



Nighttime HO_x chemistry in the Pearl River Delta and Beijing in summer 2006: intense oxidation without sunlight

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Due to the absence of sunlight, unexpected high nighttime OH concentrations reported in previous field studies are of high interest for in-depth understanding of trace gas removal and reaction kinetics. In summer 2006, within the framework of PRIDE-PRD2006 and CAREBEIJING2006, we performed intensive in-situ measurements for HO_x radicals and ancillary parameters at two non-urban sites in Pearl River Delta and Beijing, respectively. During nighttime, quite similar features for both campaigns were observed. Measured nighttime OH and HO_2 concentrations were about $0.5 - 3 \times 10^6 \text{ cm}^{-3}$ and $0.2 - 5 \times 10^8 \text{ cm}^{-3}$, respectively. A box model with the established chemical mechanism (RACM-MIM-GK) underestimated these observed OH concentrations by an order of magnitude while reproduced the observed HO_2 taking into account the known interference from ambient RO_2 radicals (Fuchs et al. 2011). By testing the recently proposed recycling mechanisms applied for daytime chemistry, we found both a small primary source and a secondary source of OH radicals, the last one comparable to daytime observations (Lu et al., 2011, Hofzumahaus et al., 2009). Interestingly, the widely applied LIM0 and MIM2⁺ showed marginal impacts on the modeled nighttime OH concentrations under high isoprene concentrations. With the help of a simple 1 d simulation, we found that direct input of RO_x radicals by vertical transport was negligible while the input of PAN and MPAN could be of significance. Averaged nighttime pollutant turnover rates by OH were as high as 8 ppb/h and 4 ppb/h for PRD and Beijing, respectively, dominating nighttime oxidation processes.

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