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Any Climate Treaty Which Does Not Dramatically Reduce Soot Is Not Worth the Paper It's Written On

By Washington's Blog
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Theme: Environment
In-depth Report: Climate Change

Preface: I studied global warming at a top university in the early 1980's. I was taught – as Al Gore was taught in college – that temperatures are directly correlated with CO2 levels.

This essay will not address the question of whether global temperatures are rising, and if so, how much. Others have written extensively on that issue. This essay also will not look at questions of the percentage of climate change attributable to natural factors, such as variations in solar output, volcanic activity or El Niño (also called the "southern oscillation"). These are important issues, but this essay will not address them.

Whether or not you believe the planet is warming or that it is warming because of CO2 is irrelevant for the purpose of this essay. Either way, you will benefit from reading this.

Finally, I am against big oil and big coal. As I have repeatedly argued, power should be taken away from the oil giants and decentralized. I have repeatedly argued for microgeneration and for alternative energy. These things are beneficial for a number of reasons – including better health, less corruption of our political systems through decentralization of power, and a boost to our economy – in addition to whatever climate benefits they may have.

Do you remember the stories a couple of years ago about all of the dust coming from China?

There were headlines such as:

- China dust shows up on U.S. peaks
- China dust cloud circled globe in 13 days

Unfortunately, it's not just dirt. It's also soot, or "black carbon".

As the Wall Street Journal wrote in 2007:

> "There are times when it covers the entire Pacific Ocean basin like a ribbon bent back and forth," said atmospheric physicist V. Ramanathan at the Scripps Institution of Oceanography in La Jolla, Calif.
>
> On some days, almost a third of the air over Los Angeles and San Francisco can be traced directly to Asia. With it comes up to three-quarters of the black carbon particulate pollution that reaches the West Coast, Dr. Ramanathan and his colleagues recently reported in the Journal of Geophysical Research."

And the New York Times wrote in 2007:

> One of China's lesser-known exports is a dangerous brew of soot, toxic chemicals and climate-changing gases from the smokestacks of coal-burning power plants.
>
> In early April, a dense cloud of pollutants over Northern China sailed to nearby Seoul, sweeping along dust and desert sand before wafting across the Pacific. An American satellite spotted the cloud as it crossed the West Coast.
>
> Researchers in California, Oregon and Washington noticed specks of sulfur compounds, carbon and other byproducts of coal combustion coating the silvery surfaces of their mountaintop detectors. These microscopic particles can work their way deep into the lungs, contributing to respiratory damage, heart disease and cancer.
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> Filters near Lake Tahoe in the mountains of eastern California "are the darkest that we've seen" outside smoggy urban areas, said Steven S. Cliff, an atmospheric scientist at the University of California at Davis.

Soot and Climate Change

Time Magazine wrote last month:

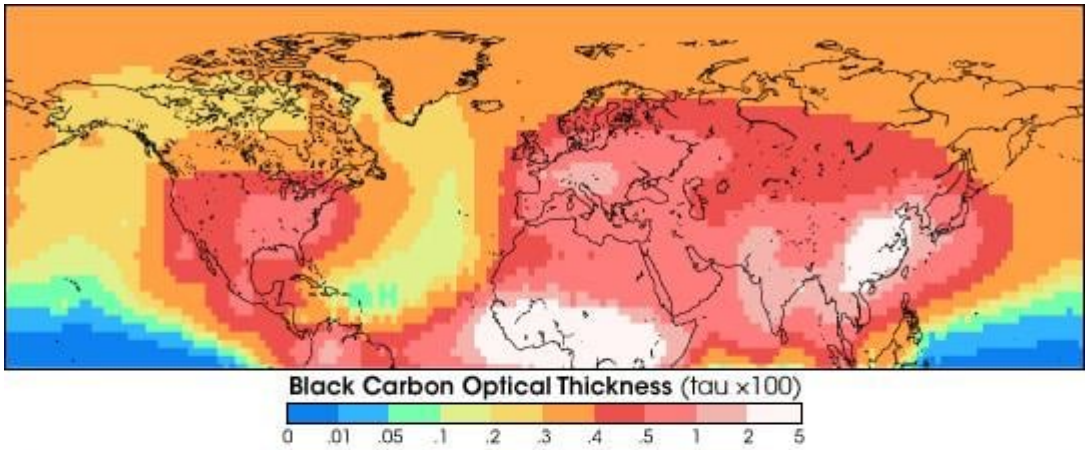
> Black carbon [another name for "soot"] in the air actually absorbs sunlight as it comes from space, directly heating up the atmosphere. "The soot particles are like the parts of a blanket, and it's getting thicker," says Ramanathan. "The smoke absorbs sunlight and heats the blanket directly."

