

China's air pollutant reduction success could make it tougher to control climate change

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China's success in improving air quality by cutting polluting emissions may have a negative knock-on effect on climate change overall, a new study has found.

The research, by scientists from Carnegie Institution for Science, U.S., Chinese Academy of Environmental Planning, China, Tsinghua University, China and the University of California Irvine, U.S., used modelling to analyse the effect China's success in reducing emissions such as sulphur dioxide, black [carbon](#), and organic carbon, has had on global [climate change](#). Their results are published today in *Environmental Research Letters*.

Lead author Dr. Yixuan Zheng, from Chinese Academy of Environmental Planning, a former postdoc at Carnegie Institution for Science, said: "Economic growth and industrialisation in China over the recent decades has been supported by increasing consumption of energy from coal, making China the world's largest emitter of major air pollutants such as sulphur dioxide and black carbon. These pollutants have significant impacts on [air quality](#) and public health, so China put stringent measures in place to reduce them. The measures were effective, and [aerosol pollution](#) in China was substantially alleviated after 2013, with notable [public health](#) benefits."

However, changes in pollutants such as sulphur dioxide and black carbon also affect radiative forcing—the determinant of the earth's temperature—with sulphate aerosol the dominant cooling agent in the atmosphere. It and other aerosols scatter and absorb incoming solar radiation and interact with clouds, affecting regional and [global climate](#).

Dr. Zheng said: "Anthropogenic sulphate aerosol was estimated to cool the earth on average by half a degree centigrade in 2010, equivalent to 76 percent of all-anthropogenic-aerosols-induced cooling. Black carbon, on the other hand, absorbs heat in the atmosphere and warms the Earth. So, understanding the effect reduction in these materials could have on warming is essential for future [climate](#) mitigation strategies."

To understand the full range of impacts of China's clean air actions, the

researchers analysed the near-equilibrium radiative and climate effects of China's reductions in aerosol (and precursors) emissions from 2006 to 2017, simulated in a fully coupled ocean and atmosphere climate model. They examined the climate effects of the reductions under the assumption these reductions continue, and that the climate system is linear enough that the climate effect of the aerosol emission changes can be considered additional to the climate effects of other forcing.

They found the potential climate effects of China's air pollution control policies—enacted between 2006 and 2017—were expected to result in more than 0.1 °C warming over the northern hemisphere. The emission reductions in China exert warming effects not only locally but also remotely.

Co-author Professor Steven J Davis, from the University of California Irvine, said: "From 2006 to 2017, China's carbon dioxide emissions grew by around 54 percent, along with around 70 percent reductions in [sulphur dioxide](#) emissions, a 30 percent reduction in [black carbon](#) emissions, and a 40 percent reduction in [organic carbon](#) emissions. The decoupling of carbon dioxide and aerosol emissions is mainly caused by installing end-of-pipe control devices, which reduce aerosol emissions but not carbon dioxide. Such decoupling exacerbated the global warming effects of China's carbon dioxide emissions."

Carnegie's Professor Ken Caldeira, also a co-author, said: "Cleaning up aerosol emissions has tremendous health benefits, but unmask some global warming. While this may seem like a climate setback, we need healthy people to help tackle the climate problem, and if we are to have more resources to allocate to better energy systems, we need to be spending less on the health damage caused by our aerosols. Helping people to become healthier can be a win for the climate system, even if it does directly lead to some warming."

More information: Climate effects of China's efforts to improve its air quality, *Environmental Research Letters* (2020). [DOI: 10.1088/1748-9326/ab9e21](https://doi.org/10.1088/1748-9326/ab9e21)

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