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Light-induced diurnal pattern of methane exchange in a boreal forest

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Boreal forests represents one third of the Earth's forested land surface area and is a net sink of methane and an important component of the atmospheric methane budget. Methane is oxidized in well-aerated forest soils whereas ponds and bog soils are sources of methane. Besides the microbial processes in the soil also forest vegetation might contribute to methane exchange. Due to a recent finding of methane consumption by boreal plants that correlated with photosynthetic active radiation (PAR), we investigate the impact of PAR on soil methane exchange at vegetated plots on the forest floor. The study site, Norunda in central Sweden, is a 120 years old boreal forest stand, dominated by Scots pine and Norway spruce. We used continuous chamber measurements in combination with a high precision laser gas analyzer (Los Gatos Research), to measure the methane exchange at four different plots in July-November 2009, and April-June 2010. The ground vegetation consisted almost entirely of mosses and blueberry-shrubs. Two of the plots acted as stable sinks of methane whereas the other two plots shifted from sinks to sources during very wet periods. The preliminary results show a clear diurnal pattern of the methane exchange during the growing season, which cannot be explained by temperature. The highest consumption occurs at high PAR levels. The amplitude of the diurnal methane exchange during the growing season is in the order of 10 μmol m-2 h-1. This indicates that besides methane oxidation by methanotrophs in the soil there is an additional removal of methane at soil level by a process related to ground vegetation.