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Observation of nocturnal atmospheric NO_3 radical over Beijing by Cavity Ring Down spectroscopy

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A cavity ring-down spectroscopy (CRDS) instrument is applied for measuring atmospheric NO_3 radical. Light from a red laser diode (661.85nm) is coupled on-axis into an optical cavity formed by a pair of high-reflectivity mirrors (R$\geq$99.9985%) to achieve an effective absorption path length of approximately 20 km. Considering its loss of the NO_3 radical in the inlet system, two kinds of direct and indirect methods are applied for calibrating its transmission efficiency. The experimental results show the overall transmission efficiency of the NO_3 radical in the system is approximately 75$\pm$5% .The detection limit of the NO_3 radical determined by Allan variance is approximately 3.2 pptv (2 σ, 10s).
Moreover, the measurement of NO_3 radical was performed at a suburb site in Beijing from October 29 to November 15, 2014. During the observation, the concentration of NO_3 radical is relatively low, the maximum of NO_3 radical concentration is 50pptv and the average of its concentration is approximately10pptv. Combining of NO_2, O_3 and NO data, the NO_3 radical production rates were calculated ranging from 0.04pptv/s to 1.03pptv/s, and NO_3 radical lifetime is averaged at 68s. The NO_3 radical loss process in the atmosphere is further analyzed. Combining of related auxiliary data, the influence of different humidity as well as particulate matter concentration on the atmospheric NO_3 radical removal is researched.