SOIL CO_2 CONCENTRATIONS AND FLUXES IN A PLOW-MANAGED AGRICULTURAL FIELD, A GRASS FIELD AND A FOREST

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ABSTRACT

In this paper we briefly introduce our results of soil CO_2 concentrations in an arable field in the campus of NIAES, a grass field and a pine forest in central mountaneous area in Japan. The soil CO_2 concentrations seasonally variated with soil temperature changes at all the three sites. Temporal variations in CO_2 concentrations in the arable and the grass field were more linked to changes in soil moisture than those in the forest. Soil CO_2 concentrations were generally largest in the grass field. CO_2 concentrations at the grass field and pine forest under snow cover showed positive relationship with snow depth.

INTRODUCTION

CO_2 concentration profile in soil is reflection of balances of physical and biological processes, namely transport/diffusion and biological respiration processes. When soil CO_2 cocentration profiles and diffusivity profiles are obtained, source profiles, namely soil respiration in soil can be calculated by diffusion equation. Then, after consideration of plant root respiration, destruction ratios of the soil organic matter can be estimated. To be available in the kind of researches soil CO_2 concentrations have been measured continuously in an arable field in NIAES and a grassfield and a pine forest in Sugadaira Montane Research Center of Tsukuba University, situated on central mountaneous area in Japan. In this extended abstract, we briefly introduce variation of soil CO_2 concentrations at the pine forest in Sugadaira Research Center of Tsukuba University.

EXPERIMENTALS

To monitor soil CO_2 concentrations, Vaisala (Finland) GMT 220 series CO_2 sensor were employed [e.g., *Nakamoto et al.*, 2002; *Hirano et al*., 2004]. The sensor has small NDIR and can measure *in-situ* soil CO_2 concentrations. Two sensors were set at 0, 5, 10, 20, and 50cm soil depth at Sugadaira sites; one sensor was set at 50cm soil depth at Sugadaira sites. Sensor ranges were set to be from 2000 ppm to 5% within relevant concentration variations. The soil type is Andisols formed by eruptions of mountains in central Japan, especially Mt. Asama.

RESULTS AND DISCUSSION

As an example of variations of soil CO_2 concentrations we show variation of CO_2 concentrations in winter season in the Sugadaira pine forest (Fig. 1). Soil CO_2 concentrations seasonally varied as the soil temperatures did (Fig. 2). Short-time variations of soil CO_2 concentrations were affected by soil moisture (data not shown). This feature is different from those at the arable and grass sites. This is explained by large soil gas diffisivity of forest soil (here data not shown). Under snow cover, CO_2 concentration under snow cover were positively related with snow depth (Fig. 3) because CO_2 release from soil was hindered by snow cover. Unexpectedly soil CO_2 concentrations at 5 and 20cm varied to the same or larger extent of those under no-snow conditions; in some cases short-time variations of soil CO_2 concentrations under snow cover were linked to changes in snow depth or wind speed. CO_2 concentrations under snow cover

were largely dependent on snow depth. When snowpack were melting in the early spring, soil CO_2 concentrations showed minimum values.

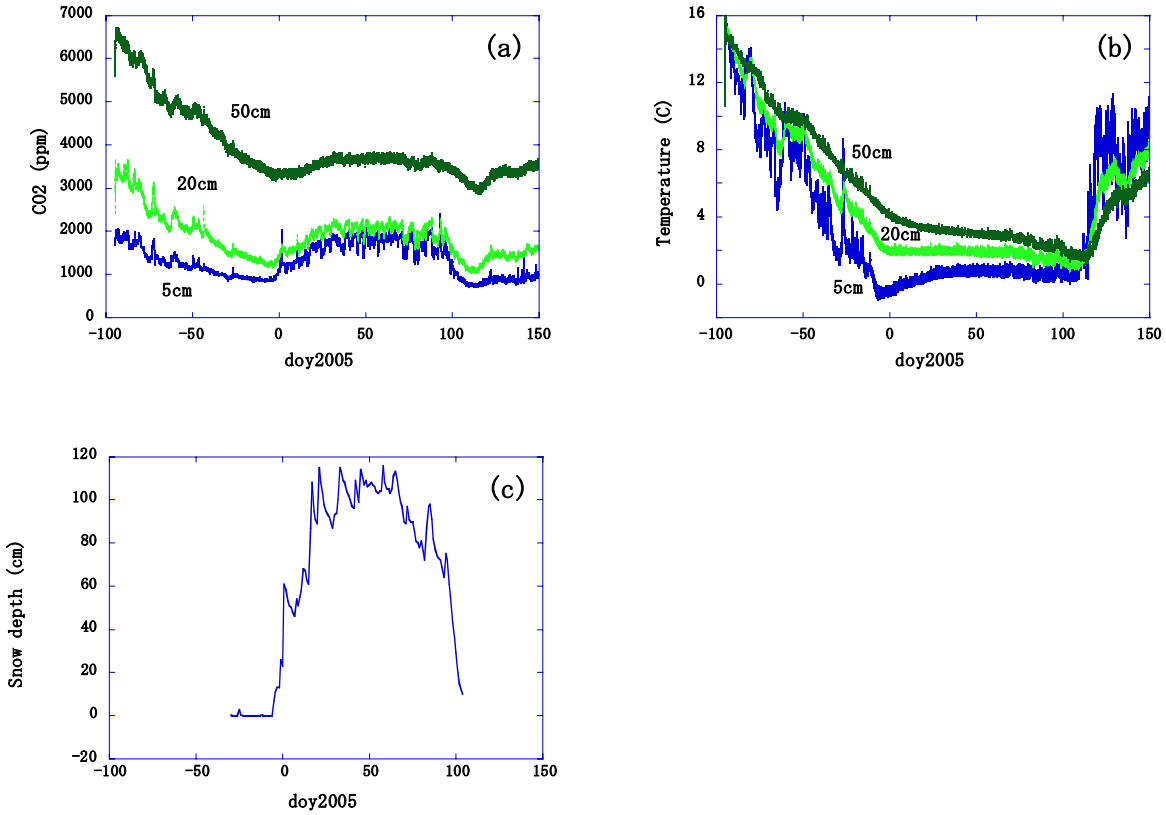

Fig. 1 Variation of (a) CO_2 concentrations, (b) soil temperatures, and (c) snow depth at Sugadaira pine forest.

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