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西太平洋における大気中放射性炭素同位体(14CO2)の観測とモデリング

Observations and modeling of atmospheric radiocarbon (14CO2) over the western Pacific

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We presented seasonal cycle and interannual variability in radiocarbon concentration of atmospheric carbon dioxide (14CO2) over the western Pacific from 1994 to 2005. Observations were made by the National Institute for Environmental Studies (NIES), Center for Global Environmental Research (CGER), using voluntary observation ships (VOS). On the Japan-Australia/New Zealand transact, 21 air samples are collected by 3L stainless steal flasks between 30N and 38S with the intervals of 3 degrees in latitude. The cargo ships repeated round trip cruises every 5 or 6 weeks (10 times/yr). We measured 14C in the air samples at the selected five latitudes (44N, 25N, 12N, Equator, and 15S) using the NIES-TERRA (Tandem accelerator for Environmental Research and Radiocarbon Analysis) accelerator mass spectrometer with a 0.3-0.4 % precision [Kitagawa et al. 2004]. Our observation showed latitudinal differences in seasonal cycle and unique IAV with 2-3 year cycle in 14C.

The observations of CO2 and 14C were compared with simulations from the atmospheric transport model (NIES TM) [Maksyutov et al., 2008]. We used monthly fossil fuel emissions by CDIAC that include no seasonal cycle but represent IAV [Boden et al., 2009], monthly NEP flux using CASA model that is the same each model year [Nakatsuka and Maksyutov, 2009], and monthly atmosphere-ocean CO2 flux calculated by the oceanic tracer transport model that includes IAV [Valsala et al., 2008]. We show that the simulated fossil fuel CO2 represents the amplitude and phase of the seasonal cycle of 14C in the NH, indicating that the transport of fossil fuel CO2 causes latitudinal differences in seasonal cycle of 14C. Biospheric 14C significantly contributes to seasonal cycle only at 44N.

キーワード:放射性炭素同位体,炭素循環,大気モニタリング,大気輸送モデル

Keywords: radiocarbon, carbon cycle, atmospheric monitoring, atmospheric transport model