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Hydrology and Earth System Sciences Discussions

Interactive comment on "Stream depletion rate with horizontal or slanted wells in confined aquifers near a stream" *by* Pei Rong Tsou et al.

Anonymous Referee #2

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1. The authors in their response to my earlier comments argue that a Dirichlet BC of the form

$$h|_{x\to\infty} = 0$$

is the same as a Neumann BC of the form

$$\left.\frac{\partial h}{\partial x}\right|_{x\to\infty} = 0.$$

They allude to the example of the Theis solution, which can be derived with either of these boundary conditions. However, their argument is not technically correct (or is only half correct). The reason one can obtain the Theis solution from either of these two boundary conditions is due to the behavior of the zero and first order modified Bessel functions of the first kind as $x \to \infty$, both of which approach

∞. The behavior of the Fourier Sine and Cosine transforms, on the other hand, is very different; the cosine and sine functions are always bounded in $[-1, 1]$. Hence, their use, for the solution to be technically correct, require that both

$$h|_{x\to\infty} = 0$$

and

$$\left.\frac{\partial h}{\partial x}\right|_{x\to\infty} = 0$$

be satisfied, not just one of them. The authors should note this in their development. It will not change their solution because this is already implicit in the definitions of $S\{\partial^2 h/\partial x^2\}$ and $C\{\partial^2 h/\partial y^2\}$ that the authors used. What the should note in the manuscript is that both these conditions have to be satisfied.

2. Of course you can use the method of images since, after superposition of the responses due to image and real wells, you just take the derivative of the head field at the stream location. This will give you the hydraulic gradient at $x = 0$, which is all one needs in equation (23).

I will not comment further on the manuscript. It is of good quality, and once the technical issue raised above is fixed with a sentence or two, I recommend publication.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2347, 2010.