

Interactive comment on “The impact of the 1783–1784 AD Laki eruption on global aerosol formation processes and cloud condensation nuclei” by A. Schmidt et al.

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Received and published: 24 March 2010

This manuscript covers the effects of a Laki-type eruption on atmospheric aerosols using a state of the art bimodal aerosol microphysics scheme within the framework of a global transport model. Both model components are established and were well assessed for modern conditions. The text and figures are concise and complete, well prepared and conclusions are substantial. Of specific interest is the effect of the eruptions on cloud condensation nuclei which has potential impact on clouds and, therefore, also on radiative effects of such eruption that has not been previously taken into account. Unfortunately, the model system works with monthly prescribed cloud fields

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and this undermines the relevance of the results substantially since the important feedbacks between cloud microphysics, cloud cover and the additional aerosols produced by the Laki emissions cannot be simulated. Anyway, the work clearly shows the importance of these processes and may count as an important step in the right direction. As with all chemistry transport models the problem is that circulation (and clouds!) are prescribed. The authors only present results for the simulations driven by 2003 reanalysis. Only at one point (deposition over Greenland) they briefly mention that using year 2000 reanalysis leads to somewhat different results. The prescribed weather conditions (Certainly massively different from the time of the Laki eruption, but what are the similarities and what the differences?) lead me to suggest to talk about a “Laki-type” eruption rather than a “Laki” eruption. Some more discussion of differences/variability when other years are used to drive the transport model would be appreciated.

P3195.25 the authors talk about “stratospheric volcanism” – this is not existent, some volcanoes just inject material into the stratosphere. There is no way to “evaluate” the model results against other models since it is not known what is “true”. P3196.21 what is meant by “volcanological point of view”? P3200 1ff discuss the model differences in terms of different processes included to make clear where GLOMAP might be superior. 9 what is meant by “normalized bias”? Ch 3.3.2: There seems to be much enhanced deposition of S over Greenland, using another year does not help since a factor of 4 is not in the range of model variability. Confidence cannot be gained from modern simulations since as shown chemical pathways are different. Such a high deposition bias severely raises doubts about the usefulness of the model. Here some more discussion is necessary to convince the reader that the model results are useful. Ch 3.4 Here some thoughts on the radiative effects of the changes in aerosol concentration and spectra would be appreciated.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3189, 2010.

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