Analysis of springtime high ozone events at Mt. Happo from 2014 to 2016

*Okamoto, Sachiko1, Tanimoto, Hiroshi1, Nara, Hideki1, Kita, Kazuyuki2, Putero, Davide3

1. National Institute for Environmental Studies, 2. Ibaraki University, 3. National Research Council of Italy

Tropospheric ozone ($O_3$) is one of the most important trace gases in the Earth’s atmosphere because it plays a central role in determining the oxidizing capacity of the atmosphere and air quality at local, regional, and global scales. Long-term trend of springtime $O_3$ at Mt. Happo (HPO; 36.70°N, 137.80°E, 1850 m a.s.l.) has been controlled by the El Niño Southern Oscillation (ENSO) as well as precursor emissions (Okamoto et al., submitted). Therefore, it is important to analyze long-range transport pattern changes induced by meteorological condition changes. In this study, we examine springtime $O_3$ enhancement events observed at HPO for the period from 2014 to 2016 focusing on its sources, characteristics of atmospheric composition and meteorological condition. HPO is located in the mountainous area near the Sea of Japan coast, and is one of the contribution site for the Acid Deposition Monitoring Network in East Asia (EANET) program. Surface $O_3$ has been measured by using UV absorption instrument since April 1998. In addition, we started measuring CO, $CO_2$ and $CH_4$ by using a Cavity Ring-Down Spectrometer since July 2013. To examine the origins and transport pathways of large-scale air masses arriving at HPO, 5-day backward trajectories were calculated using the NOAA Hybrid Single-Particle Lagrangian Trajectory (HYSPLIT, Version 4) model. We used STEFLUX (Putero et al., 2016) for evaluation of the effect of stratosphere-to-troposphere exchange (STE) on $O_3$ concentration at HPO. Our results indicate that STE has not significantly influenced on springtime $O_3$ concentrations at HPO, however STE is important source for tropospheric springtime $O_3$ in the Northern Hemispher at mid-latitudes. We calculate the residence time over the source regions by using back trajectory analysis. In the presentation, we will show the potential source regions, enhancement ratios and meteorological condition for individual $O_3$ enhancement event.

Keywords: tropospheric ozone, carbon monoxide, STEFLUX, Long-range transport