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\textsubscript{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\textsubscript{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\textsubscript{3} have been extremely lacking, limiting our understanding of their roles in the atmosphere. Here we show observational results of ambient NH\textsubscript{3} and other nitrogen-containing gases from an urban site and a rural site in the North China Plain. Ambient NH\textsubscript{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\textsubscript{3}, H\textsubscript{4}N\textsubscript{2}, CH\textsubscript{3}N, CH\textsubscript{3}NH\textsubscript{2}, CH\textsubscript{3}NHNH\textsubscript{2}, H\textsubscript{2}N\textsubscript{2}, HCN,
and CH$_3$CN, with average mixing ratios ranging from 0.45 to 52.6 ppb. Other nitrogen species with average levels over 0.10 ppb were HCCCN, C$_2$H$_6$N$_2$O$_2$, C$_4$H$_7$N$_2$O, C$_5$H$_5$N, and C$_5$H$_{10}$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$_4$N$_2$ was found to be the most non-NH$_3$ reduced nitrogen species, with average levels about 10 ppb.