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Observations of dinitrogen pentoxide in both winter and summer time in Beijing, 2016

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Dinitrogen pentoxide (N_2O_5), as the reservoir of nitrate radical (NO_3), had a significant impact to the nighttime oxidization capacity through the fast exchange with NO_3 and accounts for the nighttime NO_X removal and chlorine activation by it's heterogeneous uptake on the aerosols. A newly developed instrument based on the cavity enhanced absorption spectroscopy was deployed to measure N_2O_5 in winter and summer time of 2016 at two regional sites in Beijing, respectively. High concentrations of N_2O_5 were frequently observed in these two seasons, the maximum mixing ratio reached up to 1.0 ppb in winter and 0.8 ppb in summer during pollution episodes, respectively. The average mixing ratio of N_2O_5 in winter was significantly higher than that in summer. In general, N_2O_5 began to accumulate after sunset and reached a maximum value in a few hours later. High concentrations of N_2O_5 can be sustained till the sunrise of next morning during the clean days but decreased to zero rapidly in the first half of the night for polluted days after ambient O_3 had been titrated by NO. Fast variation of N_2O_5 were observed from time to time which were corresponding to the NO spikes due to the heavy duty car emissions near the campaign sites. In addition to N_2O_5, a comprehensive suite of gas phase and aerosol parameters were also determined in parallel. The uptake coefficient of N_2O_5 is deduced through an iterative box model approach constrained to observed trace gas compounds as well as aerosol surface concentrations. Empirical relations between the uptake coefficient of N_2O_5 and the chemical composition of aerosols are analyzed and compared to the findings reported in both United States and Europe.