Data Article

Hydro-geometrical data analyses of River Atuwara at Ado-Odo/Otta, Ogun State

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A B S T R A C T

The dataset analyzed in this article contains spatial and temporal values of the hydro-geometric parameters of River Atuwara. The hydro-geometrical data analyses of various sampling point on River Atuwara was examined and their geometric properties were taken with the use of a paddled boat, depth meter and global positioning system (GPS). The co-ordinates, width, depth, slopes, area, velocity, flow were gotten in-situ while the area and wetted perimeter were computed ex-situ. The statistical relationships between separate variables were considered using scatter plots and regression line equations. Inferences drawn from various variable comparisons can be used to validate predictive models for various time seasons.

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Specifications table

| Subject area                  | River Engineering, Water quality modelling |
|-------------------------------|--------------------------------------------|
| More specific subject area    | Water transport modeling and simulation    |
| Type of data                  | Table, image, text file, graph, figure     |
| How data was acquired         | The referenced sampling points of the Atuwara river were taken with paddled boat and a depth finder. A global positioning system (GPS) |

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Data format: Raw and analyzed

Experimental factors: The study assumes that an irregular channel cross-sections can be represented with hydraulically equivalent (that is, area to wetted perimeter remains the same) trapezoidal cross-sections. Also, the processed hydro-geometric data assumes the top-width of each cross-section were unchanged.

Experimental features: Very brief experimental description

Data source location: River Atuwara; located in Ado-Odo/Otta local government in the Southwestern part of Nigeria

Data accessibility: All the data are present in the data article.

**Value of the data**

The hydro-geometric data presented are suggestive for the following purposes:

- The data can be used to develop some numerical models that simulate and predict the transport and fate of organic pollutants in the environment [1–7].
- The dataset helps to describe the temporal and spatial behavior of pollutants and nutrients in the Atuwara River.
- These field observatory data can be used to validate predictive model for various hydrological seasons.
- The hydro-geometric data set can serve as an indicator to decision makers for consideration of current and futuristic water pollution controls.

1. **Data**

The dataset comprises of hydro-geometric analyses of selected sampling points on the River Atuwara, located in Ado-Odo/Otta, in southwest Nigeria. The hydro-geometric data was collected with the use of equipment such as depth meter, paddled boat, tape measure, and a global positioning system. Fig. 3 is illustrative of the hydro-geometric data collection process. Geometric values are shown in Table 1, with their respective unit standards. Relationships between various units of measurement were derived statistically and presented in Figs. 4–6.

2. **Experimental design, materials and methods**

Hydro-geometric data (such as depth, width and side slopes) of the Atuwara River were collected along Sixteen referenced points. The Sixteen referenced points (which is perpendicular to the direction of the river flow) were taken with the use of a boat and a Speedtech portable depth sounder. A global positioning system (GPS) unit was used to get the location of the sixteen-referenced point within Atuwara river. Fig. 2 shows the River Atuwara Watershed and built-up areas, while Fig. 1 is a plot of cross-section within the Atuwara river system, and their respective hydro-geometric channel label.

