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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A comparison of measured HONO uptake and release with calculated source strengths in a heterogeneous forest environment" *by* M. Sörgel et. al.

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This study reports vertical mixing ratio profiles of nitrous acid (HONO) measured over a forest floor and a nearby clearing. In the forest, deposition dominated the net flux day and night, while in the clearing, deposition occurred during the night and emission during the day. The measured fluxes were compared to available information about potential HONO sources. Biogenic emissions seem not to be sufficient at this site. The light induced conversion of nitrogen dioxide to HONO turned out to explain only a smaller fraction of the observed daytime emission flux, due to significant light intensity saturation reported. Photolysis of adsorbed nitrate or nitric acid would either

underestimate or overestimate measured fluxes, depending on the mechanism and parameterization used.

The budget of HONO continues to be a debated topic in atmospheric chemistry due to its role as a photolytic OH source. It's sources and sinks are not sufficiently understood, and the present study is a valuable contribution to this topic. The measurements seem to be performed carefully, the analysis appears sound, and the discussion is thoughtful and detailed. The manuscript is well structured and quite well written. I recommend publication after addressing a few minor comments.

Page 2122, line 5: reference to Gutzwiller et al., the quoted study is about diesel exhaust emissions; may be the authors rather wanted to cite Gutzwiller, L., George, C., Rössler, E., and Ammann, M.: Reaction kinetics of NO2 with resorcinol and 2,7-naphthalenediol in the aqueous phase at different pH, Journal Of Physical Chemistry A, 106, 12045-12050, 2002. This study directly reported reduction of NO2 by organics.

Page 2123, line 24ff: Discussion of mechanisms involving NO2*: Better explain what the limitation is: production rate of NO2* or the reaction rate of NO2* + H2O. This is important, since for the HNO3 photolysis pathway NO2* production rates maybe higher than those from excitation of NO2 in the gas phase. This issue is coming back in the discussion of the HNO3 photolysis pathway at the end of section 3.4.3

Page 2123: Some new studies related to the exchange of HONO with ground surfaces and their components by Van den Boer et al. (2014) and Donaldson et al. (2014) may be included in this part of the introduction.

Page 2126, line 22: . . . if water is condensing (rather than 'humidity')

Page 2129: maybe the Su et al. (2011) should also be discussed in this context, since it did not make a proof about the origin of nitrite, biogenic or through NO2 deposition. In addition, the soil pH of the present site should be mentioned and discussed already here.

Section 3.4.1: what would be the contribution of NO2 deposition to nitrite, if one would assume a reasonable uptake coefficient on the ground surface for this process?

Last paragraph of section 3.4.2: discussion of actinic flux saturation. Would the NO2 to HONO conversion be substantially higher during the day if the low irradiance linear behavior would be extrapolated linearly? As Bartels-Rausch et al. (2010) point out, the origin of the saturating behavior could also result from adsorption limitation of the adsorbed NO2 precursor. Since NO2 concentrations are low, adsorption saturation would not be a limitation in the present case.

References

VandenBoer, T. C., Markovic, M. Z., Sanders, J. E., Ren, X., Pusede, S. E., Browne, E. C., Cohen, R. C., Zhang, L., Thomas, J., Brune, W. H., and Murphy, J. G.: Evidence for a nitrous acid (HONO) reservoir at the ground surface in Bakersfield, CA, during CalNex 2010, Journal of Geophysical Research: Atmospheres, 119, 2013JD020971, 2014.

VandenBoer, T. C., Young, C. J., Talukdar, R. K., Markovic, M. Z., Brown, S. S., Roberts, J. M., and Murphy, J. G.: Nocturnal loss and daytime source of nitrous acid through reactive uptake and displacement, Nature Geosci, advance online publication, 2014.

Scharko, N. K., Berke, A. E., and Raff, J. D.: Release of Nitrous Acid and Nitrogen Dioxide from Nitrate Photolysis in Acidic Aqueous Solutions, Environmental Science & Technology, doi: 10.1021/es503088x, 2014. 2014.

Donaldson, M. A., Bish, D. L., and Raff, J. D.: Soil surface acidity plays a determining role in the atmospheric-terrestrial exchange of nitrous acid, Proceedings of the National Academy of Sciences, 111, 18472-18477, 2014.

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