Efficient formation of stratospheric aerosol for climate engineering by emission of condensible vapor from aircraft

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Recent analysis suggests that the effectiveness of stratospheric aerosol climate engineering through emission of non-condensable vapors such as SO$_2$ is limited because the slow conversion to H$_2$SO$_4$ tends to produce aerosol particles that are too large; SO$_2$ injection may be so inefficient that it is difficult to counteract the radiative forcing due to a CO$_2$ doubling. Here we describe an alternate method in which aerosol is formed rapidly in the plume following injection of H$_2$SO$_4$, a condensible vapor, from an aircraft. This method gives better control of particle size and can produce larger radiative forcing with lower sulfur loadings than SO$_2$ injection. Relative to SO$_2$ injection, it may reduce some of the adverse effects of geoengineering such as radiative heating of the lower stratosphere. This method does not, however, alter the fact that such a geoengineered radiative forcing can, at best, only partially compensate for the climate changes produced by CO$_2$.

Received 13 May 2010; accepted 28 July 2010; published 22 September 2010.


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