Physics and chemistry of aerosols to be injected into the stratosphere to cool the climate – should we participate in their study?

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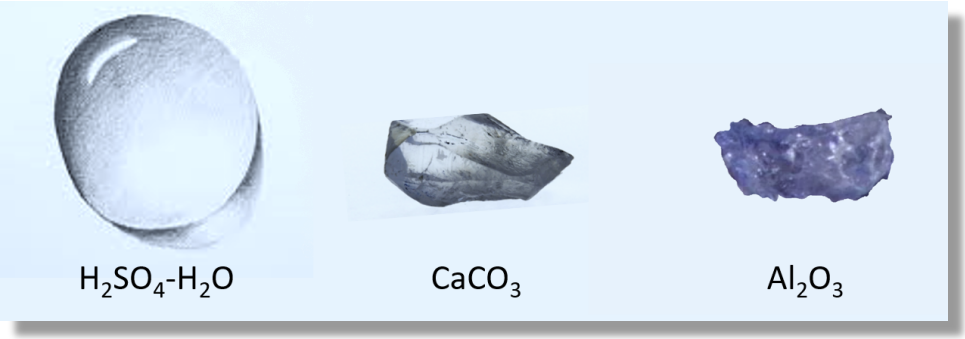
How well do we know the physicochemical properties of aerosols that are being considered for injection into the stratosphere to cool the planet? Sixteen years after Paul Crutzen's proposition for research on increasing the planet's albedo by injecting sulphur into the stratosphere, detailed knowledge is still very limited about sulphur-containing gases (SO_2, H_2S) and their conversion into aqueous sulfuric acid droplets, or about other species under consideration, such as calcite or alumina.



The response from the scientific community to Crutzen's proposal ranged from scepticism to outright rejection, not only because of the numerous unquantified negative side effects, but also because the intervention would not solve the real climate problem, but could be perceived by unscrupulous policymakers as an alternative to drastically cutting carbon emissions. In the early 2020s, there is little hope that global greenhouse gas emissions can be reduced fast enough to meet the 1.5-degree target set in the 2015 Paris Agreement. Beyond the global governance, legal, and ethical issues that must be adequately addressed before an implementation of stratospheric aerosol injections can be considered, we as scientists must be prepared to compare the uncertainties and risks of an injection system with those of no deployment, while greenhouse gas emissions continue unabated and efficient techniques for negative emissions are not yet within reach. Here we focus on one aspect of this general question, namely the impact of climate interventions on the global ozone layer, by comparing injections of sulfuric acid droplets, calcite particles, or alumina particles and assessing the relative uncertainties associated with them.