Geoengineering could complement, but not replace, CO2 emissions cuts

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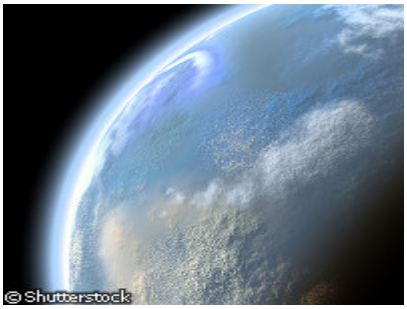

Geoengineering could help to tackle climate change, but only when coupled with efforts to drastically reduce greenhouse-gas emissions, according to a new study by UK scientists. Their analysis of several geoengineering techniques reveals that many previous studies overestimated their potential effectiveness. Furthermore, the most effective geoengineering solutions also carry the greatest risks.

The term 'geoengineering' refers to efforts to engineer the environment on a massive scale in order to counteract the effects of increased CO2 (carbon dioxide) levels in the atmosphere. In recent years, numerous ideas have been put forward, including putting sunshades in space and seeding the oceans with iron. However, accurate evaluations of these schemes' effectiveness are scarce, and their beneficial effects are often exaggerated.

In this latest study, scientists from the University of East Anglia (UEA) in the UK systematically evaluated and compared several geoengineering ideas. Their findings are published in the journal Atmospheric Chemistry and Physics Discussions.

One of the main findings is that enhancing the world's carbon sinks could bring CO2 levels back to pre-industrial levels by 2100, but only if CO2 emissions are drastically reduced at the same time. In other words, geoengineering alone cannot solve climate change.

'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 geoengineering,' explained Professor Tim Lenton of the 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.'

According to the study, the most effective schemes are stratospheric aerosol injections and sunshades in space, which cool the Earth by reflecting the sun's rays back out into space; these could cool the climate back to pre-industrial temperatures by 2050. However, these schemes also carry the greatest risk. Such systems would need ongoing replenishment, and if replenishment efforts stopped, the climate could warm up again extremely rapidly.

A more promising option involves planting new forests to capture CO2 from the atmosphere and using the wood from these forests to make charcoal, which could be added back to the soil as 'bio-char'. When used in conjunction with CO2 emission reductions, such carbon cycle geoengineering schemes could return CO2 to pre-industrial levels 'within a couple of centuries'. These schemes also have the benefit of being less risky than schemes designed to ward off the sun's rays.

The researchers describe the high levels of interest in ocean fertilisation as 'a little misplaced, because even the most promising options are only worth considering as a millennial timescale activity'. Surprisingly, fertilising the oceans with phosphorus (which is already happening through the inadvertent pollution of coastal waters) appears to be more effective than iron fertilisation. However, this pollution creates other problems, such as algal blooms. The researchers also warn that continually adding elements to the oceans is 'a mammoth geoengineering task which would itself severely disrupt marine ecosystems'.

Finally, the scientists note that widely publicised schemes such as ocean pipes (in which pipes pump nutrient-rich water from the depths of the ocean up to the surface) 'appear to be ineffective'.

The team now hopes that their findings will provide a framework for the evaluation of geoengineering schemes and aid in the prioritisation of future research efforts in the area.

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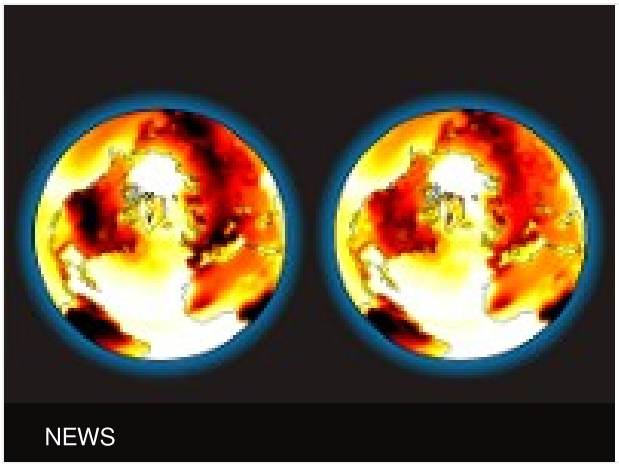

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