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Derivation of influencing natural and anthropogenic factors on groundwater level fluctuation using regression and principal component analysis.

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Groundwater level fluctuation is a complex phenomenon influenced by various natural and anthropogenic factors. The importance of groundwater level fluctuation is enormous in various applications such as groundwater assessment, development and planning. In hard rock formations, groundwater is mainly extracted from the weathered zone pertaining to 12 to 15 m depth. This annually replenishable phreatic aquifer is the source for majority of drinking water supply systems. Therefore, estimation based on the annual recharge component forms the basis for all analysis for efficient development and management of groundwater resource.

There is a growing trend of research which reveals the influence of various parameters such as rainfall, geology, geomorphology, topographic elevation, slope, drainage density, net recharge and land use / land cover on groundwater availability. Conducting multivariate analysis is recommended to determine which group of variables has a significant relationship. Such analysis is critical especially when the model involves multi-criteria analysis. The present paper attempts to analyse factors influencing groundwater fluctuation namely, rainfall variability, spell of dry days, groundwater depletion, slope, drainage density and water demand. Firstly, each factor has been individually assessed for the extent to which they exert influence on groundwater fluctuation using regression analysis. Subsequently, principal component analysis has been performed to determine which natural and anthropogenic factors contribute towards drinking water scarcity phenomenon. The principal components with eigenvalues exceeding one have been retained and the variables are classified as significant, moderate and less influencing. This exercise has demonstrated model accuracy and proven beneficial for parameter inclusion to locate potential groundwater recharge sites.

Keywords: Groundwater fluctuation, regression analysis, principal component analysis.