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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Measurements of NO and NO_2 exchange between the atmosphere and *Quercus agrifolia*" *by* Erin R. Delaria et al.

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Review of paper acp-2018-433: Measurements of NO and NO2 exchange between the atmosphere and Quercus agrifolia by Delaria et al.

The paper describes analysis of a measurement dataset on NO2 and NO exchange flux measurements using enclosure experiments on Quercus agrifolia. This is followed by interpretation of the established dry deposition velocities and NO compensation point for the overall contribution by deposition to these tree species for boundary layer NOx using a simple multi-box modelling system. Overall, this reads as a nice comprehensive study clearly indicating the implications of the results found in these experiments. Consequently, I do recommend publication of this study that does not only report on the

exchange characteristics of NOx for this specific tree species but also addresses potential issues involved in previous studies on NOx compensation points. I have mainly some minor comments mostly focussing on some of the modelling features and which hopefully nicely complements the comments by the other reviewer who had more specific comments regarding the experimental component of the study.

Below you can find my more specific comments.

Pp2, line 16: in this statement about the use the CRF referring to Ganzeveld et al. it is suggested that in this study the CRF was applied to correct the soil NO emissions. This is actually not the case; that study used a multi-layer exchange model to explicitly calculate the effective exchange between the canopy and the atmosphere and which yielded a canopy-top to soil NO emission flux quite comparable to the CRF proposed by Yienger and Levy of 50% for tropical forests. By the way, the study by Ganzeveld et al. (2002a) also presented a sensitivity analysis regarding the significance of this NO2 compensation point for global scale atmosphere-biosphere NOx exchange.

Pp 3, line 7: "…uptake rates necessary to describe the observed 20–50% reduction of soil-emitted NOx…". This statement suggests that the 20-50% of reduction of soil NO emissions can be completely explained by the NO2 removal rate. It is indeed true that existing models of in-canopy NOx cycling suggest that these canopy reduction factors are dominated by VdNO2 but we can also not rule out the important role of gradients in photolysis effecting the gradients and, consequently, atmosphere-biosphere fluxes and other in-canopy chemical transformations/interactions.

Pp3, line 17: "Observations of NOx canopy fluxes and atmospheric models…"; here you suggest that model studies show that trees take up NOx mixing ratios over 0.1 ppbv. What atmospheric models are those?? I think that models generally produce a whole range of results on NOx fluxes dependent on how the biogenic emissions, dry deposition (and canopy interactions) have been implemented and on the assumptions being made but which up to now lack actually lots of experimental information on issues such as the existence of the compensation point. Here we really need to connect leaf-to canopy-scale and in-canopy NOx gradient and flux measurements together with multi-layer exchange models to further demonstrate the potential existence and relevance of leaf- to canopy-scale NOx compensation points for difference ecosystems.

Page 5, line 19: “This corresponded to a maximum loss of 0.4 ppb at 8 ppb NO2”. Can you assume that the wall loss scales linearly with the concentration? What are the wall losses for the minimum concentrations you used for the experiments?

Page 8-9: “For all light and dark experiments the average compensation point for NO was calculated as 0.84 $\pm$ 0.32 ppb NO and 2.4 $\pm$ 1.1 ppb NO, respectively (Table 2).

Page 9: “making Quercus agrifolia a large net sink of NOx”; I see here your point that this tree species seems to be a sink of NOx given that the NO emission flux is only half the NO2 deposition flux but this doesn’t confirm so much that this tree species is overall providing a large sink of NOx (which would depend on the overall functioning of the canopy–soil system). Reading over then also later on Section 4.2, this is indeed confirmed having an overall loss by deposition to these trees on the order of 3-7% of total NOx loss in the boundary layer.

Regarding the presented study on the implications of the leaf-level measurements of NO2/NO compensation points for canopy-scale NOx exchange, there is a study by Seok et al. (Dynamics of nitrogen oxides and ozone above and within a mixed hard-wood forest in northern Michigan ACP, 2013) that addressed the potentially important role of the compensation point based on analysis of in and above-canopy NOx concentration dynamics also using a multi-layer exchange model on this dataset. The observed early morning peak of NOx was best explained actually considering the role of a NOx compensation point in the exchange simulations.

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