Wetlands are not only extremely valuable areas because of their biodiversity, rich flora and fauna, but also play a very important role in the global climate system. Although they cover only 2-6% of the land Earth's surface, they accumulate significant amounts of carbon. About one third of the world's soil organic carbon is accumulated in wetlands. High water levels and relatively low temperatures result that carbon absorbed from the atmosphere in the photosynthesis process is next stored in peat soil. Natural wetlands are therefore areas that mitigate the increase of greenhouse effect. Unfortunately, current climate change can reverse this role. Lowering the groundwater level and increasing the temperature can result in the oxidation of the peat surface layers and increased carbon dioxide (CO_2) emissions to the atmosphere. The wetlands will shift from a CO2 absorber to a CO2 emitter – a positive feedback, enhancing the greenhouse effect, will be triggered. This view is sometimes questioned, among others due to the possible adaptive mechanisms of the ecosystem (e.g. change of the vegetation cover to more productive, which may balance soil emissions). Additionally, the reduction of carbon emissions to the atmosphere in the form of methane (CH4) should be considered in dry conditions. Therefore, it is extremely important to empirically verify whether and to what extent extreme climatic events, such as severe drought, can really change the role of wetlands in the climate system from a carbon sink to a carbon source.

Due to the complexity of the wetland ecosystem, this paradigm can be finally verified only by multi-year direct measurements of CO2 and CH4 exchange between the surface and the atmosphere on the scale of the entire ecosystem. The so-called eddy-covariance method allows such measurements. The gas concentrations, temperature and wind speed components are measured with a very high frequency (10 times per second) and then the fluxes of these gases (the amount of gas emitted or absorbed from a surface unit in a time unit) are calculated using appropriate procedure. Unfortunately, both the measurements and the data processing are highly complicated. In consequence, the long-term data of this kind, which allow for estimation of greenhouse gases exchange on an annual or multi-year scale, are very rare (2-3 stations in Poland).

The measuring site established in 2012 in the central basin of Biebrza Valley (north-eastern Poland) is focused on this type of research. Through continuous measurements of CO2, CH4, H2O fluxes, we try to assess the exchange of greenhouse gases in this largest wetland area of Central Europe. In recent years, the Biebrza wetlands have been affected by severe droughts. In addition, in April this year, a huge fire consumed large areas around the measuring site (slightly damaging the station, but measurements resumed after about a week). These **climate change induced extreme events in the area covered by continuous eddy-covariance measurements of greenhouse gas fluxes give a unique opportunity to study the impact of these events on the wetlands role in the climate system. This is the main goal of the proposed project.** The measurements to date seem to confirm the paradigm of wetlands switch from carbon sink to carbon source. This is a very important conclusion, not only for cognitive reasons, but also as a strong argument for the urgent need to effectively include wetland preservation and restoration in global warming mitigation strategies. Unfortunately, our results may be questioned to some extent due to the possibility of large uncertainties in annual and long-term totals being a result of measurement technique - small systematic errors regarding the so-called self-heating effect can accumulate to significant amount over the longer period. In addition, the relatively short measurement series (7 years to date) means that the relationship between hydrometeorological parameters (e.g. groundwater level or temperature) and the annual totals of measured fluxes of greenhouse gases must be confirmed based on a larger number of data. In the project implementation we propose additional measurements which allow to eliminate these uncertainties by estimating the proper correction of existing data, and verifying suggested relationships. A longer measurement period (the data set will be extended to 12 years) will also allow to determine whether after the drying period the balance of greenhouse gases will return to the level from before the drought or how this balance will change in the case of drought persisting for subsequent years (depending on the conditions in the project implementation period). The established relationships between the total fluxes of the studied greenhouse gases and regional values of hydrometeorological parameters (for which long data series are available) will allow the assessment of long-term variability of this exchange.