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Nitryl chloride as a 'new' radical source and its role in production of ozone in polluted troposphere: an overview of the results from four field campaigns in China

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Nitryl chloride ($ClNO_2$) - a trace gas produced from heterogeneous reactions of dinitrogen pentoxide (N_2O_5) on aerosols containing chorine - 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 under different environmental conditions. This presentation gives 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 spectrometry (CIMS) system 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 of 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 enhancement was assessed with a MCM model which was updated with detailed chlorine chemistry and constrained by measurement data for the southern and a northern site. The results show that the $ClNO_2$ could increase ozone production by 2-16% in the following day. Overall, our study re-affirms the need to include $ClNO_2$ related reactions in photochemical models for prediction of ground-level ozone in polluted environments.