



EGUsphere, referee comment RC1  
<https://doi.org/10.5194/egusphere-2022-740-RC1>, 2022  
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## **Comment on egusphere-2022-740**

Anonymous Referee #1

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Referee comment on "Temperature and cloud condensation nuclei (CCN) sensitivity of orographic precipitation enhanced by a mixed-phase seeder–feeder mechanism: a case study for the 2015 Cumbria flood" by Julia Thomas et al., EGU sphere,  
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Review of the manuscript entitled: "Temperature and CCN sensitivity of orographic precipitation enhanced by a mixed-phase seeder-feeder mechanism".

The manuscript discusses the microphysical response of orographic precipitation to perturbations of temperature and cloud condensation nuclei (CCN) concentration. The authors provide technically sound analysis. There are, however, some comments that need to be addressed.

The manuscript contains English writing problems and needs to be carefully edited.

The first sentence of the Abstract is irrelevant to the subject of the manuscript and is better to be replaced by another sentence.

In the abstract and elsewhere, please replace "orographic rainfall" with "orographic precipitation"

It is better to remove the following sentence in the abstract or move it to the Introduction Section to have enough space to discuss the obtained results: "The study is motivated by the increased water vapour capacity of the atmosphere in a warming climate and the increasing frequency of extreme rainfall events."

Line 5: write out the full words for "ICON"

The Introduction is much weaker than the other parts of the manuscript and could be substantially improved. For example, the first paragraph of the Introduction does not provide any important information about the topic of the manuscript. It is irrelevant and can be omitted. Another example is in Line 22 where appropriate references and more clarification are required for the dynamic, thermodynamic, and microphysical contributions to precipitation changes under global warming. The microphysical contribution to precipitation changes is well discussed, but at least a few sentences can be added to explain the thermodynamic and dynamic contributions, particularly because the thermodynamic contribution to precipitation change is the main subject of the manuscript. As discussed in <http://dx.doi.org/10.1007/s10584-022-03316-z>, the precipitation response to climate change is regulated by two basic mechanisms, which include the wet-get-wetter mechanism and the warmer-get-wetter, both of which are referred to as the thermodynamic mechanism, while circulation changes under the impact of global warming which lead to precipitation changes are referred to as the dynamic change of precipitation.

Line 29: replace "by constant" with "be constant"

Line 34: Replace "English West coast" with "British West coast"

Line 45-46. Total precipitation might reduce or slightly change under a higher CCN concentration, but please note that some evidence suggests that heavy precipitation might increase in a polluted environment. For example, see the following paper: <http://dx.doi.org/10.1016/j.atmosres.2016.10.021>. This needs to be discussed in the Introduction, particularly because the importance of extreme precipitation and the risk of flooding is emphasized in the first paragraph of the introduction.

Line 49-50: This sentence does not mean anything: Which effect dominates highly depends on the synoptic conditions (e.g. whether convection is involved) and on the mountain geometry.

Line 56: westward or eastward?

Line 93: write out the full words in the first use of "DWD"

Parameterization schemes that are used for the boundary layer, radiation, etc. should be mentioned in Section 2.1

Lines 152-155: Rephrase the sentence.

Fig.4: It is better to start the label bar with white color representing zero value. Instead of using kg m<sup>-2</sup> for the unit of precipitation, please consider writing it as mm for this figure and the others, although the values do not change.

Line 198-201. It is expected that heavy precipitation experiences the highest increase in response to warming, while light precipitation experiences a slight change or even decrease. It is interesting to compare the obtained results with those of <http://dx.doi.org/10.1002/met.1724>. This paper is already cited in the Introduction, but here or in the discussion section you can compare your results with their results and discuss the reasons for such behavior. In this paper, it is noted that more hygroscopic aerosols in the atmosphere could potentially increase heavy precipitation but reduce light precipitation. The author argued that an ample influx of water vapour over the regions with heavy precipitation could contribute to an increase of heavy precipitation under a polluted atmosphere, while less efficient autoconversion processes and/or increased cloud-top evaporation may contribute to a decrease in light precipitation. Could the same reasons contribute to an increase in heavy precipitation and a decrease in light precipitation in response to warming in your study? Please clarify. Such discussions could improve the quality of the manuscript.

Line 282: remove "a" before "only"

Line 407: Replace "in climate change" with "under climate change"