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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterisation of ozone deposition to a mixed oak-hornbeam forest. Flux measurements at 5 levels above and inside the canopy and their interactions with nitric oxide" *by* Angelo Finco et al.

Anonymous Referee #1

Received and published: 22 May 2018

Finco et al. (2018) present a novel dataset of ozone and NOx fluxes at multiple levels from a month-long field campaign at a forest in Italy. The authors find that NO plays an important role on the observed ozone fluxes; ozone and NO reaction dominates the observed ozone flux near the canopy floor and determines the differences in observed ozone fluxes at higher levels in the canopy. The authors find that about half the ozone flux during the day actually occurs to the middle of the canopy, which is very interesting; it's typically considered that most of the ozone is deposited to the upper third of the canopy. At night, reaction of ozone and NO close to the ground dominates

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Discussion paper

the ozone flux. The weakness of the paper is that there is quite a lot of data presented (thirteen figures) but the direction of the manuscript and the significance of the authors' findings are not always clear. I would encourage the authors to better guide the reader and contextualize their findings, clearly articulating how their study advances current understanding. One way of better guiding the reader would be to hone the paper's objectives and including some overarching statements at the beginning of each section and move some of the figures to supplementary material. After substantial revisions, I think this paper should be published in ACP.

General comments.

In the introduction, the authors motivate their work with ozone damage to ecosystems. But they do not introduce stomata, non-stomatal deposition pathways, or that air chemistry can impact observed fluxes. In the abstract, the authors mention that NOx can lead to ozone production, but in the introduction the authors mostly discuss ozone destruction by NO. Spelling out the connections and expanding their introduction would help readers follow along and see the value of the authors' approach.

One of the authors' stated objectives is "to test the capacity of existing deposition models to predict intra-canopy dynamics involving ozone reactions with NOx and VOCs". But I do not see any analysis in the paper addressing this objective.

Why aren't there confidence intervals on the figures with averages?

The current contents of the discussion seem like they would better fit in the results, as there is a lot of new data analysis.

There are many figures, and relatively little text. My feeling is that many of the figures could be moved to supplementary material.

It would be helpful to the reader if the authors were more generous in referencing their figures. For example, on page 11, lines 16-24 there is no reference to any figures.

The authors should check their in-line references for commas after the author name or

“et al.” and whether their use of commas or semi-colons between references is consistent (and ACP policy as to whether there is a difference between in-line references used with “e.g.” vs. not).

In general, I would recommend that the authors do not use words that express a value-judgement, like “extremely”, “remarkable”, “peculiarity”.

Line-by-line comments.

Abstract.

Generally readers are not going to know what “in the framework of the European FP7 project ECLAIRE” means.

Instead of saying “A partition of the ozone fluxes will be shown to identify the most relevant sinks” the authors should say report their most important finding in their abstract.

Page 2, Line 4: “had” should be “has”

Page 2, Line 30-31: It’s not clear to me why this is relevant

Page 3, Line 4: What is a “climax” ecosystem?

Page 3, Lines 8 & 12: Here and in the remainder of the paper, I find it difficult to distinguish between the terms “dominant” and “dominated”. Are there other ways the author could describe them?

Page 3, Line 13: Atmospheric chemists may not know what nemoral means.

Page 3, Line 24: How do the authors calculate the fetch size?

Page 3, Line 30: Will the authors please use “instrument models” or “instrument types” here instead of “model”?

Page 3, Line 31: 10 m away from the tower in the vertical? Or in the horizontal?

Page 4, Lines 4-10: Are COFA, ROFI, FROM, and GSAS acronyms? If so, it would be

helpful to spell out what they stand for.

Page 4, Line 19: Why how the data are stored (i.e., in hourly files) relevant?

Page 4, Line 26-27: I'm not sure that I understand. Why is the chamber is only measured for six minutes? What do the authors use the measurement of the reference chamber for?

Page 5, Line 8: I don't think model should be abbreviated, here and elsewhere

Page 5, Line 22-24: The authors should check the consistency of their abbreviations. For example, Campbell Scientific is abbreviated in one sentence but in the next sentence it is not.

Page 6, Line 7-9: What was the result of the inter-comparison between the two COFAs?

