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Comment on nhess-2021-96

Dr. Andreas Becker (Referee)

Referee comment on "An ensemble of state-of-the-art ash dispersion models: towards probabilistic forecasts to increase the resilience of air traffic against volcanic eruptions" by Matthieu Plu et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-96-RC2>, 2021

The May 2010 Eyjafjallajökull eruption in combination with the at these days mandatory zero-ash policy applied by the ICAO has led to tremendous losses for the flight carriers on the one hand, but potentially saved thousands of passengers lives as it was indeed successful in preventing any flight crash related to the eruption. In the following years ICAO has revised the zero tolerance policy and replaced it by the introduction of several threshold concentrations that are attributed to corresponding flight safety measures with regard to a particular flight and the plane maintenance regarding also doses concentrations. Obviously this is an optimization problem for the air traffic management constrained by the accuracy of ash plume forecasts and re-analyses that both also depend on the high-availability of measurements.

Understanding that this optimization problem is a moving target, this paper does not suffer from a lack of originality problem, which has been my first reaction when reading about a multi-model ensemble study related to the eruption that happened 11yrs ago. Maybe this is a hint, that the paper title is sort of misleading, and could better read: "On the aid of state-of-the art probabilistic ash plume forecast modelling to increase the resilience of air traffic against volcanic eruptions" but I leave this with the authors. Anyway the word tailored should be moved forward so it reads "A multi-model ensemble tailored for air traffic management"

Besides these nitty-gritty comments I have read the paper with joy and gained a lot of insights with regard to the nowadays capabilities of state-of-the art dispersion models for the purpose of air traffic management. The mulit-model ensemble is well chosen covering the range of methodologies with regard to Eularian and Lagrangian approaches and taking advantage of inversion modelling techniques to ameliorate the source term along the different lead times of the forecast and re-analysis.

In general the paper is well and clearly written, and there's little ambiguity with regard to the way the methodologies are described. However there's some redundancy Section 2 that could be avoided by adding one or two tables listing all model realisations along their critical features stating in particular where they are similar and where not. For example FLEXPART and MATCH are pretty similar in the meteorological forcing (wind fields) at least this is my understanding. The authors could make this clear by such a comprehensive table on the model configurations.

I liked very much the comprehensive recognition of the VACOS reference observations with +-1h pictures in addition, comparing very well to the different realisations in Fig.5, so why not having the table claimed above with the same 16cells (model configurations)?

I am fully happy with the discussion provided in particular with regard to the compilation of the flight based measurements of the ash plume provided with Table 1 in connection with the discussion of the apparently to high vertical dilution that at least the ensemble results reveal. In this context I would be curious to learn, whether the Lagrangian Models performed slightly better in reproducing the filaments, but that's a minor point in the overall discussion

So I strongly recommend publication of this paper and hope that my recommendations made above, corresponding to a "minor revision" of the manuscript are swiftly addressed by the authors.