Short-term response of soil respiration to experimental soil warming in a cool-temperate deciduous broad-leaved forest in Takayama

○NamJin Noh（岐阜大・流域圏センター）, Tomoharu Inoue（早稲田大学・先進理工学研究科）,
Taku M. Saitoh, Masatoshi Kuribayashi, Hiroyuki Muraoka（岐阜大・流域圏センター）

Global warming has the potential to increase soil respiration as one of the major fluxes in the global carbon cycle. However, more experimental studies are required in various forest ecosystems in order to quantify and understand the global warming effect on belowground carbon cycles. Therefore, this study was conducted to investigate the response of soil respiration to experimental soil warming in a cool-temperate deciduous broadleaved forest dominated by *Quercus crispula* in Takayama (TKY, 36°08′N, 137°25′E, 1,420 m a.s.l.). To investigate warming the effect on soil respiration, we established experimental soil warming system in November 2011 with heating cables at the 5 cm soil depth and started warming up soil temperature by 3°C from May 7, 2012. In both control and warmed plots, monthly measurements of soil respiration were made by portable IRGA CO_2 sensors (GMP343, Vaisala CARBOCAP, Finland) during growing season, and simultaneously, continuous measurements of soil respiration were conducted by two automatic CO_2 measurement systems (Li-8100, Licor Inc., USA).

The soil warming treatment enhanced average daily mean soil temperatures by 2.8°C (Fig. 1a) and decreased average daily mean soil moisture contents by 6.4%. Soil warming tended to increase or decrease soil respiration partially (Fig. 1b). Soil warming increased the soil respiration by 11.5% over the growing season (from May 7 to November 9) and by 0.8 t C ha^{-1} yr^{-1} considering annual mean soil respiration rate (7.3 t C ha^{-1} yr^{-1}) reported by previous study. The Q_{10} values as temperature sensitivity of soil respiration were 3.21 in control plot and 2.23 in warmed plot. This preliminary study demonstrated that experimental warming significantly increased soil respiration in a cool-temperate forest ecosystem. Differently derived Q_{10} values will be used to model and predict future carbon budget in cool-temperate forest in Japan. Long-term responses of soil warming on soil respiration as well as autotrophic and heterotrophic respiration will be revealed by further monitoring.

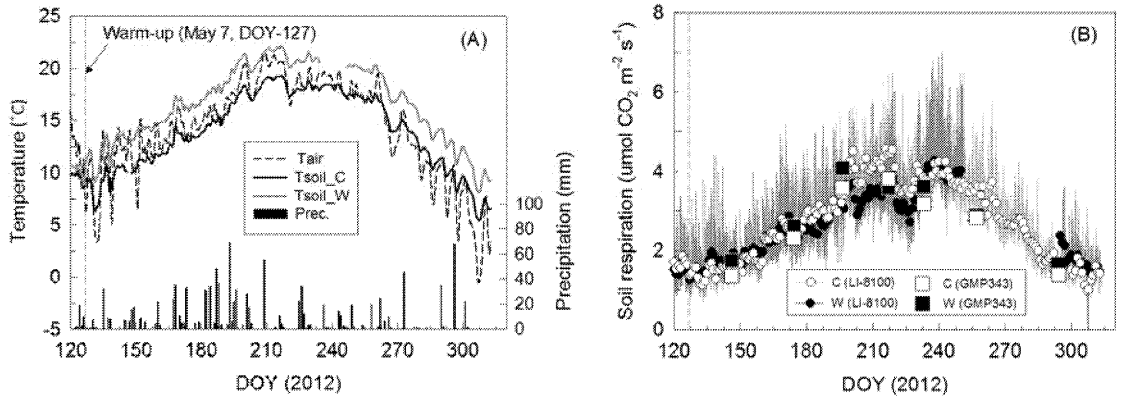

Figure 1. (a) Seasonal patterns of daily mean air and soil temperature (°C) and precipitation (mm) and (b) soil respiration (μmol CO_2 m^{-1} s^{-1}) measured using portable CO_2 sensors and automatic measurement systems in control and warmed plot of a cool-temperate deciduous broadleaved forest (TKY). Circles and squares in figure b indicate the daily mean values of soil respiration rates. Vertical bars indicate the errors of means (n=3). Soil warming-up started on May 7, 2012.