsewhere.

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