Atmos. Chem. Phys. Discuss., 4, S641–S644, 2004
www.atmos-chem-phys.org/acpd/4/S641/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gas-particle interactions above a Dutch heathland: I. Surface exchange fluxes of NH_3, SO_2, HNO_3 and HCl" *by* E. Nemitz et al.

Anonymous Referee #1

Received and published: 3 May 2004

This paper examines the characteristics of NH3, SO2, HNO3, and HCl air/surface exchange fluxes above a heathland. Due to the difficulty in measuring fluxes of NH3, HNO3, and HCl, such comprehensive datasets exist for only a limited number of ecosystems and atmospheric chemical environments. The authors reach some conclusions that are relatively important with respect to modeling of air/surface exchange, including the relatively good agreement between the canopy resistance and canopy compensation NH3 models, as well as strong evidence for non-zero HNO3 and HCl canopy resistances. Perhaps the most significant contribution, however, is the author's interpretation of the results within the context of somewhat larger scientific questions. For example, the authors suggest that the relatively high emission potential estimated for this site may be a symptom of N saturation. The authors also found higher cuticular

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resistances to NH3 deposition relative to earlier measurements at the site, which they suggest could be a response to declining SO2 deposition. One criticism may be that the manuscript provides a much more in-depth examination of NH3 relative to the other gases. Overall, the manuscript is clearly presented and well structured. The methods are suitable and appropriately applied. The subject is appropriate for this journal and the manuscript should be accepted for publication upon treatment of the comments below.

Specific Comments:

1. Similar data were collected, with similar scientific objectives, during a previous study described by Nemitz et al., 2002a. That study (North Berwick experiment) was conducted over oilseed rape at an unpolluted coastal Scottish site. As described in the introduction, the experiment under review was carried out at a site chosen for its more polluted atmospheric environment (Elspeetsche Veld experiment) relative to North Berwick. As expected, the results and conclusions from the two studies are different. As pointed out on page 21, HCl was emitted from the oilseed rape canopy, and was effectively deposited to the heathland. Perhaps there are additional differences between the two experiments that warrant discussion.

2. Section 3.2, 1st paragraph: The calculation of surface exchange fluxes assumes that the gradients are unaffected by chemical reactions. The authors state that the validity of this assumption is discussed in a companion paper. At least a brief mention of the relevant findings from this companion paper would be helpful.

3. Page 15, Line 2: Please give the range of emission potential estimated from previous measurements at Elspeet.

4. Page 15, Line 9: Incorrect spelling: "analsysis"

5. Page 15, 2nd paragraph: It is not clear to me that the T-response curve for emission potential (EP) = 2000 provides a better description of high humidity values of Rw than

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the curve for EP = 1200. However, I do agree with the explanation of cuticular desorption as a possible cause for the relatively high Rw values between 16 and 23C during conditions of high relative humidity. By definition, however, emission potential is an inappropriate explanatory variable for those values which illustrate cuticular processes, thus the curve for EP = 2000 is unnecessary. Can the influence of cuticular desorption be confirmed in another way?

6. Page 18, 2nd full paragraph, Line 6: Incorrect spelling: "firsts"

7. Page 18, 2nd full paragraph, Line 7: "previously observed" should be "previously been observed"

8. Page 19, 1st full paragraph, Line 4: "researches" should be "researchers"

9. Page 19, 1st full paragraph, Line 6: Remove the period after "indication"

10. Page 20, Last paragraph: The discussion of co-deposition is interesting. The authors state that Rw measured during this study is larger than measurements at the site during 1990-1992, which is consistent with decreasing SO2 deposition during the period. Comparing the curves in Fig. 6, the difference appears to be significant. It would seem that the increase in Rw between the two measurement periods would result in lower overall deposition rates during the most recent experiment, especially since, as stated at the top of page 20, cuticular exchange dominates the net flux. At the top of page 17, however, the authors state that the overall NH3 dry deposition rates from this study agree "remarkably well" with measurements conducted during the period 1990-1992. The conclusion that Rw increased as a result of reduced SO2 deposition is significant. Thus, the authors should attempt to explain why this response is not accompanied by reduced NH3 dry deposition.

11. Page 21, 3rd paragraph, Line 10: Change "by factor" to "by a factor"

12. Why are HCl and HNO3 deposition velocities much lower for daytime wet conditions vs. daytime dry conditions (Table 3)?

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13. Figure 1, descriptive text: Change "Gradient" to "gradient"

14. Figure 2: Include plots for HNO3 and HCl

15. Figure 7: Remove curve for EP = 2000

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 1473, 2004.