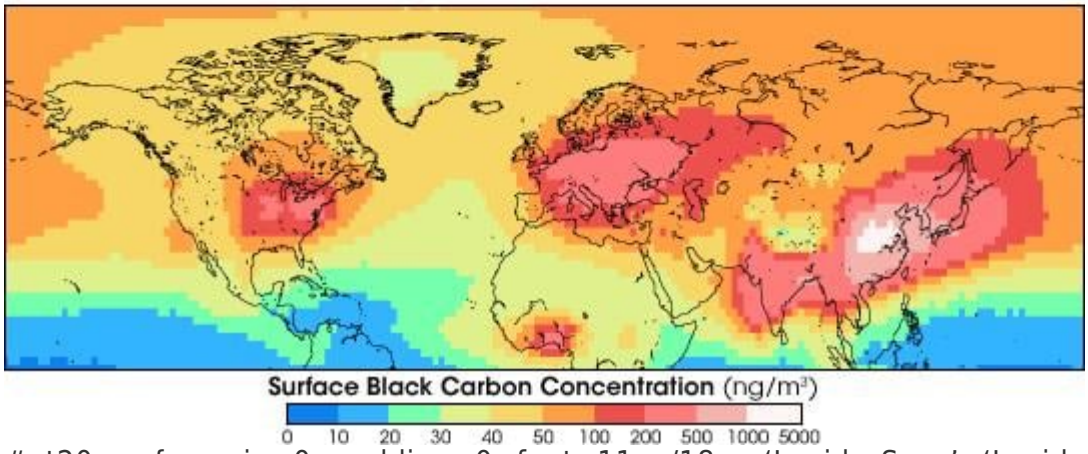
The world's leading crusader against global warming – Dr. James Hansen – said in 2003:

> Soot in snow and ice, by itself in an 1880-2000 simulation, accounted for 25 percent of observed global warming.

NASA wrote in 2005, based on Hansen's work:

> ## Soot Affects Polar Ice





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Far in the frigid north, glaciers rule and temperatures are harsh. It is not the sort of place one would expect pollution to be a problem, but new NASA research reveals that soot is traveling farther north than previously believed. Soot, or black carbon, could have a huge impact on the delicate Arctic environment by speeding up the melting of Arctic ice, altering temperatures and cloud formation, and changing weather patterns.

Black carbon is released into the atmosphere when fossil fuels are not completely burned, either in vehicles, home heating appliances, or when trees and other plants are burned. When large quantities of soot enter the atmosphere, they create a haze that absorbs energy from the Sun, so the temperature of the atmosphere increases. This atmospheric heating can affect weather patterns and cloud formation.

Dorothy Koch and James Hansen, climate scientists at NASA's Goddard Institute for Space Studies (GISS), modeled the transport of black carbon particles around the world using the GISS general circulation model. The above images show some of their results. The top image shows where black carbon is concentrated in the atmosphere, and thus where surface temperatures and weather patterns might be affected, and the lower image shows where carbon

> is predicted to settle on the ground.
>
> In the top image, the regions with the most haze—higher optical thickness—are white, while the least-affected areas are blue. As the image shows, Koch and Hansen found that soot in the atmosphere is most concentrated over southern and eastern China, where industry pumps black carbon into the atmosphere, and over central Africa, where fires are widely used for agriculture. Other regions with high concentrations of black carbon include the United States, Central Europe, and India. The model also reveals that instead of being clear of soot, the Arctic is blanketed with black carbon haze. About one-third of the haze, Koch and Hansen say, comes from Asia, one-third comes from fire around the world, and the remaining third comes from the United States, Russia, and Europe.
>
> Soot does not stay in the atmosphere; it falls out in rain or with dust. Koch and Hansen's research reveals that soot might have a longer range than previously believed, with higher concentrations reaching far into the Arctic. As dark soot falls on the snow and ice of the Arctic, it turns the white, reflective surface into a dark surface that absorbs the Sun's energy. This extra energy makes the snow melt more quickly.

Studies by other mainstream scientists also demonstrate that much of the melting of Himalyan glaciers is due to soot:

> Soot emitted when fuels like diesel, wood and coal are burned, may have a bigger impact on climate in some areas than greenhouse gases. New research presented here at the American Geophysical Union meeting shows that the 20 percent decrease in the extent of Himalayan glaciers since the 1960s may be partly due to an influx of black carbon [i.e. soot] from Asian cities.

As NASA writes:

> A new modeling study from NASA confirms that when tiny air pollution particles we commonly call soot – also known as black carbon – travel along wind currents from densely populated south Asian cities and accumulate over a climate hotspot called the Tibetan Plateau, the result may be anything but inconsequential.
>
> In fact, the new research, by NASA's William Lau and collaborators, reinforces with detailed numerical analysis what earlier studies suggest: that soot and dust contribute as much (or more) to atmospheric warming in the Himalayas as greenhouse gases.

Indeed, some scientists think that the role of soot is much bigger. As an article from 2002 pointed out:

> The research, published in this week's Science, suggests that soot — produced by diesel engines, cooking fires and other sources — could have nearly as much impact on climate change as carbon dioxide, which has long been considered the primary culprit in global warming.
>
> A group of US and Chinese researchers used a global climate model to simulate how black carbon affects weather patterns. They found that soot can influence regional climate by absorbing sunlight, heating the air and affecting

> rainfall.
>
> Emissions of soot are particularly large in China because cooking and heating are done with wood, cow dung and coal at low temperatures that do not allow for complete combustion.

