Conceptual and Modelling Studies of Integrated Groundwater, Surface Water, and Ecological Systems
(Proceedings of Symposium H01 held during IUGG2011 in Melbourne, Australia, July 2011) (IAHS Publ. 345, 2011). 55-61

Simulation of groundwater flow and salt transport in a shallow microtidal barrier aquifer during a storm surge

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Abstract We use numerical modelling to study the impact of seasonal storm surges on the aquifer–ocean exchange of fluid and salt in a micro-tidal, shallow, heterogeneous, narrow barrier aquifer. The model simulates variably-saturated groundwater flow and solute transport and incorporates dynamic boundary conditions that represent seawater inundation of the beach, seepage-face development, and recharge. Hydraulic aquifer parameters were estimated from field data. Boundary conditions were reconstructed from time-series of sea level, precipitation and salinity. A storm surge that occurred in March 2008 was simulated. The results indicate that for the field settings studied in this paper, the impact of episodic ocean events on the aquifer–ocean exchange of fluid and salt relative to the continuing influence of recharge is limited. Groundwater flow is dominated by a continuing flux of water to the ocean, driven by recharge and the hydraulic gradient between the landside and the ocean.

Key words aquifer–ocean interaction; submarine groundwater discharge; storm surge; coastal barrier aquifer; seepage; numerical modelling