BNL-64584 (Abstract)

MODELS AND SATELLITE DATA

S. E. Schwartz

Workshop on Use of Satellite Data, Global Models, and Analysis to Advance Understanding of Aerosol Direct and Indirect Climate Effects, NASA GISS, New York, NY, June 2-3, 1997.

Published chemical transport models for aerosols or for specific aerosol species such as sulfate, especially those that are driven by monthly mean winds from climatology, exhibit smooth contours. The repeated publication of figures showing such smooth contours may have prejudiced thinking that this is in some way representative of the actual distribution of aerosol loadings. Seasonal composites of satellite-derived aerosol optical depth likewise exhibit rather smooth contours. Reality is very much otherwise. The short residence times of tropospheric aerosols are comparable to the time scale of variability in synoptic scale winds and precipitation that control the distribution of aerosols. This situation, together with the highly nonuniform distribution of sources of anthropogenic and dust aerosols, leads to a highly heterogeneous distribution of aerosol loadings (in great contrast to the rather smooth distribution of the long-lived greenhouse gases). The heterogeneity in aerosol loadings is readily manifest in time series of aerosol loadings at a given location. Likewise one should expect a similar variation in the spatial distribution, as is exhibited in models for which the controlling meteorology exhibits the short-time variability of actual synoptic scale variability, but the synoptic observational coverage required to develop this picture is lacking (one might imagine trying to get this from GOES, although the photometric resolution is marginal). Models can be highly valuable in trying to discern the aerosol loading in observations, provided they accurately represent the temporal heterogeneity that is responsible for the heterogeneity in loadings. For this it is necessary to drive the model by observation-derived meteorological data, not by climatological or GCM meteorology. This situation may be turned to advantage, because the inherent spatial and temporal variability of aerosol loading allows the possibility of experiments that can discern and quantify the aerosol influences, by comparisons between high and low loading situations.

Research by BNL investigators was performed under the auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886.