CO_2 and CH_4 fluxes from forest soil in the northern Da Xing'anling Mountains in Northeast China during the freezing and thawing periods of near-surface soil in 2018-2019

Under a warming climate, effects of seasonal freeze-thaw cycles on soil respiration are key to soil carbon cycles and ecosystem responses and resilience at mid- and high latitudes. In this study, effluxes of soil surface CO_2 and absorption rates of CH_4 were measured in the Xing'an larch (*Larix gmelinii*) forest in the Da Xing'anling (Khinggan) Mountains, Northeast China using the automatic multichannel soil greenhouse gas measurement system (dynamic gas chamber method) during the periods of October–November 2018 and April–May 2019. The results showed that during the freezing period of near-surface soil (October to November), the fluxes of CO_2 and CH_4 significantly declined, approaching zero at the end of November. During the thawing period of near-surface soil (April to May 2018), CO_2 and CH_4 fluxes from surface soil fluctuated markedly at first and then rose rapidly. The respective Q_{10} values of 3.86 and 4.89 during the freezing and thawing periods of near-surface soil indicate an signicant role of the soil freeze-thaw cycles in the modification of CO_2 and CH_4 fluxes. Most of these characteristics in methane and CO_2 fluxes could largely be explained by variations in soil temperature and soil surface water vapor. Moreover, the accumulative fluxes of CO_2 and CH_4 during the freezing-thawing periods of near-surface soil contributed more to those totals of the entire winter. This study can help assess the stability of the soil carbon pool and carbon flux strength in taiga-forested permafrost regions in the northern Da Xing'anling Mountains, Northeast China.