Geoengineering could complement mitigation to cool the climate

January 28 2009

The first comprehensive assessment of the climate cooling potential of different geoengineering schemes has been carried out by researchers at the University of East Anglia (UEA).

Funded by the Natural Environment Research Council and published today in the journal '*Atmospheric Chemistry and Physics Discussions*', the key findings include:

- Enhancing carbon sinks could bring CO_2 back to its pre-industrial level, but not before 2100 - and only when combined with strong mitigation of CO_2 emissions
- Stratospheric aerosol injections and sunshades in space have by far the greatest potential to cool the climate by 2050 - but also carry the greatest risk
- Surprisingly, existing activities that add phosphorous to the ocean may have greater long-term carbon sequestration potential than deliberately adding iron or nitrogen
- On land, sequestering carbon in new forests and as 'bio-char' (charcoal added back to the soil) have greater short-term cooling potential than ocean fertilisation
- Increasing the reflectivity of urban areas could reduce urban heat

islands but will have minimal global effect

- Other globally ineffective schemes include ocean pipes and stimulating biologically-driven increases in cloud reflectivity

- The beneficial effects of some geo-engineering schemes have been exaggerated in the past and significant errors made in previous calculations

"The realisation that existing efforts to mitigate the effects of human-induced climate change are proving wholly ineffectual has fuelled a resurgence of interest in geo-engineering," said lead author Prof Tim Lenton of UEA's School of Environmental Sciences.

"This paper provides the first extensive evaluation of their relative merits in terms of their climate cooling potential and should help inform the prioritisation of future research."

Geo-engineering is the large-scale engineering of the environment to combat the effects of climate change - in particular to counteract the effects of increased CO2 in the atmosphere.

A number of schemes have been suggested including nutrient fertilisation of the oceans, cloud seeding, sunshades in space, stratospheric aerosol injections, and ocean pipes.

"We found that some geoengineering options could usefully complement mitigation, and together they could cool the climate, but geoengineering alone cannot solve the climate problem," said Prof Lenton.

Injections into the stratosphere of sulphate or other manufactured particles have the greatest potential to cool the climate back to pre-industrial temperatures by 2050.

However, they also carry the most risk because they would have to be continually replenished and if deployment was suddenly stopped, extremely rapid warming could ensue.

Using biomass waste and new forestry plantations for energy, and combusting them in a way that captures carbon as charcoal, which is added back to the soil as 'bio-char', could have win-win benefits for soil fertility as well as the climate.

A new combined heat and power plant at UEA is pioneering this type of technology.

Paper: 'The radiative forcing potential of different climate geo-engineering options' by Tim Lenton and Nem Vaughan is published on January 28 by *Atmospheric Chemistry and Physics Discussions*.

Source: University of East Anglia