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Groundwater modeling of Nubian sandstone aquifer, Darb El Arbaein area, Western Desert, Egypt

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We test the performance of the statistical analyses (SPSS) to classify groundwater samples depending on their chemical characters. All the methods are discussed and compared as to their ability to cluster, ease of use, and ease of interpretation. Principal component analysis is useful for data reduction and to assess the continuity/overlay of clusters or clustering/similarities in the data. The combination of graphical and statistical techniques provides a consistent and objective means to classify the groundwater samples. The inverse geochemical calculations (PHREEQC) delineate that the southwestern, northeastern, and southeastern part of the study area is characterized by the highest dissolution of calcite, anhydrite, and gypsum. It can increase the pore spaces (conduits) in the aquifer system. Therefore, these areas are much more enhanced for aquifer's permeability and therefore transmissivity. The calculated trend of the aquifer transmissivity was consistent with the measured trend. The groundwater flow model (PMWIN) was applied to understand a hydrologic environment and predict the outcome of a future change to the groundwater system. The potentiometeric elevation, in 2000, was simulated after 5 years, in same current pumping rate, result in drop in water level more or less similar to the measured values in 2005. The calibration was carried out in steady state and transient state; both were matching well, which reflect the model was representing the natural conditions. Three scenarios were applied; an increase in pumping rate by 100, 200, and 300 %; and the model can predict the future hydro geologic conditions. The drop in water level is much more in the second and third scenarios, which may affect aquifer quantity, cost, and quality, while the first one is moderate drop in water level that can be applied