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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Biotic controls on solute distribution and transport in headwater catchments" *by* E. M. Herndon et al.

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The objective of this paper is to elucidate the controls on concentration discharge relationships by comparing to catchments with similar underlying lithologies, however different distributions of SOM, and different climatic settings. The key take home message, in my opinion, is that concentration discharge relationships are highly dependent on the nature of hydrological connections within any given catchment. Non-chemostatic elements were found to be distributed more heterogeneously within catchments, as opposed to more chemostatic elements. Overall, I strongly believe that this paper contributes to an ongoing discussion of understanding hydrologic controls on geochemical processes in watersheds throughout the world, and is worthy of eventual

publication. However, I have a few suggestions for improving this manuscript

1 - The authors discuss the seasonal variations in element concentrations, discharge patterns, and precipitation regimes. These seasonal variations are then used to support seasonally dependent conceptual models (for example, page 226, section 4.1, lines 4-8). However, the C-Q regression analyses were all completed by using all the data, taking a single regression to explain all times of the year and flow conditions. I wonder what we can learn by sub sapling this data set to look at C-Q relationships during drier v. wetter periods. This analysis could be done by using time as a threshold between the dry and wet seasons, or by using simple discharge thresholds to define dry v. wet catchment states. When I look at the data shown in Figure 2, some of the relationships are not completely linear. For example, Figure 2f, it seems like Na and Mg show more of a dilution signal above logQ = 4.5. Or, Figure 2g, Mn is enriched at a greater rate when logQ is less than 3.7. I encourage the authors to interrogate these slope breaks a bit further. Perhaps the rationale would relate back to the degree of hydrologic connectivity in the catchment under drier versus wetter conditions?

2 - The big idea of this paper would be greatly improved by a conceptual model cartoon. Can you generate a final figure for section 4.1 of this paper that illustrates how the hydrochemical connections differ between shale hills and Plynlimon? The idea is discussed very well with text, but having a visual would improve the overall understanding of this idea.

3 - Can you make any arguments or suggestions as to how watershed modelers might improve model selection or parameterization to better account for hydrochemical interactions? You acknowledge this as a problem in on page 215, section 1, lines 5-7. In my opinion, this paper argues for more spatially explicit watershed models (perhaps TOPMODEL?) which can simulate the wetting up and drying down of individual hill slopes within a catchment. A large portion of the HESS audience is watershed modelers, so including some discussion of modeling lessons we might learn from this study would be nice.

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