



The use of UAV data for environmental monitoring of the coastal area of Lake Sevan, Armenia under the increase in water level

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High-mountainous Lake Sevan (Republic of Armenia) laying at an altitude of about 1900 m above sea level is a unique object of remote environmental monitoring due to the multidirectional dynamics of water level over the past 100 years. The artificial decrease in the lake water level began in 1930s, with the most intensive fall (over 10 m) from 1949 to 1962. In the 1990s, there was a slight increase in the level, then water level continued to fall until 2001. According to the current program of Armenian government, the lake level is planned to rise by at least 6 m in the coming years.

The current increase in water level of Lake Sevan leads to activation of both abrasive and accumulative coastal processes, intensification of eutrophication and mass flowering of lake waters. Planned increase in water level also threatens residential and recreational facilities which are abundant along shoreline of Lake Sevan. At the same time, the spatial and temporal differentiation between the current intensity of coastal processes and the state of coastal ecosystems is quite significant. In order to reveal the regularities of this differentiation, we preliminary carried out a retrospective large-scale mapping of the shoreline dynamics of Lake Sevan using archival and modern cartographic small-scaled materials and high-detailed remote sensing data for the period of over 100 years. Based on the results of interpretation of the mosaic of large-scale aerial imagery of 1960s different types of coasts were identified; the speed of receding of the lake shoreline during the period of its maximum decline was reconstructed.

For several chosen key coastal areas, characterized by the most significant changes in shoreline and different types of current coastal processes, since 2018 we have been conducting operational remote monitoring of the coastal zone from light-weight UAVs DJI Phantom 4 Pro. UAV surveys are conducted at the low altitude range (100–200 m) with the use of both optical and thermal cameras. Resulted multitemporal UAV data are dense photogrammetric point clouds (with the density more than 300 points per sq. m), three-dimensional digital surface and terrain models with spatial and vertical resolution up to 10 cm, ultrahigh-detailed orthoimagery with the spatial extent about 1 sq. km. Thematic interpretation of acquired UAV data resulted to detailed land cover mapping of key coastal areas, reliable detection of local sources of water pollution, identification of buildings and facilities more threatened to inundation under the different scenarios of water level rising. The integral synthetic assessment is made for the current environmental state of

coastal ecosystems under risk. Among more vulnerable ecosystems are coastal lagoons with associated wetland complexes and planted coastal forests which being degraded and damaged as a result of increase in lake level and inadequate management can substantially contribute to the deterioration of integral water quality in Lake Sevan.

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