Analytical Studies for Groundwater Flow in an Anisotropic Estuarine Leaky Aquifer with Considering the Effect of Aquitard's Storage

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The prediction of tide-induced groundwater fluctuations is important for the problems associated with groundwater resources management and contamination remediation in an estuarine leaky aquifer system. This study develops a three-dimensional model to describe the groundwater flow in such an aquifer bounded by a river and the ocean and subject to the effects of tide fluctuations and aquitard' storage. The analytical solution of the model is developed in Cartesian coordinates based on the method of separation of variables. The solutions by Li and Jiao (A two-dimensional analytical solution of groundwater response to tidal loading in an estuary, Advances in water Resources 2001; 24:565-573) can be shown to be special cases of the present solution if the damping coefficient and separation coefficient of the tidal river are assumed zero. On the basis of the analytical solution, the groundwater fluctuations induced by the joint effect of estuarine tides, anisotropic hydraulic parameters and aquitard' storage are examined and discussed. The analyzed results indicate that those parameters have significant impacts on the head fluctuations in the leaky aquifer.