A digital elevation model (DEM) through the use of GPS is used to derive slope, slope length, aspect and other related parameters. The GPS, a global positioning system (Garmin GPS map 76) is navigating equipment. It is a small hand held receivable used to provide global positioning information (accurate to within 10–20 m). It is a cheap, flexible, convenient and relatively accurate device used to determine the position of people and devices naming anywhere around the globe. Values from Chow (1959) were used to estimate the Manning’s roughness coefficient. The oxygen reaeration
| S/No. | Coordinates | Way points | Relative distance to STA-Atuara upstream (km) | Station description | WIDTH (m) (Top (B)) | WIDTH (m) (Bottom (B₀)) | WIDTH (m) (Left Mid Right Mean (H)) | Area (m²) | Sides slope | Area (m²) | Velocity (m s⁻¹) | Flow (m³ s⁻¹) | Manning’s Wetted perimeter (m) | Oxygen resaeration | Dispersion |
|-------|-------------|------------|-----------------------------------------------|--------------------|---------------------|----------------------|----------------------------------|---------|-------------|---------|----------------|----------------|-------------------------------|------------------|-----------|
| 1     | 523883      | STA 0     | Atuara Upstream                               | STA 0 Atuara       | 13.1                | 11.56                | 10.6                             | 10.6    | 0.41        | 1.04    | 3.18          | 0.43           | 13.899                        | 3.452            | 4.93       |
| 2     | STB 0.19    |            | Abattoir                                      | STB 0.19 Abattoir  | 4.3                 | 2.85                 | 0.71                             | 0.74    | 1           | 1.05    | 3.18          | 0.43           | 4.956                         | 4.048            | 4.722     |
| 3     | STC 0.24    |            | Abattoir Downstream                           | STC 0.24 Abattoir  | 8.4                 | 6.74                 | 0.86                             | 0.97    | 1.21        | 1.13    | 7.58          | 0.43           | 9.598                         | 2.698            | 5.743     |
| 4     | STD 1.21    |            | Sona Upstream                                 | STD 1.21 Sona      | 16.2                | 14.23                | 0.89                             | 1.08    | 1.26        | 1.53    | 22.84        | 0.42           | 9.594                         | 1.521            | 8.79       |
| 5     | STE 1.26    |            | Sona Downstream                               | STE 1.26 Sona      | 8.6                 | 6.51                 | 1.14                             | 0.95    | 1.61        | 1.34    | 11.78        | 0.38           | 4.477                         | 1.051            | 7.727     |
| 6     | STF 2.78    |            | Ewupe Upstream                                | STF 2.78 Ewupe     | 10.4                | 7.96                 | 0.99                             | 1.45    | 1.4         | 2.05    | 17.26        | 0.38           | 6.56                          | 1.133            | 9.362     |
| 7     | STG 2.83    |            | Ewupe Upstream                                | STG 2.83 Ewupe     | 13.4                | 10.81                | 1.02                             | 1.57    | 1.44        | 2.22    | 23.58        | 0.4           | 9.434                         | 1.065            | 10.45     |
| 8     | STH 3.08    |            | Ewupe Downstream                              | STH 3.08 Ewupe     | 13.5                | 11.56                | 1.02                             | 0.92    | 1.51        | 1.3     | 20.38        | 0.39           | 7.95                          | 1.323            | 8.741     |
| 9     | STJ 4.67    |            | Afara Meje                                    | STJ 4.67 Afara Meje| 16.9                | 15.26                | 1.32                             | 2.96    | 1.87        | 4.19    | 36.34        | 0.41           | 14.897                        | 0.798            | 13.083    |
| 10    | STK 7.94    |            | Ekusere                                       | STK 7.94 Ekusere   | 11.8                | 8.23                 | 2.34                             | 2.71    | 3.31        | 1.74    | 24.66        | 0.34           | 8.385                         | 0.758            | 10.547    |
| 11    | STL 8.36    |            | Ekusere Downstream                            | STL 8.36 Ekusere   | 8.9                 | 6.53                 | 1.51                             | 2.56    | 2.13        | 1.22    | 14.6         | 0.36           | 5.255                         | 1.123            | 8.764     |
| 12    | STM 9.28    |            | Igboloye Downstream                           | STM 9.28 Igboloye  | 9.4                 | 6.1                  | 1.79                             | 2.22    | 1.51        | 1.84    | 2.53         | 1.23           | 5.535                         | 0.891            | 8.74       |
| 13    | STP 9.88    |            | Igboloye Upstream                             | STP 9.88 Igboloye  | 10.2                | 6.87                 | 2.25                             | 2.06    | 1.8         | 1.8     | 3.18         | 1.53           | 5.141                         | 0.861            | 7.481     |
| 14    | STQ 9.88    |            | Igboloye Discharge                            | STQ 9.88 Igboloye  | 12.3                | 9.62                 | 1.94                             | 2.19    | 1.62        | 1.05    | 19.93        | 0.31           | 6.177                         | 1.061            | 7.454     |
| 15    | STR 10.71   |            | Igboloye 100 m Downstream                     | STR 10.71 Igboloye | 11.2                | 7.35                 | 3.45                             | 1.79    | 0.4         | 1.88    | 4.88         | 0.57           | 6.106                         | 0.821            | 8.092     |
| 16    | 516392      | STS 10.81  | Iju Water Works                               | 516392 STS Iju Water Works | 16.9 | 10.46 | 5.02 | 3.11 | 1.39 | 3.17 | 7.09 | 1.96 | 15.62 | 0.32 | 4.995 | 0.004 | 25.362 | 0.394 | 4.387 |
was gotten through Eq. (1) (O'Connor-Dobbins Formula) [6].

$$K_a = 3.93 \frac{U^{0.5}}{H^{1.5}}$$

(1)

$K_a$ = Oxygen reaeration, $H$ = Depth (m), $U$ = Velocity (m/s).

