

Atmospheric Aerosols: Tiny Particles with Huge Impacts

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Abstract

Aerosols are suspensions of solid or liquid particles in air, excluding clouds and rain droplets or crystals. These particles range in diameter from a few nanometers (nm) to tens of micrometers (μm), with *fine* particles designated as those with diameters less than $2.5 \mu\text{m}$ while *coarse* particles are those with diameters greater than $2.5 \mu\text{m}$. Fine and coarse particles typically have different sources, formation pathways, chemical composition, optical properties, removal mechanisms, and deposition pattern in the respiratory tract. A variety of measurement and modeling techniques are utilized in aerosol studies and the microphysical, chemical, and optical properties of these particles are important especially when considering their impacts on human health and the environment. Aerosols have the capacity to penetrate deep into the human respiratory system and numerous studies have associated aerosols with increased morbidity and mortality. Acidic compounds resulting from the reactions of aerosols in the atmosphere adversely affects terrestrial and aquatic ecosystems as well as building structures. Aerosols can also be transported over long distances, posing a challenge for air quality management even in areas with low emissions. The ability of aerosols to scatter and absorb light have direct and indirect effects on the Earth's energy budget and climate. Aerosols therefore have major impacts locally, regionally, and globally and it is important to better understand its sources, physical and chemical properties and transformation, transport, and effects.