Reconnaissance Investigation of Thermal Springs in the Middle Benue Trough, Nigeria by Remote Sensing

Authors : N. Tochukwu, M. Mukhopadhyay, A. Mohamed

Abstract : It is no new that Nigeria faces a continual power shortage problem due to its vast population power demand and heavy reliance on nonrenewable forms of energy such as thermal power or fossil fuel. Many researchers have recommended using geothermal energy as an alternative; however, Past studies focus on the geophysical & geochemical investigation of this energy in the sedimentary and basement complex; only a few studies incorporated the remote sensing methods. Therefore, in this study, the preliminary examination of geothermal resources in the Middle Benue was carried out using satellite imagery in ArcMap. Landsat 8 scene (TIR, NIR, Red spectral bands) was used to estimate the Land Surface Temperature (LST). The Maximum Likelihood Classification (MLC) technique was used to classify sites with very low, low, moderate, and high LST. The intermediate and high classification happens to be possible geothermal zones, and they occupy 49% of the study area (38077km2). Riverline were superimposed on the LST layer, and the identification tool was used to locate high temperate sites. Streams that overlap on the selected sites were regarded as geothermal springs as. Surprisingly, the LST results show lower temperatures (<36°C) at the famous thermal springs (Awe & Wukari) than some unknown rivers/streams found in Kwande (38°C), Ussa, (38°C), Gwer East (37°C), Yola Cross & Ogoja (36°C). Studies have revealed that temperature increases with depth. However, this result shows excellent geothermal resources potential as it is expected to exceed the minimum geothermal gradient of 25.47 with an increase in depth. Therefore, further investigation is required to estimate the depth of the causative body, geothermal gradients, and the sustainability of the reservoirs by geophysical and field exploration. This method has proven to be cost-effective in locating geothermal resources in the study area. Consequently, the same procedure is recommended to be applied in other regions of the Precambrian basement complex and the sedimentary basins in Nigeria to save a preliminary field survey cost.

Keywords : ArcMap, geothermal resources, Landsat 8, LST, thermal springs, MLC
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