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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Modeling volcanic ash aggregation processes and related impacts on the April/May 2010 eruptions of Eyjafjallajökull Volcano with WRF-Chem" *by* Sean D. Egan et al.

Anonymous Referee #2

Received and published: 30 January 2020

This paper presents the implementation of a volcanic ash aggregation scheme into the WRF-Chem model. This aggregation scheme is described and applied to simulations of Eyja in 2010. There are two sets of simulations. Sensitivity studies to investigate the properties of the aggregation scheme are presented first, followed by a simulation of the whole Eyja eruption period in 2010. Results from this simulation are compared to in-situ measurements of the ash from DLR and tephra deposits taken over the UK. Overall the paper is well written and clear to follow and provides important evidence that these schemes can be successfully implemented in state-of-the-art VATDs.

General comments: Should aggregation uncertainty be considered in an emergency

response situation? Aggregation will only reduce the distal ash concentrations so maybe computational effort should be put into performing ensemble simulations that vary eruption plume height or the meteorological situation? Can WRF-CHEM be run in real-time emergency response situation? What over head is added by including the representation of aggregation?

Comments on the text:

Ensure that references in the main body of text are in chronological order

L29: Missing "and" between tools, the study of ash physics

L30: Could state what the characteristics of the plume are required for modelling.

L37: Unsure what you mean by plume corner here

L95-102: The text here seems a bit clumsy with section numbers and headings mentioned Would it be possible to include the equations and associated parameters in Table 1 in the main body of text? It would make it easier to follow.

L163: This should be equation 6

L180: This should be equation 7

L181: Refer to Table 3 so the reader knows the particle sizes that the bins refer to.

L205: "radar" missing

L216: You refer to 10km2 as high resolution. This maybe true when considering long range dispersion but is it high enough for modelling aggregation near the eruption plume?

L223: Are 48 hourly meteorological initialisations frequent sufficient?

L244: Why change from 48 hours to 24 hours?

L245: A table outlining the different sensitivity studies would aid the reader here.

L275: How representative is a Df=3.0 of the real world? Does Df vary from volcano to volcano?

L285: Why is the difference between 2.8 and 3.0 highlighted here. Is this unexpected?

L294: Is this jump that is highlighted unexpected?

L306: What are the implications for the different processes being dominant?

L317: The small effect of coupling the aggregation to water emissions seems important. Should this be highlighted more or is it very dependent on the volcano?

L334: 3.9 should be 8.

L334/335: Unsure of the use of “cast”, “show” would be clearer.

L345: How much computational expense? Do you have plans to do this?

L346: What does 9C refer to?

L350: Why do you think that there is such a discrepancy between the observations and WRF-CHEM during this time?

L377: 11(d) should be 10(d)

L400: Is wet deposition represented in WRF-CHEM? This can have a large impact on the long-range plume development.

L450: Unsure what is meant by global models here

Comments on Figures

There seems to be a mismatch between using lower case labels on plots and capital letters in the captions. Please make these consistent.

Figure 5: Think about colouring lines to make it easier for the reader to compare lines with same Df.

Figure 6: The subfigure labels are missing. There seems to be a grey bar between the panels. Reorder the legend to make it easier for the reader (e.g. No aggregation all in same column)

Figure 7: Rainbow colour scales are not suitable for people who have colour blindness. Please considering using a different colour scale. Unsure what “Note each time output is at 00hr” means.

Figure 8: As Figure 7 – please consider using a different colour scale.

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