Reply to comments by Anonymous Reviewer#1

This manuscript introduces a new, comprehensive atmospheric CCN data set based on aerosol reanalysis, and shortly investigates the performance of this proxy against observations and compared with an earlier proxy. The new CCN product introduced in the paper is highly relevant for aerosol-cloud climate investigations, and is anticipated to have a wide range of applications. This paper is scientifically robust, and very well written and structured. I have only a few, relatively minor, issues that should be fixed before accepting this paper for publication.
We thank the reviewer for reading the manuscript carefully and acknowledging the usefulness of the new CCN dataset.

The manuscript provides a valuable discussion on the problems associated with CCN estimated from AOD measurements (section 1). Related to this, although the new CCN proxy shows major improvements over the AOD-derived one, it is still far from perfect, as can be seen from Figures 3 and 4 and Table 3. The authors should better acknowledge the remaining uncertainties, rather than claiming a good agreement with measurements (lines 378-379).
We have rewritten this paragraph and added more information regarding the uncertainties of the model compared to the measurements.

The paper would benefit from a bit more detailed discussion (1-2 paragraphs) on what might cause the remaining problems with the new CCN proxy (see my previous comment), and what could be done to improve the proxy further. One clear issue related to this is the assumption of an external aerosol mixture in the aerosol reanalysis product. This poses certainly challenges for estimating CCN concentrations, as many of the simulated components (especially SU, OM and BC) are closer to internal than external mixtures in large parts of the atmosphere.
We have added a paragraph in the conclusions that summarises the limitations of the new CCN dataset and also included more about remaining uncertainties.
However, we cannot clearly say what causes deviations of the modeled CCN from measurements as there are a lot of criterias and assumptions just from the model site. It would not be valid to say that the proxy would be better if internal mixtures were assumed, even if they are closer to reality. It comes down to how the internal mixtures are described in their size distributions, how well interactions are parameterised. Another big source of uncertainty is the emission scheme as CCN depend very much on the availability of aerosols. This is something we cannot change in our model that computes CCN as we are dependent on the IFS model and the assimilation scheme used in CAMS.
In this regard, we have one specific hint about one specific location (PGH site) that we discuss further in the document.

Saying that the correlation between the CCN proxy and measured CCN concentration almost doubles when using the new CAMS-derived CCN proxy compared with AOD-derived CCN proxy (lines 400, 416 and 450) is not a statistically robust statement. For example, doubling the correlation from 0.49 to 0.98 would be a huge improvement, while doubling it from 0.01 to 0.02 would not help at all in practice. Please reword using statistically relevant measures in expressing the improvement in the new proxy compared with the old one.
Yes, we rephrased this part.

Finally, I do not understand what is meant by the last sentence in section 3.2 (lines 350-351).
Yes, we have deleted this sentence, as we actually do not analyse anthropogenic contribution as it is implicit to the dataset.