TIME to ACT

The Opportunity to Simultaneously Mitigate Air Pollution and Climate Change

GLOBAL CHANGE
IGBP International Geosphere-Biosphere Programme
IGAC

IGBP

The International Geosphere-Biosphere Programme (IGBP) was launched in 1987 to coordinate international research on global and regional scale interactions between Earth's biological, chemical and physical processes and their interactions with human systems. IGBP sponsors 9 major international projects that combined provide the scientific basis of the Earth system. IGBP's vision is to provide essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change. IGBP provides an interface between the research community and international policy processes and institutions such as ICSU, IPCC, UNFCCC, UNESCO and UNEP (igbp.net).

IGAC

The International Global Atmospheric Chemistry (IGAC) Project was formed in 1990 to address growing international concern over rapid changes observed in the Earth's atmosphere. IGAC operates under the umbrella of the IGBP and is jointly sponsored by the international Commission on Atmospheric Chemistry and Global Pollution (iCACGP). IGAC's mission is to *coordinate and foster atmospheric chemistry research towards a sustainable world* by facilitating international collaboration of atmospheric chemistry and interdisciplinary research, coordinating the synthesis, assessment and summary of research, cultivating the next generation of atmospheric chemists, and acting as the liaison between the atmospheric chemistry community and the broader Earth System Sustainability community (igacproject.org).

Air Pollution & Climate Initiative

As part of its second phase synthesis activities, IGBP identified several key areas which cut across research in its own core projects and which also reach out beyond IGBP with the aim of exploring future cross-disciplinary research needs. As such, the IGBP Air Pollution & Climate initiative led by IGAC aims to engage a range of stakeholders (scientists, economists, policy makers, etc.) to assess the status of knowledge with regard to current understanding about air pollution and climate and their interactions in particular with relation to current and proposed mitigation options and policy discussions (igacproject.net/node/12).

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Time to Act:
The Opportunity to Simultaneously Mitigate Air Pollution and Climate Change

An integrated approach to addressing air pollution and climate change is essential if society desires to slow the rate of climate change and to protect human health, food/water security and ecosystems.

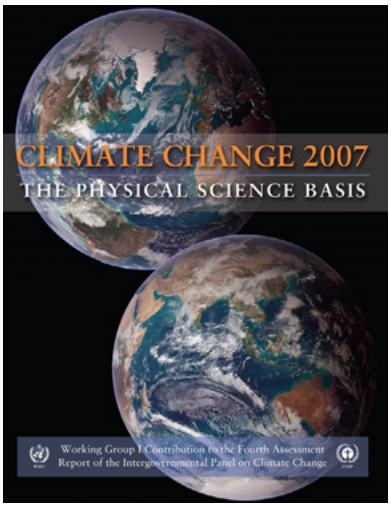
Air Pollution and Climate Change Linkages

- Control of air pollutants and their precursors that lead to warming (such as black carbon, methane and tropospheric ozone) would be a highly effective way to reduce the rate of climate change in the near-term, but would only be effective in the long-term if continued action to reduce long-lived greenhouse gases, notably carbon dioxide (CO_2), are taken in parallel.
- Reduction of air pollutants that lead to cooling, such as sulfur dioxide (SO_2), will uncover warming from CO_2 already emitted. These air pollutants are already being reduced to protect human health, food security, and ecosystems, providing additional motivation for rapid compensatory mitigation of long-lived greenhouse gases and air pollutants that lead to warming.
- Measures to mitigate greenhouse gas emissions (such as increasing energy efficiency, switching fuels, shifting technologies) could lead to decreases or increases of emissions of air pollutants. Therefore, there is an opportunity to select emission controls that can have "win-win" benefits for air quality and climate.
- Climate change may render air pollution control management strategies less effective by causing shifts in temperature, precipitation and circulation patterns.
- In order to be effective, coordinated air pollution and climate change solutions require a combination of local, national, regional and international mitigation strategies.

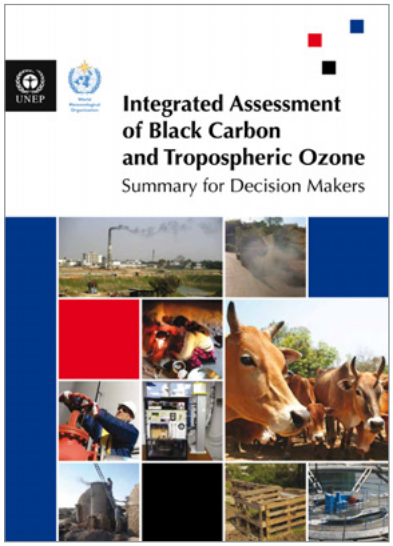
There is increasing recognition that the problems of air pollution and climate change need to be treated together. This can be facilitated by enhanced dialogue between the science and policy communities. Addressing air pollution and climate change together provides a unique opportunity to simultaneously achieve both air quality and climate policy goals in the near-term (<50 years). Air pollution regulations are an important component of strategies to protect human health and ecosystems, including crop production. However, some air pollution emission controls, such as sulfur reductions, have adverse effects on climate change mitigation efforts. Equally, measures to mitigate climate change can have adverse effects on air quality. Therefore, simultaneous solutions that offer net benefits for both air quality and climate taking into account the possible trade-offs between human health, food and water security and ecosystems would be advantageous. A sound scientific foundation is an integral part of developing such solutions.

