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Comments on "Adjusting particle-size distributions to account for aggregation in tephra-deposits model forecast" by Mastin et al.

This paper focus on constraining the particle size distribution (median and standard deviation for assumed Gaussian distributions in Φ) of volcanic ash aggregates. Optimal values are determined by best-fitting Ash3d model simulations with mapped deposits from 4 different well-studied events spanning over a wide range of erupted mass, intensity (column height), and granulometries. Despite the large differences in these eruptions, "model" optimal aggregate distributions are surprisingly similar, suggesting the possibility of a "cost-free" parameterization for operational forecast models that, at present, do not contemplate aggregation phenomena. This paper may not suppose a major advance from a theoretical point of view but I found it very pragmatic and very interesting for operational environments. For these reasons I do recommend its publication after addressing few minor/moderate comments detailed below.

- The parameterization scheme (section 3.2, lines 206-201) seems somehow arbitrary and could be better justified. On the other hand, if the TPSD is discretized on 1Φ intervals all the fines aggregate except for Φ=3, for which 50% of particles aggregate. This seems rather simplistic. To what extend the results depend on this choice? What if discretization is performed at 0.5Φ intervals and/or the limits are extended beyond Φ=4 (e.g. Φ=5 or 6)? Could the best-fit values (i.e. the conclusions of the paper) depend substantially on this?
- The authors find "optimal" values of aggregate density of about ρ_{aggr}=600 kg/m^3 consistent with (but denser than) previous studies and observations. It is important to mention that this is also a consequence of the settling velocity model chosen. Note that, for fine particles, the Wilson and Huang model gives smaller settling velocities than other fits (see e.g. Figure 1 in Folch 2012; Journal of Volcanology and Geothermal Research 235-236, 96–115). In other words, other velocity model using a smaller aggregate density would give exactly the same fit…

- Figure 2 is misleading because (at the beginning of the paper) gives the impression that only one aggregated bin is considered, contradicting the text. It would be much clearer if the distribution of aggregates is shown as an inset.
- Line 241-242. Values of settling velocity for a given particle strongly vary with height. Are these values at sea level or averaged?
- It is unclear to me how the modeled "dispersal axis" is obtained and why topography causes the oscillations observed in Figures 10-13.
- Line 320. Typo (And)
- Figure 10 and lines 322-327. The fact that diffusion can be ignored and still obtaining a reasonable fit is because the (Eulerian) model adds numerical diffusion. It is difficult to extract conclusions from here since this strongly depends on the numerical scheme, different from model to model.
- Line 428. "hundreds of thousands"? sure?
- Lines 424 to 444 in the discussion are rather speculative but interesting. I understand that the proposed "empirical" aggregation scheme would hold to model the finer aggregates (i.e. formed during transport), not for the larger aggregates (mm size) formed in the plume. That would explain why so different eruption conditions end up with similar mean and dispersal. Right?