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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement report: Short-term variation of ammonia concentration in an urban area: contributions of mist evaporation and emissions from a forest canopy with bird droppings" *by* Kazuo Osada

Anonymous Referee #2

Received and published: 30 June 2020

The author presents the analysis of 2 year hourly NHx data in Nagoya, Japan suggesting trends in ambient NH3 are due to mist evaporation and the N input of bird dropping into the surrounding vegetation. This manuscript aims at better characterizing NH3 emission sources in urban areas, which is needed. This study shows the increasing importance of bird guano as a significant source of NH3 is also true for urban areas where high populations of fowl can congregate. The long-term measurements of NHx for this region is valuable and the analysis is sound but somewhat incomplete. I would recommend publishing this manuscript after some revisions.

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Discussion paper

Major Comments

What was the measurement height of NHx? Could the repeated morning increase also be due to the increase in the boundary layer height?

The correlation to NOx measurements is useful in getting a sense of how much vehicles are contributing to total NH3 emissions. Since, as the author mentions, NH3 can easily react to form NH4, do the correlations of NOx to NHx look similar? since NHx is a better-conserved tracer for all emitted NH3.

Related to the comment above, the discussion around seasonal and interannual variations is focused on NH3, which may underestimate the impact of local sources if any NH3 is reacted to form NH4 - especially at the time resolution of the measurements. Since the study includes measurements of NH3 and NH4 (not an easy task) for such an extensive period, what do the variations in total NHx (and what % NHx is NH3) look like? are the conclusions the same?

In section 3.2, there is a brief mention of some of the other chemical components in rain. The NH4 content is reported later in section 3.3. Based on the reported pH and assuming the rain and mist content have similar NH4 content, could the fraction of NH3 emitted from mist evaporation be calculated using the expression for dew? Does this match the observed increase in NH3?

There is no discussion on the role of cuticular deposition, which is generally represented as a constant NH3 sink (Sutton et al. 1995, 1998; Flechard et al. 1999) in forest canopies. From the photograph of bird dropping, there also appears to be an increase in vegetation. The increase in leaf surface area could potentially increase the amount of NH3 dry deposited to the cuticles, also reducing overall ambient NH3 concentrations. The author discusses the potential difference in N inputs between years and is correct that both soil and leaf stoma can act as reservoirs. Can the author also comment on changes in the local NH3 sinks between years as well that would also affect the overall ambient NH3 concentrations?

Work by Decina S.M. et al (Ponette-González A.G., Rindy J.E. (2020) Urban Tree Canopy Effects on Water Quality via Inputs to the Urban Ground Surface. In: Levia D., Carlyle-Moses D., Iida S., Michalzik B., Nanko K., Tischer A. (eds) Forest-Water Interactions. Ecological Studies (Analysis and Synthesis), vol 240. Springer, Cham) shows vegetation in urban environments tend to concentrate pollutants and input them into the ground surface. The author makes an important point that for NH3 this exchange is bi-directional. The discussion around comparing the estimated compensation point of soil/leaf surface with ambient NH3 concentration does not account for the transfer velocity that ultimately determines the magnitude (and likelihood) of the exchange. Massad et al. (2010) provide a detailed description of this parameter. Would the conclusions be the same when accounting for the transfer velocity?

Minor Suggested Edits

The article would benefit from another round of general grammar and writing edits.

Include dates in Figure captions: Figure 5. Impact of the rain–mist event on the ambient NH3 concentrations from 14 to 17 November 2017.

Measurements highlighting the importance of bird guano as a significant NH3 source is relatively recent, the authors should also include the work of Croft, B.; Wentworth, G. R.; Martin, R. V.; Leaitch, W. R.; Murphy, J. G.; Murphy, B. N.; Kodros, J. K.; Abbatt, J. P. D.; Pierce, J. R. Contribution Of Arctic Seabird-Colony Ammonia To Atmospheric Particles And Cloud-Albedo Radiative Effect. Nature Communications 2016, 7, 13444.

Work by Hrdina, A. H. I.; Moravek, A.; Schwartz-Narbonne, H.; Murphy, J. G. Summertime Soil-Atmosphere Ammonia Exchange In The Colorado Rocky Mountain Front Range Pine Forest. Soil Systems 2019, 3(1) (Special Issue "Formation and Fluxes of Soil Trace Gases") also supports the dynamic range of soil emission potentials chosen by the author.

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