In-situ and continuous observation of atmospheric N_2O and CO concentrations at Syowa Station, Antarctica.

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Nitrous oxide (N_2O) is one of the most important anthropogenic greenhouse gases and its infrared absorption efficiency is 200 times more than that of carbon dioxide (CO_2). In addition, since N_2O catalytically decomposes stratospheric ozone (O_3), N_2O is concerned to be a major factor for the destruction of the stratospheric ozone after the concentrations of atmospheric chlorofluorocarbons decreases in near future. Carbon monoxide (CO) is not considered as greenhouse gas generally, but atmospheric CO is closely related to the atmospheric CH_4 concentration through OH radicals, which are important reactant both with CH_4 and CO. Furthermore, CO is also a useful tracer for biomass burning and has an important role in the atmospheric chemistry. Therefore, it is important to reveal the temporal and spatial variations the atmospheric N_2O and CO concentration and to understand the cause of their variations quantitatively.

In this study, we developed a new continuous observation system for atmospheric N_2O and CO concentrations based on an OA-ICOS (Off-Axis Integrated Cavity Output Spectroscopy) laser spectrometer (Los Gatos Research, model N2O/CO r23) (Fig.1). Repeatability for the analysis of N_2O and CO concentrations by the system is estimated to be 0.14 ppb and 0.09 ppb (one standard deviation), respectively. The system was installed at Syowa Station, Antarctica, and continuous observation started in January 2019.

Figure 2 shows the temporal variations of the N_2O and CO concentrations observed by our system at Syowa Station since January, 2019. As shown in the figure, characteristic variations of N_2O and CO are found in each season. In the austral summer, in-phase and out-of-phase fluctuations of N_2O and CO were observed several times. These fluctuations could be caused by the transport of high N_2O and CO air mass affected by outgassing from the Southern Ocean and downward transport of stratospheric air into Syowa Station. In austoral spring, high CO event was captured at Syowa Station. It had been affected by serious biomass burning in Amazon and Australia.

In this presentation, we will introduce the observation system, thus developed, and show the temporal variations in the N_2O and CO concentration observed at Syowa Station in more detail.

Keywords: Global Warming, Atmosphere, Antarctica, Syowa, N2O, CO