

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-254

Anonymous Referee #3

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Referee comment on "Modelling the size distribution of aggregated volcanic ash and implications for operational atmospheric dispersion modelling" by Frances Beckett et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-254-RC2>, 2021

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The manuscript presents the introduction of an aggregation scheme for the NAME model, which is used by the London VAAC for volcanic ash transport simulations. Particle aggregation has been in the forefront of volcanological research for the past decade due to the influence it has on the deposition of fine particles and as such the introduction of the scheme in an operational model such as NAME is a significant step. Surprisingly, results suggest a second-order of magnitude impact in the case of the Eyjafjallajökull eruption (shown as a change in the cloud area).

[1] The manuscript is scientifically-valid and the description of the scheme is comprehensive. The text is well-written, but I feel that as a whole, the paper would benefit from a change in the structure, as in its current form it becomes sprawling, with lots of short, isolated sections (in the sense that the methodology, results and a short discussion is included: Section 3, 4 and 5 in the paper). There is also an over-reliance on abbreviations and the use of letters, that although introduced (Tables 1,2), make reading the manuscript very difficult (especially Section 4), unless the reader prints out Tables 1 and 2 to keep for reference. As I wrote in my short comment I believe that with its current structure the paper feels like a better match for Geoscientific Model Development as the description of the plume model and scheme are at the forefront. Still, as the editor has accepted the submission for ACP, I would suggest making some modifications towards a more 'traditional' paper structure, which I think would be easier for the reader. Specifically, I would move Section 2 to form an Appendix and add a new Section 2 as a methodology section, that introduces (in simple terms) NAME, the plume model, and the implementation of the aggregation scheme, followed by a better organized description of the different sensitivity tests carried out in the paper.

- Introduction
- Methodology
  - NAME and the implementation of the aggregation scheme (including only key elements of the current Section 2, with the detailed description as an appendix with Tables 1,2)
  - Sensitivity and scale analysis (including Tables 3-5 found in Section 3, 4)
  - Case study details (Table 5, Fig. 7)
- Parametric study
  - Sensitivity tests
  - Scale analysis
- Case study
- Discussion
- Limitations
- Conclusions

#### Appendix A. Detailed description of the aggregation scheme

[2] I feel that after the detailed discussion presented in Section 3, 4, the results in Section 5 are a bit underwhelming. Of course, results are what they are, but I was expecting a larger impact (also given the Egan et al. 2020 paper that focuses on the same eruption). It might also have to do with the quantity chosen (ie the cloud area), but since the model choices reflect operational VAAC simulations this is still a valuable result. One of the reasons I am suggesting a more traditional format also has to do with being able to better evaluate the model choices (when they are all presented at the same place). In any case, I think that this should be discussed in the 'Limitations' section.

Some minor comments have been added in the attached PDF document.

Overall, I feel that the inclusion of aggregation is NAME is an important step forward for the community and I suggest for publication of the paper after revisiting the paper structure and discussing the case study results in more detail. I would like to wish the writers the best of luck with the revisions.

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2021-254/acp-2021-254-RC2-supplement.pdf>