

Reply to Co-editor, Dr. Sergey A. Nizkorodov,

We would like to thank you for your comments. Our manuscript was corrected on basis of your comments. Corrected parts were shown by red words in the text (please show the pdf file).

**Comments:** I encourage the authors to make writing more succinct, especially in the sections describing their observations.

**Reply:** We arranged the sections of “Sampling and analysis” and removed some sentences.

**Comments:** P1, L12 and L14: charge on the iodine ion is missing, perhaps you need to explain that you mean the sum of all forms of iodine (in the abstract and also in the analysis section)

**Reply:** We used ICP-MS for determination of iodine in frost flowers and brines. Because ICP-MS can provide only the elemental concentrations, iodine (or I) is correct here. In order to avoid misunderstanding of readers, we changed from “I” to “iodine” in abstract. In analytical section, we add short explanation about this reply.

**Comments:** Figure 4: I recommend starting all axes from 0 in the in Br<sup>-</sup> vs. Na<sup>+</sup> plot, and I vs Na<sup>+</sup> plot.

**Reply:** We modified the plots (starting all axes from 0) in Figures 4, S3 and S5.

**Comments:** P2, L24: “abilities of” -> “abilities to act as”

**Reply:** We updated the wording on basis of your comment.

**Comments:** P3, L12: “presents simultaneous observations of frost flowers, brine” -> “shows the locations where simultaneous observations of frost flowers, brine ... were made”

**Reply:** We updated the wording on basis of your comment.

**Comments:** P4, L14: “sucking” -> “flow rate”

**Reply:** Because 1L is not flow rate but air volume. We arranged a few sentences in this explanation.

**Comments:** P5, L2: please verify that the dilution factor of  $1E6$  is not a typo, it appears to be too high

**Reply:**  $10^6$  is not typo. Because concentrations in frost flowers and brine was higher than that in seawater,  $10^6$ -dilution was suitable for the analytical conditions in this study.

**Comments:** P5, L19: “in accordance with” -> “described by”

**Reply:** We updated the wording on basis of your comment.

**Comments:** P7, L6: “the Br- and I concentrations in the snow samples were not found.” – “the Br- and I concentrations were below the limit of detection” (also correct the same P14, L2)

**Reply:** We checked the words. In this study, we did not determined Br- and I in snow samples. Therefore, we changed the sentence to “the Br- and I concentrations were not determined”.

**Comments:** The discussion on pages 7 and 8 is difficult to follow. Is the main point of the discussion to prove that mirabilite precipitation was occurring? I think this point can be conveyed using much less text.

**Reply:** In page 7, we focused mainly on mirabilite precipitation and change of the ratios by mirabilite precipitation. In page 8, we attempt to show heterogeneous distribution of sea-salts in frost flowers, brines, snow. We arranged the discussion and added some comments to follow easily.

**Comments:** P10, L11: “had a liquid surface in the atmosphere. In other words, the particles were deliquescent in the atmosphere.” -> “were deliquesced in the atmosphere”

**Reply:** This sentence, “In other words~in the atmosphere”, was removed from the text, because of other comment (as mentioned below).

**Comments:** Figure 8: explain the meaning of stars in the figure caption

**Reply:** Explanation about asterisks was added in caption of Fig. 8.

**Comments:** P11,L17: “wholly Cl released sea-salt particles by  $SO_4^{2-}$ ” -> “sea-salt particles in which chloride was completely displaced by sulfate”. Also please fix other awkward definitions of particle classes in this sentence.

**Reply:** We updated the wording on basis of your comment.

**Comments:** P13, L13: This explanation: “It is noteworthy that molar ratios in frost flowers cannot change ...” is important for understanding the results of this paper and should appear earlier, perhaps in the introduction section. Otherwise readers will wonder where the precipitates go and will not find out until they get to the end of the paper.

**Reply:** Some explanation about locations where sea-salt precipitation is going on in was added in “Introduction”.

**Comments:** P14, L16: This sentence “In other words ...” repeats information in the previous sentence and is redundant (such redundancies actually happen in multiple places in the paper, I would try to eliminate them if possible).

**Reply:** We found the sentences using “In other words” in Page 10, 13, 14, and 16. The sentence in page 10 was removed. Because of importance, the sentences in Page 13 remained in the text. The sentences Pages 14 and 16 were arranged in the text.