Environmental impact of stratospheric particle injection for geoengineering

Supervisor – Dr Francis Pope

Geoengineering, the deliberate manipulation of the global environment, has been proposed as a method for managing anthropogenic climate change. Many techniques for geoengineering the climate have been suggested [1] and can be roughly divided into two strategies: either solar radiation management (SRM) or carbon capture and storage (CCS). The injection of aerosols into the stratosphere is an SRM scheme and has the potential to be both affordable and highly effective when compared with other geoengineering schemes. The injected particles scatter solar radiation back to space and thus reduce the radiative balance of Earth. A similar effect is observed after major volcanic eruptions. A range of different particle compositions have been suggested for injections; to date, most studies have focused on sulphuric acid particles to mimic volcanoes. However, the composition and size of volcanic particles are far from optimal for scattering solar radiation. Aerosols with other compositions, such as minerals, could be used to dramatically increase the amount of light scatter achieved on a per mass basis, thereby reducing the total particle mass required for injection [2]. The chemical consequences of injecting such particles into the stratosphere are uncertain. This project will investigate the environmental impact of putting large geoengineered aerosol loadings into the stratosphere.

The ozone destroying potential of stratospheric aerosol of various compositions will be probed using both single particle and aerosol ensemble physical chemical techniques. In particular, the laboratory experiments will assess how the stratospheric processing of aerosols affects the aerosol surface composition and hence its reactivity with respect to key trace gas species such as: H₂O, H₂SO₄, O₃, and N₂O₅. In addition to the ozone destruction potential, the human health and ecotoxicity effects of the aerosols will be assessed through collaborations with the groups of Prof. Harrison and Prof. Lead at the University of Birmingham.

For more information please contact Dr Francis Pope directly.
Email – f.pope@bham.ac.uk
Website – http://www.birmingham.ac.uk/staff/profiles/gees/pope-francis.aspx

References:

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