

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-529

Anonymous Referee #2

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Referee comment on " Atmospheric measurements at Mt. Tai – Part I: HONO formation and its role in the oxidizing capacity of the upper boundary layer" by Chaoyang Xue et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-529-RC2>, 2021

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This paper presents comprehensive field campaign which was performed in summer at the foot (150 m a.s.l) and the summit (1534 m a.s.l) of Mt. Tai (Shandong province, China). The author performed the analysis of HONO budget and found strong unknown HONO sources. Constraints on the kinetics of aerosol-derived HONO sources were discussed and their contribution to HONO formation were negligible. The vertical transport from the ground to the summit levels and heterogeneous conversion of NO<sub>2</sub> was proposed to support the remaining majority of unknown HONO sources. The subject is suitable for publication in ACP and I would recommend the paper is accepted after the author have addressed the following concerns.

Specific comments:

- Instrumentation: Low levels of HONO were measured by LOPAP technique with detection limit of 1.5 pptv at the summit of Mt. Tai in summer 2018. The QA and/or QC for LOPAP instrument should be stated to guarantee data quality.
- Anthropogenic emissions: The author stated that low NO<sub>x</sub>/NO<sub>y</sub> of 0.43 ± 0.28 indicated aged air masses and small impact of anthropogenic emissions. However, NO and NO<sub>x</sub> were measured simultaneously at the summit station. Why did not the author utilize NO/NO<sub>x</sub> to evaluate the influence of nearby anthropogenic emissions. Moreover, the rapid increase in pollutants (HONO, NO, NO<sub>2</sub>, NO<sub>y</sub>, CO, PM<sub>2.5</sub>) was observed on 29 July. Low NO concentrations (1-2 ppbv) were observed at high O<sub>3</sub> levels (~50 ppbv), which should originate from local emissions. However, the author stated the high HONO levels could come from the heterogeneous conversion. The author should reexamine the data and explore the sources of increased pollutants.
- Figure 5: The data of HONO and J(NO<sub>2</sub>) for summit and foot station were measured at different periods. Whether it is appropriate to exhibit the data at different periods

together in the figure? The measured data at different periods were different. Is such comparison meaningful?

- Page 13, line 285-290: The author stated that south wind could enhance the upslope valley breeze wind because higher wind speeds ( $>5 \text{ m s}^{-1}$ ) were observed at the summit station than at the foot of the mountain ( $> 2 \text{ m s}^{-1}$ ). However, the wind speeds are generally higher at the summit station, which requires detailed explanation by the author.
- Page 16, line 347-348: "Note that the uncertainty of ...". I don't quite understand this sentence. Section 3.6 stated the contribution of photolysis of HONO and  $\text{O}_3$  to OH. Please give the explanation.
- The author calculated the enhanced uptake coefficient of  $\text{NO}_2$  on the aerosol surfaces. The dark uptake of  $\text{NO}_2$  on the aerosol surface could be considered to evaluate the influence of heterogeneous reaction on the aerosol surfaces since the dark uptake coefficient of  $\text{NO}_2$  were mostly investigated.
- Page 19, Section 3.6: The author only calculated the contribution of the photolysis of HONO and  $\text{O}_3$  to OH and not  $\text{HO}_x$ . The  $\text{HO}_x$  should be replaced by OH.
- Page 21, line 470: What dose  $\lambda_a$  stand for? It is  $\gamma_a$ ?