



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-1395-RC1>, 2022
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Comment on egusphere-2022-1395

Anonymous Referee #1

Referee comment on "Revealing the chemical characteristics of Arctic low-level cloud residuals – in situ observations from a mountain site" by Yvette Gramlich et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-1395-RC1>, 2022

This paper reports the chemical composition of cloud residuals from the mountain-top field observatory in the European sector of the Arctic, where mixed-phase clouds are frequently observed. The authors' research approach of employing a combination of a counterflow virtual impactor and an advanced chemical ionization mass spectrometer is properly discussed, and the authors also appropriately discuss the limitation of their techniques (e.g., L307-320; L648-658). The results of a yearlong observation/analysis by the authors for their study period/location suggest that the composition of cloud residuals is not substantially unique as compared to general aerosol composition (especially organics), and thereby, the size may be a dominant factor for defining the particle's ability to serve as cloud seeds (unless otherwise other physical properties, such as mixing state, or compositions that are not detectable by FIGAERO-CIMS etc.). Overall, the manuscript is well-written. The findings of this study are worth publishing and being shared amongst the research community. This reviewer supports the publication of this paper in ACP after minor and technical revisions.

[Minor comments]

L121-124: The reader, who is not familiar with the visibility measurement, would appreciate a bit more general description of how the visibility is measured and how the 1000 m visibility threshold is determined. The reviewer is aware that the authors cite Karlsson et al. later on; however, the current statement seems too concise to understand how valid this threshold is.

L204-213: This part seems a better fit in Sect. 2.3 as it is explicitly about GCVI.

L211: All FIGAERO-CIMS signals for cloud residuals (e.g., Fig. 8 during) were also corrected by k ?

Table 1: Please define whether the given time stamps are in UTC or local time. More importantly, the reviewer suggests that the authors add another column listing the ratio of counterflow to input flow (refer to Fig. 5 of Kulkarni et al., 2011; DOI: 10.1080/02786826.2010.539291). Doing this might clarify how the GCVI was operated to the reader without adding too much text.

L464-465: The authors state that a high Aitken-mode particle fraction coincides with a high MSA signal. This seems not the case for the June 27-2 period as the MSA signal of June 27-2 is at the level of May 21 and other winter periods. Perhaps, rephrasing this part to "... with the MSA/SA of >10 while detecting absolute MSA signal of XX ions" would more precisely reflect what Fig. 6 infers?

Fig. 7a, L25-26, L587-589: The air masses did not get impacted by precipitation and wet-deposition of aerosols during 5-day backward trajectory history? In other words, does accounting for precipitation change the air mass origin? The reviewer is asking this since some studies set the rainfall thresh (e.g., 7 mm in Gong et al. (2020)) and, if necessary, reclassify the air mass origin to account for potential wash-out of aerosols in tracked air mass (Gong et al., 2020; DOI: 10.5194/acp-20-1431-2020).

L575-577: While the authors are using careful language here, the reviewer is a bit skeptical about the statement regarding the contribution of lactic acid to INP. Are there any previous studies vilifying lactic acid can act as INP? As the authors might know, the population of atmospheric INPs is a tiny fraction of total ambient aerosol particles, and there may be a chance that the foreign compound(s), which would not be detectable with FIGAERO-CIMS and coincidentally/inherently mixed with lactic acid, trigger(s) ice nucleation. In the reviewer's opinion, this statement is only valid if we know all the ambient droplets have a size smaller than the GCVI cut-off size (<6-7 micron, right?) and if the authors were able to extract only ice residuals. The reviewer presumes this was not the case as the ambient droplet size typically exceeds 10 micron in diameter, and the cut-size of GCVI is not flexible to extract the large particle residuals. Please re-clarify and elaborate on this point.

L593-594 & Fig. 8c during: What is the implication of a virtually equal MSA signal to the SA signal here? Based on the previous statement (L454-456), wouldn't it infer that aerosols measured for the 'during' period is dominantly anthropogenic?

[Technical comments]

P3L109: The abbreviation of NASCENT should be given in its first appearance – L103.

L237: --> Karlsson et al. (2021),

L576: INP is abbreviated in L43. The authors may double-check all the abbreviations in this manuscript.