EGU2020-8212
https://doi.org/10.5194/egusphere-egu2020-8212
EGU General Assembly 2020

Large-scale Groundwater Simulation using Artificial Neural Networks in the Danube River Basin

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In recent years, Artificial Neural Networks (ANNs) have proven their merit in being able to simulate the changes in groundwater levels, using as inputs other parameters of the water budget, e.g. precipitation, temperature, etc.. In this study, ANNs have been used to simulate hydraulic head in a large number of wells throughout the Danube River Basin, taking as inputs, precipitation, temperature, and evapotranspiration data in the region. Different ANN architectures have been examined, to minimize the simulation error of the testing data-set. Among the different training algorithms, Levenberg-Marquardt and Bayesian Regularization are used to train the ANNs, while the different activation functions of the neurons that were deployed include tangent sigmoid, logarithmic sigmoid and linear. The initial application comprised of data from 128 wells between 1 January 2000 and 31 October 2014. The best performance was achieved by the algorithm Bayesian Regularization with a error of the order based on all observation wells. A second application, compared the results of the first one, with the results of an ANN used to simulate a single well. The pros and cons of the two approaches, and the synergies of using both of them is further discussed in order to distinguish the differences, and guide researchers in the field for further applications.