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# Nighttime $NO_3$ and N2O5 measurements by cavity ringdown spectroscopy during the China-UK joint campaign.

Zhiyan Li (1,2), Renzhi Hu (1), Pinhua Xie (1,3), Hao Chen (1), Shengyang Wu (1), Fengyang Wang (1), and Yihui Wang (3)

(1) Key Lab. of Environmental Optics and Technology , Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei 230031.China (zyli@aiofm.ac.cn), (2) Science Island Branch of Graduate School, University of Science and Technology of China. Hefei 230031., (3) School of Environmental Science and Optoelectronic Technology, University of Science and Technology of China, Hefei 230026.

Nitrate radicals, $NO_3$ and dinitrogen pentoxide, N2O5 are interesting trace gas constituents of the troposphere, which play an important role in nocturnal chemical processes including the removal process of VOCs to generate organic nitrate and the heterogeneous reactions to form aerosol nitrate as well as halogen activation. During the China-UK joint campaign, $NO_3$ and N2O5 were measured at the campus of Institute of Atmospheric Physics, located in the urban area of Beijing, China (39°58[U+02B9] 28″ N, 116°22[U+02B9] 16″ E) during the night from 3 to 22, June 2017.In this paper, an inexpensive, compact instrument for the sensitive measurement of the nocturnal nitrogen oxides $NO_3$ and N2O5 in ambient air at high time resolution was described. The minimum detection limit ($1\sigma$) for $NO_3$ radicals and N2O5 were estimated to be 2.3 ppt and 3.1ppt in a 2.5s averaging time. The observed mean $NO_3$ mixing ratios and N2O5 were 36.2 ppt and 2.5ppt, respectively. Based on the equilibrium between $NO_2$, $NO_3$ and N2O5, a point-by-point comparison of the measured $NO_3$ mixing ratio with that calculated from the $NO_2$ and N2O5 observations and the temperature was conducted for the night 12-13 June, 2017 and the result show that $NO_3$(calculated)=$NO_3$(measured)*0.9-0.25ppt,with a correlation coefficient R=0.94.Under the assumption of steady state, the $NO_3$ production rates were calculated averaging at 0.73ppt/s. The regression analysis imply that the calculated $NO_3$ production rate varied mainly with the ambient $O_3$ concentrations.