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

AAS22-01 Room:511 Time:April 30 16:15-16:30

Impacts of the Arctic ozone depletion on Japan observed with FTIR

HASHIMOTO, Yuki[1] ; MURATA, Isao[1*] ; NAKAJIMA, Hideaki[2] ; NAGAHAMA, Yoshihiro[2] ; MORINO, Isamu[2] ; NAGAHAMA, Tomoo[3]

[1]Graduate School of Environmental Studies, Tohoku University, [2]National Institute for Environmental Studies, [3]Solar Terrestrial Environment Laboratory, Nagoya University

The ozone depletion occurs not only in the Antarctic but also in the Arctic. A record Arctic ozone depletion which was comparable to the Antarctic ozone depletion occurred in 2011. The ozone depletion itself occurs inside the polar vortex. But the airmass from the inside of the polar vortex is spread to mid-latitude in spring after its breakup. The purpose of this study is to quantify the impact of Arctic ozone depletion on mid-latitude by comparing the amounts of ozone in mid-latitude airmasses before and after the breakup of the polar vortex.

Vertical profiles of O_3, HF and N_2O have been retrieved from infrared spectra observed with Fourier transform infrared spectrometers (FTIR) at Tsukuba and Rikubetsu using the SFIT2 spectral fitting program. Spectra observed from 2006 to 2013 for Tsukuba and from 1997 to 2008 for Rikubetsu were used in this analysis.

HF and N_2O can be used as a tracer of the transport, because they are chemically stable species in the lower stratosphere. O_3 and HF (or N_2O) usually show a high correlation in the lower stratosphere because both species are stable. But the correlation will be changed when ozone is chemically perturbed. Therefore, we examined the correlations of mixing ratios between O_3 and HF (or N_2O) in the mid-latitude airmasses before and after the breakup and determined the chemical loss amount of ozone at the observational sites.

Some chemical ozone losses were found at the altitudes of 19 km and 21 km from O_3-HF correlation. Chemical losses in total ozone were also found from O_3-HF correlation and O_3-N_2O correlation. Then, these observed chemical loss amounts of ozone were compared with the total chemical loss amounts of ozone in the Arctic derived from Japanese Meteorological Agency [2012], Pommereau et al. [2013] and Rex et al. [2013].

Positive correlations were found between the observed chemical loss amounts of ozone at the altitude of 21 km for Tsukuba and at the altitude of 19 km for Rikubetsu and the total chemical loss amounts of ozone in the Arctic. Observed chemical losses in total ozone for both Tsukuba and Rikubetsu also showed positive correlation with the total chemical loss amounts of ozone in the Arctic.

The half-maximum total ozone loss amounts of 15 DU for Tsukba and 20 DU for Rikubetsu were estimated from the correlations, which result in the increases of 6 % and 7% of UV radiation, respectively.

Keywords: FTIR, Arctic ozone depletion, mid-latitude