

Interactive comment on “Volcanic ash forecast using ensemble-based data assimilation: the Ensemble Transform Kalman Filter coupled with FALL3D-7.2 model (ETKF-FALL3D, version 1.0)” by Soledad Osoro et al.

Anonymous Referee #1

Received and published: 14 July 2019

Review of "Volcanic ash forecast using ensemble-based data assimilation: the Ensemble Transform Kalman Filter coupled with FALL3D-7.2 model (ETKF-FALL3D, version 1.0)" by Soledad Osoro et al.

General comment

The paper presents the application of an ensemble-based data assimilation algorithm, the Ensemble Transform Kalman Filter ETKF, to the FALL3D ash dispersion model. The model is tested against synthetic observations of volcanic ash concentration and

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the authors show that the application of the kalman filter allows to better constraint column height, vertical mass distribution and atmospheric ash concentration.

The paper proposes an interesting and new application of data assimilation applied to volcanic eruptions. Indeed, despite widely used in atmospheric science and oceanography, ensemble-based data assimilation algorithms are almost unexplored within the volcanological community, with very few papers dealing with this topic. Overall the paper is well written and well structured. For these reasons I think it deserves publication after moderate revisions.

Some points could be improved and make clearer with the addition of more details and explanations. My specific comments are listed below.

Specific comments

P4L1: Specify what you mean for eruption column height. The maximum height or the neutral buoyancy.

P4L2: More details about the Suzuki vertical mass distribution should be given. A figure could be added to explain and visualize what A and λ are. Moreover the assumptions and the limits of such distribution in term of loss of mass along the column should be added.

P7L1: Have you tested your model for wind field with spatial resolution different from 0.5? Have you noticed any change in the results? I think the sensitivity of the results to wind field resolution is an important aspect which should be tested and discussed.

P7L3 More details on how synthetic observations are generated should be given, maybe adding a figure showing both the observations and the errors.

P7L8 It is not clear why the authors consider observations with values between 0.2 and 10 gm^{-2} only. Please add explanations.

P8L7 Please give more details about covariance localization and why it is not neces-

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sary for this case.

P8L9 How many negative values do you observe? Is the number of negative values changing with model setting (ensemble number, spread, observation error, wind field resolution)?

P11L13 I think you cannot say that the A-Suzuky parameter is well estimated in this case, please explain.

P14L19 “The experiments focused on two FALL3D model parameters, one that defines the vertical emission profile and the eruptive column height (and related emitted mass).” The sentence should be rephrased.

P31L2 Is the filter a Local one? I thought it was a global filter.

Figures

In the main text, figures are indicated both with Fig. and Figure. I think only one notation should be used.

Figure 8: Could you explain the measurement unit of the concentration? Are you missing m²?

Figure 12: I found Figure 12 not easy to read. In particular the blue contour is not easy to follow. Maybe the figure could be split into 4 panels showing the ash mass loading for the 4 cases.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-95>, 2019.

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