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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Determination of time- and height-resolved volcanic ash emissions for quantitative ash dispersion modeling: the 2010 Eyjafjallajökull eruption" *by* A. Stohl et al.

Anonymous Referee #1

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This paper describes how satellite observations of volcanic ash clouds can be used to constrain the source term required by dispersion models. This is a very important topic, as accurate volcanic ash cloud forecasts are critical to aviation. Overall, the paper is very well written and is a solid contribution to the volcanic ash cloud literature. However, there are some issues that should be addressed prior to full publication.

1). It is unclear how the uncertainty (estimated to be 10 K) in the ash cloud temperature and surface temperature are accounted for in the source term inversion process. Lidar measurements show that the Eyjafjallajökull ash cloud height varied considerably and the North Atlantic is quite cloudy, making clear sky regions difficult to find, which

greatly impacts the ability to accurately determine the surface temperature. Given that the satellite retrieval of mass loading used in the source term inversion process requires accurate surface temperature and cloud temperature information, the paper should contain more information on how the plus/minus 10K uncertainty in Ts and Tc is accounted for in the inversion scheme. I assume this error is accounted for in the observation error covariance matrix, but how is it combined with the baseline mass loading uncertainty of 40 – 60%?

2). How was the ash detection threshold of -0.8 K determined? Would this threshold hold up over other regions of the world?

3). What sort of re-sampling scheme is used to re-map the satellite data to a 0.25 degree by 0.25 degree grid, averaging, nearest neighbor?

4). The IASI ash retrieval methodology was "calibrated" using the SEVIRI retrievals. Why even use IASI, if the IASI mass loading information is being severely constrained by the lower spectral resolution SEVIRI results?

5). It was assumed that 10% of the erupted mass was fine ash. Is there a theoretical basis for this assumption?

6). It is unclear how this methodology can be used operationally. The source term inversion methodology seems to require a long time series of a priori source term information and satellite data for a given eruption. Is it being assumed that the a posteriori source term determined from one eruption (e.g. the April 14 – May 24 Eyjafjallajökull eruption) is valid for future eruptions of Eyjafjallajökull? If a volcano with no eruptions in the satellite era erupts, how would this methodology be employed to immediately help operational forecasts?

7). How do satellite false alarms and missed detection impact the source term inversion? Could an area of false alarms with a moderate to high retrieved mass loading significantly impact the inversion?

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11, C503–C505, 2011

8). From April 21 to May 4, meteorological clouds generally obscured the volcanic ash cloud. Under these conditions, how exactly does the satellite data constrain the source term inversion?

9). The paper should contain more information about potential limitations of the source term inversion method. For instance, how would this method work in an atmosphere with weak vertical wind shear (e.g. the tropics)?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 5541, 2011.