



Regional and Global Perspectives of Megacity Air Pollution

Gregory Carmichael, Sarika Kulkarni, Yafang Chen, Man Yu, Pallavi Marrapu, Pablo Saide, Scott Spak, and Min Huang

University of Iowa, USA (gcarmich@engineering.uiowa.edu)

Megacities are leading drivers of economic and environmental change. Fueled by high population growth and vibrant economies, energy consumption in megacities is large and growing. In Asia megacities are projected to account for ~40% of their country's GNP (gross national product) by 2030. Because fossil fuels continue to provide much of this energy, emissions of greenhouse gases, poor air quality is a major concern for megacities. In aggregate, pollution from megacities and surrounding areas can grow to create regional and global problems. The current interest in trans-boundary and hemispheric transport of pollutants reflect this. The pressing environmental problems of urban pollution and climate change are closely linked megacity problems, sharing common causes and solutions. The fact that air pollution problems and greenhouse gas emissions arise largely from fossil fuel combustion and the important role of aerosols in both air pollution and climate change are illustrative examples. Globally many megacities represent atmospheric brown cloud hotspots; regions with large aerosol radiative forcing of the atmosphere and surface (dimming), with annual mean surface dimming in most tropical mega cities exceeding 20 Wm⁻², equivalent to reducing solar irradiance at the top of the atmosphere by more than 10%. The increase in solar energy absorbed by aerosols over the atmosphere of some of these mega cities is comparable to the heat input by energy consumption. Thus in addition to contributing to regional and global climate change, the atmospheric forcing may also contribute to the urban heat island effect, and modify the weather. In this paper the impacts of megacities on regional and global pollution are discussed, drawing upon findings from our current studies done in Asia and international activities including the UNEP ABC and the WMO GURME projects.