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Significance of Nitric Acid Photolysis on Surfaces in Tropospheric Chemistry: Modeling Results

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As one of the six principle pollutants regulated by US EPA, nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$) and its secondary products (HONO, HNO_3 , PAN...) play a critical role in atmospheric chemistry because of their contribution to ozone pollution, photochemical smog, acid deposition and overall air quality degradation. The major removal pathway of NO_x from the troposphere is the formation of nitric acid. Nitric acid is regard as the end product of NO_x because its slow photolysis in the gas phase compared to its formation. However, our photochemical experiments results show that the photolysis of nitric acid on various surfaces is 1-2 magnitude faster than those in gas phase, releasing HONO and NO_x into the overlying atmosphere. To evaluate the significance of this photolysis processes in the rural and remote low NO_x area, we develop a photochemical model including this process. The results from model calculations are compared with and without the surface process. The preliminary results from our model indicate that this surface photolysis process sustains higher NO_x , OH, O_3 concentrations, higher daytime HONO concentrations and provides a HONO profile closer to our field measurements. These results imply that HNO_3 photolysis on surface has significant impact on atmospheric cycling of NO_x and HO_x , and production of photo oxidants including O_3 in low NO_x rural and remote regions.