Soot causes twice as much global warming as previously thought

Cutting 'black carbon' emissions could help to cool the planet, according to scientists

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Soot created by the incomplete burning of fossil fuels and organic matter is the second most important man-made substance behind global warming and reducing its emission into the atmosphere could buy valuable time in tackling climate change, a major study has found.

New estimates of how much soot, or “black carbon” as it is known by scientists, is released into the atmosphere show that it causes about twice as much warming as previously believed. Cutting emissions could help to cool the planet, scientists said.

Black carbon, which is released from diesel engines, coal-fired power stations and wood-burning stoves, has a warming effect of 1.1 Watts per square metre, which is about two thirds the warming effect of carbon dioxide, the principle man-made greenhouse gas.

The new study found that soot emissions globally are substantially larger than previously estimated. It found that black carbon is a significant cause of the rapid warming seen in northerly regions of America, Canada and northern Europe and Asia and its effects extend further south, inducing changes in rainfall patterns of the Asian monsoon.

Reducing soot emissions with filters or more efficient forms of combustion could lower global temperatures over the coming couple of decades and would create a breathing space for the more difficult long-term task of reducing carbon dioxide emissions, scientists said.

“There are exciting opportunities to cool climate by cutting soot emissions, but it is not straightforward. Reducing emissions from diesel engines and domestic wood and coal fires is a no-brainer, as there are tandem health and climate benefits,” said Professor Piers Forster of Leeds University, a co-author of the new report.

“If we did everything we could to reduce these emissions, we could buy ourselves up to half a degree [Celsius] less warming, or a couple of decades of respite,” Professor Forster said.

However, the incomplete combustion of fossil fuels and organic matter produces other substances, such as sulphate aerosols, that have an opposite effect by cutting out incoming sunlight and cooling the climate, the scientists warned.

“Mitigation is a complex issue because soot is typically emitted with other particles and gases that probably cool the climate. For instance, organic matter in the atmosphere produced by open vegetation burning likely has a cooling effect. Therefore the net effect of eliminating that source might not give us the desired cooling,” he said.
“One great candidate is soot from diesel engines. It may also be possible to look at wood and coal burning in some kinds of industry and in small household burners. In these cases, soot makes up a large fraction of their emissions, so removing these sources would likely cool the climate,” Professor Forster added.

The four-year study into soot, published in the Journal of Geophysical Research-Atmosphere, involved hundreds of scientists from around the world and was carried out under the auspices of the International Geosphere-Biosphere Programme based in Stockholm and the International Global Atmospheric Chemistry Project.

“This study confirms and goes beyond other research that suggested black carbon has a strong warming effect on climate, just ahead of methane,” said David Fahey of the US National Oceanic and Atmospheric Administration.

Unlike carbon dioxide, which lingers in the atmosphere for many decades, black carbon is soon washed out of the air and so cutting emissions will have an almost immediate effect on reducing global temperatures, said Tami Bond of the University of Illinois.

“Mitigating black carbon is good for curbing short-term climate change, but to really solve the long-term climate problem, carbon dioxide emissions must also be reduced,” Dr Bond said.