OMICS Group Conferences
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International Conference on
Hydrology & Ground Water Expo

September 10-12, 2012 Hilton San Antonio Airport, USA

The use of adaptive extended kalman filter in 3-D subsurface contaminant modeling

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Contaminants in porous subsurface environment have been modeled using numerical and analytical methods to predict their fate and transport. These models are made simple by approximating the model and this plagued the model with truncation and round-off errors. In order to estimate the contaminant fate and transport profile in a porous medium under uncertainty situations, data assimilation technique such Adaptive Extended Kalman filter was used in this research to model the contaminant using 3-D subsurface contaminant transport model. Adaptive Extended Kalman filter (AEKF) is a data assimilation tool used to make estimation when prior and measurement data are provided at every time step. The process and measurement noises in the dynamic models are capable of adapting to the true noise statistics to achieve a better estimation. In this research, the concentration of the contaminant is estimated spatially and temporally using AEKF. The AEKF results are compared to numerical and Extended Kalman filter (EKF) results to determine its effectiveness. Error analysis is performed to determine the accuracy of each technique. The AEKF is capable of reducing the error of the numerical solution by about 75%. The algorithms to generate the simulation results were run on Matlab 7.1.

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