

Limiting Climate Change: Reducing Black Carbon and Tropospheric Ozone Precursors

*Sunday, February 20, 2011: 1:30 PM-4:30 PM
101 (Washington Convention Center)*

This session brings together eminent scientists and pressure groups from New York to New Delhi to examine available options that can allow society to deal with the urgent task of mitigating climate change, while continuing to improve living conditions. Speakers will evidence that although reductions in carbon dioxide emissions and other long-lived greenhouse gases are essential for mitigation of long-term climate change, real leverage over near-term climate comes primarily from the tropospheric ozone precursors methane, carbon monoxide, and volatile organic compounds and, at least regionally, from black carbon aerosols. Case studies will show how these short-lived pollutants contribute to both global warming and many of the most alarming regional climatic changes, including the melting of Himalayan glaciers and Arctic sea ice and shifts in regional precipitation. They also contribute to air pollution, with adverse effects on human health, agricultural yields, and other social-economic costs. Speakers will argue for a new and more integrated approach, in which emission reductions in specific sectors are optimized to get benefits for air quality and climate. Presentations will show how this can be more robust and more cost-effective than policies that aim at air quality and climate targets separately. This session will report on recent studies in support of an assessment by the United Nations Environment Program (UNEP) of the above-mentioned options.

Speakers:

Drew Shindell, NASA Goddard Institute for Space Studies

Limiting Near-Term Climate Change While Improving Human Well-Being

Emissions of black carbon and tropospheric ozone precursors affect human well-being in many ways, altering climate and degrading air quality. Hence there have been many suggestions that in principle, control of these emissions could be a useful way to mitigate near-term climate change and improve human health. The 2011 UNEP Assessment has quantified the potential impact of specific, practical emissions control measures that could be implemented with current technology or behavioural changes. We find that globally, these measures can substantially mitigate near-term global warming, increase world food supplies, and reduce premature mortalities due to outdoor air pollution.

Sustained implementation of the selected measures between the present day and 2030 will decrease near-term (20-30 years) global and regional warming. This would reduce global warming by 0.4 +/- 0.2 oC by around 2035 compared to a reference scenario based on current trends and agreed legislation. The implementation of the selected measures in this assessment will lead to a particularly large benefit in the Arctic, reducing warming there by 0.7 +/- 0.5 oC by around 2040 compared to the reference scenario. The warming from BC and

O3 has strong regional variations that can lead to substantial regional climate impacts. For example, large regional heating from absorbing particles can disturb regional circulation patterns such as the Asian Monsoon. Hence much of the climate benefit of emissions reductions would be felt locally.

Millions of premature deaths and the loss of tens of millions of tons of crops would be avoided each year resulting from reductions of small particulate matter (PM2.5) and ozone concentrations by implementing the selected measures, in comparison to the reference scenario. The economic valuation of the health and crop yield benefits from implementing the selected measures would amount to trillions of US dollars annually. Even more so than with climate, the benefits of improved air quality will be felt most strongly in the places where emissions are reduced.

The measures examined here are already mature technologies with demonstrated results at scale in the real world. Many of the structural changes examined here present formidable hurdles to implementation, however. Efforts to scale up, replicate and expand the implementation of the selected measures could include capacity building, public-private financing, technology support, regional cooperation and agreements and community empowerment.

Tepei Yasunari, NASA Goddard Earth Sciences and Technology Center
Impacts of Black Carbon (BC) Pollution on Himalayan Glaciers

Black carbon (BC) is now well known as a solar absorptive aerosol and its higher contamination in the Indo-Gangetic Planes is a large concern. The BC deposited over Himalayan glaciers also likely contributes to snow darkening and heating the snow surface, finally leading to glacier retreats. However, still not so much observations on the snow-impurity-related topic over the Himalayas have been carried out yet and more observations are required. As the first preliminary study, we estimated at least how much BC can deposit over the southern slope of Himalayas during pre-monsoon season of 2006 from the observed meteorological data and equivalent BC concentration (eqBCC) in the atmosphere at Nepal Climate Observatory – Pyramid site (NCO-P, Nepal; lat. 27.958°N, lon. 86.815°E; 5079 m a.s.l.) with a realistic lower bound of dry deposition velocity (DDV). The BC deposition of 266 $\mu\text{g m}^{-2}$ was obtained and it can reduce snow albedo of 2.0-5.2% based the empirical equation based on the data from previous studies.

However, the above estimation is the lower bound and actual deposition is expected to be more. Here we further estimated the range of dry deposition amount of BC during the same period based on the observed eqBCC and meteorological data at NCO-P with fixed slower DDV above, GOCART DDV code used in GOCART/GEOS-4 below, and another DDV theory. In addition, two types of outputs from chemical transport models coupled to general circulation models (GCMs: NASA GOCART/GEOS-4 and NIES/CCSR/FRCGC SPRINTARS). The two GCM outputs showed much higher dry depositions of BC. Comparing all the deposition estimations, the overestimations from the GCMs are probably due to stronger surface wind than the observation at NCO-P and without ice surface

assumption for the DDV calculations. When we calculated DDVs with NCO-P based observations and ice surface assumption, the deposition velocities became slower than the outputs from GOCART/GEOS-4. It indicates that prescribed surface vegetation over glacial areas and stronger surface wind cause faster DDVs and overestimate BC deposition over glacial areas. For both fresh and aged snow cases, the estimation errors on the depositions themselves possibly cause the uncertainties on visible snow albedos of more than 5.6 and 8.0% for hydrophobic and hydrophilic BC cases, respectively. We can expect old snow and aged BC (considered as hydrophilic BC) for dry pre-monsoon period 2006. On this expectation, visible snow albedo reductions in broadband of 4.3-5.1% are considered to be reasonable range at the south-eastern Himalayas.

Markus Amann, International Institute for Applied Systems Analysis

Win-Win and Win-No-Lose Control Measures for Black Carbon and Ozone

Whereas all air pollution control measures are beneficial for health, not all of them might be beneficial for climate. The talk will identify specific measures, in particular in the transport and domestic, that reduce BC aerosols and lead to benefits in both areas.

Frank Raes, European Commission, JRC Institute for Environment and Sustainability

Benefits of BC and Tropospheric Ozone Reduction Measures for Climate, Health, and Ecosystems

This talk will more in detail discuss the health effects and climate effects of the control measures mentioned in the previous talk. The results of dedicated studies with 2 general circulation models to calculate radiative forcing and global/regional levels of BC and ozone, and of several impacts models (health, deposition, ...) will be presented.

Erika Rosenthal, Earthjustice

Good Practice in Reducing Black Carbon Emissions at the Local Level

Identifying measures and developing policies is one thing. Having them implemented is another. The talk will review bottlenecks for implementation of air pollution control measures, throughout the world. It will also review a number of good practices and success stories, in particular in reducing BC aerosols.

Martin Williams, King's College

Developing Integrated Air Pollution and Climate Change Policies

The international climate policy frameworks; UN Framework Convention on Climate Change, and the UN Convention on Long Range Transboundary Pollution, are potential frameworks to develop policies dedicated to BC and air pollution, with an eye on both human health and climate. The talk will discuss the pro's and con's of either one or the other framework.