Faster Climate Change Predicted as Air Quality Improves

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Global warming may proceed faster and be more severe than previously predicted according to research about to be published in the scientific journal *Nature*. Reductions in airborne particle pollution, or aerosols, as air quality is improved, will amplify climate change by reducing the cooling effect due to aerosols and also by increasing the amount of carbon dioxide that remains in the atmosphere. Uncertainty about the magnitude of past and present cooling, however, means that we cannot be certain about the strength of future warming, which may exceed previous estimates.

Prof. Meinrat O. Andreae of the Max Planck Institute for Chemistry in Germany, Dr. Chris Jones from the Met Office's Hadley Centre for Climate Prediction and Research, and Prof. Peter Cox from the Centre for Ecology and Hydrology have studied the consequences of the cooling effect from man-made aerosols (tiny airborne particles) on present and future climate, and on the uptake of carbon dioxide CO_2 by the land biosphere.

Such aerosols have reduced the amount of the sun's radiation that reaches the Earth's surface, and thereby have offset some of the warming impact of greenhouse gases - such as carbon dioxide - which have warmed the global climate during the 20th century. However, their harmful effects on air quality and human health have led to clean air legislation requiring us to clean up our emissions.

This necessary reduction in aerosols will result in a reduction of their

cooling effect and hence will accelerate global warming. Dr. Jones likens this to driving a car whilst pressing both the accelerator and the brake, “Now we are taking our foot off the brake, but we don't know how fast we will go. Because we don't know exactly how strong the aerosol cooling has been, we do not know how strong the greenhouse warming will be”.

Any such warming will be further amplified by interactions between the climate and the carbon cycle - i.e., the Earth's natural biosphere. Ocean and land based ecosystems presently absorb about half of our CO_2 emissions, but the impact of climate change will be to reduce this natural buffering service. “Higher temperatures mean dead matter decays faster”, explains Prof. Cox, “so if future warming is greater than expected, due to declining aerosol cooling, less CO_2 will be taken up by the land, which will leave more CO_2 in the atmosphere where it can add to greenhouse warming”.

The authors of the paper recognise the uncertainties, but maintain that this is a reason for action rather than inaction to cut global CO_2 emissions. That’s because aerosol uncertainties act to increase the upper estimate of 21st century climate change without impacting on the lower estimate. As Prof. Andreae puts it: “The policy implications of even a 5-6 ºC temperature increase, comparable to the temperature rise from the previous ice age to the present, are enormous. Given the very grave potential consequences for the Earth’s environment and human society, the only prudent course of action would be to immediately reduce the emissions of climate-warming substances, with reduction targets well below those of the Kyoto protocol.”

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Source: Natural Environment Research Council (NERC)