

## ***Interactive comment on “Ice crystal number concentration from measurements of lidar, cloud radar and radar wind profiler” by Johannes Bühl et al.***

### **Anonymous Referee #1**

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The derivation of ice crystal number concentration is an important task to better understand the effect on and off ice clouds. This paper presents a method to derive the ice crystal number concentration from a set of active remote sensing instruments and is thus highly suited for presentation in AMT. I suggest only a few minor points that could be addressed before publication of this article:

In your introduction you describe shortly current existing methods to derive ice crystal number concentration, i.e. using lidar and radar or multi-wavelength radar methods. You mention that each of this method has its limitations. In your method you use a combination of either CR+RWP or CR+lidar. What is the detection limit of the differ-

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ent instruments to detect clouds? Can you give an assumption of the benefit of the proposed method in comparison to the others mentioned here (number)? What about regions with very low ice optical thickness / very small ice crystals where only lidar measurements can detect the cloud? Isn't there still a limitation with this method to investigate ice crystal number concentration for these thin clouds. This should be addressed in the manuscript.

You do your study using side planes and column-like particles. How different would it look like, if other shapes are taken into account. Are these particle shapes enough to address all regions / stages of the cloud? What about small pristine ice particles?

The description of the results is very short.

The results for using CR+RWP and CR+lidar look quite different (Figure 8). Can you give a better comparison of the both methods. How do you deal with that in your studies. Do you use the different methods for different parts of the clouds? If yes, how is that done? If no, what about clouds in which none of the methods can be applied for the whole cloud?

Can you give a more quantitative comparison of the results using the different assumed particle shapes?

Figure 5: Please use the same range of D for both methods.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-154, 2019.

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