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Effects of site characteristics on cumulative frequency distribution of water table depth in peatlands

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Previous studies demonstrated strong dependency of vegetation development and GHG emissions from peatlands on annual mean water table depth. It is also proposed that the duration of ponding and low water level periods are important indicators for CH_4 emissions and the presence of specific plant species. Better understanding of the annual water table dynamics and the influence of site characteristics helps to explain variability of vegetation and emissions at the plot scale. It also provides essential information for a nation-wide upscaling of local gas flux measurements and for estimating the impact of regional adaption strategies.

In this study, we analyze the influence of site characteristics on the cumulative frequency distribution of water table depth in a peatland. On the basis of data from about 100 sites we evaluate how distribution functions, e.g. the beta distribution function, are a tool for the systematic analysis of the site-specific frequency distribution of water table depth. Our analysis shows that it is possible to differentiate different shape types of frequency distributions, in particular left-skewed (bias towards the water table minimum), right-skewed (bias towards the water table maximum), and 'S'-shaped distributions (bias towards the mid of min and max). The shape is primarily dependent on the annual mean water table depth, but also shows dependencies on land use, peatland type, catchment size and soil properties. Forest soils are for example all characterized by a 'S'-shaped distribution. Preliminary results indicate that data sets that do not show a beta distribution are mostly from observation wells that are located close to drainage courses and/or are from sites characterized by strong water management (e.g. abruptly changing weir levels). The beta distribution might thus be a tool to identify sites with a 'non-natural' frequency distribution or erroneous data sets. Because the parameters of the beta distribution show a dependency on site characteristics, they can be used for the regionalization of threshold exceedance probabilities.