

Abstracts FM 08

A HIERARCHICAL CLUSTERING APPROACH TO GROUNDWATER CLASSIFICATION

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In dry zone regions of Sri Lanka, groundwater sources are commonly used for domestic and agricultural activities. They are not recommended for drinking purposes due to high fluoride and total dissolved solid (TDS) levels. Therefore, groundwater evaluation is highly desired. Piper diagrams are widely used to represent major ions in water samples in classifying groundwater, geochemical facies analysis and water mixing demarcations. However, geochemical zonation cannot unambiguously be demarcated by the sole use of Piper diagrams. In this research, Piper based classified geochemical data are coupled with the Hierarchical Cluster Analysis (HCA) Method to elucidate fine geochemical structures. The relative merits of the graphical and multivariate statistical methods used in hydro-geochemical classification are tested and compared. The graphical methods used are Piper diagrams, Stiff pattern diagrams and HCA dendrograms. Over thirty-six groundwater samples, collected from existing wells in Netiyagama village (X-181018, Y-347127) using simple random sampling techniques, were analyzed for physical and chemical parameters; pH, TDS, Na⁺, Mg²⁺, K⁺, Ca²⁺, Cl⁻, SO₄²⁻ and HCO₃⁻. According to Piper plots, water samples categorized into four distinct groups; Ca-HCO₃, non-dominated cation (NDC)-HCO₃, Mg-HCO₃ and Na+K-HCO₃. The HCA classifies the data into six major groups and eleven sub-groups, while the Stiff pattern diagrams describe similar geometry of all the sub-groups except well location N1 (X-180109, Y-346875). The Piper diagram also supports the above conclusions. For large data sets ($N > 50$), Piper and stiff diagrams are inefficient when compared to HCA method. Research findings suggest that the integration of graphical diagrams with dendrograms yields a consistent, unbiased classification method when dealing with large data sets.

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