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Hydrology and Earth System Sciences Discussions

Interactive comment on "Subsurface lateral flow from hillslope and its contribution to nitrate loading in the streams during typical storm events in an agricultural catchment" *by* J. Tang et al.

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The proposed study addresses the contribution of subsurface storm flow on nutrient export in a steep agricultural catchment in China. This is a very important issue to complete our understanding about the interplay of flow and transport processes (beyond nutrients). The study is based on a sound data set and mostly on a sound analysis. I have only one major point to admit and a few small suggestions to optimize the study, avoid over generalizations and to assure that other important work in that field is properly addressed.

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Major point: - I am no expert in mixing models. However, using EC in such equation means, however, not substiture a mass balance equation by to balance electrical charges (in fact it balances electrical currents and is equal to Kirchhoffs rule). As long as all Ions in the game have the same electric charge or the mixing rate between Ions of different charges remains stationary this is a more or less equivalent to a mass balance equation but only then. Isn't that a very strong assumption for transient subsurface processes?

- Related to this, I could imagine that subsurface flow from different soil compartments bears different ion loads. In this case this case it is not appropriate to treat the entire subsurface as a well mixed system? To my feeling these systems are not well mixed, otherwise the community wouldn't complain about preferential flow. I would thus expect that subsurface flow generated in different soil compartments/depth Qs(z) carries different electrical charges. Thus Q(z) and EC(z) are not independent.

Minor points - Generally it is not true that lateral subsurface flow has been "forgotten" when dealing with nutrient loads. Soil physics has been furthermore for a long time dealing with the contribution of tile drains flow to overall nutrient and pesticide loads (nice papers on that Stamm 2002, 1998 JEQ for dissolved P), Zehe and Flühler 2001 Joh for pesticides), Mohanty et al. 1997 WRR van der Velde et al. 2010 VZJ for Nitrate. As many tile drains are installed above an impermeable layer and drain permanent shallow groundwater bodies, this is nothing else than lateral pipe flow on an impervious layer.

- Concerning the statement that hillslopes are fundamental landscape units in rural catchments: Lin was not the first on to stress this fact for hilly landscapes (Bronstert and Plate, 1997, Zehe and Bloeschl 2004 WRR). Second it is again far too general! There are agricultural areas for instance in Northern German lowlands as the Havel catchment without a single hillslope! Nutrient export in these areas is exclusively driven by fast interaction of shallow groundwater bodies and streamflow (Krause et al. 2007 JoH).

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- Please note that subsurface storm flow is not in general slow as shown for instance Wienhoefer et al. 2009 HESS or van Schaik et al. HP 2008

- Maybe vertical macropores are the reason for the anisotropy of ks at this site?

- Eq. 4 is in fact Gaussian Error Propagation and the Wxi are no uncertainties but measurement errors. Please give the merits to the scientist who really invented the method (though Gauss doesn't really need them).

- I think that additional third level headlines would strongly improve the structure and readability of the manuscript

Best regards,

Erwin Zehe

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