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Interactive comment on "FALL3D-8.0: a computational model for atmospheric transport and deposition of particles, aerosols and radionuclides. Part I: model physics and numerics" *by* Arnau Folch et al.

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We thank reviewer#1 (Fabio Dioguardi) for his constructive review.

Q1. Abstract. I would like the authors to add some more explicit conclusive statements on the impact of the improvements of FALL3D, particularly the implication and possible future applications that are now possible thanks to the new features.

R1. We added the following sentence to the abstract: "All these new features and improvements have implications on operational model performance and allow, among

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Discussion paper

other, adding data assimilation and ensemble forecast in future releases."

Q2. Line 67-69. Could the authors provide more detail here? To my knowledge, all model parametrizations of the volcanic source (a part from more complex models) assume a relationship between plume height/trajectory and emission rate at the source, regardless the grainsize distribution. Hence, total emission rate should always apply to the whole granulometric spectrum. Why do the authors write "several"? Can they provide examples for which the above does not necessarily apply?

R2. Some resuspension schemes (e.g. for tephra or dust emission) give emission rate for each particle bin. This is not the case of volcanic plumes, for which emission schemes are always parameterized in terms of the total grainsize distribution. To avoid confusion we have replaced the word “several” by “volcanic plume source parameterisations”.

Q3. Line 118. I would like the authors to give more insight on the limitations/consequences of the "passive transport" assumption for solid particles here. Could they explain which is, e.g., the maximum particle size for which this assumption may be considered reasonable?

R3. The “passive transport” approach assumes that particles do not interact (dilute concentration) and that, except for the settling velocity term, are coupled with the carrier fluid. This means that the particle Stokes number is “low”, which in the case of air typically holds up to few millimeters. We added the following sentence: “Note that the passive transport equation (1) neglects inertial terms and, consequently, assumes low particle Stokes number."

Q4. Line 160. Could the author give more insight and/or instruction to the reader and model user on the "characteristic grid cell measure"?

R4. The model use the equivalent area length for eq(8). We added the following sentence: (e.g. the equivalent area length)

Q5. Line 262. Is there a particular reason why the model of Degruyter & Bonadonna (2012) has been removed from FALL3D?

R5. This parameterization gives similar results to that of Woodhouse but, given the structure of meteo data profiles in the code, has a much larger computational penalty and has been removed for this reason.

Q6. Please check the use of symbols throughout the manuscript, some symbols have been used twice for different physical quantities/constant. Some examples are highlighted in the attached manuscript but I urge the authors to review all symbols and possibly add a Symbol list table.

R6. Thank you; the (several) repeated symbols have been corrected. In addition, we added 2 new Tables containing the list of Latin and Greek symbols as suggested by the referee.

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