



## Semi-quantitative understanding of source contribution to nitrous acid (HONO) based on 1 year of continuous observation at the SORPES station in eastern China

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Nitrous acid (HONO), an important precursor of the hydroxyl radical (OH), has long been recognized as of significance to atmospheric chemistry, but its sources are still debated. In this study, we conducted continuous measurement of HONO from November 2017 to November 2018 at the SORPES station in Nanjing of eastern China. The yearly average mixing ratio of observed HONO was  $0.69 \pm 0.58$  ppb, showing a larger contribution to OH relative to ozone with a mean OH production rate of  $1.16$  ppb  $h^{-1}$ . To estimate the effect of combustion emissions of HONO, the emitted ratios of HONO to  $NO_x$  were derived from 55 fresh plumes ( $NO \square NO_x > 0.85$ ), with a mean value of 0.79 %. During the nighttime, the chemistry of HONO was found to depend on RH, and the heterogeneous reaction of  $NO_2$  on an aerosol surface was presumably responsible for HONO production. The average nighttime  $NO_2$ -to-HONO conversion frequency ( $C_{HONO}$ ) was determined to be  $0.0055 \pm 0.0032$   $h^{-1}$  from 137 HONO formation cases. The missing source of HONO around noontime seemed to be photo-induced, with an average  $P_{unknown}$  of  $1.04$  ppb  $h^{-1}$ , based on a semi-quantitative HONO budget analysis. An over-determined system of equations was applied to obtain the monthly variations in nocturnal HONO sources. Besides the burning-emitted HONO (accounting for about 23 % of the total concentration), the contribution of HONO formed heterogeneously on ground surfaces to measured HONO was an approximately constant proportion of 36 % throughout the year. The soil emission revealed clear seasonal variation and contributed up to 40 % of observed HONO in July and August. A higher propensity for generating HONO on aerosol surfaces occurred in severe hazes (accounting for 40 % of the total concentration in January). Our results highlight ever-changing contributions of HONO sources and encourage more long-term observations to evaluate the contributions from varied sources.