

Optical, Physical and Chemical Properties of Aerosols Around Japan from Shipboard Measurements

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Aerosols play an important role in the global climate system due to their radiative effect to the Earth's radiation energy balance. Though it is well known that aerosols have two-fold significant effects characterized by "direct" and "indirect", the quantity of both effects is still uncertain. The direct effect is for aerosols to affect directly on the radiation budget by scattering and absorbing solar radiation in the atmosphere. Therefore the aerosol optical properties are essential for quantitative estimation of the direct effect of aerosols. The aim of this study is to investigate the spatial variation of aerosol optical, physical and chemical properties and its relation to the origin of aerosols for estimating the direct effect of aerosols in East Asia. For this purpose, we carried out the aerosol measurement on board the instrumented R/V Shirase during the Japanese Antarctic Research Expedition Training Cruise with counterclockwise coastal round cruises from Yokosuka via the Western-North Pacific, the Sea of Japan, and the East China Sea in early autumns of 2002, 2003, and 2004. The R/V Shirase was equipped with an Optical Particle Counter, an Integrating Nephelometer, and a Particle Soot/Absorption Photometer for optical measurements of aerosols and also an impactor-filter system for chemical analysis for water-soluble aerosols. Water-insoluble aerosols were measured with a Coulter Counter. In this paper, results from the shipboard aerosol measurements are shown and compared for discussion on the optical, physical and chemical properties of aerosols in the marine boundary layer around Japan. The result shows some characteristic features of aerosol properties and their difference in spatial distribution. Summarizing the result, we can understand that the marine boundary layer aerosol around Japan consists of maritime sea-salt particles from remote ocean, soil dust from Chinese Continent, and anthropogenic aerosols produced in Japan and neighboring countries including Korea and China. The mixing state of these aerosols is strongly related to the air mass origin and history.

Keywords: aerosol; Japan; radiative effect; aerosol optical properties; shipboard measurement; optical particle counter; integrating nephelometer; PSAP; Coulter counter.