

Abstract

The presented study covers long-term 10-year period of continuous observations of the net carbon dioxide fluxes (CO_2) of the peatland using the eddy covariance (EC) technique. Furthermore, the data were analyzed and also taking into account the optical properties of the atmosphere. The long-term data was obtained from research station located on the peatland in Rzecin, Poland.

The main purpose of the dissertation was to estimate the dynamics of CO_2 exchange for individual plant communities, taking into account the optical properties of the atmosphere.

The standard meteorological observations e.g. air temperature and relative humidity, photosynthetic photon flux density (PPFD) were carried out along with flux measurements. The obtained flux data was divided according to four wind directions (North, East, South, West, sectors) in order to analyze the different vegetation types to understand the CO_2 exchange dynamics of four wind directions. The study showed that the annual dynamics of CO_2 productivity depend on the variability of meteorological conditions, i.e. periods of drought and/or high temperature.

There was a higher ecosystem production found in the northern sector, where the plant structure was characterized by leaf area index (LAI) higher than 2 [-]. The lowest significant mean values (0.016 []) of light use efficiency (LUE) were found in the southern sector where the sedges and mosses were the dominant one. Vegetation located in E and S sectors show the higher mean value of LUE (0.004 [-]) during clear sky than under cloudy conditions but this relation occurs only when PPFD is below $400 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. Above this threshold, the diffuse radiation always enhances LUE of the plant canopy.

The study concludes that vegetation types react differently to various radiation conditions, in particular, to diffuse solar radiation share in global radiation and the complex structure of vegetation, determine both spatial and temporal variability of the net ecosystem production of the Rzecin peatland.

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