Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

U04-P01 Room:Poster Time:April 29 14:00-15:15

Aerosol particles collected using aircrafts from anthropogenic sources and biomass burning and electron microscopy

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Aerosol particles collected during four sampling campaigns using aircrafts were analyzed using transmission electron microscopes (TEM). The samples were collected from two A-Force campaigns in 2013 (winter and summer) conducted in Japan and Korea, BBOP campaign in 2013 in the USA, and MILAGRO campaign in 2006 in Mexico. These campaigns aim to characterize aerosol particles from regional transportation, biomass burning, and both. The samples collected using aircrafts are useful for characterization of particle agings, especially changes of their mixing states, from emissions as the aircrafts can chase plumes of different aging periods. An example of such aerosol-particle aging is tar ball formation in biomass burning smoke. Tar ball is spherical, organic aerosol particles commonly from combustion smoke of a wide range of biomass burning. At the early stage of the emission, tar balls are liquid but as they age in the smoke, they become solid and spherical. Sets of biomass burning aerosol samples with different aging stages collected using an aircraft revealed such processes in atmosphere. I will also discuss the samples collected over Japan during the A-Force campaigns.

Keywords: Electron microscope, East Asia, Northwest US, A-Force, BBOP, MILAGRO

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Aerial observations for nitrogen compounds over the East China Sea

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In order to clarify long-range transport of air pollutants from the Asian continent, we have conducted aerial observation over the East China Sea and measured air pollutants centering on aerosols, as part of Grant-in-Aid for Scientific Research on Innovative Areas " Impacts of Aerosols in East Asia on Plants and Human Health (ASEPH) " . In this presentation, the results of nitrogen compounds such as nitrate are mainly described.

The aerial observations were conducted in October, 2009 (autumn), December, 2010 (winter) and March, 2012 (spring) over the East China Sea. The flights were performed between Fukue Island and the southern offing of Jeju Island and the flight altitudes were 500, 1000, 2000 and 3000 m. Onboard measurements of gaseous total odd nitrogen species, gaseous nitric acid (HNO_3(g)), O_3, SO_2, CO and black carbon were made and particles were collected on filters for ionic and metal component analyses.

The concentration ratios of particulate nitrate (NO_3^-(p)) to inorganic total nitrate (T.NO_3 = HNO_3(g) + NO_3^-(p)) were less than 0.5 in most of the flights except under high concentrations of dust particles (Kosa) or transboundary air pollutants. Most of NO_3^-(p) would be $NaNO_3$ formed by the reaction of gaseous nitric acid (HNO_3(g)) with sea salt aerosols during the observations in autumn and winter except on October 17 and December 11, when high concentrations of Kosa were transported. In the spring observation, the fraction of $NaNO_3$ in NO_3^-(p) was low and a large part of NO_3^-(p) would be originated from reactions of HNO_3(g) with gas phase ammonia and soil dust particles.

O_3 concentrations decreased with altitude in autumn and increased in winter. Positive and negative correlations between NO_y-T.NO_3 and O_3 concentrations were observed throughout the flights in autumn and winter, respectively. This indicates that the major components of NO_y-T.NO_3 were secondary photochemical nitrogen oxides such as PANs and NO_x, in autumn and winter, respectively. The differences of vertical distribution and NO_y components between autumn and winter may be caused by the variation of solar radiation intensity.

Keywords: aerial observation, nitrate, total odd nitrogen species, East Asia

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Airborne lidar measurements of water-vapor profiles

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Measurements of water vapor profiles are very important in studies of the atmospheric dynamics, aerosol growth effect and the eartlfs radiation effects. Water vapor is the predominant greenhouse gas and its vertical distributions are important parameters in model simulation of the global climate system. Passive remote sensing techniques from space provide global coverage of water vapor distribution but do not provide good vertical resolution, while lidar remote sensing techniques can provide high resolution measurements of water vapor distributions.

For future spaceborne water vapor DIAL systems, we developed a high power diode-pumped Nd:YLF laser and Ti:sapphire laser for water vapor DIAL. A Ti:sapphire laser is pumped by the SHG of the Nd:YLF laser. Tuning of the Ti:sapphire laser to a strong absorption line (ON1), a weak absorption line (ON2) of water vapor and an off line (OFF) is made by an injection seeder which consists of two single longitudinal mode laser diode modules. Two on-line laser diodes are locked to water vapor absorption lines using an absorption cell or a photo-acoustic cell. These three laser lines (ON1, OFF and ON2) are transmitted into the atmosphere with a triple pulse technique for measurements of water vapor profiles from the ground up to 10 km. The laser spectral width of the on line was 0.045 pm with a stability of 0.06 pm. The output energy of each laser line is more than 45 mJ. We have demonstrated airborne measurements of water vapor profile using this laser system.

Keywords: water vapor, airborne, lidar