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Development and testing of autonomous water quality monitoring system in the littoral zone of Lake Baikal

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Currently, shipborne observations using CTD-type instruments are the main method for studying the hydrological characteristics of Lake Baikal. They provide episodic information about the spatial distribution of temperature, mineralization and dissolved oxygen over the depth of the lake but do not provide detailed information about their temporal variability. As a rule, hydrochemical parameters are measured even more pointwise because they require sampling and subsequent analysis. To study spatiotemporal variability of ecosystem characteristics in more detail, it is necessary to combine shipborne observations with long-term measurements at coastal stations or develop a network of abyssal buoy stations equipped with various hydrophysical instruments.

The first step in this direction was the development and implementation of an automated hydrometeorological station at Limnological Institute SB RAS to organize online monitoring of hydrophysical, hydrochemical and meteorological parameters in the littoral zone of Lake Baikal. The developed station is based on an AAQ177 Rinko water quality profiler (JFE Advantech, Japan) and water level sensor developed at Limnological Institute SB RAS. Meteorological parameters are measured with a set of Vantage Pro 2 sensors (Davis Instruments, USA). The environmental parameters measured every 10 seconds are transmitted in real time via wireless communication channels to a remote Internet server. Functionally, this server is a data collection and data processing centre (data centre). Tasks of the data centre include receiving data from the network of monitoring stations, primary processing, storage and provision of the access through the WEB page.

The monitoring station was installed at the pier of Limnological Institute SB RAS in the Bolshiy Koty settlement in August 2020. The obtained comparatively high-frequency and quasi-continuous measurements of the indicated parameters allowed us for the first time to trace in detail their daily and monthly variations during the summer-winter transition period. A comparative analysis of the obtained data with the results of parallel chemical analyses of the daily samples revealed their good agreement. In general, it is noteworthy that the set of measured parameters of develop station is sufficient to assess water quality and track its changes over time.

The development of systems for online monitoring of water balance parameters, such as water temperature, solar irradiance, wind regime, chemical and biogenic elements, etc., can provide additional information to understand the causes of the recent ecological transformation of the

littoral zone of Lake Baikal. Thus, we will be able to switch from discrete/one-time observations to quasi-continuous ones, which will significantly improve the forecasting of natural and anthropogenic phenomena that are hazardous for the residents and ecosystem of the Baikal natural territory, and will form the basis for the development of the solutions for their prevention or mitigation.

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