

Researchers Work to Better Understand How Soot Emissions Impact Global Warming

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(PhysOrg.com) -- Researchers from Tech, Carnegie Mellon University and the California Institute of Technology are collaborating to study the effects of soot on global warming.

Soot, tiny airborne particles that billow out of diesel trucks and industrial smokestacks, is not only harmful to humans, but may be causing harmful warming effects that could create more severe [weather patterns](#) and hotter temperatures worldwide. Other major sources of black carbon [soot](#) include use of biofuels for cooking and heating in developing countries and [forest fires](#).

In a study recently published in [Geophysical Research Letters](#), Carnegie Mellon's Peter Adams and colleagues John H. Seinfeld of the California Institute of Technology and Athanasios Nenes of the Georgia Institute of Technology report that controls on [black carbon](#) soot might not slow global warming as much as previously thought.

Adams, the study's co-author and an associate professor of civil and environmental engineering and engineering and public policy at Carnegie Mellon, said the study focused on atmospheric cloud condensation nuclei (CCN) concentrations, airborne particles that are the seeds upon which cloud droplets form. Clouds that form in polluted air masses with high CCN concentrations tend to reflect more sunlight back into space than their cleaner counterparts. According to the study, if soot particles were cut in half, cloud reflection would decrease to allow an additional 0.13 watts per square meter of sunlight — the equivalent of about 10 billion

[light bulbs](#) spread across the United States — to reach and warm the earth.

So, what does this mean for policymakers?

"In some ways, the study doesn't change much. Soot particles are still a big air quality and health problem, and their emissions should be cut for this reason alone," Adams said. "What our study highlights is the competing warming and cooling effects that result from soot emissions, making it hard to say what its net effect is on global temperature. From a global climate standpoint, cutting soot is probably worth a shot but it is not a slam dunk like cutting carbon dioxide and other greenhouse gases. A lot will depend on what kinds of emission sources are targeted and the specific control strategies chosen."

The study has implications for the ongoing climate policy debate about assigning a [global warming](#) potential (GWP) to soot, a metric for comparing its climate impact to carbon dioxide. GWP values have been assigned to a wide range of greenhouse gases.

"Our research shows that uncertainties on how clouds will respond to soot controls may make it difficult to define a GWP value appropriate for soot," said Seinfeld, study co-author and the Louis E. Nohl Professor at Caltech.

"And even if its effect on global average temperature is unclear, besides its effects on human health, soot interferes with regional precipitation and circulation patterns, so control of soot should remain on the table," said Nenes, an associate professor of earth and atmospheric sciences and chemical and biomedical engineering at Georgia Tech.

Provided by Georgia Institute of Technology

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