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Recent hydrographic measurements in the Lake Issyk Kul: Coastal currents, thermohaline structure, water quality indicators

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Issyk Kul is a deep (670 m) terminal lake in the northern Tian Shan mountains in eastern Kyrgyzstan. It is the tenth largest lake in the world by volume, and the second largest saline lake after the Caspian Sea. The lake is a Ramsar site of globally significant biodiversity.

We report preliminary results of a field survey undertaken in the northern coastal part of the lake, off Cholpon-Ata township, on September 10-13, 2014. A fishery boat was used to carry out CTD profiling and water sampling at 16 stations. An UV fluorescent lidar working continuosly throughout the survey yielded surface concentrations of chlorophyll-a, suspended matter, and dissolved organic substances. In addition, we deployed 3 mooring stations equipped with current meters, all at approximately 15 m isobath, recording the velocity and direction of the near-bottom currents with 10 min sampling intervals.

During the experiment, the coastal waters of the lake were fully mixed down to the depth of 15-20 m and nearly uniform vertically at salinity about 5 g/kg. The only exception referred to the areas adjacent to the mouths of small river and creeks, where stable salinity stratification developed at 0.01-0.03 g/kg per 1 m of depth. The temperature stratification generally followed the diurnal pattern.

The dominant coastal currents were directed westward, which agrees with the established notion about the cyclonic character of the basin-scale circulation. Superimposed on this general cyclonic pattern, there was a persistent variability of currents at the periods of 17 to 24 hours, likely associated with the interplay between the inertial oscillation and signal of breeze in the wind forcing. There was an evidence of mesoscale eddies, possibly, associated with topographic features of the shoreline. The observed velocity in the near-bottom layer was about 9 cm/s on the average, with the maximum values exceeding 25 cm/s.

The Issyk Kul lake is ultra-oligotrophic - the concentrations of chlorophyll-a were below 0.4 mcg/l in all cases. The suspended matter concentrations were also low, about 0.7 mg/l on average. Consequently, the water was very transparent, with Secchi depth exceeding 16 m. The ratio between the mineral and organic suspended matter in water is about 5. The water quality in the study area was good, no significant polutants were detected. Nevertheless, we documented an increase of concentration of dissolved organic matter increases near the coast, especially near resort infrastructure in Cholpon-Ata, pointing on detectable, although moderate, anthropogenic impact.

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