

***Interactive comment on* “Transient flow between aquifers and surface water: analytically derived field-scale hydraulic heads and fluxes” by G. H. de Rooij**

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Initial reply to Referee no. 3 (R3)

Reply to General remarks:

1. Adding a list of symbols can be included.
2. Incorrect use of then: thank you, I will make the corrections.
3. In such cases, between 1000 and 2000 terms will generally be needed (see Section 3). Since computational times were always within 10 s (while using 2001 terms

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throughout), the extra computational cost is not considered an issue (Section 3).

4. In principle, it is not exceedingly complicated (although laborious) to add convective solute transport of non-point-source solutes. An advantage of this model is that it allows the solute to reverse course if the flow direction does (for instance when the ditch level is increased to let water infiltrate during a dry period). For local sources such as the waste dumps mentioned by R3 I would recommend setting up a site specific numerical model since that will be able to provide much better tailored guidance towards clean-up and remediation efforts.

It should be noted though that in cases where some of the drains or ditches fall dry intermittently, the solute transport problem (and indeed the groundwater flow problem itself) becomes much more complicated. I cannot claim with confidence at this time that an analytical approach such as advocated here will be very helpful in such cases. Numerically, it should be feasible though (although it will not be a walk in the park).

With some more generality, R3 wonders if models such as this can be used to calculate the shortened travel times brought about by a coupling between groundwater flow and solute transport. The solutes need to reach the groundwater before they can be carried away with it. The solutions presented here contain all information necessary to compute the non-stationary flow velocity field in the aquifer. Thus, if a module is added to describe the delivery of solutes from the soil into the groundwater, the overall solute transport can in principle be computed. At this stage, the flow velocity field is not (yet) calculated though.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 8435, 2011.

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