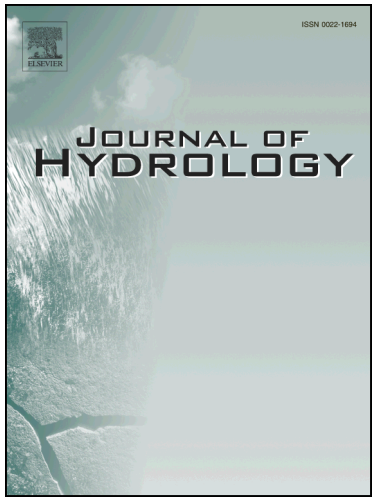

Research papers

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Emulation of recharge and evapotranspiration processes in shallow groundwater systems

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Abstract

In shallow groundwater systems, recharge and evapotranspiration are highly sensitive to changes in the depth to water table. To effectively model these fluxes, complex functions that include soil and vegetation properties are often required. Model emulation (surrogate modelling or meta-modelling) can provide a means of incorporating detailed conceptualisation of recharge and evapotranspiration processes, while maintaining the numerical tractability and computational performance required for regional scale groundwater models and uncertainty analysis. A method for emulating recharge and evapotranspiration processes in groundwater flow models was developed, and applied to the South East region of South Australia and western Victoria, which is characterised by shallow groundwater, wetlands and coastal lakes. The soil-vegetation-atmosphere transfer (SVAT) model WAVES was used to generate relationships between net recharge (diffuse recharge minus evapotranspiration from groundwater) and depth to water table for different combinations of climate, soil and land cover types. These relationships, which mimicked previously described soil, vegetation and groundwater behaviour, were combined into a net recharge lookup table. The segmented evapotranspiration package in MODFLOW was adapted to select values of net recharge from the lookup table depending on groundwater depth, and the climate, soil and land use characteristics of each cell. The model was found to be numerically robust in steady state testing, had no major increase in run time, and would be more efficient than tightly-coupled modelling approaches. It made reasonable predictions of net recharge and groundwater head compared with remotely sensed estimates of net recharge and a standard MODFLOW comparison