Hydrol. Earth Syst. Sci. Discuss., 7, C260–C261, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C260/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Spectral approach to seawater intrusion in heterogeneous coastal aquifers" *by* C.-M. Chang and H.-D. Yeh

Anonymous Referee #2

Received and published: 23 March 2010

The paper presents a stochastic-perturbation study of seawater intrusion into a coastal aquifer based on the Ghyben-Herzberg approximation. The log-hydraulic conductivity and a source term are assumed to be stationary spatial random fields. The authors employ a spectral approach to solve for the fluctuations of the interface position and specific discharge.

Comments:

The recharge term in Eq. (1) does not represent the surface recharge sketched in Figure 1. This would be correct if Eq. (1) were the vertically integrated flow equation. The authors, however, use the Dupuit approximation of horizontal flow. If there is recharge over the top boundary of the aquifer (which is represented by a boundary condition for the flow equation), this assumption is, strictly speaking not valid. The source term

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

given in Eq. (1) denotes a volume source term which does not vary in z-direction, only in the horizontal directions. This should be clarified and the motivation for this volume source term explained.

The authors employ a continuous spectral approach, however, the model domain is finite. Thus, strictly speaking, a discrete spectral approach should be used. The authors state that the results of Ababou (2005) demonstrate that this approach is justified for the variance. The authors should explain, why this is so.

On page 636, lines 11-12 it is mentioned that the mean elevation can be obtained from Eqs. (21) and (51). The authors should provide this explicit expression. Furhtermore, for a homogeneous medium, this solution should reduce to the Ghyben-Herzberg solution as does the corresponding solution for flux boundary conditions given in Section 5.4.

Figures 2 and 4 indicate that the variance of the interface is decreasing towards the toe position and is largest at the seawater boundary. It would be good if the authors would extend the x-axis in Fig. 4 to include the toe position. Intuitively, I would think that the toe position should be subject to quite some variability due to spatial heterogeneity while the variability at the sea-boundary should be zero, because there the interface elevation is basically prescribed by the boundary condition. The authors should explain the behavior observed in Figures 2 and 4.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 621, 2010.