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COST-EFFICIENT BATHYMETRIC MAPPING USING SENTINEL DATA

Caleb Olutayo OLUWADARE and
Emmanuel Tolulope SANYAOLU
Department of Surveying and Geoinformatics,
Obafemi Awolowo University, Ile-Ife, Nigeria.

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Introduction

- Bathymetry measures underwater topography.
- Acoustic systems are costly and limited, so satellite-based bathymetry is a fast option for depth information.
- QGIS 3.10 was used to apply the ratio-transform algorithm proposed by Stumpf et al. (2003) on Sentinel-2A imageries.

Theory

- Various wavelengths of light penetrate water to varying degrees
- As light travels through water, contact with the column of water attenuated it.
- Longer wavelength light (red and near infrared) has a greater coefficient of attenuation than short wavelengths (blue).
- Penetration depth depends on water turbidity, suspended sediment particles, phytoplankton, and dissolved organic compounds.

Methodology

Table 1: Methodology based on objectives

Objectives	Data Used	Methods of Analysis
1. Depth Determination	Sentinel 2A Satellite Images (Band 2 – Blue, Band 3 – Green and Band 8 – Near Infrared) for the year 2016 to 2020	Stumpt et al. (2003) Ratio-Transform Algorithm
2. Profile and Cross-Section Generation	Results obtained in Objective 1	Profile Tool Plugin in QGIS
3. Rate of Spatio Temporal Variation of the Dam Bed	Results obtained in Objective 2	- Average - Net Change - Trend over time

