

Interactive comment on “Uptake of nitric acid, ammonia, and organics in orographic clouds: Mass spectrometric analyses of droplet residual and interstitial aerosol particles” by J. Schneider et al.

Anonymous Referee #4

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This work provided comprehensive measurements during HCCT-2010 campaign at the Schmucke mountain site towards to understand the cloud properties. The simultaneous measurement of cloud droplets residues and interstitial aerosols with two AMS highlight the role of cloud processing in enriching aerosol particles by uptake of reactive gas species. This kind of dataset with high quality is rarely obtained and of great value. The analysis of temperature dependence of mass fraction of nitrate and distribution of f44 and f43 shone a light on the uptake/scavenging process of the chemicals, indicating the adverse effect of temperature on the uptake of nitric acid gases and more oxidized organics onto cloud droplets. Moreover, the organic nitrate concentration in

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cloud droplet residual (CDR) is discussed as well. A positive correlation between organic nitrate in CDR and temperature was suggested. In addition, the authors have added a case study to further compare the effect of activation of nitrate containing particles and uptake of nitric acid gas onto cloud droplets and therefore making the whole article a thorough and logical analysis of the chemical composition evolution between CCN, precursor gases, interstitial aerosol and cloud droplet residual. In general, the conclusion was reasonably supported by the data and analysis. The manuscript was overall well written. I recommend this work can be published after some minor revision.

P.2 line 15-25 The formula of molecule shall be rewritten with subscripts.

P.3 line 30 Please clarify the “similarity” of trajectories. Is it subjective or did you use any objective method?

P.5 line 4 Please unify the expression of temperature unit (‘-’ or ‘minus’) according to the ACP writing instructions.

P.8 line 1-14 The map of trajectories in figure 1 are somehow changed, making it difficult to understand the exact properties of different trajectories like length of path or the location of polluted regions. Please offer some vertical description like the height of air mass’s center. It may help to understand the uptake of gases if there were no precursor measurements.

P.8 line 35 The conclusion drawn here shall be more careful, since if the fraction of nitrate in CDR was elevated, the out-of-cloud aerosol could have an elevated fraction of nitrate as well due to the evaporation or re-partitioning.

P.10 line 18, Considering that the uptake of nitric acid gas, ammonia and organics caused elevation of corresponding CDR compositions, the authors should be more careful to use the term of “xx% of total submicron aerosol mass partitioned in to cloud phase”, which is very likely to lead to a misunderstanding that the CDR composition came all from aerosols.

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P.14 line 15-20 The abundance of a certain chemical composition is not always equal to formation. Only by taking the ratio and the absolute concentration into consideration could tell one if there is formation of the specie. Therefore, the difference here might indicate different mechanisms or different form of organic nitrates.

P.14 line 24, Rephrase “our CDR data do not such a clear trend:”.

P.16 line 30, A $r^2=0.32$ could not be described as “significant linear correlation”.

P.35 Figure 9, There is approximate of O:C on the right axis in the upper panel while it's absent in the lower panel.

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