Response of CO_2 and CH_4 emission from a poorly-drained black spruce forest over permafrost in an Interior Alaska

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In northern high-latitude regions, air temperatures have risen 0.6 °C per decade over the last 30 years, twice as fast as the global average (IPCC, 2013). Numerical simulations by the use of several Earth system models predict further warming trend in this region. The warming trend could change esternal and interanl forcing, such as temperature and rainfall regimes, biochemical cycle, and plant activities. Then, the greenhouse gases production, consumption, and transport will be affected by not only the direct and short term changes in temperature and rainfall but also indirect and long term impacts such as changes in substrate availability and active layer thickness. In general, tundra and wetland ecosystems largely contribute greenhouse gases, especially methane, emission in the Arctic biosphere (e.g., Bousquet et al., 2006). Furthermore, our recent study found methane emission from a boreal black spruce forest, mainly owing to poorly drained conditions (Iwata et al., 2015). The finding indicates that undarstanding of greenhouse gases emission under changing physical and biological factors is necessary. The primary objective of this study is to clarify high and low-frequency contributions of physical and biological factors controlling greenhouse gases production, consumption, and transport from a poorly-drained black spruce forest over permafrost in Interior Alaska.

We continuously measured CO_2 and CH_4 fluxes over twolve years from 2004 to 2015 during the vegetation growing season from April to October. Based on the measurements, growing season CO_2 budget was a sink of approximately 215 g C m^{-2} $season^{-1}$. In contrast, the growing season CH_4 flux was almost neutral. The CH_4 flux increased with increasing air temperature and rainfall and deepening active layer thikness.

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