

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

Anonymous Referee #2

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This paper presents analytical solutions for transient horizontal groundwater flow to surface water for aquifers with parallel and radial flow. Relationships between the average hydraulic head in the aquifer and discharge to surface waters or recharge from surface water are developed for a number of initial and boundary conditions. Furthermore, expressions for aquifer scale hydraulic conductivity are presented. All solutions presented are discussed in detail.

General comment:

Paper is generally well written and organised. It also provides interesting insight into

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the upscaling of small scale equations to relationships applicable to catchments scales. However, models that calculate groundwater discharge towards surface waters from atmospheric forcing and aquifer properties are applied at catchment scales for many years. One example are linear reservoir models, which assume that the outflow of the groundwater reservoir is directly proportional to the average head for the aquifer (Hornberger et al., 1998, p.164-165). On the one hand, I am not sure if these types of models have to be reinvented; they may have to be refined. On the other hand, I believe that a more practical problem is how to relate local groundwater level measurements to average storages calculated by these reservoir type of models. These relationships would make local groundwater measurements more useful for modelling at catchment scales. Unfortunately, the paper does not really address this burning issue in its present form but it may have the potential to do so. A contribution into this direction would probably be most useful to the hydrological community.

Specific comments:

1. A discussion on fully integrated type of models (e.g HydroGeoSphere) as an alternative to the model type proposed in the paper may be insightful in the introduction.
2. There is an issue with numbering of equations after eq (34).
3. Eq. (41): Could you please elaborate a bit on under which field conditions you would expect the Q-H relationship to be linear and non-linear, respectively?

References:

Hornberger et al. (1998): Elements of Physical Hydrology, The Johns Hopkins University Press.

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