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Hydrology and Earth System Sciences Discussions

Interactive comment on "Technical Note: Linking soil – and stream-water chemistry based on a riparian flow-concentration integration model" *by* J. Seibert et al.

Anonymous Referee #3

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The draft manuscript presents a novel model relating stream chemistry to near-stream ground-water chemistry. The model is elegant in its simplicity, the latter being a virtue in the opinion of this reviewer. Stream flow and chemistry are related exponentially to water elevation in and solute fluxes from the near-stream aquifer in a manner that lends itself reasonably well to prediction and testing.

Several comments follow.

Specific comments.

1.) Equation 5.

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In attempting to follow the various steps in equation 5, I came to a different solution. The apparent error lies in the third step [that is, the material following the second equals sign; "L" being the first step, the second step being "ac(o) followed by an integral from Z(0) to Z(1), and the third step being "ac(o) followed by an integral from Q(0) to Q(1)]. The difference between equation 5 and the solution that I derived is in the first set of parentheses. The draft manuscript has "bQ/a", whereas I obtain "aQ/b".

I asked a colleague to see if he could derive the third step from the second step (using the other equations up to that point, as necessary, and not allowing him to see my work). He also derived "aQ/b" instead of "bQ/a". Also of note, his method differed from my method, yet yielded the same answer that I derived.

I did not follow through the remainder of equation 5 to evaluate the impact of this apparent error, and I did not follow through the remaining equations either. Thus, I cannot comment on how this apparent error affects the remaining equations or the results presented in the draft manuscript.

One last point on equation 5 . . . please note that the equation between equations 4 and 5 (an equation on line 14 that does not have an equation number) is similar to equation 5, but with an additional step. Only one of these two equations (the unnumbered equation and equation 5) are needed (once corrected).

2.) The term "soil" is used throughout the manuscript. The term "soil" appears to refer both to the shallow organic-rich soils that presumably were developed in situ, as well as to the deeper till that presumably was transported by glaciers. Some would argue that sediments transported from elsewhere (till, alluvium, etc.) are not soils. The authors might reach a larger audience if they were to use a different term than "soils"–a term that could be viewed as being overly restrictive. After all, it is possible that this model could be used in systems where a stream is bound by aquifer materials rather than soils or soils/till. However, the term "soil" could be used, albeit with perhaps some loss of reader interest or understanding, as long as the term is adequately defined.

HESSD

6, C2270–C2273, 2009

3.) Related to comment number 2, many streams cut into aquifers and receive most groundwater directly from the aquifer (bypassing riparian zone soils). The model appeared to work well in this particular setting (although it is not clear if the model results will change in response to comment number one, above). However, it is not clear how well it will work in catchments where soils are hydrologically isolated from streams by unsaturated zones and non-soil sediments.

4.) The authors did a good job of documenting a variety of potential limitations in the use of this model. I would suggest that the authors add a caution that some high-organic-carbon water in near-stream clay- and muck-rich sediments could be measured in soil profiles but be relatively isolated from the stream on account of the very low hydraulic conductivities often associated with these kind of organic-rich but relatively tight sediments.

5.) Figure 4. It is not clear to my why the predictions do not extend closer to the top of the water table. The measurements indicate water and solutes at depths of less than 0.2 meters, but the curves (predictions) do not extend that far. Please correct or explain in the caption or text.

Technical corrections.

1.) Page 5604, lines 2-3. “the last few meters of soil through which water flows before entering the stream”. Suggest “the last few meters of soil through which water flows before entering a gaining stream”.

2.) Page 5605, line 28. I am not sure what the difference is between a “perceptual” model and a “conceptual” model. Is perceptual the best choice of words? At a minimum, the word “perceptual” might need some explanation or definition.

3.) Page 5610, lines 2-3. “direction of soil water fluxes is parallel to the ground surface”. Ground surface is variable. Do you mean “horizontal and in the direction of the hydraulic gradient”? Also, there must be an assumption that for streams that are not

HESSD

6, C2270–C2273, 2009

incised to bedrock (Z(o)), all horizontal flow still discharges to the stream?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5603, 2009.