

2.133 Reduced nitrogen species as observed in urban and rural areas in the North China Plain.

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Abstract:

Numerous trace gases exist in the atmosphere, some of which are nitrogen-containing species. Oxides of nitrogen (such as NO_x , HONO, etc.) play vital roles in atmospheric chemistry and have been extensively studied. However, less attention has been paid to reduced nitrogen species with the exception of NH_3 , which plays an important role in the formation of secondary aerosols and the acidification of ecosystems. So far, observational studies of reduced nitrogen species other than NH_3 have been extremely lacking, limiting our understanding of their roles in the atmosphere. Here we show observational results of ambient NH_3 and other nitrogen-containing gases from an urban site and a rural site in the North China Plain. Ambient NH_3 was observed at China Meteorological Administration (CMA) in Beijing from 1 December 2015 to 31 January 2016 and at Raoyang (RY) in central Hebei province from 19 June to 26 July 2016 using an off-axis integrated cavity output spectroscopy (ICOS) analyzer and a chemiluminescence analyzer, respectively. Other nitrogen-containing gases at both sites were observed using an IONICON proton transfer time of flight mass spectrometer (PTR-TOFMS). About fifty nitrogen-containing species showed average levels above the detection limit (10 ppt). The top eight reduced nitrogen species at both sites were NH_3 , H_4N_2 , CH_3N , CH_3NH_2 , CH_3NHNH_2 , H_2N_2 , HCN,

and CH_3CN , with average mixing ratios ranging from 0.45 to 52.6 ppb. Other nitrogen species with average levels over 0.10 ppb were HCCCN , $\text{C}_2\text{H}_6\text{N}_2\text{O}_2$, $\text{C}_4\text{H}_7\text{N}_2\text{O}$, $\text{C}_5\text{H}_5\text{N}$, and $\text{C}_5\text{H}_{10}\text{N}_2$. Although NH_3 was the most abundant nitrogen species, the sums of other reduced nitrogen species at CMA and RY were about 2.5 and 0.4 folds of the NH_3 levels, respectively. At both sites H_4N_2 was found to be the most non- NH_3 reduced nitrogen species, with average levels about 10 ppb.