And an article published in the journal *Nature Geosciences* (subscription required) concludes "increasing concentrations of black carbon have substantially contributed to rapid Arctic warming during the past three decades", and that aerosols are responsible for "half or more" of Arctic warming.

Indeed, Dr. Hansen himself now admits:

> Black soot is probably responsible for as much as half of the glacial melt.

A paper published by the National Academy of Science in July 2009 notes:

> Our ability to predict how global temperatures will change in the future is currently limited by the large uncertainties associated with aerosols. Soot aerosols represent a major research focus as they influence climate by absorbing incoming solar radiation resulting in a highly uncertain warming effect. The uncertainty stems from the fact that the actual amount soot warms our atmosphere strongly depends on the manner and degree in which it is mixed with other species, a property referred to as mixing state. In global models and inferences from atmospheric heating measurements, soot radiative forcing estimates currently differ by a factor of 6, ranging between 0.2–1.2 W/m2, making soot second only to CO2 in terms of global warming potential. This article reports coupled in situ measurements of the size-resolved mixing state, optical properties, and aging timescales for soot particles. Fresh fractal soot particles dominate the measured absorption during peak traffic periods (6–9 AM local time). Immediately after sunrise, soot particles begin to age by developing a coating of secondary species including sulfate, ammonium, organics, nitrate, and water. Based on these direct measurements, the core-shell arrangement results in a maximum absorption enhancement of 1.6× over fresh soot. These atmospheric observations help explain the larger values for soot forcing measured by others and will be used to obtain closure in optical property measurements to reduce one of the largest remaining uncertainties in climate change.

This is a new discovery. As Time notes:

> The science is evolving — it's so new that black carbon wasn't even listed as a warming agent in the most recent report from the Intergovernmental Panel on Climate Change — but it cannot be ignored.

Soot Has a More Immediate Effect than CO2

The key is that there is a much shorter lag time between soot and temperature that between CO2 and temperature. As Time writes:

> Unlike CO2, which can hang around in the atmosphere for centuries — CO2 that was emitted by the first coal-powered train is probably still in the air,

> warming the planet — black carbon has a relatively brief life span. It remains just a few weeks in the air before it falls to earth. That's key, because if the world could reduce black carbon emissions soon, it could help blunt warming almost instantly. "You can wait a week or a month and the totals in the atmosphere can be significantly different," says Eric Wilcox, an atmospheric scientist with NASA. Meanwhile, if we were to vastly reduce new CO2 emissions immediately, the billions of tons that already exist in the atmosphere would keep warming the planet for decades.

As the Institute for Governance & Sustainable Development writes:

> Because black carbon only remains in the atmosphere for several days to weeks, reducing it can bring about almost immediate mitigation of warming, whereas decreases in temperature lag reductions in CO2 by 1,000 years or more.

Good News

Time points out that it is relatively easy to reduce soot:

> The good news is that while taking CO2 out of our energy cycle has proven very difficult — especially in poorer developing nations — black-carbon emissions should be easier to curb. Reducing deforestation will help — the burning of tropical rain forests is a big contributor to the black-carbon load. Next, diesel filters in cars can be upgraded, and biomass-burning stoves can be exchanged for technology that uses solar power or natural gas. These changes will cost money, but they should be cheaper than decarbonization. And cutting back on black carbon will also pay immediate health dividends, with less air pollution and fewer deaths from respiratory diseases. We might even be able to see the sky in New Delhi again.

Similarly, Dr. Ramanthan notes in a new paper:

> A neglected fast-action strategy presented in the paper is reducing black carbon soot, an aerosol produced largely from the incomplete combustion of diesel fuels and biofuels, and from biomass burning. It is now considered to be the second or third largest contributor to climate change.
>
> "If we reduce black carbon emissions worldwide by 50% by fully deploying all available emissions-control technologies, we could delay the warming effects of CO2 by one to two decades and at the same time greatly improve the health of those living in heavily polluted regions," said Dr. Ramanathan.

The New York Times also notes the cost-effectiveness of reducing soot:

> Decreasing black carbon emissions would be a relatively cheap way to significantly rein in global warming — especially in the short term, climate experts say …

For these reasons, any international treaty or domestic law which does not focus on significantly reducing soot is not worth the paper it's written on.

Note 1: As I have previously noted, Dr. Hansen, the economists who invented cap and trade, and the head of California's cap and trade offsets program for the EPA are all opposed to cap and trade. I have also noted that the person who invented credit default swap derivatives is one of the key people pushing cap and trade.

Therefore, any treaty which pushes cap and trade at the exclusion of soot reduction is doubly worthless.

Note 2: As one example of an inexpensive soot reduction measure, solar cookers or plans for building them could be given to millions of people in the developing world, thus slashing soot from the burning of wood and dung.
