$^{13}C/^{12}C$ ratio of CO_2 respired from deciduous needleleaf forest ecosystem in east Asia

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Temporal variation in the carbon stable isotope ratio of CO_2 respired from ecosystem ($\delta^{13}C_r$) had been investigated since July 2000. The study site was in an artificial deciduous needle-leaf forest dominated by Japanese Larch (*Larix kaempferi*) and was located in the northern island of Japan.

Larix species was representative for a large portion of the northeast Eurasia. $\delta^{13}C_r$ was evaluated from the night-time data using two end-member simple mixing model. $\delta^{13}C_r$ observed during the green season of the forest had significant temporal variation with the range of about 2 ‰, and its arithmetical mean was –28.0‰ PDB. The temporal variation in $\delta^{13}C_r$ was highly irregular. The mean values of $\delta^{13}C_r$ of 2001 and 2002 were more negative than that of 2000 (Figure 1). During the summer of 2001 and 2002, the weather condition was more cloudy and rainy compared with summer of 2000. This inter-annual difference in $\delta^{13}C_r$ likely reflected the difference in photosynthetic isotope discrimination caused by changes in water and light availabilities. The correlations between $\delta^{13}C_r$ and environmental variables showed that $\delta^{13}C_r$ had link with vapor pressure deficit of several days earlier. This feature was consistent with that reported for coniferous forests in the North America.

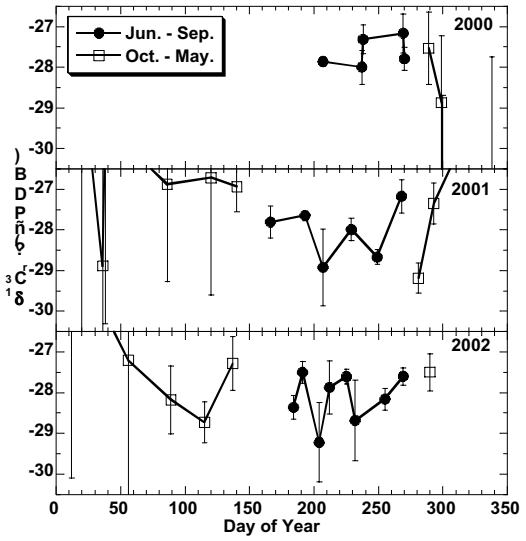

Figure 1 Temporal variation of carbon stable isotope ratio of CO_2 respired from the ecosystem.

Precise measurement of heavy noble gases in seawater

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Introduction

Noble gases are useful tracers of oceanic circulation studies because of their conservative properties. For example, mantle-derived ^3He distributions in the ocean can be used to derive spreading patterns of waters. As well as helium, elemental abundances of heavier noble gases dissolved in seawater can also be important geochemical tracers for oceanic circulation and mixing studies. However, previous work on concentrations of heavy noble gases in seawater has yielded results lacking high analytical precision.

We have developed an analytical system for precise measurement of noble gas concentrations in seawater using a quadrupole mass spectrometer and isotope dilution technique. The system was evaluated using results of some basic experiments, and then applied to seawater collected in the northwestern North Pacific.

Sampling and experimental method

Seawater samples were taken into 3/8" diameter copper tubes from Niskin bottles installed in a rosette-style CTD frame. Then both ends of the tube were sealed by tightening steel clamps.

After known amounts of isotopic spikes (^{22}Ne, ^{36}Ar, ^{86}Kr, ^{124}Xe) were introduced into the vacuum line, dissolved gases were extracted from seawater. Purification and separation of noble gases were made using hot titanium getters and activated charcoal traps held at low temperature. Contents of noble gases were measured by a quadrupole mass spectrometer.

Results

From the results in measurements of the air standards and seawater samples equilibrated with atmosphere at several temperatures, precision in the measurement of noble gas concentrations was estimated to be about 1% except for helium.

We found that krypton and xenon concentrations in seawater samples collected in the North Pacific increases with increasing depth and were nearly constant below 1000m depth. Also these concentrations were close or slightly excess to equilibrium ones in temperature and salinity at sampling depth. We will discuss oceanic circulation at sampling sites from these results.