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CONTINUOUS MEASUREMENTS OF THE ATMOSPHERIC O₂/N₂ RATIO AT NY-ÅLESUND, SVALBARD

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Simultaneous observations of atmospheric O₂ (defined as O₂/N₂ ratio) and CO₂ concentrations provide valuable information about the global land and ocean carbon exchanges. For a better understanding of the global carbon cycle, several laboratories have developed precise measurement systems for the O₂/N₂ ratio and carried out systematic observations since the early 1990s. To elucidate the variations of the atmospheric O₂/N₂ ratio and to understand role of the Arctic region on regional and global carbon cycle, we developed a continuous measurement system using differential fuel-cell O₂ analyzer, and initiated continuous observation at Ny-Ålesund (78°55'N, 11°56'E), Svalbard in November 2012, which is the first such observational system operated from the Arctic region. We will report results based on the first two years of measurement.

The O₂/N₂ ratio observed at Ny-Ålesund shows a clear seasonal cycle with peak-to-trough 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 CO₂ concentration varies seasonally in opposite phase with the O₂/N₂ ratio, showing a seasonal amplitude of 16 ppm. Short-term variations on time scales of several hours to several days are also clearly observed. In spring to summer, irregular fluctuations of O₂/N₂ ratio reaches 50–60 per meg (corresponding to about 10–13 ppm). Similar fluctuations of CO₂ are also found in opposite phase with O₂/N₂ ratio. However, their amplitudes are 5 ppm at most. The comparison of backward trajectories of air parcels with the distributions of marine biotic net primary production suggests that such fluctuations of O₂/N₂ ratio are closely related to O₂ emission due to marine biological activity near Norwegian Sea.