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Different responses of the Arctic polar vortex to aerosol forcings from volcanoes and sulfate climate engineering

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It has been suggested to artificially cool the climate through injection of sulfur into the stratosphere to form particles which will reflect solar radiation. It is uncertain how much material would need to be emitted in order to reach a certain climate effect, but the experience with the global cooling occurring after large volcanic eruptions suggests that some temperature reduction is possible.
The volcanic cooling effect is, however, not globally homogeneous. A winter warming in northern Eurasia has been observed after several big tropical eruptions. In general, this warming is attributed to a strengthening of the stratospheric polar night jet, related to the stratospheric effects of the volcanic aerosol, and a subsequent downward propagation of this dynamical signal. Can such a winter warming pattern also be expected for sulfate climate engineering? Here we use Geoengineering Intercomparison Model Project (GeoMIP) experiments where sulfur is injected to reduce warming during the 21st century to study the potential response of stratospheric dynamics to this type of climate engineering and compare it with the response to volcanic eruptions simulated by the same models in the CMIP5 historical simulations. We show that due to the different time scales involved in volcanic eruptions in comparison to assumed climate engineering a quite different dynamical response in the stratosphere can be expected for the two cases.