Geophysical Research Abstracts
Vol. 20, EGU2018-18785, 2018
EGU General Assembly 2018

An visual modeling platform designed for integrated hydrological simulation

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Physically based integrated hydrological models (IHMs) have been used to study a variety of water resources issues. However, the models are very difficult to use because of their complexity and high data requirements. This study designed and developed a comprehensive graphical data processing and modeling system, named Visual HEIFLOW (VHF), for integrated surface water-groundwater modeling. Its distinctive features in comparison with existing systems include the following. First, VHF uses a generic multivariable-space-time data cube model, which enables the system to efficiently handle large time-series datasets over a large spatial domain. Second, VHF streamlines the entire integrated modeling procedure, from data preparation at the very beginning to visualization and analysis of modeling results, in a uniform environment. Third, VHF allows updating the land use input at user-specified time points without manual interruption and therefore enables the model to directly simulate the hydrological effects of changing land use. The applicability and versatility of VHF were demonstrated by a case study in the Heihe River Basin, the second largest inland river basin in China. The case study also showed that the visualization and spatial-temporal analysis in VFH can greatly facilitate process understanding and support management decision-making. Although the current version of VHF was developed for a specific IHM, it has a general design and can be easily extended to accommodate other IHMs.