

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-652

Anonymous Referee #1

Referee comment on "Aerosol–precipitation elevation dependence over the central Himalayas using cloud-resolving WRF-Chem numerical modeling" by Pramod Adhikari and John F. Mejia, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-652-RC1>, 2022

The study presents convection permitting simulations on how aerosol affects the amount of precipitation in the mountainous terrain. Although the results are very similar to earlier studies in similar environments, it nicely adds on existing literature and in the discussion references are adequately made. As the aerosol effect on precipitation is highly relevant especially in the locations vulnerable for climate change and changing aerosol emissions, the study fits well in the scope of ACP. I find the manuscript well written and have only a few comments I suggest being addressed before acceptance to the final publication.

As both ARI and ACI effects are analyzed, a more detailed information related to ACI would be needed. Currently there is no information about CCN or cloud droplet number concentrations and how those are affected by changing emissions. As the manuscript itself contains already quite many figures, these could be also provided as supplementary material, but discussed in the main text together with changes in updraft velocities and liquid/ice water content.

Minor comments

Lines 84-90: Barnan and Gokhale (2022) is later referenced, but as the aerosol effect is studied also there with quite similar setup as here, the clear difference between that and this study should be presented. The same holds also to Adhikari and Mejia (2022).

Line 190: Are the aerosol properties only altered in WRF-Chem simulation always employing the same boundary conditions from CAM-Chem? If so, is the domain large enough to exclude the aerosol effect caused by aerosol changes outside the boundaries of WRF-domain?

Line 194: Aerosol radiation “feedback” should probably be “interaction”.

3.1 Model Evaluation: It is well known that the relationship between AOD and CCN concentration might be very weak. Still there is no discussion how well the simulated aerosol size distribution matches with observations. Are such observations completely missing from the area?

Lines 297-299: It is difficult to see the elevational gradient in observed precipitation both using direct observations in Fig 5 or satellite data in Fig 6. Thus stating that model captures the elevational gradient based on data presented is quite strongly said and seems actually opposite that model simulations has a gradient nonexistent in the observations.