1. CO₂, CH₄ and N₂O flux from a larch forest soil in Central Siberia

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Abstract

Larch forest in Central Siberia was characterized by low temperature and precipitation, and the presence of permafrost. Especially, the ground surface was characterized by well-developed mound-trough microtopography with various lichens and mosses. CO₂, CH₄ and N₂O flux from the forest soil could be influenced by these climate and soil condition. The purpose of this study was to characterize the relationship between these gases fluxes and soil properties in a larch forest in Tura (64° 12’ N, 100° 27’ E), Central Siberia. The forest consists mainly of Larch (Larix gmelinii) trees 105 years old. Patches of lichens and mosses, mainly Pleurozium sp., Aulacomnium sp. and Cladina sp., cover the forest floor. Six chambers were set on the patches those all vegetation was cut in July 2005. The gas flux measurements by applying a closed chamber technique were carried out nine times in a day. Soil temperature at a depth of 10 cm in the Aulacomnium (6.4 ± 2.5 °C) site was significantly lower than that in Pleurozium (9.0 ± 3.4) and Cladina (8.6 ± 3.2) sites. Soil moisture in the Aulacomnium (0.31 ± 0.10 m³ m⁻³) site was significantly higher than that in Pleurozium (0.17 ± 0.10) and Cladina (0.20 ± 0.09) sites. There were significant differences among the mean CO₂ fluxes of different sites. CO₂ fluxes for each site were in the following order: Pleurozium (110 ± 36 mg C m⁻² h⁻¹) > Cladina (85 ± 21) > Aulacomnium (68 ± 21). CH₄ (Pleurozium; -3.0 ± 2.4, Cladina; -1.6 ± 3.8, Aulacomnium; -3.4 ± 3.7 μg C m⁻² h⁻¹) uptakes and N₂O (Pleurozium; 1.0 ± 1.7, Cladina; 1.2 ± 1.1, Aulacomnium; -0.4 ± 2.8 μg N m⁻² h⁻¹) fluxes were very small. There were no differences among the mean CH₄ and N₂O fluxes of different sites. The values of the CO₂ emission and CH₄ uptake were lower than those previously reported 64 - 389 mg C m⁻² h⁻¹ and -17 - -13 μg C m⁻² h⁻¹ for a forest in eastern Siberia, respectively. CO₂ flux was positively correlated with soil temperature (r=0.75 p<0.01) and negatively correlated with soil moisture (r=-0.52 p<0.01). However, both CH₄ and N₂O flux was not correlated with these factors. Rain and melted water could be gathered in Aulacomnium site depend on relatively lower microtopography, and prevented to increase soil temperature. So that, the CO₂ emission in the Aulacomnium site was the smallest among the sites. However, the effect of low soil temperature and high soil moisture on CH₄ and N₂O emission was not clear.