Cost-Efficient Bathymetric Mapping Using Sentinel Data

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SUMMARY

The high cost associated with traditional bathymetric survey, high resolution imagery such as IKONOS and insufficient/lack of up-to-date bathymetric charts of most areas in Nigeria calls for a pragmatic and urgent intervention. This study adopts a ratio-transform algorithm on Sentinel-2A imageries for a period of five years (2016 and 2020). Spatio temporal changes along Opa river bed were determined from the bathymetric data obtained from Sentinel-2A imageries. Cross-sections and profile along the water channel of the dam were generated. This study offers a new method to provide an accurate depth map while reducing cost up to 75%. Cloud-free Sentinel-2A (Level1) images for 5 years (2016-2019) were downloaded United States Geological Survey (USGS) Earth Explorer's and Global Land Cover Facility's (GLCF) websites. Water/land separation was done using QGIS 3.10. Stumpf's algorithm was used to determine the Bathymetric Ratio of Blue/Green Bands. Digitization was carried out along the profile and cross sections of the dam bed. Spatio-temporal variation of the dam bed was determined. Analysis of the average bathyRatio depth and the net change between 2016-2020 were also determined. The result showed that the deepest value along the channel was recorded in 2016. Gradual accumulation of silt at the base continued till 2018 with 1.043 as the value. Between 2018-2020, maintenance activities were suspected. Average BathyRatio for the period was lowest in 2017 (0.990) and the highest was 1.129. The results further revealed that the bathymetric map produced from Sentinel provided significant depth value in terms of Bathymetric Ratio ratio with no significant difference in the pattern from the field depth data obtained using acoustic method. The use of Sentinel data provides a cost□effective methodology for estimating water depth and mapping.