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Holocene methane flux reconstruction from peat macrofossils at Siikaneva bog and fen, Finland

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Previous studies have shown that a correlation exists between methane flux and peatland plant species abundance. Furthermore, it has been demonstrated that the composition of plant species or functional groups of species can be used as indicator for methane fluxes in peatlands, using weighted averaging. This method has the potential to be very useful in palaeoecological studies of peatlands as well. This method offers the possibility to reconstruct past methane flux based on vegetation remains still present in the peat archive and together with reconstructions of carbon accumulation can give a more complete picture of peatlands' carbon dynamics during the Holocene. Furthermore, effects of changes in hydrology or temperature on methane fluxes can be studied over much longer time scales, compared to what experimental setups allow for. For four peat cores from Siikaneva peatland in southern Finland, we reconstructed the methane flux during the Holocene. Two cores represent a part of the peatland that has currently a fen type vegetation. The other two cores were taken from a part of the peatland that has transformed into a bog, around 3.5 - 5.5 cal. year before present. The development of methane flux during the fen to bog transition is especially of interest. We used vegetation data and methane flux data from chamber measurement from all microtopographies found on Siikaneva and from a few similar peatlands in southern and central Finland as a training set. The plant species were classified into functional groups. Firstly, because it has been shown that usage of functional groups leads to better predictions of methane flux when compared to e.g. species or dominant species. Secondly, the information from the peat cores used as input for the reconstruction is based on progressively decomposed plant remains in subsequent peat layers, for which identification to species level is not always possible (most notably for sedges). We compare the predictive performance of two types of vegetation classification: one based on growth form and typical microtopography; and the other based on plant traits expected to influence methane production and transport.