

Interactive comment on “Real-time measurements of ammonia, acidic trace gases and water-soluble inorganic aerosol species at a rural site in the Amazon Basin” by I. Trebs et al.

Anonymous Referee #1

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General comments

The manuscript describes quasi synchronously online measurements for gaseous species and particle mass constituents in the troposphere. The measurement method realized by a continuously working wet annular denuder technique coupled to a steam-jet for particle sampling. The ion content in the denuder stripping solution (corresponding with the collected acidic gaseous species: HCl, SO₂, HNO₃ and HNO₂) and in the condensed water after the cyclone (corresponding with the ion content in particles: NO₃⁻ and SO₄²⁻) quantified by online IC. NH₃ from the gasphase and NH₄⁺ from particles were also quantified online using ammonium flow injection analysis (addition of OH⁻ to convert NH₄⁺ to NH₃, which will pass through a Teflon membrane and taken

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up as NH_4^+ in highly purified water, NH_4^+ quantified than by conductometry). This method allows measurements with the necessary low detection limit for the measurement site in the Amazon Basin during dry and wet seasons.

The manuscript is well arranged and brief. All Tables and picture are concise. In the literature described measuring methods are discussed detailed. The purposes of the measurements and the technical mature realization have been described clearly. A comprehensive discussion of possible sources of errors guarantees the accuracy of the preserved numerous measuring values. The manuscript is an important contribution to Atmospheric Chemistry and Physics Discussions and can be print with minor revisions.

Specific comments

In Table 1 a hint can be given for the method diffusion denuder for the NH_3 ammonia monitor (<http://www.mechatronics.nl>) as example for a continuously working and minimized system that uses a much lower air flow and less liquids as the wet annular denuder of Slanina and Wyers, 1994. The rotating wet annular denuder is replaced by a channel system positioned on a Teflon membrane and ammonia selected from the ambient airstream via this membrane into demineralized water. The detection of ammonia is similar to FIA (Wyers et al., 1993). A short description is given in Erisman, J.W., Orjes, R., Hensen, A., Jongejan, P., van den Bulk, P., Klystov, A., Möls, H., Slanina, S. Instrument development and application in studies and monitoring of ambient ammonia. Atmos. Environ. 35, 1913-1922, 2001.

The problem of gas phase losses (especially for HNO_3) in the inlet system was minimized realizing laminar conditions in the conduit and using appropriate material (polyethylene). A worst case scenario that estimates HNO_3 losses for the described experiment to lower as 15 % seems to be realistic.

The major problem with any denuder systems for measurement of nitrous acid is the formation of artifact nitrous acid by reaction of NO_2 with S(IV) on basic coatings (here 10-4 M NaHCO_3 solution). The fact that the SO_2 concentration is very low at the

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described measurement site (NO₂ concentrations are not shown) indicates that this nitrous acid formation is unimportant here. But it would be better to mention this potential interference, described recently: Spindler et al., Wet annular denuder measurements of nitrous acid: laboratory study *Environ. Atmos. Environ.* 37, 2643-2662, 2003

The addition of a small map to the site description (surroundings of the measurement place) makes these better understandable.

Technical corrections

Page 1216 line 14 the correct number for the Equation of temperature dependency for the conductivity is Eq. (4) instead of Eq. (6).

Page 1230 and Table 1 There are two citations as Simon and Dasgupta, 1995 for different papers, it would be better to mark these as 1995a and 1995b

Page 1229 The citation Middlebrook et al., 2003 is not used in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 1203, 2004.

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