

## ***Interactive comment on “Effect of crustose lichen (*Ochrolecia frigida*) on soil CO<sub>2</sub> efflux in a sphagnum moss community over western Alaska tundra” by Yongwon Kim et al.***

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Soil CO<sub>2</sub> efflux-measurements represent an important component for estimating an annual carbon budget in response to changes in increasing air temperature, degradation of permafrost, and snow-covered extents in the Subarctic and Arctic. However, it is not widely known the significant effect of crustose lichen (*Ochrolecia frigida*)-infested sphagnum moss on soil CO<sub>2</sub> emission. Here, continuous soil CO<sub>2</sub> efflux measurements by a forced diffusion (FD) chamber were investigated for intact and crustose lichen-infested sphagnum moss within covering over a tundra ecosystem of western Alaska during the growing seasons of 2015 and 2016. We found that CO<sub>2</sub> efflux in

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crustose lichen infested moss during the growing season of 2016 was 14 % higher than in intact sphagnum moss community. This suggests that temperature relative to soil moisture is an invaluable driver in stimulating soil CO<sub>2</sub> efflux, regardless of the restraining functions of soil moisture over emitting soil carbon. Soil moisture does not influence soil CO<sub>2</sub> emission in crustose lichen, reflecting the constraint of ecological and thermal functions relative to intact sphagnum moss. During the growing season of 2016, there was a significant difference between soil CO<sub>2</sub> effluxes in intact and crustose lichen sphagnum moss, compared to 2015, based on a t-test at the 95 % confidence level ( $p < 0.05$ ). Mean snow-covered and snow-free CO<sub>2</sub> contributions to annual carbon budgets correspond to 28.4 % and 71.6 % in intact sphagnum moss, and 25.0 % and 75.0 % in a crustose lichen sphagnum moss, respectively. Therefore our findings demonstrate that soil CO<sub>2</sub> emissions in the crustose lichen-infested sphagnum moss would be steadily stimulated by a widespread outbreak of airborne lichen over intact sphagnum moss. This might result in rapid degradation of permafrost in the Subarctic and Arctic.

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