

## ***Interactive comment on “Properties of Arctic liquid and mixed phase clouds from ship-borne Cloudnet observations during ACSE 2014” by Peggy Achtert et al.***

### **Anonymous Referee #3**

Received and published: 23 April 2020

General global comment:

This paper documents the geometrical and microphysical properties of Arctic clouds from observations based on remote sensing instruments onboard the Oden vessel during the 3 months of the ACSE experiment. The authors focused on cloud properties during summer and autumn seasons and differences are highlighted.

I think the data and results presented in this manuscript are useful since Arctic clouds are still less documented than their mid-latitude or tropical counterparts. Moreover, the study area is very large since it extends from Tromsø to Barrow, so the present results are representative of the Arctic region.

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My main comments are below:

- My first main remark is that the authors could greatly enhance the discussion of the results by including the environmental conditions when comparing the cloud properties (and not limit only to the comparison between summer and autumn). Indeed, I think the paper would be greatly improved by a section presenting the meteorological conditions during ACSE. Not a detailed characterization of course, but at least some statistics about environmental parameters (temperature, humidity, winds, air mass origins) in order to identify the main regimes encountered during the experiment. In this new section, you may include for example the description of the WAA events.

- Moreover, since all the results are based on remote sensing measurements, I think the authors could develop the uncertainties and limitations of such instrumentation in more details.

- You compare your results with satellite observations, but not to in situ measurements. I would suggest to do it, keeping in mind that in situ measurements remain very localized in time and space.

- Line 96: Please, could you explain how is used the training dataset in the radiometer retrieval algorithm and why you could not use the radiosondes from ACSE? Moreover, in this section 2.2, you mention the radiosondes and the vertical profiles of temperature and humidity made during ACSE. I suggest the authors to show some statistics/figures about these data to present the context of your results (you may include them in the “meteorological conditions”, cf. previous comment).

- The presented statistics are made for each identified cloud layer. Since you analyze up to three by profiles (cf. line 166), I think it could be interesting to calculate the ratio of single layer cloud vs multilayer cloud (with keeping in mind this maximum limit of 3 layers).

- In lines 122 to 131 you present the target classification. The readability would be

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enhanced with a schemed summarizing this classification.

- Was there an instrument on board to measure the precipitation? It could be of great interest to identify the precipitating clouds from the non-precipitating. Precipitation is closely linked to cloud properties and is a key factor but still difficult to assess. Also, it would help the discussion, for example in lines 373-374 on the IWC profiles.

Technical corrections:

- Do all the instruments work well all along the 3 months? You should mention it and if there is some missing data. - Line 91: typo : “and was” - Line 175: typo: “summer and winter” - Line 254: error on unities in “ 0.25 to 0.75 g.m-3 ”. You mean 0.025 to 0.075 ? - Line 331: Quote the previous studies please. - Line 386: error in unity: “ 100g.m-3 ”.

Here are some typos in the reference list:

- Line 40: Karlsson and Svensson instead of Karlsson? - Line 100: Crewell and Lohnert instead of Crewell et al? - Line 284: is it Shupe et al (2006) or Shupe (2007) ? - Line 497: Shupe (2011a) not present in the text. - Line 499: 2011b at the end of citation - Line 518: 2014 at

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-56>, 2020.

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