

Global carbon budget estimation based on atmospheric oxygen and carbon dioxide observation during recent 15-year period

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Time series of atmospheric O₂/N₂ ratio and CO₂ mixing ratio of flask samples taken from NIES's flask sampling network are presented. The network includes ground sites, Hateruma Island (lat 24°03'N, long 123°48'E) and Cape Ochi-ishi (lat 43°10'N, long 145°30'E), and cargo ships regularly sailing in the Pacific region. The air samples collected in Pyrex glass flasks were sent back to our laboratory and the O₂/N₂ ratio and CO₂ mixing ratio were analyzed by using a GC/TCD and NDIR analyzers. Taking into account the global mass balances of atmospheric CO₂ and O₂, we estimate the global carbon sequestration rates of the ocean and land biosphere for the recent 15-year period. In this carbon budget calculation, we use the secular changes in the atmospheric O₂ and CO₂ burdens based on our flask observations and the fossil fuel-derived CO₂ emissions based on energy statistics. We also adopt the ocean O₂ outgassing fluxes (~0.5 PgC/yr), which is estimated from secular changes in the ocean heat content (0-2000m) and an estimated O₂-to-heat flux ratio. For example, the oceanic and land biotic carbon sequestration rates for the 15-year period (1999-2014) calculated from the observation at Hateruma Island are 2.4±0.7 Pg-C yr⁻¹ and 1.5±0.8 Pg-C yr⁻¹, respectively. In the presentation, we also examine the temporal changes in the global carbon budgets and compare our estimations with the other reported carbon budget estimations.

Keywords: global carbon budget, oxygen, carbon dioxide