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AAS21-P19 Room:Convention Hall Time:May 22 17:15-18:30

Continuous measurements of the atmospheric O2/N2 ratio at suburban and coastal sites in the northeastern part of Japan

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To contribute to a better understanding of the global carbon cycle in terms of atmospheric O_2, a high precision continuous measurement system of the atmospheric O_2 concentration (defined as $d(O_2/N_2)$) was developed. Using this measurement system, systematic and continuous observations of the atmospheric $d(O_2/N_2)$ were initiated at Aobayama (AOB), Japan in February 2007 and on Enoshima Island (ENS), Japan in October 2008.

At AOB, $d(O_2/N_2)$ showed a clear seasonal cycle with the minimum value in late March to early April and the maximum value in late July to early August, superimposed on a secular decrease. The CO_2 concentration increased secularly and varied seasonally in opposite phase with $d(O_2/N_2)$. Short-term variations on time scales of several hours to several days were also clearly observed. In winter, it was often seen that $d(O_2/N_2)$ sharply declined in a short time, accompanied by an increase in the CO_2 concentration, and the low values last for several hours to a few days. The $-O_2$:CO_2 exchange ratio was found to be 1.39-1.38 ppm/ppm for such wintertime short-term variations. Since these ratios are in good agreement with a mean value of the $-O_2$:CO_2 exchange ratio calculated for fossil fuel consumption in Japan, the observed decline in $d(O_2/N_2)$ is ascribed to the transport of urban air influenced by human activities. In summer, a clear diurnal cycle was observable for both the atmospheric $d(O_2/N_2)$ and CO_2 concentration, due mainly to terrestrial biological activities near the site. The average $-O_2$:CO_2 exchange ratio over the summer periods of 2007-2010 was found to be -1.08 ($0.10^{\#}$) ppm/ppm for the daytime and -1.08 ($0.10^{\#}$) ppm/ppm for the nighttime, which are in excellent agreement with -1.10 ($0.05^{\#}$) ppm/ppm reported by previous studies. ($^{\#}$: standard deviation)

At ENS, $d(O_2/N_2)$ and CO_2 concentration varied seasonally, the respective temporal patterns being similar to those at AOB. However, the seasonal peak-to-peak amplitude of APO ($=O_2-1.1*CO_2$), which varies mainly by the air-sea O_2 exchange, is twice larger at ENS than at AOB. This implies that the seasonal cycle of $d(O_2/N_2)$ at ENS is much more strongly affected by the air-sea O_2 exchange, compared to that at AOB. In addition to the clear seasonal cycle, irregular short-term fluctuations of APO were observed especially in spring and summer. By comparing the backward trajectories with the distributions of marine biotic net primary production (NPP) around Japan, it was suggested that the short-term APO fluctuations are closely related to O_2 emissions due to marine biological production.