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# Lithology and channel network initiation and orientation: A case study of Upper Ogun River Basin, Southwestern Nigeria

Adeyemi Olusola[α] and Adetoye Faniran[α]

[α]Department of Geography, University of Ibadan, Ibadan, Nigeria

# Introduction

- Several studies have highlighted the importance of structure on landform evolution[1].
- Most of these studies especially in temperate regions or river channels with(out) glacial history have been extensively studied and underlying interactions between process-form dynamics presented in the literature.
- However, narratives concerning humid tropical basins without glacial history are still growing.
- The problem, however, is that information on basins within humid tropical region is too limited for any reasonable and definitive inferences and deductions to be made[1]
- Hence, the need to take advantage of big data available in Digital Elevation Models and emerging geo-computational tools.

[1]Faniran, A., Jeje, L. and Ebisemiju, F. (2006). *Essentials of Geomorphology*, Penthouse Publications, Ibadan, Oyo State, Nigeria.

# Aim

- This study aims to understand the influence of lithology on river channel orientation.
- To achieve the aim of the study, Digital Elevation Models (DEMs) and Rose Diagrams will be used to highlight the influence of underlying lithological units on river network orientation and initiation.

# Study Area and Methodology

- The study was carried out within Upper Ogun River Basin, Southwestern Nigeria (Figure 1).
- Seventeen (17) third-order basins were identified using Shuttle Radar Topography Mission (SRTM) at 30m resolution. These basins were validated using topographical maps.
- For the geoprocessing, the channel networks were extracted, clipped and processed from the filled DEM using hydrological tools of the ArcToolbox (ArcGIS 10.x)[2].
- The extracted channels were ordered using the Strahler method.
- To identify the basins to be studied, a systematic and random sampling technique was employed (Figure 2).
- Topographic properties were extracted using SAGA, while Rockworks was used in creating the Rose diagrams.

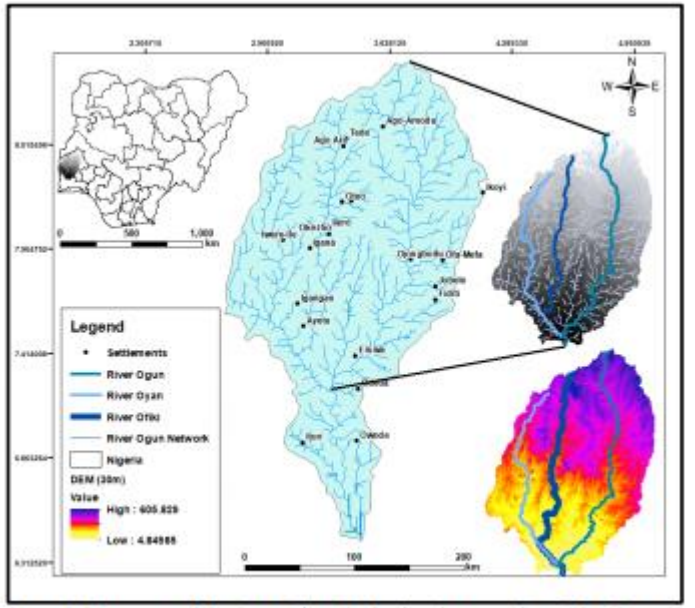


**Figure 1.** The extent of the Ogun River Basin showing a section of the Upper Ogun River Basin and the DEM

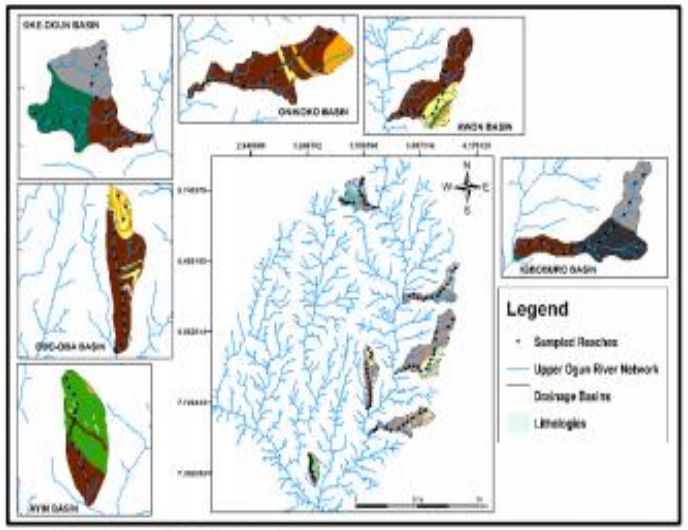


**Figure 2.** Selected third-order basins

[2]Adeyemi, O., Olutoyin, F., & Olumide, O. (2020). Downstream hydraulic geometry across headwater channels in Upper Ogun River Basin, Southwestern Nigeria. African Geographical Review, 39(4), 345-360.

