スヴァールバル諸島ニーオルスンにおける大気中CO_2濃度および炭素同位体比の時間変動
Temporal variations of the atmospheric CO_2 concentration and $d^{13}C$ at Ny-Ålesund, Svalbard

*後藤 大輔[1]、森本 真司[2]、石戸谷 重之[3]、青木 周司[2]、中澤 高清[2]、弓場 彬江[1]
*Daisuke Goto[1], Shinji Morimoto[2], Shigeyuki Ishidoya[3], Shuji Aoki[2], Takakiyo Nakazawa[2], Akie Yuba[1]

1.国立極地研究所、2.東北大学、3.産業技術総合研究所
1.National Institute of Polar Research (NIPR), 2.Tohoku University, 3.National Institute of Advanced Industrial Science and Technology

Long-term measurements of the atmospheric CO_2 concentration and its carbon isotope ratio ($d^{13}C$) have been used for partitioning CO_2 sinks into the terrestrial biosphere and the ocean. However, the CO_2 sinks estimated from $d^{13}C$ suffer with uncertainties in isotopic disequilibrium flux between the atmosphere and the ocean and between the atmosphere and the terrestrial biosphere (so-called isoflux). For a better understanding of the global carbon cycle, we have been carrying out the systematic observation of the atmospheric CO_2 concentration and $d^{13}C$ at Ny-Ålesund (78.93°N, 11.83° E), Svalbard since 1991 by weekly air sampling with subsequent analysis in NIPR. Here, we will present the observational results of CO_2 concentration and $d^{13}C$ for 1991–2013 and 1996–2013, respectively. The $d^{13}C$ data before 1996 were removed from our analysis due to experimental and sample quality problems (Morimoto et al., 2001).
The CO_2 concentrations show a clear seasonal cycle with peak-to-peak amplitude of about 17 ppmv, which reaches the maxima in late April to early May and the minima in late August, superimposed on a secular increase with an average rate of 2.0 ppmv/yr for the period of 1996–2013. On the other hand, the $d^{13}C$ decreases secularly at an average rate of −0.018 ‰/yr, and varies seasonally in opposite phase with the CO_2 concentration. We have also maintained atmospheric $d(O_2/N_2)$ measurements at Ny-Ålesund since 2001 (Ishidoya et al., 2012). Using the atmospheric $d(O_2/N_2)$ and CO_2 concentration records, the terrestrial and oceanic CO_2 sinks are estimated to be 1.7 ±0.8 GtC/yr and 2.2 ±0.7 GtC/yr, respectively, for the 13-year period (2001–2013). Using these values of CO_2 sinks and the $d^{13}C$ record, the average isofulx for the period of 2001–2013 is estimated to be 99 ± 28 Gt ‰/yr.

References

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