

Peatlands play a very important role in the global carbon balance. They cover only 3% of the land but, they contain about 30% of soil Carbon. The understanding of peatlands functioning and the prediction of their reaction to the globally observed changes is one of the ecological key issues. Scientific publications indicate the fundamental impact of peatlands on the Earth's climate, while the recent research indicates a clear impact of the scattering of solar radiation on the amount of CO₂ that is absorbed by the ecosystems. There is a lack of literature where the effect of solar radiation scattering on the peatlands CO₂ absorption has been described, or where the dynamics of CO₂ exchange between raised Baltic bogs and the atmosphere has been discussed. There are still open scientific issues related to the assessment of the changes in these ecosystems functioning in context to the optical properties of the atmosphere, as well as issues related to the climate changes.

Research objectives

The main objective of this project will be the estimation of the peatland CO₂ uptake dynamics in the context of the optical parameters of the atmosphere (scattering index). Another aim of the research will be the description and parameterization of CO₂ uptake by the raised Baltic bog. There will be also a projection of the peatland ecosystem production as a result of the upcoming changes of the level of scattered radiation as well as climate changes.

Methodology

The proposed research approach requires simultaneous and continuous measurements of: CO₂ exchange, aerosol optical thickness and meteorological conditions in the peatland. These measurements will be supplemented by botanical surveys, peat water chemical parameters analysis, Testate amoebae population study and the optical parameters of the atmosphere measurements using the lidar techniques. Additionally, climate and satellite data of northern Poland will be collected. The CO₂ absorption model will be developed, parameterized and validated on the basis of the obtained field data. This model will be used to assess the impact of solar radiation scattering on the amount of peatlands CO₂. Then, it will be used for projections of CO₂ uptake of raised bog in the context to predict the optical properties of the atmosphere and climate changes.

Motivation

The main reason for this research is to fill the gap in knowledge related to the carbon exchange of raised bogs in this part of Europe. There is a lack of scientific studies on the interaction between the level of solar radiation scattering and the ability of peatlands to absorb the atmospheric CO₂. Optical parameters of the atmosphere undergo dynamic changes and it is due to the changes of the concentration of both anthropogenic (e.g. soot) and natural (e.g. Saharan dust) aerosols in the air column. Simultaneous measurements of CO₂ exchange between peatland and atmosphere as well as optical parameters of the atmosphere (e.g. aerosol optical thickness) is the core of this research. The research will be realized using the techniques and methodologies that corresponds with the activities carried out within research structures, such as European Space Agency (ESA) and the Integrated Carbon Observation System (ICOS). The proposed innovative and holistic research approach is part of the current trend of the environmental study which are concentrated to the impact of atmospheric degradation on the terrestrial ecosystems functioning. The high methodological and scientific level of the project guarantee good and publishable (in high impact factor journals) results.