## 2.022 Wintertime photochemistry in Beijing: Observations of ROx radical concentrations in the North China Plain during the BEST-ONE campaign.

Early Career Scientist

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Abstract:

The first wintertime in-situ measurements of hydroxyl (OH), hydroperoxy ($HO_2$) and organic peroxy ($RO_2$) radicals ($RO_x$=OH+$HO_2$+$RO_2$) in combination with observations of total reactivity of OH radicals, $k_{OH}$, for the Beijing area are presented. The field campaign “Beijing winter finE particulate STudy - Oxidation, Nucleation and light Extinctions” (BEST-ONE) was conducted at the suburban site Huairou near Beijing from January to March 2016. It aimed to elucidate the mechanism of formation of secondary pollutants in the North China Plain (NCP) during wintertime. Unexpectedly high OH radical concentrations were observed during the campaign with noontime average concentration values of about $2.8\times10^6$ $cm^{-3}$, with a slight difference in relatively clean ($3.6\times10^6$ $cm^{-3}$) and severely polluted days ($2.4\times10^6$ $cm^{-3}$). The Beijing winter OH concentration is nearly two-fold larger than what was observed in Birmingham, Tokyo, and New York City during wintertime. The simultaneous measurements of nitrogen monoxide NO and of the total reactivity of OH, $k_{OH}$, allows constraining the production and destruction rates in the radical chain reactions. During this campaign, the total primary production rate of $RO_x$ radicals was dominated by the photolysis of nitrous acid accounting for 46% of the identified primary production pathways for $RO_x$ radicals. Other important radical sources were alkene ozonolysis (28%) and photolysis of oxygenated organic compounds (24%). An observation based model was used to simulate the OH, $HO_2$ and $RO_2$ concentrations, which was capable of reproducing the observed $RO_x$ concentrations during clean days. However, it largely underestimated $HO_2$ and $RO_2$ concentrations during pollution episodes. The $HO_2$ and $RO_2$ observed-to-modeled ratios increased with increasing $NO_x$ concentrations, both during clean and polluted periods, implying that the current chemical mechanism has difficulties in the high $NO_x$ regime.