

CLIMATE AND CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Characterizing the Impacts of SLCPs

1. Summary of key messages and recommendations

Key message: Controlling emissions of short-lived climate pollutants (SLCPs) such as black carbon or black soot, methane, carbon monoxide and some hydrofluorocarbons (HFCs) could roughly halve projected warming over the next few decades while saving millions of lives and increasing crop yields by tens of millions of tons annually via improved air quality. These benefits would be obtained by reducing emissions of some SLCPs, such as black carbon and methane, that are at historically high levels, whereas emissions of others, such as HFCs, would have to be prevented from growing from their current low levels. Thus the historical contribution of SLCPs to warming does not provide a good indication of the potential benefits achievable via policies to reduce current and projected emissions.

Recommendation: We recommend that the CCAC emphasize the potential benefits from SLCP emission control measures for near-term climate, human health, agriculture and ecosystems rather than the contribution of historical SLCPs to current warming.

2. Introduction to the issue (*context and presentation of the issue*)

Policy makers may be using a chart of preindustrial to present-day radiative forcing broken down by the various agents (e.g. from the IPCC AR4 or AR5 SPM). This chart is likely the source for most of the numbers quoted in the question posed to the SAP. Comparison of radiative forcing due to a particular set of SLCPs with total radiative forcing is problematic, however, as it is somewhat arbitrary which agents are included within both the SLCPs and the total. In addition, preindustrial to present-day radiative forcing does not relate directly to temperature change realized to date, however. This is because the realized temperature change to date is a result of the time history of the forcing due to CO₂, SLCPs and other climate forcing. This time history is not captured by the sort of chart in IPCC AR4.

3. Discussion

The short lifetime of SLCPs in the atmosphere means that reducing their emissions will reduce their atmospheric concentrations in a matter of weeks to few decades, with a noticeable effect on global temperature during the following decades. Thus large reductions in SLCP emissions over the next 1-2 decades can have a substantial impact on climate during the next few decades relative to waiting to reduce SLCPs until mid-century. Hence the urgency for SLCP reductions comes from their ability to reduce near-term warming and improve human well-being.

In contrast, plausible emission scenarios for CO₂ reductions lead to climate benefits that primarily occur after several decades due to the long lifetime of CO₂. Because of its long lifetime, it is urgent to begin reducing CO₂ immediately to avoid the worst impacts of long-term climate change, but such reductions will likely have comparatively smaller effects on climate of the next few decades (near-term climate). Thus SLCPs and CO₂ affect climate on very different timescales.

Comparison of the radiative forcing, a measure of the effect of a particular driver of climate change on the Earth's net energy (positive forcing causes warming), due to historical changes in SLCPs with

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other agents is problematic. One could compare the forcing due to emissions of various SLCPs such as methane, carbon monoxide, black carbon and HFCs with the net forcing due to all drivers, but as the net is the difference between multiple positive and negative forcings the role of a particular set of drivers can exceed 100%. One could instead compare with the total from all positive forcings, but this would ignore the fact that black carbon, for example, is almost never emitted without some partially offsetting negative forcing agents. In addition, as noted, pollutants such as HFCs have contributed a miniscule amount of historical forcing, but are projected to cause a large positive forcing in the future without policies to control their emissions.

Analysis of the temperature response to current emissions shows that black carbon and methane emissions cause the greatest amount of warming during the first decade, whereas emissions of carbon dioxide dominate at longer timescales (see the Figure). This highlights the importance of controlling emissions of both the SLCPs and carbon dioxide in order to reduce warming in both the near- and long-term as well as the limitations of any comparison between SLCPs and carbon dioxide at a single point in time.

Slowing the rate of near-term climate change leads to multiple benefits, including reducing impacts from climate change on those alive today, reducing biodiversity loss, providing greater time for adaptation to climate change, and reducing the risk of crossing thresholds activating climate feedbacks (e.g. from emissions associated with melting permafrost). There are also a range of near term health and other co-benefits from such policies as a result of reduced exposures to hazardous pollutants. Additionally, reducing SLCPs is likely to have enhanced benefits in mitigating warming in the Arctic and other elevated snow and ice covered regions in the Himalayan/Tibetan regions and in reducing regional disruption of traditional rainfall patterns.

While fast action to mitigate SLCPs could help slow the rate of climate change and greatly improve the chances of staying below the 2°C target, long-term climate protection will only be possible if deep and persistent cuts in carbon dioxide emissions are realized in the near future.

4. Recommendations

We recommend that the CCAC emphasize the potential benefits from SLCP emission control measures for near-term climate, human health, agriculture and ecosystems rather than the contribution of historical SLCP emissions to current warming.

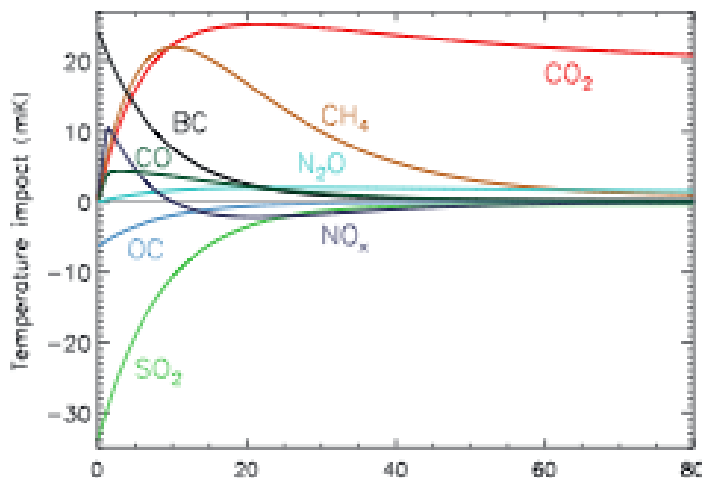


Figure. Temperature response by emitted compound for a 1-yr pulse of current anthropogenic emissions (Figure reproduced from IPCC AR5, chapter 8, Figure 8.33).

Resources (list relevant publications and articles)

- UNEP/WMO (2011). *Integrated Assessment of Black Carbon and Tropospheric Ozone*. United Nations Environment Programme, Nairobi.
http://www.unep.org/dewa/Portals/67/pdf/BlackCarbon_report.pdf
- Velders, G., Fahey, D., Daniel, J., McFarland, M. and Andersen, S., 2009. The large contribution of projected HFC emissions to future climate forcing. *Proceedings of the National Academy of Sciences of the United States of America*, 106(27): 10949-10954.