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MICROSCALE VARIATIONS IN CH_4 FLUXES FROM BOREAL MIRES

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A process–based model describing methane flux dynamics in different microsites of boreal peatlands is presented. The model emphasizes the importance of microsite characteristics, water level and vegetation cover for CH_4 fluxes. Water level determines the moisture and oxygen profile in peat matrix and therefore affects methane production and oxidation rates in peat profile. Vascular plants provide methanogenesis with substrates, form a pathway for methane to liberate from peat to the atmosphere and enhance methane oxidation by transporting oxygen to water saturated peat. The model connects methane fluxes to the seasonal photosynthetic cycle of plants at the microsite level and hence dynamically combines the microbial processes in peat to changing environmental factors in the level of peatland ecosystem. Sensitivity analysis of the model reveals the importance of substrate supply to methane fluxes. In addition, the capability of the vascular plants to transport oxygen downwards has a large effect on model outcome. Lack of oxygen and methane keep methane oxidation at a low level in the model simulations and changes that compensate for these lacks have a remarkable decreasing effect on simulated flux. Dry periods decrease the simulated methane flux considerably, especially if the drought prevails long, threshold for a dramatic decrease lying between 4 and 6 weeks of drought. Increase in air temperature enchances methane flux especially if the effect of increased temperature on gross primary production is taken into account. Overall, the current study provides a lot of information on the relative importance of changes in environmental controls or model parameters that can be used when considering the dynamics of methane fluxes in current and future conditions.