Effects of experimental soil warming on the temperature sensitivity of soil CO_2 fluxes in cool-temperate deciduous broad-leaved forests

○ NamJin Noh, 栗林正俊, 斎藤琢（岐阜大・流域圏科学研究センター), 中路達郎, 中村誠宏, 日浦勉（北海道大・北方生物圏フィールドセンター), 村岡裕由（岐阜大）

Global warming has the potential to impact on soil respiration (R_S), one of the major fluxes in the global carbon cycle. The different responses of autotrophic (R_A) and heterotrophic (R_H) components of R_S to increasing temperature are expected to have significant consequences for forest ecosystem carbon dynamics. Many studies have emphasized the necessity for more reliable respiration model due to the complexity in the regulation of respiration rates such as in acclimatization. Here we examined the effects of elevated temperature on the respiration rates and their temperature sensitivities to provide the empirical field evidence and respiration parameterization for accurate future prediction of carbon dynamics to climate change.

The experiments were carried out in two cool-temperate deciduous broad-leaved mature forests belonging to JaLTER sites, Takayama in central Japan (TKY, 36°08’ N, 137°25’ E) and Tomakomai in Hokkaido island of northern Japan (TOEF, 42°40’ N, 141°36’ E). The dominant tree species (*Quercus crispula*) and annual mean air temperature (6.5-6.6°C) are similar between the sites. We combined artificial soil warming (+3°C in TKY and +4.7°C in TOEF by installing heating cables into the soil) with trenching treatment in both sites to assess how R_S, R_A, and R_H are affected by the treatment differently. The warming treatments enhanced annual R_S by 10.0% (0.8 t C ha^{-1} yr^{-1}) in TKY and 20.2% (1.43 t C ha^{-1} yr^{-1}) in TOEF, respectively. Figure 1 shows the relationships between the respiration rates and soil temperature with the Q_{10} values derived in control and warmed plots in TKY and TOEF. The temperature sensitivities of R_S and R_A acclimatized to the warming treatment in both sites, while R_H was not acclimatized. These responses of those variables to experimental warming will be potentially useful for parameterizing and better understanding carbon cycle to climate warming.

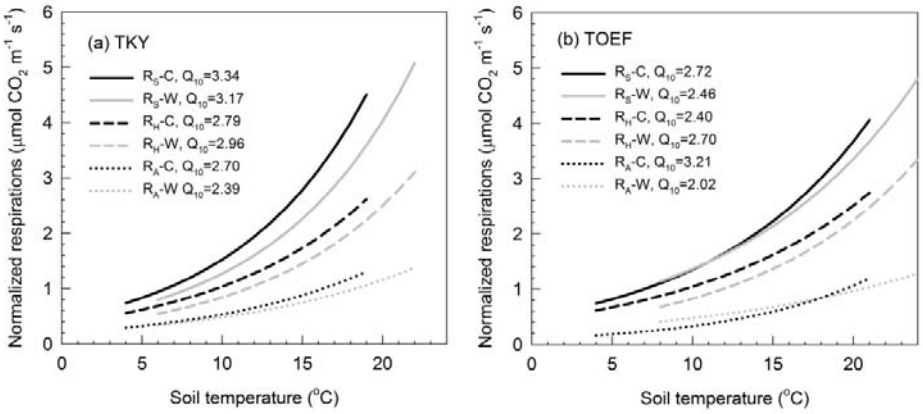

Figure 1. Relationships between the respiration rates (soil, autotrophic and heterotrophic respirations) and soil temperature in control and warmed plots in the cool-temperate deciduous broad-leaved forests of (a) Takayama and (b) Tomakomai in Japan. Gray line indicates the warmed treatment. Q_{10} value as a temperature sensitivity index was calculated by exponential curve ($R=ae^{bTs}$, $Q_{10}=e^{10b}$).