3.125 Dry deposition of PM2.5 nitrate in a cool-temperate forest in northern Japan by vertical profile measurements.

Early Career Scientist

Presenting Author:
Akiyoshi Nakahara, Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Fuchu, Tokyo, Japan, s171923v@st.go.tuat.ac.jp

Co-Authors:
Mao Xu, Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Fuchu, Tokyo, Japan
Keita Suzuki, Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Fuchu, Tokyo, Japan
Taiichi Sakamoto, Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Fuchu, Tokyo, Japan
Kentaro Takagi, Hokkaido University, Field Science Center for Northern Biosphere, Sapporo, Hokkaido, Japan,
Atsuyuki Sorimachi, Fukushima Medical University, Department of Radiation Physics and Chemistry, Fukushima, Fukushima, Japan
Genki Katata, Ibaraki University, Institute for Global Change Adaptation Science, Mito, Ibaraki, Japan
Kazuhide Matsuda, Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Fuchu, Tokyo, Japan

Abstract:

In Asia, the significant emission of oxidized nitrogen from fossil fuel combustion has been concerned associated with air pollution, as well as the acidification and eutrophication of ecosystems. To better understand the process for removing the oxidized nitrogen from the atmosphere, we conducted vertical profile measurements of $PM_{2.5}$ and coarse aerosol components and gaseous HNO_3 in a cool-temperate forest in remote area of northern Japan. Previous observations (e.g. Honjo et al., J. Jpn. Soc. Atom. Env., 51, 257-265, 2016) indicated the deposition velocities of $PM_{2.5}$ nitrate were higher than those of $PM_{2.5}$ sulfate above forests. In this regard, almost observations were done above forest canopies. To understand the removal mechanisms in forest, we measured the vertical profiles above and below the forest canopy using both the filter and the denuder-filter sampling method. We set filter holders at 4 heights (0.1, 2, 8 and 16 m) and denuder-filter systems at 2 heights (2 and16 m) on an observation tower in the forest. Height of the forest canopy was about 6 m. During the period from 21 July to 7 August in 2017, the filter samplings to collect $PM_{2.5}$ and coarse aerosols were done every day and the denuder-filter samplings to collect HNO_3 and $PM_{2.5}$ without the effect of volatilization of ammonium nitrate on the filter were done every 2 days. Both sampling methods indicated the vertical gradients of $PM_{2.5}$ nitrate were significantly larger than those of $PM_{2.5}$ sulfate. The gradients of $PM_{2.5}$ nitrate above the canopy increased with

the daytime temperature increase rate from 21 m to 4 m. That is because the steep gradients of the $PM_{2.5}$ nitrate were associated with the volatilization of ammonium nitrate, as semi-volatile aerosols, near the leaf canopy layer due to the higher temperature. In this study, calculations of the gas-particle equilibrium were also attempted.