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***Interactive comment on* “Estimating seasonal variations in cloud droplet number concentration over the boreal forest from satellite observations” by R. H. H. Janssen et al.**

Anonymous Referee #1

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The reviewed paper deals with the seasonal variation of cloud droplet concentrations and Cloud Condensation Nuclei (CCN) in stratiform clouds at Northern high latitudes above the boreal forest region. In the manuscript, the authors use MODIS remote sensing data together with a cloud model to calculate the cloud droplet concentrations over a period of 9 years and correlate them with aerosol data (total aerosol and CCN concentrations) from a ground station in Finland. Due to the limitation of the remote sensing retrieval only the months of April – September were studied.

A detailed discussion about the cloud model is provided including an uncertainty analysis for the different variables that play a role in this scheme.

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The manuscript continues long scientific effort to characterize the aerosol-cloud-climate feedbacks in this region and certainly fits the objectives and the topics of the journal Atmospheric Chemistry and Physics. The manuscript is recommended to be published in ACP following some revisions.

I would like to bring into a discussion few points that should be clarified or corrected in the paper.

1. Were there any problems to use MODIS data from the Aqua satellite? 2. I speculate that Fig. 3b can tell more than is stated in the manuscript. It looks like the bottom error bars for the months April to June are shorter as compared to later months. This implies that the modal size of the accumulation mode aerosol is smaller for those months i.e. less large aerosols are present. The low Reff measured for these months by MODIS can be related to the very low modal size of the aerosols (Fig. 3a) and not to the large number concentration of cloud droplets as calculated by the cloud model (Fig. 3b). In that case the cloud droplet number concentration from the cloud model should be revisited. While the authors claim later in the manuscript that cloud droplet activation is updraft limited, I wonder if the authors considered the above mentioned hypothesis.

3. I believe that some data about drizzle formation and precipitation in this region may support or disagree with the lack of correlation between ground aerosol concentration and cloud properties. Did the authors have any access to such data? I do suggest to search for documented data about precipitation in the ROI and study whether it agrees with the results.

4. p. 10004, line 12 – What is the meaning of the word “about”? 5. p. 10004, sec. 2.1 – A map of the ROI will be very helpful for the readers who are not familiar with the Hyytiala area. 6. p. 10005, line 11-14 – The sentence should be reworded 7. Fig. 6 – Further discussion is needed about the differences between the activation ratio definitions. Perhaps the authors can show what would be the activation ratios in the cases where they have data about aerosol concentration, CCN concentration and

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calculation of the cloud droplet concentrations.

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