Seasonal and diurnal patterns of soil respiration in an evergreen coniferous forest: Evidence from six years of observation with automatic chambers

*Makita Naoki[1]

1. Shinshu University

Soil respiration (R_s) plays a key role in the carbon balance of forest ecosystems. There is growing evidence that R_s is strongly correlated with canopy photosynthesis; however, how R_s is linked to aboveground attributes at various phenological stages, on the seasonal and diurnal scale, remains unclear. Using an automated closed dynamic chamber system, we assessed the seasonal and diurnal patterns of R_s in a temperate evergreen coniferous forest from 2005 to 2010. High-frequency R_s rates followed seasonal soil temperature patterns but the relationship showed strong hysteresis. Predictions of R_s based on a temperature-response model underestimated the observed values from June to July and overestimated those from August to September and from January to April. The observed R_s was higher in early summer than in late summer and autumn despite similar soil temperatures. At a diurnal scale, the R_s pattern showed a hysteresis loop with the soil temperature trend during the seasons of high biological activity (June to October). In July and August, R_s declined after the morning peak from 0800 to 1400 h, although soil temperatures continued to increase. During that period, figure-eight-shaped diurnal R_s patterns were observed, suggesting that a midday decline in root physiological activity may have occurred in early summer. In September and October, R_s was higher in the morning than in the night despite consistently high soil temperatures. We have characterised the magnitude and pattern of seasonal and diurnal R_s in an evergreen forest. We conclude that the temporal variability of R_s at high resolution is more related to seasons across the temperature dependence.

Keywords: continuous monitoring, phenology, gross primary production, soil CO2 efflux, soil temperature, temperature sensitivity

