Clue: A major city

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Extreme and risky action the only way to tackle global warming, say scientists

· Geo-engineering 'better than doing nothing'
· Fake clouds among ideas in Royal Society papers

David Adam, environment correspondent
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Scientists have suggested creating areas of oceanic algae to absorb carbon dioxide. Photograph: Associated Press

Political inaction on global warming has become so dire that nations must now consider extreme technical solutions - such as blocking out the sun - to address catastrophic temperature rises, scientists from around the world warn today.

The experts say a reluctance "at virtually all levels" to address soaring greenhouse gas emissions means carbon dioxide levels in the atmosphere are on track to pass 650 parts-per-million (ppm), which could bring an average global temperature rise of 4C. They call for more research on geo-engineering options to cool the Earth, such as dumping massive quantities of iron into oceans to boost plankton growth, and seeding artificial clouds over oceans to reflect sunlight back into space.

Writing the introduction to a special collection of scientific papers on the subject, published today by the Royal Society, Brian Launder of the University of Manchester and Michael Thompson of the University of Cambridge say: "While such geoscale interventions may be risky, the time may well come when they are accepted as less risky than doing nothing."

They add: "There is increasingly the sense that governments are failing to come to grips with the urgency of setting in place measures that will assuredly lead to our planet reaching a safe equilibrium."

Professor Launder, a mechanical engineer, told the Guardian: "The carbon numbers just don't add up and we need to be looking at other options, namely geo-engineering, to give us time to let the world come to its senses." He said it was important to research and develop the technologies so that they could be deployed if necessary. "At the moment it's almost like talking about how we could stop world war two with an atomic bomb, but we haven't done the research to develop nuclear fission."

Such geo-engineering options have been talked about for years as a possible last-ditch attempt to control global temperatures, if efforts to constrain emissions fail. Critics argue they are a dangerous distraction from attempts to limit carbon pollution, and that they could have disastrous side-effects. They would also do nothing to prevent ecological damage caused by the growing acidification of the oceans, caused when carbon dioxide dissolves in seawater. Last year, the Intergovernmental Panel on Climate Change dismissed geo-engineering as "largely speculative and unproven and with the risk of unknown side-effects".

Dr Alice Bows of the Tyndall Centre for Climate Change Research at the University of Manchester said: "I'm not a huge fan of messing with the atmosphere in an geo-engineering sense because there could be unpredictable consequences. But there are also a lot of unpredictable consequences of temperature increase. It does appear that we're failing to act [on emissions]. And if we are failing to

act, then we have to consider some of the other options."

In a strongly worded paper with colleague Kevin Anderson in today's special edition of the society's Philosophical Transactions journal, Bows says politicians have significantly underestimated the scale of the climate challenge. They say this year's G8 pledge to cut global emissions 50% by 2050, in an effort to limit global warming to 2C, has no scientific basis and could lead to "dangerously misguided" policies.

The scientists say global carbon emissions are rising so fast that they would need to peak by 2015 and then decrease by up to 6.5% each year for atmospheric CO2 levels to stabilise at 450ppm, which might limit temperature rise to 2C. Even a goal of 650ppm - way above most government projections - would need world emissions to peak in 2020 and then reduce 3% each year.

Globally, a 4C temperature rise would have a catastrophic impact. According to the government's Stern review on the economics of climate change in 2006, between 7 million and 300 million more people would be affected by coastal flooding each year, there would be a 30-50% reduction in water availability in southern Africa and the Mediterranean, agricultural yields would decline 15-35% in Africa and 20-50% of animal and plant species would face extinction.

Martin Rees, president of the Royal Society, said: "It's not clear which of these geo-engineering technologies might work, still less what environmental and social impacts they might have, or whether it could ever be prudent or politically acceptable to adopt any of them. But it is worth devoting effort to clarifying both the feasibility and any potential downsides of the various options. None of these technologies will provide a 'get out of jail free card' and they must not divert attention away from efforts to reduce emissions of greenhouse gases."

Mike Childs of Friends of the Earth said: "We can't afford to wait for magical geo-engineering solutions to get us out of the hole we have dug ourselves into. The solutions that exist now, such as a large-scale energy efficiency programme and investment in wind, wave and solar power, can do the job if we deploy them at the scale and urgency that is needed."

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