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Comparative effect of lateritic shield in groundwater vulnerability assessment using GLSI and LC models: a case study of Ijero mining site, Ijero-Ekiti

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Abstract

Aquifer vulnerability assessment has been carried out using many approaches and models. Most overlay/index approaches in vulnerability assessment are hydrogeological and subjective in principle, while others, like longitudinal conductance (LC) and Geoelectric Layer Susceptibility Indexing (GLSI), are geophysical. These two geophysical models are based on the properties of geoelectric parameters as vulnerability assessment is not just dependent on the thickness of the overburden but is also incomplete without examining the properties of the geologic materials that make up the overburden. The LC and GLSI models were employed in this study to evaluate groundwater vulnerability to contamination from a mining site in Ijero-Ekiti, Nigeria. The maps generated by the two models were graphically compared. The results showed that the GLSI model compensated for the LC model's intrinsic flaw of being insensitive to the presence of lateritic formations. Although the LC model accounts for the geologic property of clay as a groundwater protective shield, it is insensitive to the presence of relatively high resistive geological formations like laterites, which are relatively low in hydraulic conductivity but are known to be good protective barriers for the underlying aquifers, and this gap has been bridged by adopting GLSI in the vulnerability assessment. As a result, the GLSI model has proved to be an improved and effective vulnerability assessment method. Hence, both models are recommended for detailed vulnerability assessment.

Availability of data and materials

All the data used were presented in the write-up. No other data was applied.

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Contributions

AF: Conceptualization, Methodology, Software, Visualization, Investigation, Supervision, writing – reviewing, and editing. TO: Visualization, Investigation, Software, Validation, Writing-Reviewing and Editing. AO: Conceptualization, Methodology, Software, investigation, Validation, writing. All authors read and approved the final manuscript.

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Ethics declarations

Conflict of interest

The authors declared that they have no competing interest.