Scientific Evidence

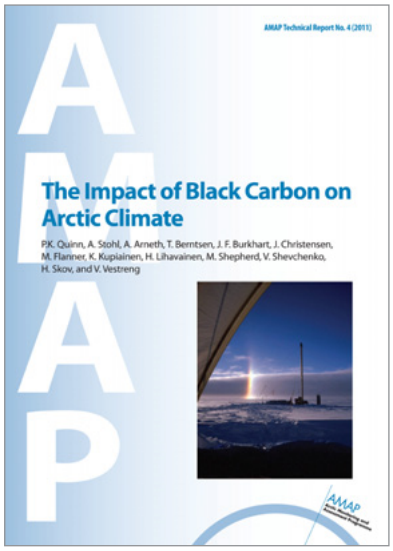
Over the last 15-20 years, efforts have been made to quantify the air pollution "co-benefits" of various climate policies. In the last 5-10 years, an increasing body of scientific evidence has demonstrated that air pollution and their mitigation strategies can have significant effects, both positive and negative, on near-term climate change at the regional and global scales. Increasing evidence also shows that global warming aggravates existing air pollution problems but most climate change mitigation efforts could have significant co-benefits for air pollution reduction, a "win-win" opportunity. These findings have led both the climate change and air pollution science and policy communities to pay more attention to one another. Several recent assessment reports have advanced further our understanding about the relationship between air pollutants and near-term climate change at the local, regional and global scale. The main messages from key recent efforts are summarized below.



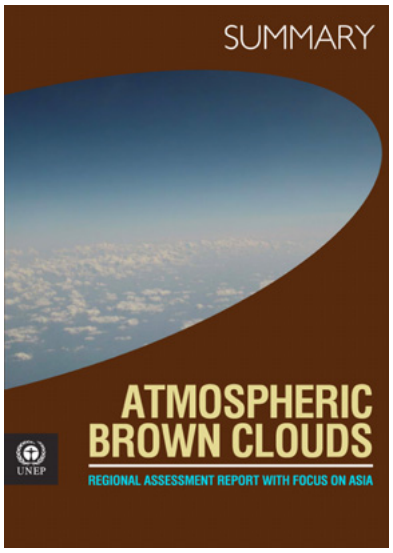
Global atmospheric concentrations of the two most significant long-lived greenhouse gases, carbon dioxide and methane, have increased significantly since pre-industrial times and these increases are primarily due to increased anthropogenic emissions. Changes in tropospheric ozone, a short-lived greenhouse gas, impact both air quality and climate change. Emissions of aerosols from anthropogenic activity produce a net cooling effect. However, while most aerosols (e.g. sulfate, organics and nitrate) have a cooling effect, some aerosols (e.g. black carbon) have a warming effect. The complex properties and geographical distribution of aerosols impact the climate system in a variety of ways through direct and indirect radiative forcings.[1]



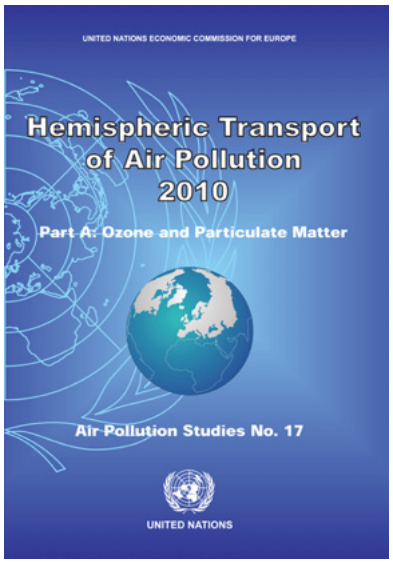
Scientific evidence and new analyses demonstrate that rapid implementation of existing cost-effective emission controls of certain sources of black carbon and methane (to reduce tropospheric ozone) would have immediate and multiple benefits to protect climate, public health, water and food security and ecosystems. Control measures for black carbon and methane would be most effective if they are country and/or region specific and integrated with existing policies to address air quality and other development concerns.[2]



Black carbon emitted in or transported to the Arctic leads to direct warming of the atmosphere. Black carbon deposited on Arctic snow and ice results in additional warming. Emission sources of black carbon located near or in the Arctic have the greatest impact on Arctic climate. However, there is also pole-ward transfer of the warming caused by black carbon in other regions of the world. This indicates that global strategies to mitigate black carbon emissions would benefit Arctic climate.[3]



