Abstract

The assessment of atmospheric optical properties impact on the carbon dioxide uptake ability of the peatland

This paper presents the results of analyses of the carbon dioxide uptake capacity (productivity) of a transitional peatland in the context of the impact of various biotic and abiotic factors, with particular emphasis on the optical parameters of the atmosphere. The research was carried out in a peatland located in Rzecin, in the northwestern part of the Wielkopolska region, and the periods of the 2016 and 2018 growing seasons were adopted for analysis. In addition, an analysis of the role of peatlands in the context of climate change was made. This analysis indicates the need for research on these unique ecosystems, prevention of their degradation and restoration, e.g., due to their ability to accumulate huge amounts of carbon in peat mass over the long term.

The main objective of the dissertation was to quantitatively assess the impact of selected optical parameters of the atmosphere, affecting both the amount and the degree of shortwave radiation scattering, on the amount of carbon dioxide absorption from the atmosphere by the peatland. During the conducted research, CO_2 uptake by the peatland was simulated under different values of atmospheric optical parameters, such as aerosol optical thickness (AOT), single scattering albedo (SSA) and solar diffusion index (DI). Other factors that significantly affect ecosystem productivity were also considered, such as air temperature, water vapor pressure deficit (VPD), and normalized difference vegetation index (NDVI). On the basis of the simulations, it was concluded that changing the amount and parameters of aerosols in the atmosphere will support (increase in AOT and DI) or inhibit (decrease in SSA) the ability of peatlands to absorb CO_2 from the atmosphere.

An undoubted advantage of this research is the unique approach to the issue of peatland productivity in Central Europe, which takes into account the optical parameters of the atmosphere. It provides new knowledge about the effect of solar scattering on the carbon dioxide balance of peatlands.

Key words: peatland, climate change, carbon dioxide, aerosols, diffuse shortwave radiation

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