Page 6, Line 10: Are the authors examining the relative standard deviation for a given half-hour?

Page 6, Line 11: Why is systematic in parenthesis?

Page 6, Line 22: I don't think including this sentence is necessary.

Page 7, Line 9: "were" should be "was"

Page 7, Line 10: What does "semi-hourly" mean?

Page 7, Line 13: "k" should be "K" in kinematic

Page 7, Line 26: Is V0 the initial voltage?

Page 7, Line 32: The "C" of "C_O3" is missing

Page 7, Line 33: "let" should be "allow"

Page 8, Line 17: What is "it" here?

Page 8, Line 7-19: What is the timescale that the authors correct for storage over?

Page 8, Line 24: There is a “the” missing from between “cooled” and “air”

Page 8, Line 28: Is this local time? If so, it would be more straightforward to refer to it as local time.

Page 8, Line 29: Do the authors mean the respective lower and higher levels by “other ones”?

Page 8, Line 29-30: I think the authors mean that only two significant rainfalls occurred during the campaign and they happened at the end of the campaign

Page 11, Line 10: Why is this remarkable?

Page 11, Line 11: Why would ozone fluxes and LE fluxes be correlated?

Page 12, Line 1: There is a rogue “g);” in this line that needs to be deleted

Page 12, Lines 7-8: But there weren’t necessarily decreases in emission, there were just decreases in the observed flux (perhaps one could call this the effective emission?)

Page 12, Lines 9-10: Instead of “followed nearly symmetrical” I would say they were close to inversely proportional

Page 12, Lines 11-12: Do the authors mean that the simultaneous minimums?

Page 12, Lines 24-16: The authors should refer to the figures that they are concluding this from. Will the authors please be more explicit about what they mean by “in relation to” here? Why is NO deposition most apparent at this time?

Page 12, Lines 22-25: Are the authors talking about the decreasing instrument footprint size at lower levels of the canopy? I think their logic needs to be spelled out a little more.

Page 13, Line 12: The authors should be careful as to whether they refer to time as HH.MM or HH:MM, here and elsewhere

Page 13, Lines 4-21: I find the discussion of the sensible heat fluxes interesting, but tangential. It would be helpful to the reader if the authors did not digress.

Page 13, Lines 27-34 & Page 14, Lines 1-7: This text should be one paragraph, not three. Also, I would avoid using the word “fact”

Page 14: Lines 1-3: I am not sure I am following this description well. It would be helpful if the authors more clearly spelled out their calculation. Perhaps pointing the readers to compare the grey dashed line and the red line would be helpful for readers.

Page 14, Line 4: instead of “to this ozone sink”, will the authors say something like “to the observed ozone flux”?

Page 14, Lines 4-5: By “the contribution of the NO deposited from the atmosphere above”, are the authors talking about the contribution of NO transported into the forest to the observed ozone fluxes?

Page 14, Line 6: What is the “top canopy enhancement of the ozone sink”?

Page 14, Line 8: The “of that” is unnecessary

Page 14, Lines 8-25: This should be one paragraph, not three

Page 14, Lines 33-34: Please clarify the last calculation - "the residual of the difference of ozone deposition at 5 m and the NO emitted from soil”. Also, do the authors perform this calculation on half-hourly data or on the campaign averages for a given hour?

Page 15, Line 3: Specify that it’s ecosystem removal relative to air chemistry removal

Page 15, Line 5: Isn’t the depression in the ozone deposition to the dominated crown?

Page 15, Line 14: Specify NO depletion of ozone

Page 15, Line 17: What do the authors mean by “stirred”?

Page 15, Line 19: Why is only a small amount of uptake of NO possible? What are the references for this?

Page 15, Line 20: What do the authors’ findings mean for the canopy reduction factor for NOx?

Page 15, Line 27: Which studies are these values comparable to?

General comments on figures and tables.

Table 1: What does the text in the parentheses mean? What do these instruments measure? What height is the nearby mast?

Figure 5: What are the distributions over? All the days in the measurement campaign? What is z? What is L? What are the values of z/L used for each class? The height label is missing for plot e).

Figure 10d: Please indicate the green line is rainfall. Also, is rainfall in the context of NO fluxes discussed?

Are all figures averages over the entire campaign? If so, please specify in the figure captions.

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