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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The initial dispersal and radiative forcing of a Northern Hemisphere mid latitude super volcano: a Yellowstone case study" *by* C. Timmreck and H.-F. Graf

Anonymous Referee #1

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General Comments:

Timmreck and Graf examine some seasonal differences of the initial dispersal of volcanic aerosol from a proposed mass injection into the low stratosphere above Yellowstone. They show different dispersal characteristics for injections in N.H. winter and summer conditions and show enhanced global dispersion due to aerosol-radiative feedback on the transporting wind fields. They examine the heating, radiative flux and temperature anomalies introduced by the presence of the aerosol and its dispersion. The strongest feature of this paper, in my opinion, is the discussion of the solar and

terrestrial heating and radiative flux anomalies, which is interesting and illuminating. On the other hand I am disappointed that the authors appear not to have exploited the full resources of their model. The model is described as interactive, both radiatively and chemically, yet there is no attempt to examine or discuss the circulation response, nor the chemical impact on e.g. ozone and NOy components of the aerosol injection. I feel that such an analysis would be of much interest to the community, particularly in light of previous studies [see for example the paper by Al-Saadi et al. (2001) for the Pinatubo case] and the paper would become a more substantial study than it currently is. The impact of radiative feedback on aerosol dispersal is illustrated, but the circulation changes responsible for the enhanced dispersion are not investigated. No chemical responses are discussed, yet the model appears to have been integrated with full gas phase and heterogeneous chemistry in the stratosphere. Are the authors only concerned in the radiative flux anomalies? I feel the authors could have made much more of these simulations. As such, the paper provides limited new information.

Specific comments:

p.7289, line 16. I don't see why the initial dispersal for YESTJUN is "unexpected" given that the summertime stratospheric circulation is very different from the wintertime circulation. I expect and even wider range of initial transport pathways would be discovered for initial injections in different months. Do June and December represent extreme cases in the model?

p.7289, line 2. My copy of Fig. 1 comprises two identical 4-panel figures.

p.7291, lines 2–6. Is it so surprising that the radiatively noninteractive solutions should be less dispersed, particularly for such a large injection. The authors argue that it's important to include radiatively interactive aerosol to represent global dispersal characteristics, but has this not been established in earlier studies, as the authors point out (p. 7290, line 16.)

p.7296, line 1: with reference to a dynamic vegetation model, I feel that the authors

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have not yet fully exploited the current level of sophistication of their model, without introducing more feedbacks.

p.7302–7305, Figs. 3 and 4 could be improved by removing much of the isobaric grid structure.

Reference: Al-Saadi, J.A. et al., 2001, Response of middle atmospheric chemistry and dynamics to volcanically elevated sulfate aerosol: three-dimensional coupled model simulations, J. Geophys. Res. Vol. 106, D21, p. 27,255–27,275.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 7283, 2005.