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Selection of grid network for groundwater modeling using geostatistical approach

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Modeling of the groundwater system is known as a common practice to understand and management of the groundwater system. Generally, the modeling process initiates by construction of a conceptual model followed by mathematical model. Discretization of the groundwater system by grid network helps to assuming constant hydrodynamic properties of fluid and porous media (i.e. homogeneous media). The size of grid network has been selected conventionally due to objective of the modeling process, available data, elements of conceptual model and as well as modeler experiences. In this paper a geostatistical approach based on variogram concept is used for decision about size of grid network. The variogram has been extensively used to measure the spatial variability of spatial data in different fields of earth sciences such as petroleum industry, mining activities, environmental science, hydrology and climatology. One of the important properties of the variogram function is the range where interpreted as a measure of similarity and correlation distance between spatial phenomena.
Taken the concept of range into account, several available spatial variables of the under study aquifer were used to plot of the variogram in different direction. The study area is an unconfined aquifer (Bushkan Plain) with average thickness of 50 meters and area of 100 km2, located south of Iran. The used variables for computing of variogram include aquifer thickness, groundwater pumping rate, electrical resistivity, water table elevation and long period drawdown of water table. Values from 2500 to 3500 meters were obtained for the range based on variogram plot of different variables. The decision between these values was done via comparison of statistical parameters of spatial variables over the grid network. The optimum size of grid network was selected according to minimum of the variance and coefficient of variation over each cell size. Results reveal a 2500×2500 m grid size for the modeling process in the studied aquifer. The bounded area of each cell could be considered homogenous media according to spatial variation of the used variables. The results emphasize the role of variogram function in selection of grid size for the groundwater model process.