Oral | Symbol A (Atmospheric, Ocean, and Environmental Sciences) | A-CG Complex & General

[A-CG36_30PM1]Science in the Arctic Region

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The Arctic region and surrounding circumpolar region is the key area for the study of global change because the anthropogenic impact is projected to be the largest in this area due to the complicated feedback processes of the nature. A number of international and interdisciplinary research projects are in progress for the studies on the atmosphere-ocean-land system under the extension program of the International Polar Year (IPY) during 2007 to 2008. In order to understand the feedback processes occurring in the Arctic and to project the global warming in the future, we need to establish the intense observational network and to exchange the knowledge and information by combining the different scientific communities under the common interest of the Arctic. Contributions from Green Network of Excellence (GRENE) Arctic Climate Change Research Project are also welcome.

2:15 PM - 2:30 PM

[ACG36-P09_PG]Continuous measurements of the atmospheric O2/N2 ratio at Ny-Alesund, Svalbard

3-min talk in an oral session

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Simultaneous observations of atmospheric O_2 (defined as O_2/N_2 ratio) and CO_2 concentrations provide valuable information about the global carbon cycle. For a better understanding of the global carbon cycle, several laboratories have developed precise measurement systems for the O_2/N_2 ratio and carried out systematic observations since the early 1990s. To elucidate the variations of the atmospheric O_2/N_2 ratio in detail and to contribute to a better understanding of the role of Arctic region on the regional and global carbon cycle, we developed a continuous measurement system using a differential fuel-cell O_2 analyzer, and then initiated systematic observation at Ny-Å lesund, Svalbard in November 2012, which is the first continuous observation in the Arctic region. The system is equipped with NDIR analyzer to measure CO_2 concentration simultaneously. The analytical precisions of O_2/N_2 ratio and CO_2 are estimated to be ±1.4 per meg and ±0.03 ppmv, respectively. Here, we will present observational results of the first year. The O_2/N_2 ratio observed at Ny-Å lesund shows a clear seasonal cycle with peak-to-peak amplitude of about 120 per meg, which reaches a minimum in late March to early April and a maximum in August. On the other hand, the CO_2 concentration varies seasonally in opposite phase with the O_2/N_2 ratio, showing the amplitude of 16 ppm. Short-term variations on time scales of several hours to several days are also clearly seen. In winter, it is often observed that the O_2/N_2 ratio sharply declines in a short time, accompanied by an increase in the CO_2 concentration, and the low values last for several hours or days. The O_2:CO_2 exchange ratio defined as the slope of a linear regression line between the measured values of O_2/N_2 ratio and CO_2 range between -1.6 and -1.5 ppm/ppm, which are close to the average O_2:CO_2 exchange ratio expected from fossil fuel burning in Europe. The results of backward

trajectory analysis indicated that the air masses arrived at Ny-Å lesund during the periods when such short-term variations were observed passed near or over Scandinavian Peninsula. Therefore, such a decline in the O_2/N_2 ratio is ascribed to transport of urban air influenced by human activities in Europe. In spring to summer, irregular fluctuations of O_2/N_2 ratio are often observed. The amplitude of such fluctuations reaches 50-60 per meg (corresponding to about 10-13 ppm). Similar fluctuations of CO_2 are also found in opposite phase with O_2/N_2 ratio. However, their amplitudes are 5 ppmv at most. The comparison of backward trajectories of air parcels with the distributions of marine biotic net primary production suggests that such fluctuations of O_2/N_2 ratio are closely related to O_2 emission due to marine biological activity near Norwegian Sea.