Biogeosciences Discussions

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Comment on bg-2022-72

Anonymous Referee #2

Referee comment on "Forest–atmosphere exchange of reactive nitrogen in a remote region – Part II: Modeling annual budgets " by Pascal Wintjen et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-72-RC2, 2022

General comments

This study deals with the modeling of reactive nitrogen (Nr) deposition fluxes on a German forest, and with the calculation of annual budgets of Nr, based on a previous paper (https://doi.org/10.5194/bg-19-389-2022), where measurements of Nr concentrations are published.

Different modeling approaches are used, from 1D (with DEPAC-1D) to 2D (with LOTOS-EUROS) and with a Canopy Budget Technique. Differences and similarities of results between the different approaches are highlighted.

The study is useful and interesting, but is presented with too many details and lacks synthesis. The reader gets lost when all results are described. The comparison with literature results is not always useful: if a comparison is made with other results, this should help the authors to explain their own results. In this paper, the comparison with results often remains at a stage of quantification without giving any keys on how to go further to explain the processes leading to differences between studies. In other words, the discussion lacks depth.

The question of soil resistance is not addressed, especially for NH_3 deposition modeling, and could help to adjust NH_3 deposition flux overestimation.

Point of attention: I have the impression that the authors would like to include results from the previous paper (Wintjen et al., 2022, Part I on measurements) and add modeling results in this paper. Be careful of correctly synthesize the right information needed for this study.

I did not understand how the authors selected the figures to be put in supplementary material of in the main manuscript. The figures in supp mat are often widely described (this suggests that they are important for the study), the authors should revise either the description or the location of the figures.

Generally speaking, the manuscript needs to be synthesized, shortened, and above all deeper discussed with highlighted scientific questions. The abstract and the conclusion should be further adapted. Therefore, the manuscript needs major revisions.

Specific comments

Abstract

L10: "total atmospheric deposition": precise if you talk about wet and dry or only dry but for all N reactive species.

L36: this statement is not at the right place and should be placed at the beginning of the abstract.

Introduction

L92 "Using the so- called canopy….": if you give information on the CB technique, you should also explain the inferential method using measured concentrations of gases and particles and modeled deposition velocities in comparison to throughfall measurements.

L95: redundant with sentence above

L100: rewrite the sentence by replacing the numbers (1), (2) and (3) by first…, then we…, and we finally…at the beginning of each statement. Add a fourth statement on the uncertainties assessment.

Material and methods

L110 Beudert and Breit, 2010: this reference is not recent, Anthropogenic activities and influence may have changed. Please update or confirm that the situation is still as described in 2010.

L115: "…are responsible for the contribution to these networks": what do you mean?

L122: specify the sampling resolution for all variables.

L155: The soil resistance may have an important influence on NH3 bidirectional fluxes. Is the parameterization used adapted to the soils considered in this study? Are the values realistic? Did you realize sensitivity tests?

L168: is there a reference for the national emission inventory?

Paragraph 2.2.3: a table summarizing what model provides what output, and with what inputs are calculated deposition fluxes, would be useful

L191: "concentration measurements on monthly and half hourly…": for which species? Based on available measurements?

L197: what do you mean by instationarities? This explanation on gap filling is not clear. Please try to be more concise.

L221: avoid the use of etc…, not precise enough.

I do not understand how this 2.2.3 paragraph is organized. It should be about site base modeling with DEPAC ID, and this paragraph from L215 to L230 deals with LOTOS-EUROS model and TRANC measurements. A bit of storage is needed.

L239 to 246: in this paragraph, you should specify where you talk about dry, wet deposition and what you mean when you talk about total deposition: total atmospheric (wet+dry) or total species?

L243: what do you include in "deposite inorganic nitrogen into dissolved organic nitrogen?

L246: Does total nitrogen deposition Nr include organic and inorganic species?

Results

Add "particulate" in front of NO_3^- and NH_4^+ if this is about dry deposition to avoid confusion with ions in DIN.

L295: "However…" combine this sentence with the one above.

L305 to 330: too much description. Go directly to what is important and speaks above all of what poses a question.

Your first paragraph in the results section deals with concentrations. Rather than separating the analyses model by model, why don't you write another paragraph on deposition velocities, and another paragraph on deposition fluxes? The comparison between each approach would be easier.

L354: give the principle of the scheme in one sentence.

L372: if the authors want to talk about errors in the stability parameterization, they should be more precise, because it is not possible to understand which process is involved, and why it influences the result. If it is crucial, it should be corrected for this study and not for after the study.

Generally speaking, this paragraph page 12 is too long. The reader gets lost. Please synthesize, and find a way to classify.

L495: An example of sentence not useful which could be removed to clarify the important

text: “Until June 2018, measured deposition was higher than the half of the previous years”. Same comment for the sentence after this one.

Line 500 to 510: please synthesize and shorten this paragraph

Discussion

The comparison with literature data should be based on a discussion on processes. If the comparison is only quantitative, it is not a discussion. The first paper by Wintjen et al. (2022) has shown a predominant role of NOx, contrary to model results. This particular result could be a major axis of the discussion, by analyzing which processes and which parameterizations are responsible for such a result. The comparison with literature should give ideas for the interpretation of your data and not only give possible range of values.

Once again, axis of discussion should be highlighted as scientific questions, and illustrated by results, rather than willing to illustrate all concentrations, than all fluxes, because we get lost with too many quantitative details.

L552: How can you prove the application of fertilizers? What do you exactly mean by “these times”? Any indication about the practices? It is interesting to discuss this question about fertilizer application, but this discussion should not be flooded among the other statements.

L566: this is theory, not discussion.

L580 to 600: same remark as above: the comparison with literature remains too quantitative and this is not a discussion.

L611: are the conditions in Trebs et al. (2005) comparable to your study to allow you give this interpretation?

L616 to 622: this sounds like a partial conclusion.

L651 to 661: this paragraph on critical load is very small despite being an interesting point of discussion. Should be expanded, while previous paragraphs should be reduced.

L664: the paragraph is entitled uncertainties in DEPAC 1D, but deals with all model results. Change the title and adapt the content to your own results. Another solution could be to include uncertainty considerations in each question, influence of meteorological parameters, influence of soil resistance parameterizations on NH3 deposition velocity, etc…(these are examples, not mandatory to follow).

L687: "no distinct…": what do you mean?

L699: you mention hydrochloric acid. Do you have any idea of the concentrations in your study? Is it relevant to mention it?

L701 to 707: this is not a discussion topic.

L751: 761: OK for the discussion on the combination of long term measurements and intensive campaigns but why is it mentioned in the paragraph about uncertainties in DEPAC-1D?

L771: considerations about NH3 emission inventory should be merged with discussion on NH3 above. What is the range of these emissions?

L815: "overestimation was only partly related to other issues like grid cell size", but you have written above that the grid cell size was not a problem. Please rephrase.

Summary and conclusion

In my opinion, should be conclusion only. Summary is abstract.

L837: DEPAC-1D and DEPAC-1D only: is there a mistake?

L845: erroneous parameterizations? If this is true then the modeling results should not be published and the parameterizations should be corrected before. Once again, the discussion should focus on some important processes and how they are represented in the model, which could explain discrepancies with observations.