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High resolution vertical distributions of NO_3 and N_2O_5 through the nocturnal boundary layer

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Abstract. The shallow mixing depth and vertical stratification of the lowest levels of the atmosphere at night has implications for the chemistry of nitrogen oxides emitted from the surface. Here we report vertical profiles of NO_3, N_2O_5 and O_3 measured from in-situ instruments on a movable carriage on a 300 m tower. The study offers high-resolution (<1 m) vertical distributions of both NO_3 and N_2O_5 and shows that the nocturnal mixing ratios of these compounds vary widely over short vertical distance scales (10 m or less). Furthermore, there are systematic differences in the steady state lifetimes of NO_3 and N_2O_5 and in the partitioning among nitrogen oxides between different near-surface layers. These differences imply that NO_3 and N_2O_5 occupy distinct chemical regimes as a function of altitude, potentially serving as sinks for nitrogen oxides and O_3 near the surface but as reservoirs of NO_x and O_3 aloft.

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