

Interactive comment on “Aerodynamic gradient measurements of the NH_3 - HNO_3 - NH_4NO_3 triad using a wet chemical instrument: an analysis of precision requirements and flux errors” by V. Wolff et al.

Anonymous Referee #1

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The manuscript characterizes a wet chemical instrument that can quantify the triad of NH_3 - HNO_3 - NH_4NO_3 in the atmosphere. With the used modern measuring system of GRAEGOR - among other gases and ions - NH_3 and HNO_3 and the corresponding water soluble ions NH_4^+ and NO_3^- in particles can be quantified semi-continuous in two different heights over ground. The realized time-resolution of one hour for the concentration gradient allows in combination with micrometeorological quantities (turbulent exchange coefficient) the calculation of the surface exchange flux. The measuring results investigated in terms of the instrument precision to resolve vertical concentration

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differences and the associated errors of surface-atmosphere exchange fluxes. The authors estimate the different errors for measurements over two contrasting ecosystems (grassland, low aerodynamic roughness and spruce forest, high aerodynamic roughness). Both measuring places are well characterized and described in the literature. The paper is in the focus of Atmospheric Measurement Techniques. I recommend the publication with same minor revisions.

The manuscript is written very systematically and well structured. The complicated micrometeorological background was described understandable. The important formulas for the flux calculation and the error estimation are complete explained. The results are presented clearly in tables and graphs. The conclusions are a good summary of the very complex results. The cited literature is new and relevant. I will recommend the publication of the manuscript. Because I am not a native speaker I can't appreciate the quality of English writing in general.

Detailed comments:

Page 2426 Line 3: For a more complete discussion of the available instruments please add e.g. after the sentence "To characterize the surface exchange of the NH₃-HNO₃-NH₄NO₃ triad, simultaneous measurements of NH₃, HNO₃, particulate NH₄⁺ and NO₃⁻ are mandatory and they should be highly selective with respect to gaseous and particulate phases." a hint to the measurement system MARGA (ten Brink et al. 2007).

ten Brink, H., Otjes, R., Jongejan, P., Slanina, S.: An instrument for semi-continuous monitoring of the size-distribution of nitrate, ammonium, sulphate and chloride in aerosol, *Atmos. Environ.*, 41, 2768-2779, 2007.

Page 2427: The headline for section 2.1 (Site descriptions) in chapter 2 seems to be incomplete, because not only the site descriptions are given in 2.1.1 and 2.1.2 rather in 2.1.3 to 2.1.5 also the measurement-method, the calibration and determination of concentration difference errors are discussed. Therefore it seems to be better to give section 2.1 a more complex title e.g. "Site descriptions, measurement-method, calibra-

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tion, and concentration difference error determination”.

Page 2435: The description of formula 7 (line 19) “. . . where Sc and Pr are the Schmidt and Prandtl number (≈ 0.72), respectively. Sc is a strong function of the molecular diffusivity of the trace gas (for $HNO_3 \approx 1.25$) . . .”. can be misunderstood because only for Pr a number is given in brackets. A better formulation can be the following: “. . . where Sc and Pr are the Schmidt and Prandtl number, respectively. Pr is ≈ 0.72 and Sc is a strong function of the molecular diffusivity of the trace gas (for $HNO_3 \approx 1.25$) . . .”.

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