Estimation of Volume-Depth Relationships Using Sentinel -3 Mission data for Inland Lakes: Case Study, Nasser Lake, Egypt

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Description

Nasser Lake is an artificial lake in Egypt. It was formed due to the construction of Aswan High Dam (AHD) in the South of Egypt in YEAR. It became a hot spot at both local and global levels since the commencement of Grand Ethiopian Renaissance Dam (GERD) construction in the Year. The regular Lake surveying mission was stopped since 2012 after the January revolution in Egypt in 2011. This leads us to think in a cost-effective monitoring method to have the volume-depth relationship of Nasser Lake thanks to EU sentinel mission. This work explores and assesses the performance of Sentinel-3A optical imagery data in the visible and NIR bands from the two optical instruments SLSTR and OLCI, and proposes the integration with Sentinel-3A radar altimetry from SRAL instrument applied to Nasser Lake. This preliminary study investigates the relationship between the reflectance data and in-situ data for water depth after a bathymetric campaign in the relatively deep water region in the south of the lake using statistical regression models. The developed models provide promising estimations with correlation value ($R^2 > 0.8$) and NRMSE <0.3.. Also, Heron's formula was applied to combine optical imagery and Sentinel-3 altimetry water level data sets to estimate water storage variations in Nasser Lake. In addition, equations governing the relationship between water level and water surface area and water volume were developed. The obtained results are useful for Nasser Lake authorities and stakeholders dealing with Nasser Lake and all similar inland water bodies. Keywords: Sentinel; SLSTR; OLCI; Inland water body; Egypt; Water Depth; AHD, GERD; Nasser Lake.