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Modification of cirrus clouds to reduce global warming

Focus on Climate Engineering: Intentional Intervention in the Climate System

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Part of Focus on Climate Engineering: Intentional Intervention in the Climate System

Greenhouse gases and cirrus clouds regulate outgoing longwave radiation (OLR) and cirrus cloud coverage is predicted to be sensitive to the ice fall speed which depends on ice crystal size. The higher the cirrus, the greater their impact is on OLR. Thus by changing ice crystal size in the coldest cirrus, OLR and climate might be modified. Fortunately the coldest cirrus have the highest ice supersaturation due to the dominance of homogeneous freezing nucleation. Seeding such cirrus with very efficient heterogeneous ice nuclei should produce larger ice crystals due to vapor competition effects, thus increasing OLR and surface cooling. Preliminary estimates of this global net cloud forcing are more negative than -2.8 W m^{-2} and could neutralize the radiative forcing due to a CO_2 doubling (3.7 W m^{-2}). A potential delivery mechanism for the seeding material is already in place: the airline industry. Since seeding aerosol residence times in the troposphere are relatively short, the climate might return to its normal state within months after stopping the geoengineering experiment. The main known

drawback to this approach is that it would not stop ocean acidification. It does not have many of the drawbacks that stratospheric injection of sulfur species has.

PACS

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92.60.Vb Solar radiation

92.60.Nv Cloud physics; stratus and cumulus clouds

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