# Results and Discussions

- Rose diagrams (Figure 3) present the influence of underlying lithological units on river network orientation.
- It has been established that known methods of relating lineament patterns to morpho-tectonic subsets are Rose diagrams[3,4].
- The frequency and length of lineaments (fractures) in the Rose diagram for the study area (Figure 3) shows a bi-modal distribution in most cases along the EW-NS (East West – North South) and N-S (North-South) directions.
- The distributions (EW-NS and N-S) have corresponding peaks on the length-orientation axis of the Rose diagram of the river channels (Figure 3).

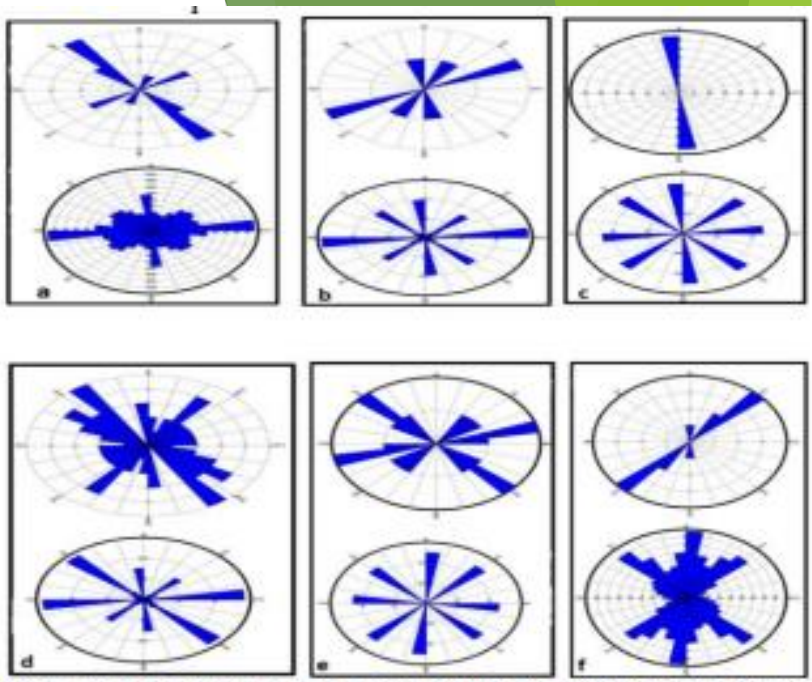

**Figure 3.** Rose diagram illustrating trends of lineament (upper Rose diagram and channel network (lower Rose diagram) (a) Oke-Ogun Basin (b)Igboburo Basin (c) Awon Basin (d) Onikoko Basin (e) Odo-Oba Basin (f) Ayin Basin

[3]Smithurst, L.J.M. (1990). Structural remote sensing of SouthWest England. *Proceedings of the Ussher Society*, 7, pp.236-241

[4]Anifowose, A.Y.B. and Kolawole, F. (2012). Tectono-hydrological study of Akure Metropolis, Southwestern Nigeria. *Hydrology for Disaster Management*. Special Publication of the Nigerian Hydrological Sciences.

# Conclusion

- In conclusion, four major trends were observed; the E-W, N-S, SSE-SSW and NESW. Across these four major trends, the N-S and E-W were particularly dominant.
- The general trend of tectonic grains within the Nigerian Basement is relatively in the N-S trend. Therefore, the main channels draining the selected basins in Upper Ogun appear to have been controlled along pre-existing weak zones in the country.
- It is established that groundwater flow in the Basement complex is likely to follow the path of porosity in fractures as well as weathered overburden.
- It can, therefore, be implied that these two lineament orientation sets (N-S, E-W) could define the preferred orientation of groundwater occurrence within the Upper Ogun River Basin (UORB).

***Thank you for listening!***

*olusolaadeyemi.ao@gmail.com*