VERTICAL PROFILES OF AEROSOL OPTICAL THICKNESS OVER SYOWA STATION, ANTARCTICA (ABSTRACT)

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Attenuation measurements of solar irradiance using an airborne sun photometer were performed for the first time over Syowa Station, Antarctica. The NIPR's Cessna 185 aircraft equipped with a sun photometer (Eko, Model MS-111) took 4 flights during JARE-25, on January 19, September 3, December 25 and 26, 1984. The aerosol optical thicknesses (AOT) at wavelengths of 0.369, 0.5, 0.675 and 0.862 μm were obtained at several altitudes up to 5 km on each flight.

The temporal change of vertical profiles of AOT confirmed that the decrease of AOT found in the ground-based measurements during 1984 (*cf.*, M. SHIOBARA *et al.*: Mem. Natl Inst. Polar Res., Spec. Issue, **45**, 93, 1986) reflects the depletion of stratospheric aerosols enhanced by the El Chichon eruption in 1982.

The tropospheric AOT over Syowa Station was estimated as 0.005–0.01 at 0.5 μm wavelength and was nearly comparable with the non-disturbed stratospheric AOT in contrast with the mid-latitude region where the tropospheric AOT constitutes most of the AOT of the whole atmosphere.

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EXPERIMENTAL STUDY ON "HALO" FORMATION IN THE POLAR REGION (ABSTRACT)

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When cirriform clouds or ice fogs lie down between the observer and the sun (or moon), refraction and reflection effects of light rays by small ice crystals (diamond dust) can lead to one or more "halo" phenomena (R. GREENLER: Rainbows, Halos and Glories. Cambridge, Cambridge Univ. Press, 1980). For example, the most common—the 22°—halo, which occurs when the cloud form is a veil of cirrostratus and when the predominant ice crystal form is that of hexagonal prism of uniform size, is explained form the fact that the angle of deviation (*i.e.* the angle of minimum bending from a straight line by refraction) is 22° for a triangle with apex angle of 60°. However, it has not as yet been satisfactory explained how the appearance of halo phenomena and the halo intensity depend on the basic properties of ice crystals such as morphology, spatial concentration, size distribution, and falling orientation (J. HALLETT: J. Opt. Soc. Am., **A4**, 581, 1987). The purpose of this study is to observe the halo phenomena in ice fogs made artificially in the laboratory and to clarify their formation mechanisms in connection with aspects of both crystal growth and meteorology.

An experiment was carried out for the 22° halo. As a result, we showed that the artificial formation of halo with enough intensity was possible and the effects of the variety of crystal forms and crystal size for halo formation were extremely severe. On the basis of these experimental results and theoretical consideration, we discuss the formation mechanism of the "halo". Finally, we mention important applications of halo study such as remote sensing of cloud particles from the ground or a satellite.

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CHEMICAL NATURE OF HEAVY METAL ELEMENTS IN ANTARCTIC SNOW (ABSTRACT)

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Analysis of firn block samples from site S25 near Syowa Station revealed that significant parts of Al, Fe, Zn and Cu are contained in the snow sample as organic metal compounds. They dissolve into the melt water of the snow sample and become reactive only after oxidative digestion with $HClO_4$ and HNO_3.

The same organic metal compounds were found in atmospheric aerosols collected at Syowa Station and Mizuho Station, which suggests that these were incorporated into the snow from atmospheric aerosols.

The above observation, in association with the finding that these organic metal compounds also exist in aerosols from the North Pacific as well as from the Southern Sea, indicates that these compounds are widely distributed in the global atmosphere and further suggests the existence of gaseous organic metal compounds in the air as a precursor of these compounds in the aerosols.

The samples of snow from site S25 and atmospheric aerosols from the Southern Sea were subjected to volatilization experiments in the vacuum and the vapor was collected in the cold trap immersed into the liquid N_2. Significant amounts of the heavy metals were found in the cold trap, showing the volatile nature of these heavy metal elements contained in the Antarctic snow and aerosols. These results support the idea that the gaseous organic metal compounds exist in the air as a precursor of aerosols. Experiments to directly determine the gaseous organic metal compounds are now in progress.

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