

Interactive comment on “NH₃-promoted hydrolysis of NO₂ induces explosive growth in HONO” by Wanyun Xu et al.

Anonymous Referee #1

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The article “NH₃-promoted hydrolysis of NO₂ induces explosive growth in HONO” discussed the mechanism behind explosive HONO formation during field observation in a rural site in North China. In general, the phenomenon, confidence of related evidence were sufficient to show the role of NH₃ in HONO productions via heterogeneous reaction during fog/smoke events. The observation data was well linked to possible atmosphere processes, which might greatly promote the understanding of HONO sources and thus providing new insights of pollution control strategies for China. Yet, the authors should address several minor points to make the narrative as well as the deduction more convincing. Minor suggestions First, it is well known that the HONO is extremely reactive especially during daytime. For most of the cases, the author noted that the rarely seen Ozone was the evidence that there was no sufficient sunlight. It

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seems that the Ozone concentration was used as an indicator of UV radiation and possible photochemistry reactions (line213-line218). But the Ozone could be titrated by NO, which was often measured a high level during nighttime in North China. Therefore, even the Ozone was observed to be nearly zero, there might be enough UV radiation for the quick HONO photolysis. This leads to a further question - can we trust the HONO measurements by a denuder system? The annular denuder method of detecting might have artefacts regarding to measuring HONO due to: 1. Hydrolysis of NO₂ onto wet surface; 2. Aqueous reaction of S(IV) with NO₂ in the solution (Spindler, Hesper et al. 2003, Nie, Ding et al. 2015). The second reaction could likely be accelerated in the presence of ammonia as reported in the previous studies (Cheng, Zheng et al. 2016, Wang, Zhang et al. 2016). Therefore, it is strongly recommended that the authors should conducted some validation of the HONO data from IGAC, given the fact that the HONO data obtained by denuder system need further calculation/reprocessing.

The second point will be lying in the mechanism discussions. Though R1 could not explain the increasing nitrate (line 260-261), but attributing all the SIA (secondary inorganic aerosols) increase due to HONO formation and thus denying the role of R1 seems to be assertive. Actually, the nitrite in the aqueous phase might have produced OH radicals in aerosol liquid water or fog droplets (Vione, Maurino et al. 2006). It would be good to illustrate or maybe quantify the relative contribution of R1 v.s. R2 to HONO production as well as SIA production.

Besides the above comments, some technical notes shall be taken as well (mostly on the writing and texts): 1. Line110-111: “Under highly polluted conditions such as our site”. Might have wrong grammar used. 2. Figure 3. The time label on X axis causes misunderstanding, might change to Date-Time format. 3. Figure 4. The unit of aerosol composition (nitrate/sulfate/ammonium) should be in mass concentration.

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