Atmos. Chem. Phys. Discuss., 15, C8817–C8819, 2015
www.atmos-chem-phys-discuss.net/15/C8817/2015/

Atmospheric Chemistry and Physics
Discussions

Interactive comment on “Cloud water composition during HCCT-2010: Scavenging efficiencies, solute concentrations, and droplet size dependence of inorganic ions and dissolved organic carbon” *by* D. van Pinxteren et al.

Anonymous Referee #2

Received and published: 1 November 2015

The present manuscript describes the chemical composition of clouds sampled during the HCCT-2010 campaign. It features an impressive dataset in terms of physical and chemical parameters (inorganic ions together with DOC) measured. The cloud sampling is performed using several cloud collectors allowing to analyze the cloud chemical composition as a function of the droplet size. Sampling of the interstitial phase and of the cloud water by the CVI/INT system allows estimating the scavenging of the chemicals by the cloud water. Finally, AMS measurements allow to evaluate the variability of the cloud water composition with a high time resolution. Such analysis of cloud chem-

istry is very rare and difficult and by themselves worthwhile additions to the scientific literature. The discussion of the results is very detailed but clear and organized in a logical way. Some results like the correlation between LWC and cloud concentrations are expected/traditional. Other approaches are rather novel. For example, the way you connect air masses collected at three campaign sites (connected air flow) is interesting and allows documenting "full cloud events". Factors controlling solute concentrations are more subject to debate since there are so many factors that can explain concentration variability... So certain of your conclusions are more or less speculative...

Overall the study is an interesting contribution to atmospheric cloud chemistry and I would support publication of the manuscript while encouraging the authors to consider the following comments.

1- The introduction part is too long and should be reduced. Too many details are present and need to be suppressed for more clarity. Most of the information in the introduction part is even discussed in the results part.

2- p. 24319, line 12 : you argue that samples are stored at -20°C until analysis. For H2O2 analysis, this can lead to strong underestimation of the concentration. Indeed, the retention coefficient of H2O2 is below 1 (around 0.3 following Snider et al., 1992). This means that about 1/3 of aqueous H2O2 is retained in the crystal during freezing of the samples.

3- p. 24321. Please notify the nature of the filters (teflon, nylon?).

4- p. 24324. Definitely, I think that CASCC2 bulk samplers are not fitted to collect successive cloud water samples... especially for trace ions. For FCE 1.1 and FCE 13.3, the concentrations of certain chemical compounds should be carefully considered. This leads also to a general comment. To my opinion, CASCC2 sampler concentrates the cloud samples due to the way they collect the water. I know that most of the cloud water collection are performed with this Teflon strands system but I prefer the system where droplets impact on flat surface. This leads to my question. Did you compare you measurements performed on cloud water collected by your various cloud water collectors (CASCC2 vs. 5 stage for example)?

5- p. 24325. Your lowest value for cloud pH (3.6) seems really low. You need high concentration of strong inorganic acids (mainly nitrate and sulfate) to reach this value. If you compare for example with puy de Dôme measurements, you reach a pH value closed to 3.6 with significantly higher concentration of nitrate and sulfate. Please discuss.

6- Conclusion. What is the next step? Modeling investigations to explain the results? Is it feasible with current cloud chemistry models? Please discuss.

Minor comments:

1- Please add in the table 1, pH values for each FCE.

2- Figure 1. Please indicate the total concentrations of measured chemicals for each FCE. This will help the readers.

Reference: Snider, J. R., D. C. Montague, and G. Vali : Hydrogen peroxide retention in rime ice, J. Geophys. Res., 97 (D7), 7569–7578, 1992.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 24311, 2015.