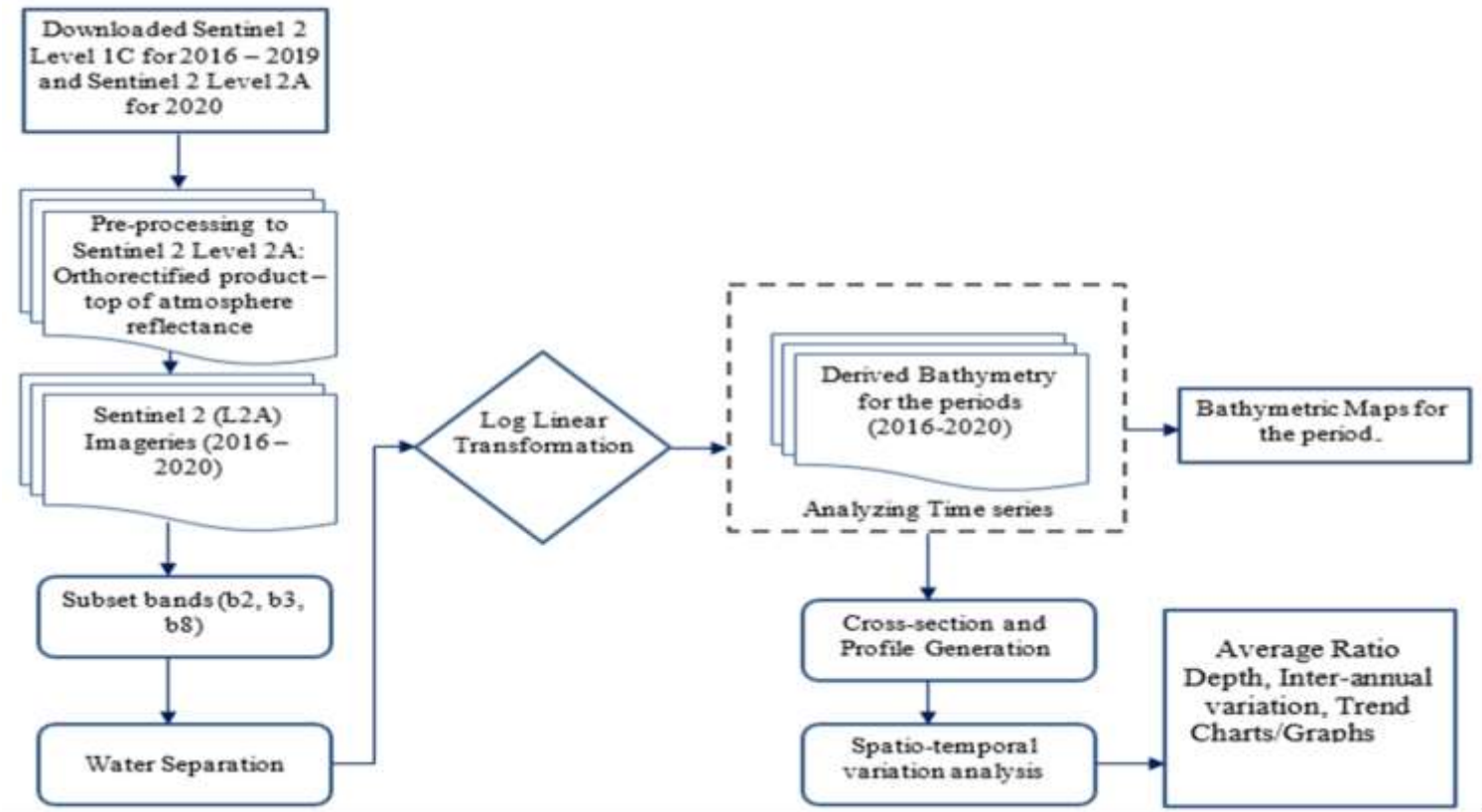


Figure 1: Methodological Workflow

Results and Discussion

- Depth Determination

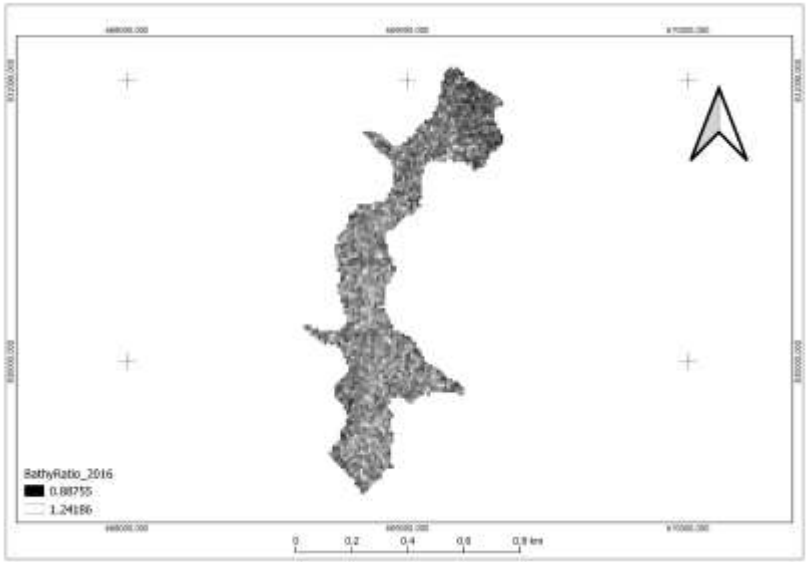


Figure 2: 2016 BathyRatio

Year	2016	2017	2018	2019	2020
Shallow	0.88755	0.856757	0.955587	0.946289	1.06478
Deep	1.24186	1.12094	1.04306	1.05746	1.19638

We found it out that the BathyRatio for 2016, 2017, 2018, 2019 and 2020 are having ratio depth ranging 0.88755–1.24186, 0.856757–1.12094, 0.955587–1.04306, 0.946289–1.05746, and 1.06478–1.19638 respectively, over the years.

