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### METHANE EXCHANGE IN A POORLY-DRAINED BLACK SPRUCE FOREST OVER PERMAFROST OBSERVED WITH THE EDDY COVARIANCE TECHNIQUE

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The ecosystem-scale methane (CH<sub>4</sub>) exchange was observed in a poorly-drained black spruce forest over permafrost in Interior Alaska for snow-free seasons of 2011-2013 with the eddy covariance technique. The magnitude of average CH<sub>4</sub> exchange differed depending on the wind direction, reflecting the spatial variation of soil moisture condition around the observation tower due to the elevation change within the small catchment. The CH<sub>4</sub> exchange did not show a clear diurnal variation. Seasonally, the average CH<sub>4</sub> in the wetter bottom of the catchment increased from 1.9±0.1 and 1.2±0.4 nmol m<sup>-2</sup> s<sup>-1</sup> in May/June in 2011 and 2012, respectively, to 3.6±0.8 and 3.3±0.1 nmol m<sup>-2</sup> s<sup>-1</sup> in July/August in 2011 and 2012. In 2013, the average CH<sub>4</sub> exchange was reduced to 1.4 nmol m<sup>-2</sup> s<sup>-1</sup> in the drought period in August in the wetter bottom of the catchment. The environmental variables controlling the seasonal variation in CH<sub>4</sub> emission varied from drier upper position to wetter bottom of the catchment. In the drier upper position, the seasonal variation in the CH<sub>4</sub> exchange was explained by the variation of soil water content only. On the other hand, in the wetter bottom, in addition to soil temperature and soil water content, seasonal thaw depth of frozen soil was also an important variable to explain the seasonal and interannual variations in CH<sub>4</sub> exchange in this ecosystem. The season total (day of year 134-280) CH<sub>4</sub> exchange was 11.96±1.00, 19.61±2.98, and 36.64±4.36 mmol m<sup>-2</sup> for drier upper position, moderately wet area, and wetter bottom of the catchment, respectively. The observed season total CH<sub>4</sub> exchange was almost one order smaller than those reported in other northern wetland ecosystems, probably due to the relatively low ground water level as well as low soil temperature. The different environmental response of CH<sub>4</sub> exchange depending on the position of small catchment should be considered in estimating the spatial variation of CH<sub>4</sub> exchange accurately in ecosystems over permafrost.