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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Microphysical investigation of the seeder and feeder region of an Alpine mixed-phase cloud" *by* Fabiola Ramelli et al.

Anonymous Referee #2

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Ramelli et al. presents remote and in situ observations of a mixed phase cloud in the Swizz Alps and discusses the processes responsible for the origin of the ice. The paper is well written, and the figures are high quality. The range of measurement techniques in this study are impressive and should provide a useful dataset for further process studies. However, I found the discussion of the origin of ice speculative and I am not sure how much it adds over previous studies other than stressing the importance of secondary ice processes and the difficulties in quantifying them. Despite this, I did find the case study interesting and the paper should be suitable for publication with relatively minor revisions.

I would like to see further discussion regarding the instrumentation used in the paper and their respective uncertainties. Currently uncertainties are not discussed making it difficult to assess the strength of the relationships between INP and ice number concentration.

Section 2- The paragraphs in this section are very long. At a minimum each type of instrument should be a separate paragraph. You could also have separate subsections for remote sensing and in situ instruments.

Page 4 line 105 to 107. More information is needed about how LWP is retrieved and its uncertainty.

Page 4 line 114 to 119. It is not clear what you mean by classification here. Is it referring to the process of separating 'real' particles from noise in the holograms? You need to discuss the uncertainty in this process and the resulting uncertainty in the ice and droplet concentrations.

Page 5 –Saying the uncertainty in the derived concentration is one order of magnitude needs further justification. The uncertainty is not necessarily the same as Buhl et al., 2019 (different radar, microphysics etc). You need a much more thorough description of this method and its uncertainties.

Page 6 line 145 – What is the instrumental uncertainty and how is it calculated.

Page 8 line 193 – remove 'more easily'.

Page 10 line 209 – 'Ice crystals were especially observed when fallstreaks of enhanced. . .' please rephrase e.g. 'Ice crystal concentrations were higher when fallstreaks. . .'

Page 12 line 215 – Is the radiometer sensitive to ice crystals.

Page 13 line 260 – Since this is a relatively new analysis technique a bit more information about how the peaktree analysis works would be useful.

Page 17 line 291 – You assume that the ice particles >500um formed near cloud top, to place this in context you should include the total ice crystal concentration with your comparison with INP in Figure 11. What is the counting uncertainty on the ice crystal concentrations?

Page 17 line 295 – The observed INP vs T relationships (Figure 10) show a high degree of variability. Yet none of this variability is accounted for in the INP concentration you derive for cloud top. You could use this variability to estimate the upper and lower bounds of INP concentration.

Figure 14. Were the ice crystal images manually classified into habits?

Page 24 line 437 to 439. The uncertainty on the factor 3.3 and 1.2 is likely extremely large. If you are going to include these numbers, you need to include some discussion about their uncertainty.

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