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SEASONAL BALANCE OF CARBON DIOXIDE FLUXES THROUGH THE NAROCH LAKE SURFACE (BELARUS) BASED ON IR SPECTROSCOPY AND THE METHOD OF CLOSED CHAMBERS

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This article presents the results of the assessment of carbon dioxide fluxes through the Naroch lake surface during the vegetative season (May–September) of 2017, obtained by the method of closed chambers and IR spectroscopy. The results show that the average daily runoff values are 0.409 mg C/m^2 in the pelagic zone and 0.647 mg C/m^2 in the littoral zone. The carbon dioxide fluxes balance indicates the runoff over emission prevalence. The total seasonal carbon runoff into the lake from the atmosphere is 128.6 t C, including 26.3 t C and 102.3 t C received through the surfaces of the littoral and pelagic zones, respectively.

Keywords: *seasonal balance (emission/runoff) of carbon dioxide, IR spectroscopy, method of closed chambers, Naroch Lake, littoral zone, pelagic zone.*

Introduction. The steady increase in the concentration of carbon dioxide in the Earth's atmosphere is a global environmental problem and is one of the causes of climate change [1]. Analysis of carbon fluxes has historically focused on the study of terrestrial and oceanic ecosystems [2, 3]. However, the presence of mass imbalances within the continental balances [4] stimulated the investigation of the role of lakes as possible overlooked contributors to the carbon budget [5].

Attempts to estimate the annual CO_2 emission by the world′s lakes showed that lake water in most cases is oversaturated with carbon dioxide [6]. Nevertheless, the role of freshwater ecosystems in the balance of carbon dioxide remains unclear, and the results obtained in different regions of the globe are often contradictory. For example, there are no clear ideas about intra-ecosystem factors that determine the direction and magnitude of the carbon balance (emission/runoff) throughout the vegetation season [7, 8]. Today, it can be argued that the role of freshwater ecosystems in the global carbon cycle can be significant and lakes should be accounted for in regional carbon budgets, especially in lake landscapes [9]. Thus, at this stage of investigation, it seems important to gather more data on gas fluxes in freshwater ecosystems in order to determine their relationship with environmental factors.

There are a number of methods for estimating the flux of carbon dioxide in the water–atmosphere system, which are actively used in field observations, namely: the closed chamber method [10]; the eddy covariance method, the main disadvantages of which are expensive equipment and the complexity of data processing [11]; a method for measuring CO_2 fluxes based on determining the partial pressure of gas (pCO_2) in the water–atmosphere system, followed by calculation of the magnitude and directivity of the flux according to the developed model [12, 13]. In a comparative analysis, it should be borne in mind that the obtained flux values do not always coincide. This is due to both different approaches to data extrapolation and indirect methods for obtaining results based on computational models [14].

In 2012 in Belarus, a comparative analysis of some lakes of the Narochansky region was attempted in order to evaluate the ability to exchange carbon dioxide with the atmosphere via elements of the carbonate system, namely, the partial pressure of gas in water [15]. In this work, carbon balance estimates for the growing season (May–September) using Lake Naroch as an example were first obtained by direct instrumental measurements of CO_2 based on IR spectroscopy using closed

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