

## Review

This paper reports on aerosol-cloud interactions observed from satellite measurements and simulated with a high-resolution regional model (Unified Model) using the Holuhraun eruption as an opportunistic experiment. The authors find strong aerosol and “total” effects on cloud droplet number concentrations and effective radius due to the volcanic eruption with minimal and statistically insignificant responses to cloud fraction and liquid water path. The high-resolution of the UM allowed for sufficient realization of the cloud responses to the eruption as compared to more coarse model comparisons that were not as successful. However, uncertainties in the simulation of background aerosols in the UM may complicate these results. This is a fairly straightforward and clearly written paper that carefully walks through the differences in observed and simulated effects and the limitations of each data source in evaluating these differences. I believe this paper is suitable for this journal as it uses innovative approaches for quantifying aerosol-cloud interactions from an opportunistic experiment and provides recommendations for improving future efforts. The authors should consider the following minor comments, questions, and recommendations to improve the work before it should be published.

- Are the authors able to add titles to the sets of columns in Figure 1? Left: Simulated, Right: Satellite? This would allow for a more accessible direct comparison between the plots.
- The amount of underprediction in CDNC in the model seems rather notable. Is the magnitude of the CDNC underprediction similar to previous work using this and other models? Does the claim that background aerosols are likely to blame for this discrepancy consistent with underpredictions in other work or a known issue with this model? How does the out-of-plume model AOD compare to the satellite AOD to support this claim?
- In the discussion and conclusions, can the authors posit on the potential meteorological covariabilities that may lead to a reduction in the TOTAL and LOCATION effects for CDNC and Reff in week 3? Why did the authors not consider these effects and the other mentioned effects using cloud-controlling factors for this purpose?
- Can the authors briefly speak to some (if any) of the microphysical parameterization scheme differences that could lead to differences in effects between model datasets?
- Lines 468-469: has evidence of this semi-direct effect been suggested or shown in similar previous work? If so, the authors should provide citation here. If not, I still feel it appropriate for the authors to provide some citation to support this point of discussion.
- Lines 473-474 (answer to intro question 1): can the authors please provide a quantification of the CDNC and Reff increases/reductions?