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# Aerosol nucleation and growth in the TTL, due to tropical convection, during the ACTIVE campaign

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The Aerosol and Chemical Transport In tropical convection (ACTIVE) campaign took place between October 2005 and February 2006. This investigation involved the sampling of deep convective storms that occur in the Tropics; the campaign was based in Darwin, Northern Territory, Australia – the latter half of the campaign coincided with the monsoon season. A range of scientific equipment was used to sample the inflow and outflow air from these storms; of particular importance were the NERC Dornier (low-level) and ARA Egrett (high-level outflow) aircraft. The Dornier held a range of aerosol, particle and chemical detectors for the purpose of analysing the planetary boundary layer (PBL), in the vicinity of tropical convection. The Egrett contained detection instrumentation for a range of sizes of aerosol and cloud particles (2 Condensation Particle Counters (CPC), CAPS, CIP, CPI) in the storm outflow. This allowed a quantifiable measurement to be made of the effect of deep tropical convection on the aerosol population in the Tropical Tropopause Layer (TTL).

The ACTIVE campaign found that there were large numbers of aerosol particles in the 10 – 100 nm (up to 25,000 /cm$^3$ STP) and 100 – 1000 nm (up to 600 /cm$^3$) size ranges. These values, in many instances, surpassed those found in the PBL. The higher levels of aerosol found in the TTL compared to the PBL could indicate that aerosol nucleation was occurring in the TTL as a direct result of convective activity. Furthermore, the Egrett aircraft found distinct boundaries between the high levels of aerosol, which were found in cloud free regions, and very low numbers of aerosol, which were found in the cloudy regions (storm anvil). The air masses were determined, from back trajectories, to have been through convective uplift and were formerly part of the anvil cloud. The cloudy regions would have contained high levels of entrapped precursor gases. Reduced nucleation and cloud particle scavenging of aerosol and gases would give a much reduced aerosol number concentration in cloud. The high aerosol (cloud free) areas would appear after the cloud began to evaporate through the process of aerosol nucleation. The evaporating cloud particles and reduced cloud surface area would allow aerosol nucleation to occur – typically involving sulphuric acid and water, released from ice crystals. The time scales for the particle production have also been investigated using satellite and wind projections/ECMWF back trajectories.