The dispersion was analysed as the function of Eq. (2) [8]. Where $D$ = Dispersion ($L^2/T$).
Fig. 3. Hydro-geometric measurement on River Atuwara.

\[
y = -0.0012x + 0.3889
\]

Fig. 4. Velocity of River Atuwara against the area.

\[
y = -0.094x + 3.1406
\]

Fig. 5. Oxygen reaeration of River Atuwara against the area.
\[ d = \text{depth or stage (L)} \]

\[ D = \frac{0.01V^2W^2}{dU^*} \]

\[ g = \text{acceleration due to gravity (L/T}^2) = 9.8 \text{ m/s}^2, \ s = \text{slope (L/L) (channel slope), } W = \text{width (L)} \]

\[ U^* = \sqrt{gHS}, H = \text{mean depth or (d)} \]

2.1. Study area

River Atuwara, located in Ado-Odo/Otta local government with co-ordinates 523883N 745372E in Ogun state. River Atuwara moves transversely toward other neighboring villages and serve as a water source [9,10]. Fig. 2 shows the river and other built-up areas. The course of River Atuwara flows westward toward the Atlantic Ocean.

2.2. Data collection and processing

After collecting the hydro-geometric cross-sectional data, the hydro-geometric data was analyzed with the use of Microsoft office (Excel). The study assumes that an irregular channel cross-sections can be represented with hydraulically equivalent (that is, area to wetted perimeter remains the same) trapezoidal cross-sections as shown in Fig. 1. The hydro-geometric data was processed to determine the average depth of each cross-section, assuming the top-width of each cross-section were unchanged. Methods and processes of measurements, data collection and recordings employed along the river course are shown in Fig. 3.

2.3. Statistical analyses

The statistics analyses such as comparison of various unit of measurements are applied. The statistical summaries are shown in Figs. 4–6. The relationship between two-compared variable can obtained through the coefficient of the x-variable (gradient) in the regression equation indicated in Figs. 4–6. Negative gradient indicates inverse relationship while positive gradient shows direct relationships.

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References

[1] J. Cheng, K. Wang, J. Yu, Z. Yu, X. Yu, Z. Zhang, Chemosphere Distribution and fate modeling of 4-nonylphenol, 4-octylphenol, and bisphenol A in the Yong River of China, Chemosphere 195 (2018) 594–605.

[2] E. Hendriarianti, Hydrogeometry and water quality data analysis for one dimension water quality modelling of Lesti River at Malang Regency, J. Appl. Environ. Biol. Sci. 2 (6) (2012) 232–243.

[3] C. Wang, Y. Feng, P. Gao, N. Ren, B. Li, Science of the total environment simulation and prediction of phenolic compounds fate in Songhua River, China, Sci. Total Environ. 431 (2012) 366–374.

[4] G.B. Mcbride, S.C. Chapra, New hydroepidemiological models of indicator organisms and zoonotic pathogens in agricultural watersheds, Ecol. Modell. 222 (13) (2011) 2083–2102.

[5] R.B. Ambrose, T.A. Wool, WASP8 stream transport – model theory and user’s guide supplement to Water Quality Analysis Simulation Program (WASP) user documentation, Atlanta Ga (2017).

[6] D.O. Omole, E.O. Longe, A.G. Musa, An approach to reaeration coefficient modeling in local surface water quality monitoring, Environ. Model Assess. 18 (1) (2013) 85–94.

[7] D.O. Omole, A.A. Badejo, J.M. Ndambuki, A.G. Musa, W.K. Kupolati, Analysis of auto-purification response of the Apies River, Gauteng, South Africa, to treated wastewater effluent, Water SA 42 (2) (2016) 225–231.

[8] H.B. Fischer, Mixing in Inland and Coastal Waters, Academic Press (1979) 483.

[9] I.K. Adewumi, A.S. Ogbiye, E.O. Longe, D.O. Omole, Effect of industrial effluents on water quality of River Atuwara in Ota, Edited by, in: R. Adeyemo (Ed.), Urban Agriculture, Cities and Climate Change Environmental Research, Ecology and Landscape conservation, Cuvalier Verlag, Göttingen, Germany, 2011, pp. 272–280.

[10] D.O. Omole, E.O. Longe, Re-aeration coefficient modeling: a case study of river Atuwara in Nigeria, Res J Appl. Sci. Eng. Technol. 4 (10) (2012).