Part III: Global and Future Implications

10. Global and Future Implications

10.1. Global

Climate change: It is important to differentiate the decadal to centennial time scales involved in greenhouse gases (GHG) warming from the several days time scale of aerosol life times. On the regional scale, anthropogenic aerosols are already affecting surface forcing, atmospheric heating, and precipitation. It is important to recognize that Asia is not the only source of manmade particles. Anthropogenic aerosol sources are distributed worldwide. Globally averaged, the aerosol net radiative cooling effect may currently be quite comparable with the forcing due to GHG emissions. The role of GHG in global warming will increase because of their accumulation in the atmosphere. For the next decades, the regional aerosol effects will continue to play a major role as long as such strong sources of air pollution remain. It appears that the strongest GHG effect (on surface temperature) will be felt in the southern hemisphere and at the extra-tropical latitudes, whereas the effects from aerosols will be felt most in the tropics and the sub-tropics, particularly in view of the large tropical and sub-tropical aerosol emission sources in the Asian region.

Transcontinental nature of the haze: Life times of most anthropogenic aerosols (sulfates, black carbon, dust) are in the range of 5 to 10 days. If the aerosol is mostly confined to the first 1 kilometer, the transport will be limited to a thousand kilometers or less. However during INDOEX the haze was elevated to higher layers with a peak concentarion at about 3 kilometers. An air parcel at 3 kilometers can travel half way around the globe within a week (Figure 10.1) thus raising the possibility of hemispheric wide dispersal for particles such as black carbon. In addition, gaseous air pollutants, such as CO and O_3, having substantially longer lifetimes can be strongly involved in transcontinental pollutant transport.

Hydrological Cycle: The large reduction in solar radiation at the surface by black carbon has potential implications for spinning down the hydrological cycle. This issue is particularly important in view of the longrange transport of black carbon.

Potential Transcontinental Nature of the "Haze"
Forward Trajectories from 700 mb, March 14-21, 1999

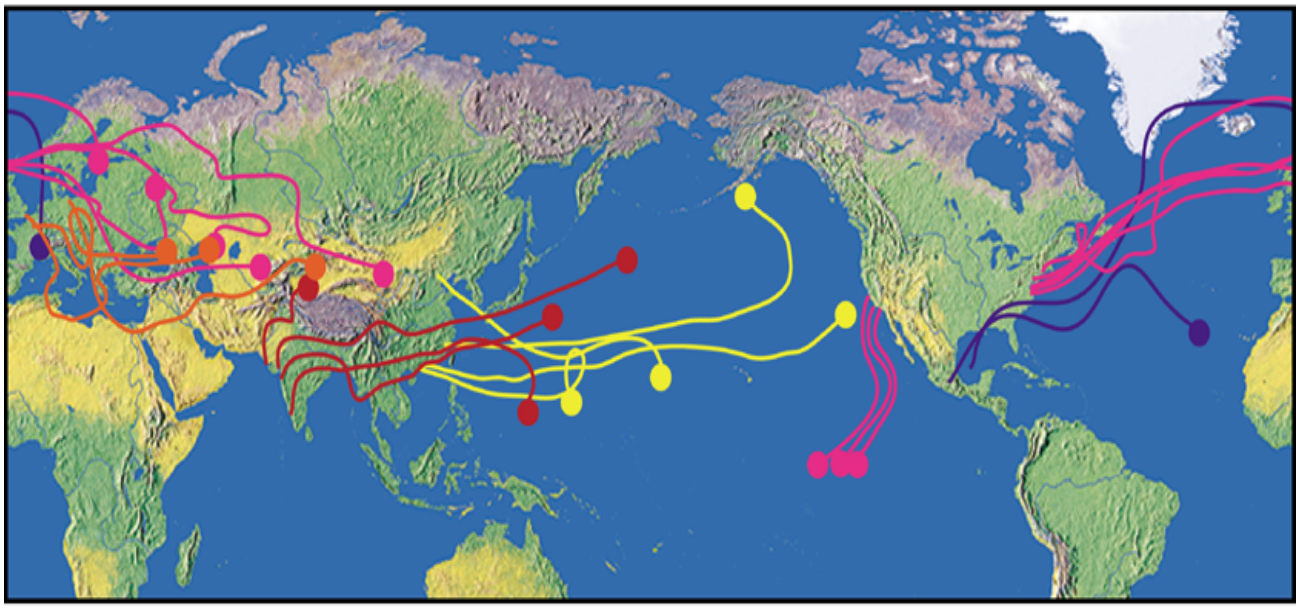


Figure 10.1: Trajectories are from India, China, Mexico, US east and west coasts, London, Paris and Berlin (courtesy of T.N. Krishnamurti).

