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Nighttime dinitrogen pentoxide measurements by cavity ringdown spectroscopy in the suburban area of the megacity Beijing, China

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Dinitrogen pentoxide, N2O5 ,as the reservoir species of the nitrate radical which is a major oxidant for pollutants during the night and contributes to the oxidative capacity of the atmosphere, plays an important role in nocturnal chemical processes. Cavity ringdown spectroscopy (CRDS) had been used to measure the sum of concentrations of NO_3 and N2O5 from the roof of the building 16 m above street level in the suburban area of the megacity Beijing during the UCAS Winter Campaign in 21 Februry and 4 March in 2016. The results showed an excellent correlation with that measured by cavity enhaced absorption spectrometer(CEAS).For example:during period from 29 Februry to 1 March, the slopes of the CEAS/CRDS data is 1.02,with a correlation coefficient r=0.98.Substantial variability was observed in these nighttime nitrogen compounds: peak NO_3+N2O5 mixing ratios reached 1400pptv, whereas the mean night-time NO_3+N2O5 was approximately 147 pptv. Additionally, [NO_3+N2O5] showed negative correlations with [NO] and a positive correlation with [O_3]. Co-measurements of temperature and NO_2 from the campaign were used to calculate the equilibrium partitioning between NO_3 and N2O5 which was always found to strongly favour N2O5.Two methods were used to calculate the lifetimes for NO_3 and N2O5, the results being compared and discussed in terms of the implications for the night-time oxidation of nitrogen oxides.