Atmospheric Brown Clouds (ABCs), made up of aerosols and other pollutants, significantly impact monsoon patterns and Himalayan glacier regional climate systems subsequently threating Asian water supplies, food security and human health. Some components of ABCs, such as sulfate, nitrate and organic aerosols scatter solar radiation and act as cooling agents that lead to a reduction of solar radiation at the surface (known as surface dimming). This results in the cooling of the surface-atmosphere system. Other components of ABCs (especially black carbon) warm the atmosphere through complex processes such as the absorption of solar radiation and deposition on glaciers reducing snow albedo.[4]



Air pollution is caused by sources at the local, regional and global scales. In most cases, reducing local or regional emission sources is the most efficient approach to mitigate local impacts. However, pollution is also transported on intercontinental scales where it can impact regional air quality far from its emission sources. This makes it difficult for many nations to meet their goals and objectives for protecting human health and environmental quality and necessitates the need for international and regional cooperation. Air pollution control has significant benefits for human health, food security and ecosystem protection that extend globally, far beyond the region of control.[5]

Policy Perspective

Public policy priorities vary around the globe and efforts to address environmental concerns often come second to measures that are perceived as more directly focused on providing livelihoods, shelter, food, water and other basic amenities and services. However, climate change, air pollution and ecosystem degradation have demonstrable and significant impacts on core development goals.

There is an increasing awareness that environmental change affects any nation's ability to achieve economic and development goals. However, challenges in inter-ministerial coordination, financing constraints, political disinterest and limited quantification of co-benefits handicap efforts to integrate environmentally focused initiatives with traditional investment and subsidy programs focused directly on economic development.

There is no single best approach to integrating air pollution and climate change considerations into economic development programs. Air pollution and climate change mitigation efforts should be adapted to the physical, economical, political and social contexts within each region to best deploy scarce financial, technological and human capital to address the challenges of sustainable development. Although regional approaches may differ, it is also important for regional efforts to be linked through a sound scientific basis, robust information-sharing infrastructure and shared lessons from experience to build greater capacity and ensure that the global trade-offs are clear inside and outside a region. Addressing air pollution and climate change simultaneously therefore would be most effective with a combination of local, national, regional and international strategies that include a strong scientific knowledge basis.

Way Forward

The scientific and economic basis for a coordinated approach to mitigating air pollution and climate change is well established. It is clear that promising mitigation technologies and practices already exist that can provide "win-win" benefits for both air pollution and climate change. There is also increasing international recognition of the importance of addressing air pollution and climate change simultaneously (e.g. *The Climate and Clear Air Coalition to Reduce Short-Lived Climate Pollutants*[6]). However, many challenges remain in translating this knowledge to action.

To address the implementation challenges, a holistic framework is needed to understand how air pollution and climate change concerns can be integrated into economic development and other broader decision processes in various local, national, regional and global contexts. This integrated framework should be informed by scientific research that cuts across traditional disciplines and addresses the issues at various scales from the individual and local level up to national and international levels.

The physical and social science research and policy communities all have a role to play in advancing such an integrated approach. The physical science community can provide the best knowledge on how the Earth System will respond to global change and what risks are associated with those responses to human health, ecosystems and climate. The social science

community can provide information on the feasibility of implementing mitigation options taking into account differing social, economic, and political priorities across the globe. As part of an open dialogue with the policy community, the physical and social scientific evidence can be used as the foundation of credible decision-making and to assess the impacts of implemented policies. Such an open dialogue will ideally lead to robust approaches to simultaneously mitigating air pollution and climate change while also protecting human health, food, water and energy security, ecosystems and economic stability.

Therefore, the IGBP, as part of its Air Pollution & Climate Initiative, will release a Strategic Plan for an interdisciplinary programme to address air pollution and climate change in Autumn 2012. The Strategic Plan will present key areas, such as urban development and agriculture, where an integrated approach to air pollution and climate change would be beneficial, along with a framework on how to develop interdisciplinary programmes to tackle these challenges.

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[2]UNEP/WMO (2011). *Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers*. UNON/Publishing Services Section/Nairobi, ISO 14001:2004.

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[5]Task Force on Hemispheric Transport of Air Pollution (TF HTAP) (2010). *Hemispheric Transport of Air Pollution 2010, Part A: Ozone and Fine Particles,* Air Pollution Studies No. 17, edited by Frank Dentener, Terry Keating, and Hajime Akimoto. Geneva: United Nations Economic Commission for Europe, ECE/EB.AIR/100.

[6]On 16th February 2012, U.S. Secretary of State Hillary Rodham Clinton announced the *Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants*. The founding coalition partners are Bangladesh, Canada, Mexico, Sweden and the United States, together with the UN Environmental Programme (http://www.state.gov/r/pa/prs/ps/2012/02/184042).


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