

東京における大気O₂、CO₂濃度の連続観測Continuous measurements of atmospheric O₂ and CO₂ at Tokyo

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High-precision measurements of atmospheric carbon dioxide (CO₂) in megacities are useful to validate the inventories of the fossil fuel-derived CO₂ emissions. In addition, recent studies suggest that combination of the atmospheric oxygen (O₂) and CO₂ measurements have potential for disaggregate the emissions of CO₂ into biosphere and fossil fuel combustions, which are coal, liquid fuel and natural gas. Since the exchange ratios between O₂ and CO₂ ($-O_2/CO_2$) are difference values for fossil fuel burning (1.17 for coal, 1.44 for liquid fuel and 1.95 for natural gas) and biotic process (1.0) due to depending on the elemental compositions. For a better understanding of the seasonal and long-term changes in CO₂ emission and contribution from fuels in the megacity, we started a continuous observation of atmospheric O₂ and CO₂ concentration at Tokyo Skytree in February 2017.

The observed CO₂ showed not only a seasonal variation but also short-term variations with amplitudes of more than several tens ppm, which were mirrored by the O₂ variations. The monthly averages of the $-O_2/CO_2$ ratios for the short-term variations, ranging from 1.35 to 1.63, were low in summer-autumn and high in winter. Since the short-term variations unclear correspond to the diurnal cycles, these variations may be attributed to the synoptic scale mixing of air. Examining the relation between CO₂ concentration and wind direction, we found that the high CO₂ concentration events with durations of several hours to few days were often observed when southwest wind blew. It should be noted that the $-O_2/CO_2$ ratio of such high CO₂ event tended to be high. This result seems to suggest that there are strong CO₂ sources with relatively high $-O_2/CO_2$ ratio, for example natural gas-fired plants, to the southwest of Tokyo Skytree.