

## ***Interactive comment on “Ice particle properties of Arctic cirrus” by Veronika Wolf et al.***

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Manuscript: Ice particle properties of Arctic cirrus Referee comments: Overall: This manuscript needs to be improved significantly. There are many issues related to text flow and scientific understanding of the Arctic cirrus clouds, check on cirrus dynamics from SHEBA project. .... Results are also contradictory for the theory of parameterizations and needs to be clarified. More cases wrt satellite and lidar/radar should be used and connected to IC concentrations. Presently content is poorly written and not discussed based on other works in the Arctic clouds. Specifically, liquid origin and local origin concepts are misleading formation of these clouds. There are many issues with this paper and they are listed as: 1. abstract is not given explicitly; no info on what kind of balloon being used? 2. what sensors are used? 3. no meaning of liquid clouds at cirrus level? Not good naming, and very confusing. 4. in-situ origin cloud? Cirrus form due to IN and its properties are related to local or advection. 5. how do you explain the

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liquid origin and local origin? This doesn't make sense; and you don't have a mechanism to explain it. 6. 61% compact??? And 25% irregular, is this a resolution issue? Seems to me it is resolution issue unless you have a proof of it. 7. page2; no shattering at this level because already they are small, take out refs on this. Balloon is not like airplane. .8. what parameterizations? 9. “we detect particles. ....” no you don't, sensor does. 10. depends on ambient conditions. .... do not include waves, systems, and temperature together. ... Confusing and not meaningful. What is role of T wrt waves or systems. Talk about its physics, T ok. 11. For these reasons????? What reasons? 12. introduction is confusing and not clear. 13. location; what level (height) measurements were taken? Is this cirrus or arctic BL cloud? 14; what is the in-situ imager? Imager of what? name should be ice crystal imaging probe or similar. .... ICIP???? Check your earlier works, it says differently. 15. what is the compact means? I feel these are not resolved particles, out of focus particles. 16. page 4; lidar extinction? You should include some work here on this. 17. radar and lidar images were not clearly used to support cirrus dynamics. But they should. Not enough to say water origin or local origin. Table 1 should state height levels. Figure 2; size of these particles should be in the image. Again, what is the meaning of compact? Page 6; shows how did you use satellite images, show a case. Page 7; smaller particles are not efficiently sampled. .... how small? Page 8; Table 2; at >-60C, you have more IN, why you have these??? But not always true? It is against IN parameterizations, explain it. Fig 4; liquid origin? How do you know? Page 10; higher than this in liquid origin? Why? This is against the nature of formation again. Figure 5; what is the uncertainty in Ni measurements? and what is the time period for collection of Ni? How did you calculate Ni? Figure 6; this figure useless; need to show sampling time, and number of points used in Ni calculations. Need to show all other cases. Ni is calculated what? TAS? Sampling area? Etc. Fig. 7; you need to show calculation of ext here. Also you need to show at least cases with extreme conditions such as Ni~5 and Ni~300 L-1, and then discuss it. Fig. 7b; why the Vd given at the BL is important for cirrus level? Don't you have a figure for cirrus level? You need a comparison table or figure for outcome of this work. Then explain

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what the results are significantly different.

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