

## ***Interactive comment on “First Look at the Occurrence of Horizontally Oriented Ice Crystals over Summit, Greenland” by Sebastian Cole et al.***

### **Anonymous Referee #2**

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In this paper, the authors use one year of lidar measurements acquired at Summit, Greenland, to analyse the occurrence of oriented ice crystals in clouds. They make some statistics on the frequency of occurrence with respect to atmospheric variables such as temperature, wind, humidity, or cloud height. Although these variables vary widely, within a range that is mostly similar between clouds with and without oriented particles, the authors claim that the mean values are different, and that the differences are significant. They attempt a physical interpretation of the differences.

The manuscript is not acceptable for publication in ACP for several reasons

The main reason is that, contradictory to the authors claim, the differences between the means of the various variables are most likely non significant. Indeed, Figures 8, 9 and 10 clearly show that the variability of the atmospheric parameters are very large in

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comparison to the differences between the means (with and without oriented particles). The means are computed based on a few tens of days. How can they found these differences to be significant at the 95% level ? The answer lies in a sentence at the bottom of page 12, where the authors say that the statistics are based on more than 50 000 data points. It is then clear that they use the lidar data at a high temporal resolution. The authors fail to appreciate that the data point are then not independent (ie many observations for a single clouds), when their assessment of the representativeness of the difference assumes independent data.

Then, in section 4, there is a strong tendency to attempts interpretations of the differences found on the various atmospheric parameters (for cases with or without oriented particles) without any consideration of the large variability of these parameters (much larger than the difference). The interpretation made is based on very little ground. Clearly, for the atmospheric variables that have been tested, there are no significant differences between clouds with and without oriented particles. It is then fruitless to attempt any interpretation of the atmospheric conditions that are favourable for the formation of such particles.

Finally, I would like to stress that the author justify their research in the introduction by the specific radiative effect of oriented particles in clouds. Indeed, an oriented particle may have a cross section for the incoming solar radiation that is different from that of its non-oriented counterpart. Yet, the author do not seem to be aware that, even when oriented particles are present in a cloud, they constitute a very small fraction of the total so that the overall radiative effect is insignificant.

There are other problems in this manuscript, such as many redundancies, too many figures, and poor interpretations of the results. However, because of the major problem presented above, there is no point in discussing them further.

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