Detection and analysis of the short-term increases of column-averaged dry air mole fraction of CO (XCO) observed at Rikubetsu, Hokkaido in 2015 early winter

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The National Institute for Environmental Studies (NIES) has observed solar absorption spectra in near-infrared region with a high-resolution FTIR (Bruker IFS120/5HR) set up at Rikubetsu in Hokkaido (43.46˚N, 143.77˚E, 380 m a.s.l) as a site of the Total Carbon Column Observing Network (TCCON) since 2014, and retrieved the column-averaged dry air mole fractions of various species such as CO_2, CH_4 and CO. Although seasonal and short-term variations of the their species were observed, we focus on the short-term events that CO column-averaged mixing ratio (XCO) increased and decreased. In 2015 early winter, the observed XCO started increasing on 13 November, and became about 4.5 times larger than the seasonal mean value on 30. After that, on 9 December, it returned to the mean value. The same features also appear in CO_2 (XCO_2) and CH_4 (XCH_4), suggesting that this was caused by an air mass inflow from combustion sources. In order to understand the relation between the XCO enhancement and emission sources, we made trajectory analysis during the period of this event by using FLEXPART (Stohl et al. 2005) and NCEP CFSv2-6hour analysis dataset. In each day, we made the back-trajectory calculations in 2 weeks at the height of 1, 5 and 7 km, respectively. The results show that the air mass mainly comes from the North-east China and far distant regions. To evaluate influence on XCO in each region, we picked up the hotspots in the regions estimated above from the MODIS hotspot dataset, and made the forward-trajectory calculations from them. The result is that influence of the emission from the North-east China region was about 10 times larger than those in other regions. Thus, the observed increase of XCO is like to be the effect of air mass inflow from combustion source of the North-east China.
In this presentation, we discuss the comparison with other XCO-increasing events during the observation period and the relation among the species as well as the details of trajectory analysis.

Keywords: near-infrared solar absorption spectra, tropospheric carbon monoxide, trajectory analysis

