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Interactive comment on “A synthetic ice core approach to estimate ion relocation in an ice field site experiencing periodical melt; a case study on Lomonosovfonna, Svalbard” by C. P. Vega et al.

Anonymous Referee #2

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This paper describes relocation and eluent of ion species in snowpack by the effect of melt water at Lomonosovfonna, Svalbard. The authors compiled data of chemical profiles in 1 year dry snowpack observed in 2008, 2009, 2010 and 2011, and constructed “synthetic ice core” profiles as a reference profiles which were not affected by melt water to compare chemical profiles after effect of melt water. The study and discussion of the relocation/eluent processes using field snowpack are very valuable and the approach of “synthetic ice core” is excellent. The results obtained in this study are very important not only to understand chemical characteristics in Lomonosovfonna, but also to study “wet” ice cores obtained from sub-polar or alpine glaciers. However, I think there are issues that have to be clarified and presented more thoroughly. I have

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described them below.

Major comments

1. In the latter part of 3.4 Synthetic ice core, the authors estimated relocation length of ion species from the distance between maximum (deposition) peaks and minimum (elution) peak in Figure 8. When surface melting occurs, melt water washed out the ion species from initial depth to deeper depth. Therefore, elution peaks should appear above deposition peaks. However, elution peaks of all ion species appeared below deposition peak in Figure 8. Consequently, the distances between elution peaks and deposition peaks in Figure 8 are not relocation length. The authors should clarify their discussions about the relocation length. In addition, I could not understand the reason why the secondary relocation length was adopted for only nitrate.

2. The authors estimated amount of melt water product from PDD estimation, snow-energy model and snow densification model in the chapter 3.5. I suggest that the discussion about the comparisons of these values to melt water product estimated by ion relocation behaviors such as melt index should be included in this chapter. The authors mentioned them only in abstract, but did not describe the details of the estimation in text and conclusions. I believe that the evaluation of melt product estimated by the profiles of ion species is important information to develop the studies of “wet ice core”.

Minor comments

In chapter 3.2 and Table 3, the authors showed that the correlation coefficients in LF-08 and LF-09, and it was different from that in LF-97 and LF-08. The authors should describe discussion about the results, and relations of the result to the subject of this study.

I could not read how the authors estimated the snow accumulation by LF-syn core in Figure 6 right. Please describe the details of the estimation.

Geographical name (Sveagruba and Nordenskioldbreen) should be described in the

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map of Figure 1.

P.5063 L. 16: “LF-09 and LF-09” -> “LF-08 and LF-09”

Table 3: Description about the bottom table (LF-08 and LF-09 ice cores) should be added.

Interactive comment on The Cryosphere Discuss., 9, 5053, 2015.

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