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Morphometric analysis with open source software to explore shallow hydrogeological features in Senegal and Guinea

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Water represents a vital resource for everyone on this Planet, but, for some populations, the access to potable water is not given for granted. Recently, the interest in low cost technical solutions to improve access to ground water in developing countries, especially for people located in remote areas, has increased. Manual drilling (techniques to drill boreholes for water using human or animal power) is well known and practiced for centuries in many countries and represents a valid alternative to increase water access. Lately, this practice has raised the attention of national governments and international organizations. This technique is applicable only where hydrogeological conditions are suitable, namely in presence of thick layers of unconsolidated sediments and a shallow water table

Aim of this study is exploring the potential of morphometric analysis to improve the methodology to identify areas with suitable hydrogeological conditions for manual drilling, supporting the implementation of water supply programs that can have great impact on living condition of the population.

The characteristics of shallow geological layers are strongly dependent from geomorphological processes and are usually reflected in the morphological characteristics of landforms. Under these hypotheses, we have been investigating the geo-statistical correlation between several morphometric variables and a set of hydrogeological variables used in the estimation of suitability for manual drilling: thickness of unconsolidated sediments, texture, hydraulic conductivity of shallow aquifer, depth of water table.

The morphology of two study areas with different landscape characteristics in Guinea and Senegal has been investigated coupling the Free and Open Source Software GRASS GIS and R. Several morphometric parameters have been extracted from ASTER GDEM digital elevation model, and have been compared with a set of hydrogeological characteristics obtained from semi-automatic analysis of stratigraphic logs from water boreholes. We observed the relationships between the spatial distribution of hydrogeological features and the morphology, applying multivariate statistical analysis. The ultimate goal of this study is to infer hydrogeological information of shallow aquifers, exploiting morphometric parameters (together with other layers of information from existing thematic maps and remote sensing) and to reconstruct the geometry and the characteristic of shallow porous aquifer.

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