Global warming and climate change: Impact on India

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Global warming is here to stay and climate change will be intense. The warming could range from 1.8 dgrees to 4 degrees C. , which could lead to water scarcity and droughts as well as higher rainfall and floods. The impact will also affect biodiversity, forests and agriculture. India has seen stupendous growth in the agricultural sector and has become from once-food-importing to food-exportring country, after adopting new technologies and agriculture and its allied industries contribute to nearly 19 per cent of the total Gross Domestic Product (GDP). More than 60 per cent of the work force is dependent on this sector. Nearly two-thirds of the cropped areas in the region is rain-fed. Apart from this, the northern rivers derive much of their waters from the Himalayan glaciers. It has been reported that there has been accelerated rate of melting of these glaciers. Still higher rate of melting could affect fresh water supply sources in the Ganga-Brahnmaputra basin which could directly affect the biodiversity, livelihood of people in that region and lead to dramatc consequences of the country's economy. Hydropower generation could be drastically reduced, leading to an energy crisis. The country has a coastline of 6,000 km around which about 400 million people live. Any rise in the sea level, say by a meter, can lead to welfare loss of $1.859 million in India. As it is, tropical cyclones in the Bay of Bengal cause havoc in the coastal areas and any rise in sea level could mean a loss of 15 per cent of land area by 2020. Biospheres like the Sunderbans can be lost for ever and other mangrove forests may meet the same fate. Forests play a crucial role in the social, economic and cultural spheres of India. Many river systems originate in the forests and anchor rich biodiversity. Some 200,000 villages are located inside or on the fringes of forests and some 200 million people depend on forests for their livelihood. The Indian subcontinent is projected to experience a warming of 2 to 6 degrees by the end of the current century with consequences of reduced or increased rainfall, threat to biodiversity and in general to the rate of growth of its economy. Urgent steps are needed to face these threats and the Government of India is grappling with this problem.

Direct aerosol effect from multimodel simulations in AeroCom

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There has been a substantially development of the global aerosol models over the last decade. Despite this development and advanced aerosol observations uncertainties in the direct aerosol effect is substantial. AeroCom is a global aerosol model intercomparison exercise [1, 2] and Phase II simulations have recently been performed. Here we present results from several global aerosol models with simulations of the direct aerosol effect based on aerosol emissions for present and pre-industrial conditions. The solar radiative forcing (RF) of the total direct aerosol effect range between -0.6 and -0.05 Wm^{-2}. All models in the study include anthropogenic changes in sulphate, black carbon (BC) from fossil fuel, organic carbon (OC) from fossil fuel, and biomass burning aerosols (BC and OC). Some of the models also include anthropogenic changes in secondary organic aerosols and nitrate in the model simulations. The spread in the RF is large for the carbonaceous aerosols, with RF for BC from fossil fuel ranging from 0.14 to 0.37 Wm^{-2}. The few models performing RF of secondary organic carbon and nitrate shows even larger relative range in the RF.

We analyze the results with respect to burden, aerosol optical depth, and extinction coefficients to explore the causes for the differences. Further, vertical profile differences which are particularly important for BC is quantified in terms of RF.

[1] Schulz, M. Textor, C. Kinne, S. Balkanski, Y. Bauer, S. *et al*. (2006) *Atmos. Chem. Phys*. 5225–5246. [2] Textor, C. Schulz, M. Guibert, S. Kinne, S. Balkanski, Y. *et al*. (2006) *Atmos. Chem. Phys*. **6**, 1777–1813.