

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-133

Anonymous Referee #1

Referee comment on "Atmospheric deposition of reactive nitrogen to a deciduous forest in the southern Appalachian Mountains" by John T. Walker et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-133-RC1>, 2022

The manuscript by Walker et al. presents results from a study investigating atmospheric deposition of reactive nitrogen to a deciduous forest at the USDA Forest Service Coweeta Hydrologic Laboratory in the southern Appalachian Mountains. The authors use several well-established measurement methods to differentiate between oxidized and reduced as well as organic and inorganic compounds found in wet and dry deposition. Finally, they apply a bi-directional resistance-based model driven with the observed measurements of Nr air concentrations, micrometeorology, canopy structure, and biogeochemical parameters to present the full reactive nitrogen budget for the site.

While the character of the paper is a report-style compilation of results from a multitude of methods rather than following a clear scientific question, the authors do a great job in thoroughly describing the complexity of reactive nitrogen field investigations and long-term observation. Though continuous eddy-covariance observations are not included, the study represents the state-of-the-art in Nr monitoring and data interpretation. I particularly appreciate the inclusion of field investigations of the ammonia emission potential of green and senescent leaves as well as from litter, which is crucial for model parameterization and rarely conducted. The results are put into a broader context and discussed with regard to air quality regulations in the past, e.g. reduction in oxidized N is now clearly visible. Method uncertainties are sufficiently considered and presented.

The text is very well written and easy to follow. Figures are clear and easy to grasp. The supplemental material is useful and the selection of graphs and tables that were put into this section is good. This is the most comprehensive single-site study I am aware of and definitely deserves publication.

I only have a few, rather minor, points that should be considered before final presentation in the BG journal:

- With regard to Section 2.2.7, how exactly were the NH₃ data from hourly measurements used to impose diurnal variability on the biweekly data to be used as hourly input for the model? It is stated in line 393 that continuous NH₃ concentrations were only measured during the last two intensives (in spring and summer, I guess?). The diurnal variability is known to be driven by temperature, humidity, light availability, phenology, etc., how was the amplitude of the variability from these two campaigns transferred to the other – probably much cooler – seasons?
- The method section is very informative, but quite long. I'm wondering whether it would make sense to put all detailed descriptions from 2.2.1 up to 2.2.5 into the supplement, just adding a few sentences to 2.2 what has been done and referring to the respective part in the Supplemental Material. It's not a must, but would significantly reduce length and better highlight the findings given the potential readership of people who work in conservation and are likely more interested in the results and their interpretation than in every technical detail of the methodology.

Other:

- Introduction: I suggest adding information on measurement period, length, etc.
- Line 41-42: "many areas" and "some regions", please specify where, e.g. near hotspots of animal husbandry, chemical industry, etc.
- Line 153: Is 8 m the correct height? What was the reason for this height?
- Line 170: What was the selection criteria for the two respective heights?
- Line 178: "to the analytical box for analysis Ion Chromatography (IC)", is there a word missing?
- Line 270: Check for consistency in unit notation: "g⁻¹ tissue" vs. "kg tissue⁻¹"
- Line 312: Delete "is R_a" after "z₀"
- Line 449: Is RH defined before?
- Line 505-506: Do two decimal places reflect the measurement accuracy?
- Line 605-606: 61.4% wet plus 38.7% dry deposition equals 100.1%, check rounding
- Line 617: Can a bit more explanation given why stomatal fluxes are so low compared to cuticular fluxes?
- Line 708: Why would the aerodynamic resistance become zero at steep forested slopes? R_a is turbulence and wind speed driven, so why would it approach zero?