BNL -65518-AB

UNCERTAINTIES IN CLIMATE FORCING BY ANTHROPOGENIC AEROSOLS

S. E. Schwartz
Environmental Chemistry Division
Department of Applied Science
Brookhaven National Laboratory
Upton, NY 11973-5000

December 1997

For presentation at the
American Geophysical Union 1997 Fall Meeting
San Francisco, CA
December 8-12, 1997

Research by BNL investigators was performed under the auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886, with support from the Atmospheric Chemistry Program (ACP) under the Office of Health and Environmental Research.

ABSTRACT

Tropospheric aerosols influence the earth radiation budget and climate by scattering and absorbing shortwave radiation (direct effect), by modifying cloud shortwave and longwave optical properties (indirect effect), and by modifying cloud hydrology. Specification of the direct forcing by anthropogenic aerosols requires knowledge of the history over the industrial period of loading, distribution, composition, and microphysical properties of these aerosols, as well as determination of the radiative influence of a specified well characterized aerosol. Similar considerations apply for the indirect forcing, with additional uncertainties involving cloud microphysics and radiative transfer. Because of the short atmospheric residence times of aerosols (days), their distribution and properties are quite nonuniform geographically and temporally, necessitating highly resolved specification of aerosol properties. For example direct aerosol forcing varies several fold as a function of relative humidity as a consequence of hygroscopic growth. Uncertainties in aerosol forcing represent the greatest source of uncertainty in forcing of climate change over the industrial period--so much so that no meaningful empirical inference of the climatic effect of greenhouse gases can be drawn from the climate record. This talk reviews the major sources of uncertainty in aerosol forcing and identifies research needed to reduce these uncertainties.