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A robust geostatistical method for geophysical investigation and groundwater modeling

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The Most Frequent Value Method (MFV) elaborated at the University of Miskolc is applied to geophysical investigation and groundwater modeling as a robust and effective geostatistical method. The Most Frequent Value method is theoretically derived from the minimization of the information loss called the I-divergence. The MFV algorithm is then coupled with global optimization (Very Fast Simulated Annealing) to provide a powerful method for solving the inverse problems in groundwater modeling. The advantages and applicability of this new approach are illustrated by means of theoretical investigations and geophysical and hydrogeological case studies. It is demonstrated that the MFV method has certain advantages over the conventional statistical methods derived from the maximum likelihood principle.

The application of the P-norms based on the MFV principle has been shown to be advantageous over the other types for inverse parameter estimation calculations. The automated parameter estimation method facilitating the Most Frequent Value method and linked to the MODFLOW – 2000-reference flow code has been shown to be effective for deriving the groundwater model parameters. The use of the Most Frequent Value weights of the head residuals readily improves the groundwater interpretation results during traditional trail-and-error calibration processes. The Very Fast Simulated Annealing optimization method has been shown to be reliable without requiring the initial guess of the model parameter values to be sufficiently close to the actual values. Besides these advantages, the interpretation of the measured geophysical data can be more accurate and reliable if the NFV method is involved into the data processing.

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