10.2. Recommendations

A new approach: A more complete picture of the roles and interactions of GHG, aerosols and ozone is urgently needed. Problems such as haze, smog, and acid deposition fall under the general category of air pollution. The aerosols and high level of ozone that result from rural and urban air pollution are part of the global warming issue since they could induce climate change by altering the radiative balance of the planet. Their presence can also have ecosystem impacts, notably on agriculture and public health. Thus, there is a need to assess the impacts under one common framework (Figure 10.2), which is the goal of the proposed strategy for *Project Asian Brown Cloud (ABC)*.

It is now undisputed that primary air pollutants and their chemical products can be transported over distances of many thousands of kilometers. Thus, emissions in one country can cause damage in other countries through transnational and even transcontinental transport. This transport of pollutants converts local issues into regional and global concerns. Thus this issue cannot be addressed by individual national efforts alone. Past experience has demonstrated that the most effective way of tackling air pollution is through international cooperation which is the essence of this proposed strategy. To aid policy actions, we urgently need scientific data on the sources of primary and secondary aerosols from various regions within Asia. In particular we need to characterize the relative strengths of biomass burning and fossil fuel combustion. Such data for India and China are needed first since they contribute the bulk of the total emissions.

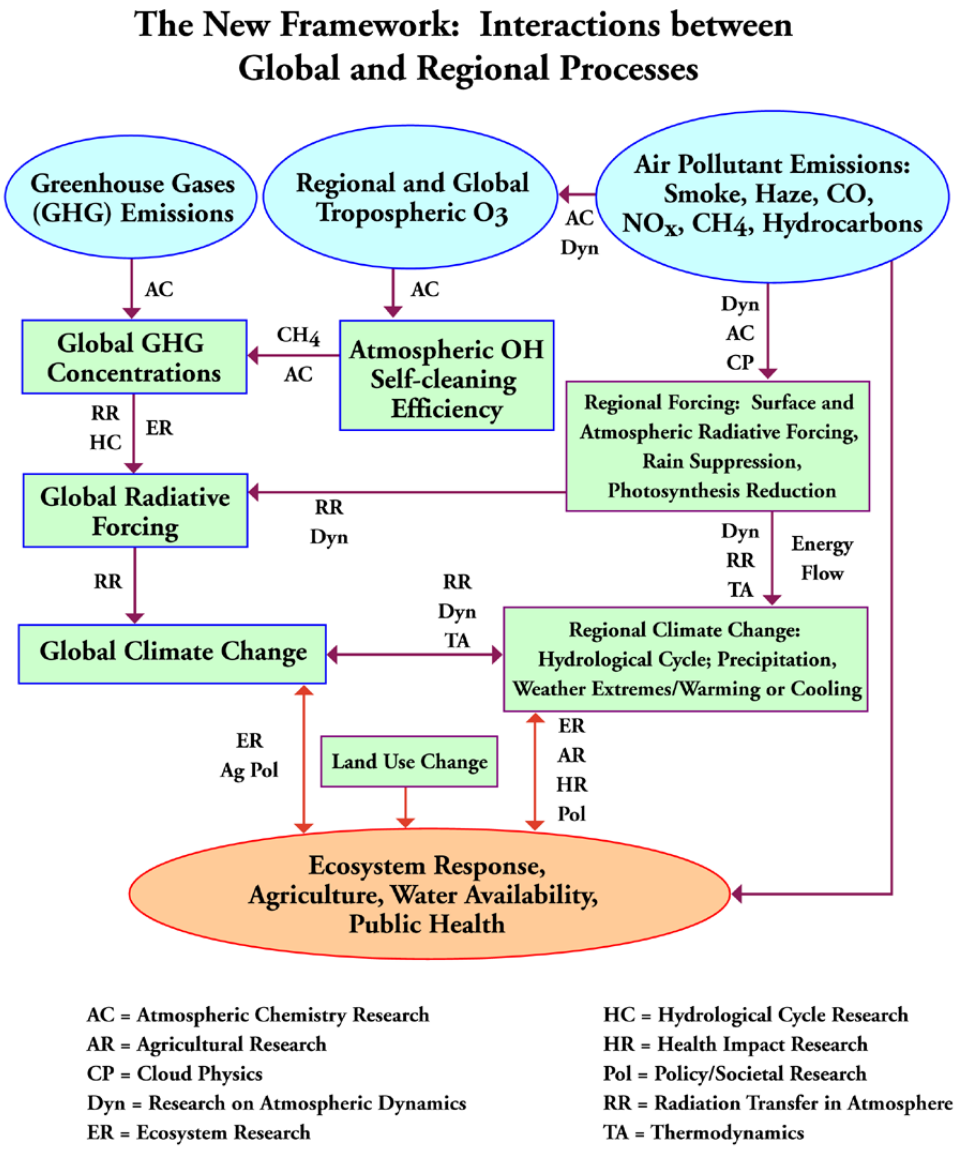


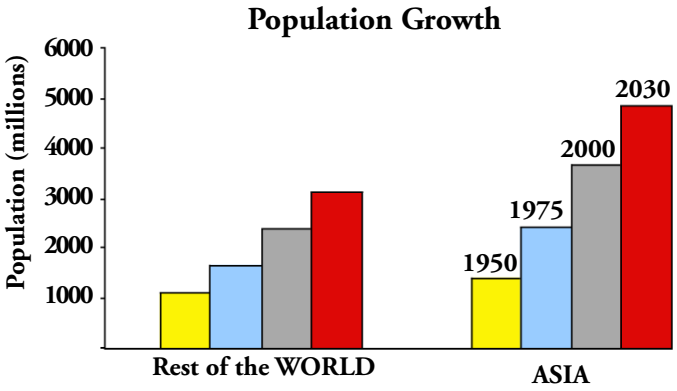
Figure 10.2

A comprehensive program needs to be developed and implemented for understanding the nature and scope of environmental issues facing Indo-Asia-Pacific, and develop a framework for assessing past and future impacts. Such a program should include integration of satellite data with regional surface data, global atmospheric chemistry and climate models in correlation with critical data from public health, agriculture, and marine and terrestrial ecology. Specifically, in the area of capacity building, it should include field experiments to facilitate active collaboration with regional scientists and practical training for regional students and post graduates.

