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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Long range transport and fate of a stratospheric volcanic cloud from Soufriere Hills volcano, Montserrat" *by* A. J. Prata et al.

Anonymous Referee #1

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This paper examines the long-range transport of material emitted by the Soufriere Hills Volcano in Montserrat, West Indies, utilizing four satellite instruments to determine the mass loading, vertical penetration, horizontal extent, and dispersion of volcanic material. A lagrangian transport model is used to verify vertical extent and mass loading of SO2. The paper tries to relate this volcano to climate forcing sensitivity, but this effort is largely unsuccessful. The model results shown in the movie represent serious discrepancies that are not discussed in detail. One figure is virtually unreadable. Thus the paper requires extensive modifications before it can be acceptable for publication in ACP. Yet the satellite data shown and analysis of this volcanic eruption is scientifically interesting from the viewpoint of atmospheric transport and potential chemical

and climate effects.

Paragraph 1 of the Introduction confuses the issues of large episodic eruptions that penetrate the stratosphere (El Chichon, Pinatubo, Cerro Hudson), minor eruptions that may account for annual stratospheric input, and Crutzen's geo-engineering proposal. The statement that "the average injection required is about 1-2 Tg(S) per year", if it refers to geo-engineering proposal, is not relevant to this paper and should be omitted.

Figure 1 is entirely too small and unreadable. Horizonal domains are not apparent. The most relevant of the 5 panels combined into Figure 1 should be shown at larger scale and the others should be dropped. Figure 1a at it's current size does not add anything to the text regarding the ice cloud and ash. Figure 1b is a repeat of Movie S1. In Figure 1c, the trajectories are not visible at the current scale. This figure should be enlarged. Figures 1d and 1e should perhaps be enlarged in a separate figure.

The chemical transformation of SO2 to H2SO4 is barely mentioned in this paper. Model calculations over a 23 day period inappropriately ignore this reaction, which gives SO2 a liftime of ˜30 days in the stratosphere. Movie S3 shows the simulation to be very different the OMI observations. It transports material too far north. The usefulness of this simulation seems limited to the first few days when it helps confirm the height of the SO2 cloud. The simulation results beyond the first 5-10 days are not useful because of the lack of chemical loss. Either the model run should be repeated with chemical loss (even a simple first order loss rate would work) or stopped at 5-10 days.

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