- Temporal Changes: Average BathyRatio Depth

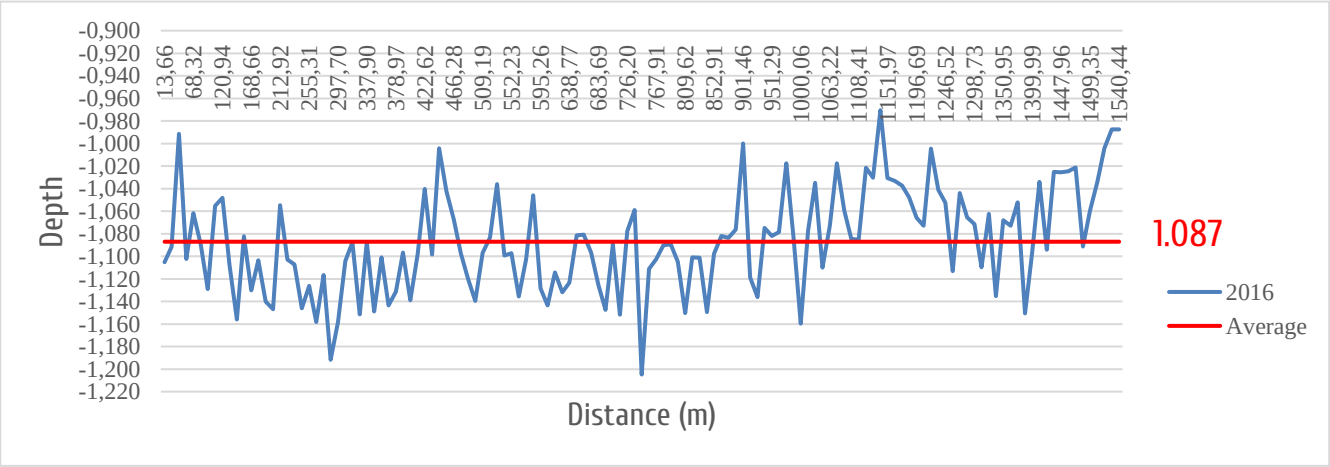
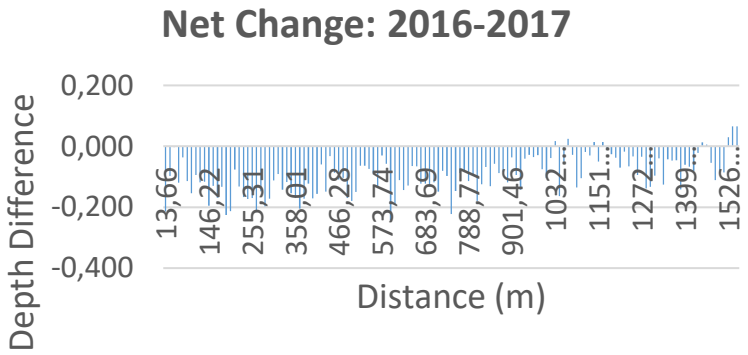


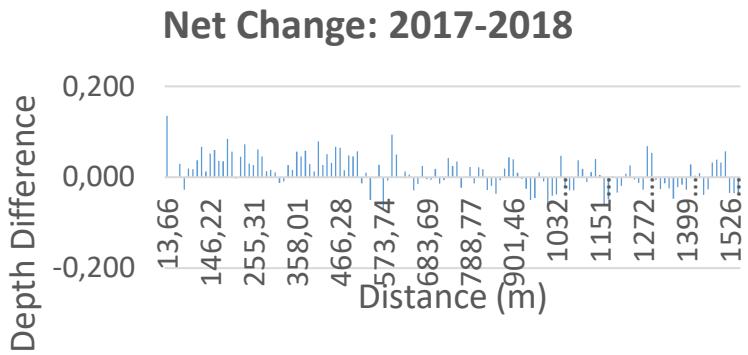
Figure 2: Profile with Average BathyRatio Depth 2016

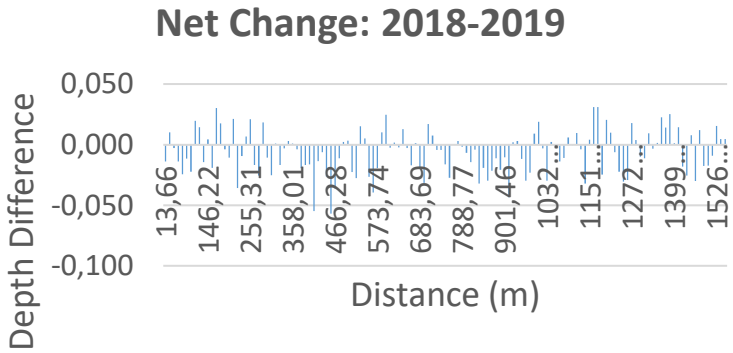
Table 3: Average BathyRatio Depth between 2016 and 2020 in Tabular Form

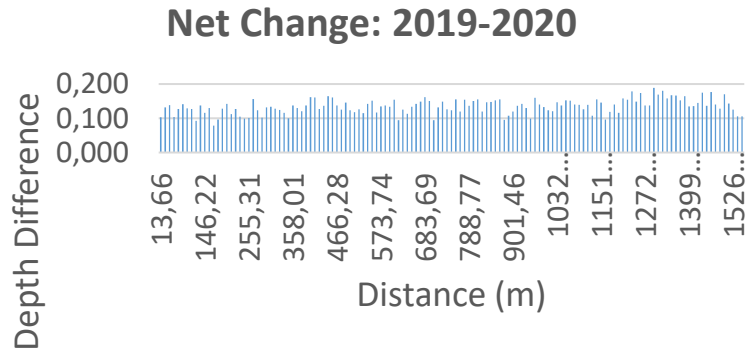
YEAR	2016	2017	2018	2019	2020
AVERAGE BATHYRATIO DEPTH	1.087	0.990	1.001	0.994	1.129

