Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-354-RC2, 2017
© Author(s) 2017. This work is distributed under
the Creative Commons Attribution 3.0 License.

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Volcanic ash modeling with the NMMB-MONARCH-ASH model: quantification of off-line modeling errors" *by* Alejandro Marti and Arnau Folch

L. Mastin (Referee)

lgmastin@usgs.gov

Received and published: 20 June 2017

Comments to the paper: "Volcanic ash modeling with the NMMB-MONARCH-ASH model: quantification of off-line modeling errors" By Alejandro Marti and Arnau Folch This paper compares results of volcanic ash-cloud simulations generated with the on-line model NMMB-MONARCH-ASH with those of the same model, used offline. The on-line mode calculates both meteorology and ash dispersion simultaneously whereas the offline mode reads pre-calculated meteorology at designated time (or "coupling") intervals. The manuscript compared on-line and offline results for three cases: a synthetic eruption and the real eruptions of Eyjafjallajökull (2010) and Cordon Caulle

(2011). The comparison found large differences in cloud location and concentration, which increased with time during a single simulation and which were greater as the coupling interval increased, from 1 to 12 hours. This study pointed out a critical and perhaps poorly appreciated advantage of on-line modeling; that coupling meteorology with ash dispersal models run offline can lead to significant errors if met. conditions are changing rapidly. Prior to reading this manuscript I had assumed that on-line models were an advantage primarily in rare cases where the ash cloud influenced wind or other meteorological conditions. The paper is written clearly, the results appear to be robust, and I think are highly significant. Therefore I highly recommend publication. There are however some minor changes that I think would help the paper before publication 1) How does the offline version of your model handle meteorology at the times between the coupling times? On p. 5, line 16, you suggest that meteorological parameters are set to constant in between coupling times. But many offline models linearly interpolate. Could higher-order interpolation schemes reduce error? 2) Section 2.3.1. It was difficult for me to grasp the physical significance of some of the quantities used to compare output from the offline and online models. For example, the Structure component S is said (line 3, page 8) to capture information about the size and shape of cloud objects. But all of the terms in S refer to mass; of a node, column or nodes, or cloud object. How do differences in S reflect variations in size and/or shape? The exact meaning of some other parameters, such as R_xy and D were unclear. And it was unclear to me how one could get a value less than zero for L_1. Also, I didn't see a definition of the parameter B in eq. 11. More comments are included in the returned pdf. 3) Several source parameter terms in Table 2 are not adequately explained. Details are in comments in that table. Also, I don't see sources cited for the observations used to constrain the eruption source parameters. Other key observations, like the arrival time of the Cordon Caulle ash cloud in Buenos Aires on 4 June 2011 (p. 20, line 3) do not cite sources. 4) Some of the figures need more description. For example, the methods of estimating mass eruption rate plotted in Fig. 5b. And the various lines in Fig. 10b representing mass eruption rate with time. 5) Section 4.1.2: In examining the

Eyjafjallajökull eruption, why do you think the misses were in the south and the false alarms were in the north? Dacre et al. (2011) suggested there was an error in the modeled wind speed over England. Was the south-oriented wind just accelerating, and the acceleration was not being caught when the coupling intervals were too infrequent? 6) Section 4.1.3: You say that bias scores suggest that offline forecasts tend to systematically underestimate ash column loading? Is there a physical explanation for this? If the model is conserving mass, does this imply that offline models also systematically overestimate cloud area? And how does this statement square with your statement on p. 19, line 6, that all off-line forecasts OVER-estimate ash column loading?

Additional minor and specific comments are included in the attached pdf. I look forward to seeing the final version of this paper.

Larry Mastin

References: Dacre, H. F., et al. (2011), Evaluating the structure and magnitude of the ash plume during the initial phase of the 2010 Eyjafjallajökull eruption using lidar observations and NAME simulations, Journal of Geophysical Research: Atmospheres, 116(D20), n/a-n/a, doi:10.1029/2011JD015608.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/acp-2017-354/acp-2017-354-RC2-supplement.pdf

---

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-354, 2017.