The agriculture assessment should be gradually expanded to include Pakistan, China and particularly Indonesia, Thailand and Vietnam, the region's main rice producers. Of particular interest, to complement and to validate modeling studies, in-situ observations should be set up to provide critical data input for the models. Together with satellite observations, data from these sites should provide critical coverage to understand the long-term build up of atmospheric pollutants in the Indian Ocean/South Asian region and gain insights on the role of transboundary transport of pollutants. When these data are integrated with air pollution data from various cities and surface stations in Asia, we will have a much better understanding of how air pollution is transported and how it impacts on the South Asia-Pacific region.

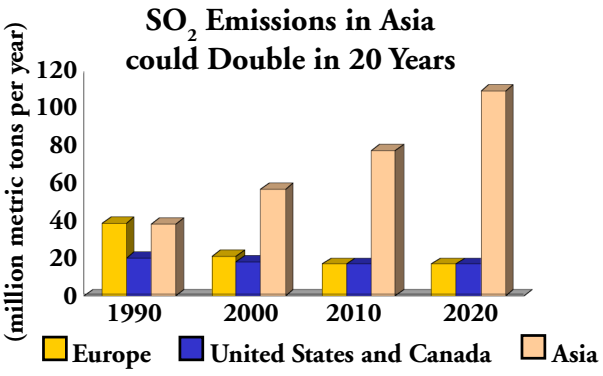
By the year 2030, the Asian region will house about 5,000 million people (Figure 10.3). According to one projection (Figure 10.4), SO_2 emissions could double during that period. A corresponding increase in the concentration of black carbon and other aerosols can have major negative impacts on the radiation, temperatures and water budget of Asia and of the planet. It is important that steps be taken to slow down the growth of pollutants.

Lastly, given the importance of the South Asian region, we recommend that UNEP undertake such regional assessments periodically. Such an enterprise should be expanded to other parts in the developing world, such as Africa and South America.



Source: World Population Prospects: The 2000 Revision; United Nations New York.

Figure 10.3



Source: World Resources Institute, Global Environmental Trends, *http://www.wri.org/wri/trends*, R. Downing, R. Ramankutty, and J. Shah, RAINS-ASIA: An Assessment Model for Acid Deposition in Asia (The World Bank, Washington, D.C. 1997), p. 11.

Figure 10.4

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