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Appendices

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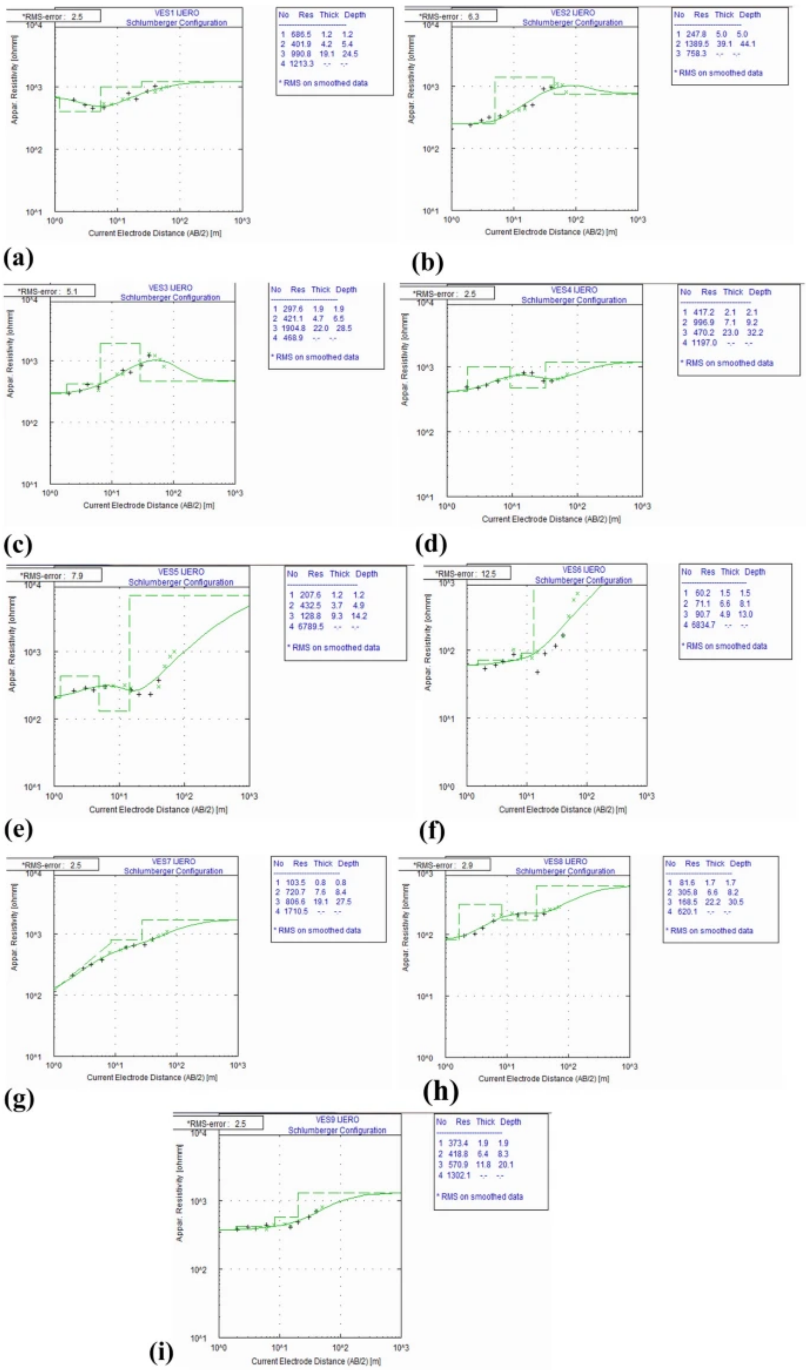
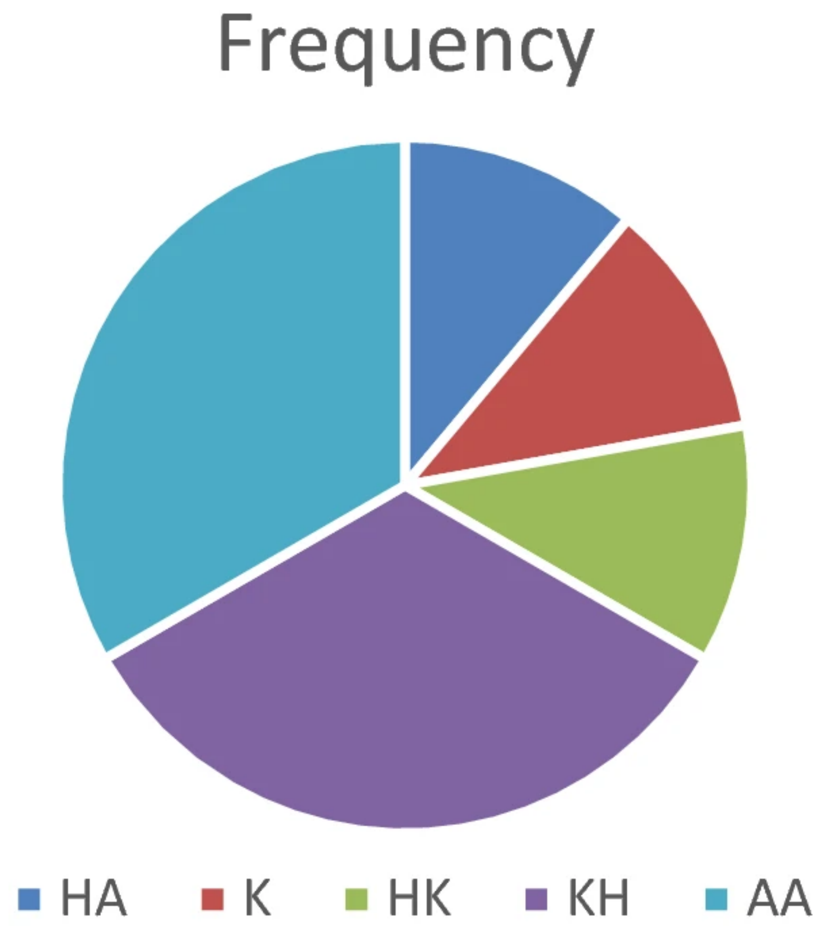
See Figs. 7 and 8.

Fig. 7



Resistivity Profiles for **a** VES1 **b** VES2 **c** VES3 **d** VES4 **e** VES5 **f** VES6 **g** VES7 **h** VES8 **i** VES9

Fig. 8



Frequency distribution of curve types

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Geoelectric Layer Susceptibility Indexing (GLSI)