

## 8.6 Measurement of optical and chemical properties of atmospheric aerosols

### (1) Personnel

#### On board scientists

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#### Co-workers not on board

Tatsuo Endoh (Institute of Low Temperature Science, Hokkaido University): Associate Professor

Sachio Ohta (Graduate school of Engineering, Hokkaido University): Professor

Tamio Takamura (Center for Environmental Remote Sensing, Chiba University): Professor

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### (2) Objectives

It is necessary to measure spatial distribution and variation of optical properties and chemical species of the atmospheric aerosol to estimate the radiative forcing. But, there are no data available of aerosol properties on the western Pacific Ocean.

We, thus, measure the distribution of aerosol optical thickness, volume scattering coefficient, volume absorption coefficient, size distribution and chemical properties of atmospheric aerosols on the Pacific Ocean east of Japan.

### (3) Measured parameters

Obtained parameters and samples inventory are shown in table 8-6-1 and in table 8-6-2.

Table 8-6-1 Obtained data inventory

Parameter	Period, Cycle	Instruments	Data Status / Data Format	comment
Optical thickness and size distribution	May14~28 every 5min	Sky Radiometer (PREDE,POM-01MKII)	ASCII	measurement in clear sky
Aerosol size distribution	May14~28 every 1min	Optical Particle Counter (RION,KC-01C)	ASCII	
Scattering coefficient	May14~28 every 1min	Intgrating Nephelometer (Radiance Research Model 903)	ASCII	
Absorption coefficient	May14~28 every 1min	Particle Soot/ Absorption Photometer (Radiance Research)	ASCII	

Table 8-6-2 Obtained sample inventory

Parameter	Period, # of Samples	comments
Teflon filter	May14~28 13 samples	After sampling kept in refregiator
Quartz fiber filter	May14~28 9 samples	After sampling kept in refregiator

#### (4) Methods

Sky Radiometer (POM-01MK ; PREDE), equipped on deck, measures direct and scattering solar radiation. The data provide optical thickness, Ångstrom exponent and size distribution of atmospheric aerosols.

Sample air is drawn through inlets 5m height on compass deck, to manifold in research room. Particle larger than 2 μm in diameter are removed by cyclone separators. From the manifold, the sample air is distributed to Particle Soot / Absorption Photometer (PSAP; Radiance Research), Integrating Nephelometer (IN; M903; Radiance Research) and Optical Particle Counter (OPC; KC-01C; RION). PSAP measures volume absorption coefficient, IN measures volume scattering coefficient and OPC counts number concentration of aerosols larger than 0.3, 0.5, 1.0, 2.0 and 5.0 μm in diameter. The aerosols are also collected on filter for chemical analysis by using another sampling system. The sampling system consists of three parts. One is Teflon filter sampling line (FP-500; 47mm ; SUMITOMO DENKOH), the other is quartz fiber filter sampling line (2500QAT-UP; 47mm ; Pallflex). And another is teflon and quartz fiber filters in tandem use line. Filter sampling is performed with the special cautions not to be contaminated by chimney exhaust. The filters are stored in the refrigerator. From the aerosols collected on Teflon filters, amounts of inorganic and metal components are analysed by Ion chromatography and ICP-MS. From the sample on quartz fiber filters amounts of analyzed elemental and total carbons are determined by carbon analyzer.

#### (5) Results

The sky radiometer has been going well owing to more calm, silent condition and circumstances about shivering problems provided by the R/V Mirai, whose engines are supported by well defined cushions. Therefore, measured values will be expected to be considerably stable and provide good calculated parameters in higher quality. However, some noise waves were found to interfere the 16,13 and 12channel marine bands of VHF from sky radiometer. Fortunately the origin and source were identified by using a VHF wide band receiver and the interference waves were kept by fairly separating from two VHF antennae and decreased to recovery of 100%.

The volume scattering and absorption coefficients were, respectively,  $1.3 \times 10^{-5} \text{m}^{-1}$  and 0.1

$5 \times 10^{-6} \text{ m}^{-1}$ . Particle concentration larger than  $0.3 \text{ }\mu\text{m}$  was  $3 \times 150 \text{ cm}^{-3}$ .

(6) Data archive

The data of PSAP, IN, OPC and skyradiometer are numerically analyzed and filter samples are chemically analyzed. All data are archived at Hokkaido University (Endoh and Ohta), University of Tokyo (Nakajima) and Chiba University (Takamura), and submitted to JAMSTEC within 3-years.