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Application of Bayesian Maximum Entropy Filter in parameter calibration of groundwater flow model in PingTung Plain

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Due to the limited hydrogeological observation data and high levels of uncertainty within, parameter estimation of the groundwater model has been an important issue. There are many methods of parameter estimation, for example, Kalman filter provides a real-time calibration of parameters through measurement of groundwater monitoring wells, related methods such as Extended Kalman Filter and Ensemble Kalman Filter are widely applied in groundwater research. However, Kalman Filter method is limited to linearity. This study propose a novel method, Bayesian Maximum Entropy Filtering, which provides a method that can considers the uncertainty of data in parameter estimation. With this two methods, we can estimate parameter by given hard data (certain) and soft data (uncertain) in the same time.
In this study, we use Python and QGIS in groundwater model (MODFLOW) and development of Extended Kalman Filter and Bayesian Maximum Entropy Filtering in Python in parameter estimation. This method may provide a conventional filtering method and also consider the uncertainty of data. This study was conducted through numerical model experiment to explore, combine Bayesian maximum entropy filter and a hypothesis for the architecture of MODFLOW groundwater model numerical estimation. Through the virtual observation wells to simulate and observe the groundwater model periodically. The result showed that considering the uncertainty of data, the Bayesian maximum entropy filter will provide an ideal result of real-time parameters estimation.