Assessing the Climatic Benefits of Black Carbon Mitigation

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To limit mean global warming to 2°C, a goal recognized as an important threshold in a global effort to prevent "dangerous anthropogenic interference with the climate system", it will likely be necessary to reduce emissions not only of greenhouse gases but also of air pollutants with high radiative forcing (RF), particularly black carbon (BC). Although several recent research papers have attempted to quantify the effects of BC on climate, not all these analyses have incorporated all the mechanisms that contribute to its RF. For example, analyses have included a varying subset of effects including the effects of BC on cloud albedo, cloud coverage, and snow and ice albedo, and the optical consequences of aerosol mixing, and have reported their results in different units and with different ranges of uncertainty. In our work we attempt to reconcile the results of four recent analyses [1-5] and present them in uniform units that include the same forcing factors. We use the best estimate of effective RF obtained from these results to analyze the benefits of mitigating BC emissions for achieving a specific equilibrium temperature target. For a 500 ppm CO_2e (3.1 W m^{-2}) effective RF target in 2100, which would offer about a 50% chance of limiting equilibrium warming to 2.5°C above pre-Industrial temperatures, we estimate that failing to reduce carbonaceous aerosol emissions from contained combustion would require CO_2 emission cuts about 8 years (range of 1 to 15 years) earlier than would be necessary with full mitigation of these emissions.

References

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