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## Lightning-produced NO<sub>x</sub> during the Northern Australian monsoon; results from the ACTIVE campaign

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**Abstract.** Measurements of nitrogen oxides onboard a high altitude aircraft were carried out for the first time during the Northern Australian monsoon in the framework of the Aerosol and Chemical Transport in Tropical Convection (ACTIVE) campaign, in the area around Darwin, Australia. During one flight on 22 January 2006, average NO<sub>x</sub> volume mixing ratios (vmr) of 984 and 723 parts per trillion (ppt) were recorded for both in and out of cloud conditions, respectively. The in-cloud measurements were made in the convective outflow region of a storm 56 km south-west of Darwin, whereas those out of cloud were made due south of Darwin and upwind from the storm sampled. This storm produced a total of only 8 lightning strokes, as detected by an in-situ lightning detection network, ruling out significant lightning-NO<sub>x</sub> production. 5-day backward trajectories suggest that the sampled airmasses had travelled over convectively-active land in Northern Australia during that period. The low stroke count of the sampled storm, along with the high out-of-cloud NO<sub>x</sub> concentration, suggest that, in the absence of other major NO<sub>x</sub> sources during the monsoon season, a combination of processes including regional transport patterns, convective vertical transport and entrainment may lead to accumulation of lightning-produced NO<sub>x</sub>, a situation that contrasts with the pre-monsoon period in Northern Australia, where the high NO<sub>x</sub> values occur mainly in or in the vicinity of storms. These high NO<sub>x</sub> concentrations may help start ozone photochemistry and OH radical production in an otherwise NO<sub>x</sub>-limited environment.

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