BNL-68812-AB

SIZE-DEPENDENT SEASALT AEROSOL PRODUCTION FLUX: A CRITICAL REVIEW

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November 2001

For presentation at the
American Geophysical Union Fall Meeting
San Francisco, CA
Dec. 10-14, 2001

Abstract

Seasalt aerosol (SSA) is a major source of cloud condensation nuclei and is important in atmospheric chemistry, atmospheric radiation transfer, and air-sea interaction. Knowledge of the size-dependent SSA production flux is crucial to quantify the role of SSA in these processes and is necessary for representing SSA in chemical transport and climate models. We review methods to obtain this flux from laboratory and field measurements and the conditions required for successful implementation. We compare and critically evaluate reported fluxes based on measurements of size-dependent SSA concentrations, whitecap ratios, size-dependent oceanic bubble concentrations, and size-dependent drop production from bursting bubbles. Widely used formulations of key quantities such as wind-speed dependences of whitecap ratio and mass concentrations, which have virtually attained the status of gospel, are not supported when compared to measurements. The uncertainty in production flux obtained with any one method due to the scatter in the input data is typically an order of magnitude for a given wind speed, despite the much greater precision implied in published formulations, and may be much greater because inherent assumptions are not valid and necessary conditions are not satisfied. Fluxes obtained by different methods differ by up to several orders of magnitude. Few data are available for particles with r80 (radius at 80 relative humidity) less than 1 μm, important for cloud nucleation, atmospheric chemistry and light scattering. Particles with r80 greater than 30 μm contribute little to effective production flux at 10 m because of rapid gravitational removal and long times for relative humidity equilibration.

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