

Kriging method for estimation of groundwater resources in a basin with scarce monitoring data

CHENGPENG LU^{1,2}, LONGCANG SHU^{1,2}, XUNHONG CHEN³, YUEZAN TAO⁴ & YING ZHANG^{1,2}

1 *State Key Laboratory of Hydrology-water Resources and Hydraulic Engineering, Hohai University, Nanjing, 210098, China*
thebest@hhu.edu.cn

2 *College of Hydrology and Water Resource, Hohai University, Nanjing 210098, China*

3 *School of Natural Resources, University of Nebraska-Lincoln, Lincoln, Nebraska 68583-0996, USA*

4 *College of Civil Engineering and Hydraulic, Hefei University of Technology, Hefei 230009, China*

Abstract Construction of the water table map is a key step in the assessment of water resources. However, the scarcity of groundwater monitoring data in some basins remains a problem for determination of a reliable variogram model, which is the starting point for kriging interpolation. Researchers have used the secondary variable, the sampling number of which is usually much greater than that of the primary variable, in assisting the spatial interpolation of the primary variable, e.g. by the regression kriging and co-kriging methods. These methods still require a variogram model to characterize the spatial structure of the primary variable. In this study, the authors proposed an approach that derives the variogram model of the groundwater level based on the elevation of the land surface data sets. The measurements of land surface elevation are widely available to researchers, and the density of the data locations is much larger than that of groundwater monitoring records. The land surface elevation was assumed to have a linear relationship with the groundwater level. A relationship between the variogram model for the groundwater level and the variogram model for the land surface elevation were established; the variogram model for the former can be directly inferred from the variogram model of the latter. In the derivation of the groundwater level variogram, the precipitation data can also be taken into account. This approach was implemented for the Nanjing watershed, China. A variogram model of the groundwater level was obtained from the DEM data set of 1000 m × 1000 m grid spacing.

Key words kriging; regression; groundwater resources; geostatistics