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High resolution vertical distributions of NO₃ and N₂O₅ through the nocturnal boundary layer

S. S. Brown¹, W. P. Dubé^{1,2}, H. D. Osthoff^{1,2}, D. E. Wolfe¹,
W. M. Angevine^{1,2}, and A. R. Ravishankara^{1,3}

¹NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305, USA

²Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80305, USA

³Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO 80309, USA

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 NO₃, N₂O₅ and O₃ 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 NO₃ and N₂O₅ 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 NO₃ and N₂O₅ and in the partitioning among nitrogen oxides between different near-surface layers. These differences imply that NO₃ and N₂O₅ occupy distinct chemical regimes as a function of altitude, potentially serving as sinks for nitrogen oxides and O₃ near the surface but as reservoirs of NO_x and O₃ aloft.

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