

## VARIATIONS OF CARBON ISOTOPIC RATIO OF ATMOSPHERIC CARBON DIOXIDE OVER JAPAN (ABSTRACT)

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Carbon dioxide samples collected in the troposphere over Japan during the periods from April 1984 to November 1990 were analyzed for the carbon isotope ratio,  $\delta^{13}\text{C}$ , with a precision of 0.03 ‰ (one standard deviation). The seasonal cycle of  $\delta^{13}\text{C}$  decreased with increasing height, with a phase delay of about one month between the lower and upper troposphere, which was quite similar to that of the  $\text{CO}_2$  concentration. It was found from the observed seasonal cycles of the  $\text{CO}_2$  concentration and  $\delta^{13}\text{C}$  that the rate of change in  $\delta^{13}\text{C}$  with respect to the  $\text{CO}_2$  concentration is about  $-0.05$  ‰ per ppmv. This implies that the seasonal  $\text{CO}_2$  cycle over Japan is mainly induced by seasonally dependent biospheric activities. However, the air transport from different latitudes is also important for the seasonal  $\text{CO}_2$  cycle, especially in the upper troposphere.  $\delta^{13}\text{C}$  decreased secularly at an average rate of about  $-0.03$  ‰ per year due mainly to combustion of fossil fuels with lighter  $\text{CO}_2$  relative to the atmospheric  $\text{CO}_2$ . Irregular variations of  $\delta^{13}\text{C}$  with the periods of two or three years, superimposed on the secular trend, were also observed; they were almost in phase with these of the  $\text{CO}_2$  concentration. From the comparison of both irregular variations, it was found that the cause could primarily attributed to the imbalance in  $\text{CO}_2$  exchange between the atmosphere and biosphere in association with climate change, rather than between the atmosphere and oceans.

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