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Hydrophysical and hydrochemical features of Lake Issyk-Kul (Kyrgyzstan) as revealed by field survey of June, 2015

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Lake Issyk-Kul is a major (volume 1700 km^3, depth 668 m) terminal lake in Kyrgyzstan, Central Asia. The lake has a longstanding history of research and recently attracted international attention, in particular, as a potentially promising site for scientific drilling and reconstructing paleo-climate variability (e.g., Oberhansli and Molnar, 2012). However, the in situ hydrophysical and hydrochemical data collected from Issyk-Kul are still limited, and those available are somewhat outdated, given that the most recent field campaign reported in the literature dates back to about 15 years ago. A new field survey was conducted in June, 2015. The measurements included CTD profiling and water sampling at 19 stations in all parts of the lake, as well as continuous measurements by a pump-through system and an ultraviolet lidar along the ship's track. The water samples were analyzed for a variety of hydrochemical indicators, including nutrients, dissolved oxygen and methane. In addition, velocity meters were deployed at 3 mooring stations to investigate the synoptic variability of currents.

The nitrates, nitrites, phosphorus and silica exhibited elevated surface concentrations in the central part of the lake, which is likely to be associated with the upwelling induced by the basin-wide cyclonic circulation gyre evident from the current measurements. At the same time, the coastal waters were characterized by very low content of nutrients, except the southeastern part of the lake exposed to significant continental discharges from the Tyup and the Dzhergalan rivers. In the areas of continental water influence, concentration of dissolved silica attained minimum values in the surface and intermediate layers. On the other hand, silica concentrations grew steadily from the depth of about 100 m down to the bottom. In general, concentrations of principal biogenic elements in the euphotic layer were relatively low - albeit not low enough to be a limiting factor for phytoplankton life cycle. However, the vertical profiles of dissolved oxygen indicated that the most intense photosynthetic activity took place in the intermediate layers, while in the surface layer it was suppressed, hypothetically, by excessive insolation. The ionic salt content of the Issyk-Kul waters was essentially uniform throughout the water column, which points towards efficient mixing in the cold period. In summer season, temperature stratification was sufficiently strong to provide for significant reduction of dissolved oxygen and increase of nutrients in the bottom layer. Samples collected and analyzed for dissolved methane generally yielded low concentrations below 0.5 μl/l at the surface and 0.2 μl/l in the bottom layer, however, values as high as to 3.9 μl/l were documented in some samples corresponding to near-shore stations at depths of about 70 m.

We also used a towed side-looking sonar to obtain detailed maps of bathymetric features, including the channels formed by ancient beds of the Tyup and the Dzhergalan Rivers. These channels are believed to represent important pathways for ventilated water and terrigenic substances penetrating into the deep central part of the lake following seasonal differential cooling on the eastern shelf (Peeters et al., 2003). Quantitative assessment of this plausible mechanism is subject to future work.

References

Oberhansli, H., and P. Molnar (2012) Climate evolution in Central Asia during the past few million years: A case study from Issyk-Kul. Scientific Drilling, 13, doi: 10.2204/iodp/sd.13.09.2011

Peeters F, Finger D, Hofer M, Brennwald M, Livingstone DM, Kipfer R (2003) Deep-water renewal in Lake Issyk-Kul driven by differential cooling. Limnol. and Oceanogr. 48: 1419- 1431.