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Atmospheric
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Discussions

Interactive comment on "Amino acids in Arctic aerosols" *by* E. Scalabrin et al.

Anonymous Referee #2

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The paper describes measurements of amino acids on Svalbard Islands in summer 2010. They are interpreted with the help of back trajectories calculated with the HYSPLIT model. The sampling procedure and the chemical analyses are well described but the interpretation of the results and the conclusions drawn from the combination of the observed concentrations with back trajectories leaves a number of doubts. In particular, the back trajectories need to be re-calculated for more than one arrival time and then again interpreted. I do not agree that the influence of volcanic emissions on some of the observations could be shown

The paper needs to be carefully revised to be appropriate for publication in ACP. The authors need to explain in a better way which conclusions can be drawn from the results of their observations.

My specific major comments are as follows:

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p 1, l 14: “The wide range of amino acid reactivities suggest that amino acids may serve as markers of atmospheric transport and deposition of particles” Why? Could you explain this with one sentence?

P 2, l 8: “Amino acids can beinvolved in cloud formation or act as ice-forming nuclei due to their hygroscopicity (Szyrmer and Zawadzki, 1997) and affect atmospheric radiation balance and climate (Chan et al., 2005).” This is true for all kinds of aerosols and does not justify why you have a special look at amino acids. Their share in the total aerosol mass is likely very small, so why should you study them? One reason could of course be that they are markers for certain types of aerosol sources but you did not explain which sources are represented by which type of amino acids.

P2, 1 16: “Free amino acids (FAAs) are particularly bioavailable and therefore may also significantly contribute to organic nitrogen and carbon in atmospheric depositions “: How much is “significantly”?

P2, l 28: If they are detected in tobacco smoke, why does this show that they are associated with combustion-derived aerosols? The product of a combustion process depends on what is burned. I wouldn’t agree that tobacco represents a number of different combustion processes.

P3, l 5; “During the Arctic summer, aerosol chemical compositions are strongly affected by local natural emission sources and aerosol concentrations are comparable to the Antarctic flux.” So you expect that your summer measurements are mainly influenced by local sources. If this is true, why do you take 4-5 days back trajectories into account?

P3, l 8: “This increased input of FAAs from Eurasia has the potential to alter regional bioavailability of organic nitrogen as well as changing the formation of cloud condensation nuclei, and by extension, regional cloudiness and precipitation.” This sounds a bit exaggerated taking into account that amino acids are only a small fraction of the total aerosol. Could you say how big their share in the total aerosol mass is?

P3, l 12-23: Why did you choose these compounds? Why is it interesting to look at different size classes? Please explain these questions to the reader.

P3, l 27/28: You should say here how long the sampling periods are.

P3, l 28: Why did you focus on summer? Just for practical reasons or because of a scientific hypothesis that is not mentioned here?

P4, l 23: Please explain why the filter is broken into pieces.

P4, section 2.3: What happens after the described steps? Which volumes were used for the final analysis?

P5, section 2.4: What are the recovery rates of the standards?

P5, section 2.5: What were the concentrations in the blanks? You refer only to the standard deviations. What is the relation of the LOD to the minimum detectable concentration in air?

P5, l 30: “Of the 17 collected samples, 9 were analyzed in all 6 of the size ranges. For the other 8 samples, only the background (< 0.49 μm) filters were analyzed.” Please give the reason for this.

P6, l 3: “Samples collected during the first week of May have the highest concentrations, with total FAA concentrations double than those collected from June 6-16.” Why do you compare these two periods?

P6, l 11 -19: Which conclusions can you draw from a comparison to other observations reported in the literature? Are the amino acids of marine origin?

P6, l 19: What is meant here with “profiles”?

P6, l 33: So virus and bacteria are rather big. You need to explain this here.

P7, l 7: If the large particles originate from bubble bursting, why don’t you see them all the time? Is there any hint that bubble bursting was particularly dominant as a source of amino compounds connected with large particles during these two periods?

P7, l 12-20: What does this tell me? Can you draw any conclusions from this?

P8, l 8-11: Again my question is if tobacco smoke is representative for biomass burning in general.

P8, l 14: you should not call volcanic ash “smoke”.

P 8, l 12-26: I would doubt that this is a proof that FAAs from Eyjafjallajoekull were detected. Do you have any other indication that volcanic ash was in your samples? If you calculate the trajectories for arrival heights of 2500, 5000 and 7000m: What does this tell you? These air masses were not detected at 500 m altitude where your sampler is located.
Were ultrafine particles emitted from the volcano or what are the corresponding precursor gases that stem from the volcano?
The back trajectories may indeed help you to interpret your results but I have the impression that you used them in a wrong way. Why do you have only one trajectory for the entire sampling period? Is this the trajectory that arrives at the sampling site at the end of the period? If you collect for 131 to 246 hours you need to take all trajectories that arrive during this time at your sampling point into account. It might be sufficient to consider 2 trajectories per day, but you cannot use just one for the entire period. This is a severe problem for your entire interpretation. You need to solve this.

P9, l 5: “ . . .suggesting that during the Arctic summer regional aerosol concentrations are significantly less than boreal winter and spring concentrations.” What is the reason for these differences? Is it due to transport patterns or due to missing sources?

P9, l 12-14: Generally, one would expect that the longer the aerosol particles stay in the atmosphere the more they will be found in larger size classes and in the accumulation mode with a size of about 1 micrometer. How does that fit with your observations?

P9, l 16: What is the half life of MetSO_2?

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P9, l 20: “The mean Met/MetSO ratio was 0.4 ± 0.1 indicating the contribution of mid-distance (10s to 100s of kms) aerosol sources.” How exactly do you come to this conclusion?

P10, l 19: “Tyr and Ser are reactive and hydrophilic compounds, while Pro and Val are hydrophobic, so the relation between the four compounds appears to be more affected by source differences than by similar chemical behaviors.” I do not understand this point. Why do they cluster if their sources and their chemical behaviour is so different?

P11, Conclusions: It would be good to know which of the “classical” compounds were found in the aerosol samples, e.g. sea salt, nitrate, sulphate, etc, to facilitate the interpretation of the results. I do not agree that you proved and influence of volcanic activity for May 13-19 period.

P12, l 2: “Numerical simulations demonstrate that the sea spray height and transfer of local sea spray aerosols to Svalbard depends on surface wind speeds (Doernbrack et al., 2010) suggesting that marine FAAs may increase during times of increase wind speeds.” Did you see this, too? I assume that wind speed information is available.

P12, l 7: “ . . . although many of these originally marine aerosols contain aged sea salts that have reacted with atmospheric NO_x or HNO_3.” This was not shown in the paper before, although it would be of interest to know more about it.

Table 1. Table2: Why is MetSo not given in Table 1?

Table 2: Why is the mean for Ser given as $3 \cdot 10^2$ while the median is 262? How can the mean be less accurate in terms of valid digits than the median?

Figures 3 and 4: As mentioned earlier: I do not think that this analysis has been done in a proper way.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 17367, 2012.