- Temporal Changes: Net Changes









- Trend

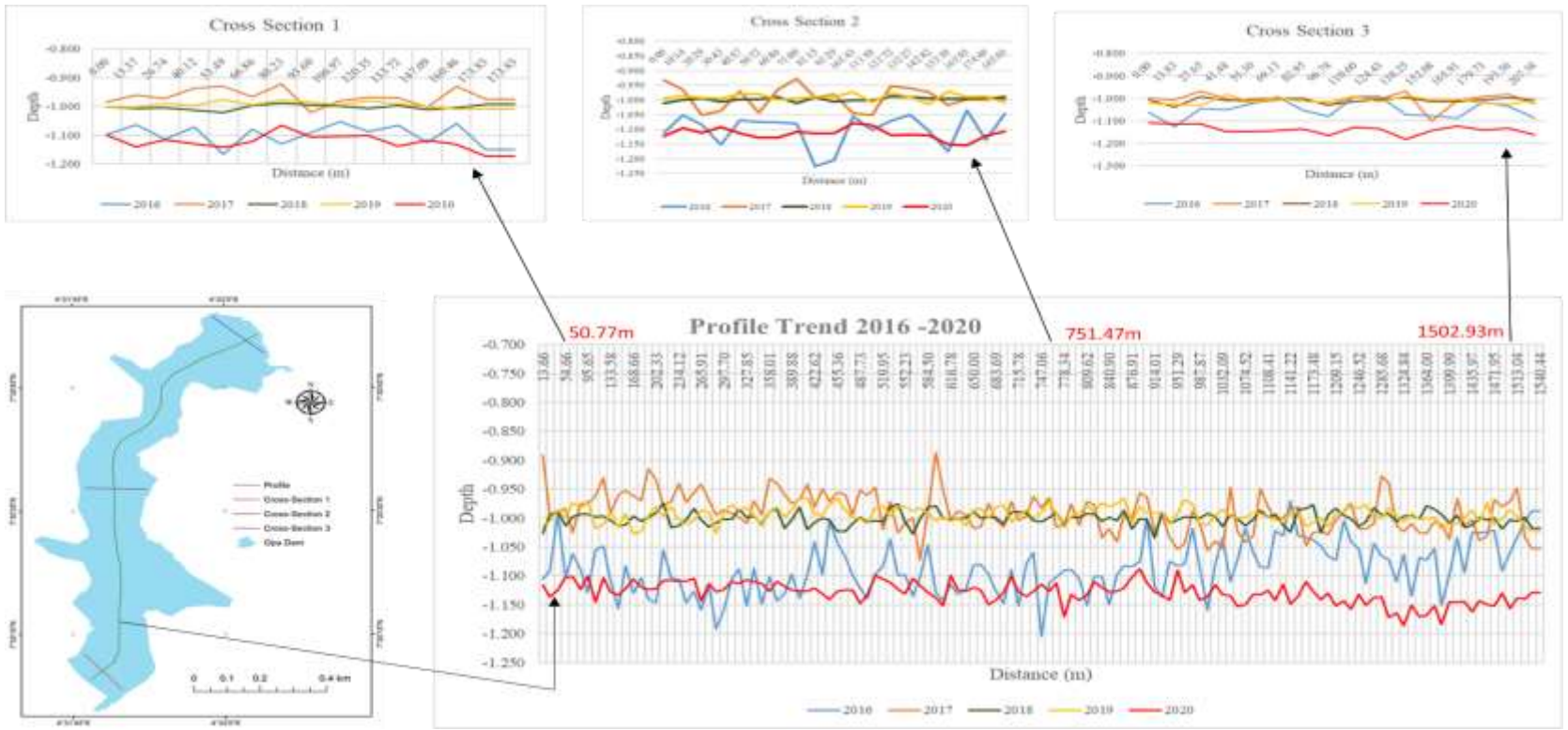


Figure 2: BathyRatio Depth Trend from 2016 to 2020

Conclusion

A ratio-transform algorithm proposed by Stumpf *et al.* used on Sentinel-2A imageries for a period ranging between 2016 and 2020 had proven useful to assess variation in the depth of Opa Dam bed which could support the stakeholder in continuous monitoring and sustainable planning of the dam.