1.073 Nitryl chloride as a ‘new’ radical source and its impact on ozone in polluted troposphere: an overview of field measurement and model results in China.

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Abstract:

Nitryl chloride ($ClNO_2$), which is produced from heterogeneous reactions of dinitrogen pentoxide (N_2O_5) on chorine containing aerosols, can significantly affect radical budget and concentrations of ozone and other secondary pollutants. However, the abundance, formation kinetics, and impact of $ClNO_2$ are not fully understood in different environmental conditions. This poster presents an overview of recent field campaigns of $ClNO_2$ and related chemical constituents in China, including one at a mountain top (957 m a.s.l) in Hong Kong of South China in winter 2013 and three in North China (urban Ji'nan, semi-rural Wangdu, and Mt Tai (1534 m a.s.l)) in summer 2014. $ClNO_2$ and N_2O_5 were measured with a chemical ionization mass spectrometer (CIMS) with iodide as the primary ions. Ambient concentrations of several hundreds ppts and up to 4.7 ppbv of $ClNO_2$ were observed in these locations, suggesting existence of elevated $ClNO_2$ in both coastal and inland atmospheres of China. Measurements in North China exhibited generally low concentrations of N_2O_5, indicative of its fast uptake on aerosols under aerosol and humid conditions. Indications of anthropogenic sources of chloride were observed at all these sites. The impact of photolysis of $ClNO_2$ on radical budget and ozone was assessed with a MCM model which was updated with detailed chlorine chemistry and constrained by measurement data. The results show that the $ClNO_2$ could increase ozone production by 2-16% in the following day. An improved WRF-Chem chemical transport model was applied to Hong Kong-Pearl River Delta region to simulate the spatial impact of N_2O_5 uptake and Cl activation on ozone and reactive nitrogen. Overall, our study re-affirms the need to include $ClNO_2$ related reactions in photochemical models for prediction of ground-level ozone and secondary aerosols in polluted environments.