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Simulated aerosol size as leading cause of inter-model disagreement within the VolMIP-Tambora pre-study

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As part of the The Model Intercomparison Project on the climatic response to Volcanic forcing (VolMIP), several climate modeling centers performed a coordinated experiment in alignment with Coupled Model Intercomparison Project Phase 6 (CMIP6) protocols to assess radiative forcing uncertainties in aerosol climate models for a Tambora-like eruption. Results showed large disparities between models in the stratospheric global-average aerosol optical depth (AOD) in the visible. We find that stratospheric global average AOD differences among the VolMIP models for the first year after the eruption are due to differences in effective radius. The maximum global average stratospheric values of individual models varied by a range of 7% of the multi-model average for sulfate burden, by 53% for effective radius, and by 85% for AOD. These peak values occurred during the first year. After the first year, the intermodel disagreement in AOD is primarily due to differences in the simulated sulfate burden. The differences in effective radius can be traced to missing physics and chemistry in some of the models.