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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 #1

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This work covers the very important topic of volcanic ash aggregation that must be taken into account when modeling the dispersion of volcanic clouds. Aggregation of volcanic particles shapes the size distribution of particles in the traveling plumes and affects the long range transport of ash with important implications for aviation safety. The authors develop a physically based WRF module to describe such processes with improved results compared to observations. Overall the paper is important and well written and I suggest publication with a few minor comments as seen below:

Specific comments

– Is the 10x10 km grid size adequate to discribe the near-source aggregates (<15km

distance from the volcano)? Could you consider a nested higher resolution grid over Iceland to address these processes? This may not be important for the long range transport since anyhow the bigger particles will be removed from the model but it could provide more insight on the processes and probably improved deposition fluxes near the erruption.

– Please check that the references are provided in chronological order throughout the text.

– In line 92 " As an example, FALL3D is typically initialized with a WRF model run that is executed prior to the dispersion model. Modeling particle dispersion with WRF-Chem is, therefore, as computationally feasible as running these models since in many cases, a mesoscale, gridded model must be run for their initialization". Indeed, but you can run multiple faster Lagrangian dispersion simulations with different configurations using a single meteorological output (e.g. WRF) which may be important for determining aviation hazard under different emission scenarios.

– "One peak concentration was observed at 15:30 UTC on April 19, which was not resolved by WRF-Chem (Fig. 8b). Typical of any Eulerian air quality model, WRF-Chem tends to diffuse ash concentrations, an effect that is also dependent on the model resolution." I suggest that you should elaborate more on this mismatch between model and observed ash concenntrations. Such high peaks are the primary threat for aviation and moreover these are observed at about 2km elevation which may imply approach or takeoff heights thus increasing the potential danger. This may not be due to Eulerian diffusion otherwise one would expect a more uniform reduction of the concentration fields. Could you please check the concentration at the surounding gridpoints to check if possibly such concentrations exist and are misplaced by the model ?

– "Without aggregation, the only sinks for volcanic ash are via settling or via the plume traveling out of the model domain." . Don't you condider also the wet removal from incloud and below cloud processes?

– I would suggest to extend the sensitivity analysis including not only the total domain mass but also the maximum traveling range from source for the various bins.

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