Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-108-RC2, 2019
© Author(s) 2019. This work is distributed under
the Creative Commons Attribution 4.0 License.

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Spatial and temporal variation in river corridor exchange across a 5th order mountain stream network" *by* Adam S. Ward et al.

Anonymous Referee #2

Received and published: 18 June 2019

The work presented by Ward et al. represents an incredible amount of analysis based on an extensive dataset presented in a companion article. I was very excited to read and review this paper and hope that my comments will help improve it. The companion piece lays out data from synoptic and baseflow sampling of fluid fluxes through a variety of low order streams and this paper describes the analyses the team took to understand how exchange varies in relation to streamflow in space and time. With these analyses they seek to in/validate the model set forth by Wondzell (2011) and show that exchange decreases with increasing discharge through space, but that exchange varies in response with time in fixed stream reaches. Ward suggests a number of best practices for future large-scale sampling excursions to improve on these find-

Printer-friendly version

Discussion paper

CC BY

ings and reach a more parsimonious conclusionâĂŤfirst, control for advective time; second, control for storage volume. Finally, they note that a multivariate approach is likely necessary to improve the systematic understanding of exchange in response to spatiotemporal variations in stream discharge. This is an important contribution to the discipline, and I will be delighted to see it in print after some revisions.

The introductory section argues convincingly that many parameters affect the exchange in streams – channel width, K, hydraulic gradient, etc. The authors spend a lot of time walking us through the measurement and calculation of many of these values, and some discussion of what those values mean and why they do or do not correlate with exchange. While this discussion is useful, I had trouble following all of the methods, results, and discussion. I think discussion of these parameters could be streamlined somewhat. For instance, I'm not sure that all of the panels of tables 3 and 4 belong in the body of this paperâĂŤseveral are not discussed and could be moved to the supplement. Additionally I spent a lot of time searching through the text to remind myself how each variable was defined. I think extra care could be taken when terms are defined, but I think most readers would find a list or table of variable definitions to be especially helpful.

In the results and discussion sections there is a brief mention that a multivariate approach is likely necessary to understand these relationships more thoroughly, but no analyses to investigate and present any such multivariate relationships. The authors return to this topic in the conclusion and argue that future studies must focus on these higher-level statistics. I would suggest the authors pursue this topic further within or at least explicitly discuss why they did not pursue this approach further. Ultimately, the authors reach the conclusion that skewness is the most predictive statistic. I think it is important to expand and further justify this conclusionâĂŤespecially to explore a rationale for why skewness is a good indicator. I think it is also important to better support their claim with regards to skewness. In particular, I had trouble understanding figures 5 and 6. Figure 5 was of low image quality, so an enhanced resolution image might

Printer-friendly version

Discussion paper

CC BY

have helped, but I had trouble seeing where the points were plotted in 3d space, and thus could not follow their argument. I found figure 6 unconvincing. The argument rests on best fit lines that don't seem supported by the underlying data. I would suggest replacing the figure, removing the lines, or at least presenting some statistical treatment of why they believe the best fit lines are justified.

A last concern is the number of authorsâĂŤI am not used to seeing such a large author list on a data analysis paper. I think it is important to justify and define the contribution of each author toward the different tenets of authorship in a systematic mannerâĂŤI think it is important that the authors make an earnest attempt to do so. One approach would be the approach suggested by Clement (2014).

Minor/general comments follow and are ordered chronologically. Pp:line:comment General: The paper would benefit greatly from a table/list of all variables at the start/end/supplement. I spent a lot of time flipping through the paper trying to remember what the variables and subscripts represented. 2:5: The "more than 60 solute tracer studies" were conducted in a companion paper, not this article, it is probably worth clarifying here and elsewhere. Careful throughout that data from the companion paper are not presented as results of this paper. 3: 13-14: is it expected that exchange volume will decrease or the ratio of Qex/Q? 3: 25: is it expected that exchange volume will decrease or the ratio of Qex/Q? Please clarify here and several other places. 6: Table 1: I suggest you change the order of table items to match order they're presented in the text. 7: 15-25: The presented replicate falling head tests were all conducted at one location in the stream channel. Were tests conducted to understand the spatial variability of K within the channel and floodplain sediments? K varies widely over relatively short scales, is there any way to bracket the errors associated with this? 7: 25: K is typically log-normal, should this be the log-geometric mean? 8: 4-7: If Qsub,cap is volumetric and based on Darcy, I don't understand why porosity is included in the calculation of the "capacity of the subsurface to convey water down to the valley bottom" as porosity should impact velocity only, and not impact volumetric flux. If porosity is

Printer-friendly version

Discussion paper

CC BY

estimated as 30% for all sites, this shouldn't impact findings, but clarification would be helpful. 8:6-7: You say, "hvalley is the valley colluvium depth (m; estimated as 50% of the wetted channel width)". To clarify, depth of colluvium is never independently determined, it's only estimated as $\frac{1}{2}$ wetted channel width? If so, wetted at what stage (e.g. high discharge, mean discharge)? Please provide some references to support this as a valid approach. 8:9: Suggest changing "nor" to "or" 8:20-29: Please define more thoroughly the term "mixing length." Is this the length required for advective mixing to result in a homogeneous surface water concentration of a released solute? How was this determined in cases without any tracer. 9:1-2: The term "conflicting research" is unclear. Do you mean that you could not complete the test because other experiments meant that you could not do your own experiment, or that the findings of other experiments convinced you that your results were invalid, or something else? 10:4: Please clarify how MREC was determined. Is "mass recovered" the total mass recovered during the entire tracer test, the tracer test up to time t, or the mass recovered during the current time step? Also, how was a tracer test duration determinedâĂŤwas it continued until 99% recovery or something similar? 10:8-9: I'm confused about this equation. CAD (left hand side) is based on CAD (right hand side), which suggests CAD is known a priori? Should the RHS be CADE? 10:10: "associated with" is confusing. Do you mean something more like the "total solute mass" moved downstream by advection and dispersion? 10:20: same comment as above about "Associated with" Pp 10 and 11: 't' appears in some equation but not others that I expect to see it in. For instance, in all terms of "CTS=Cobs-CAD" I would expect the concentration to be a function of time. 11:3: Why 99% Is there some particular justification? Were you calculating this in the field to determine the length of time that tracer tests should be run? 13:7: What is tau? 13:15: What is "P"? Should this be "PQ"? I never see "P" defined. This is one of many cases where a symbology sheet would help immensely. 13:30: Again, what is "P"? 16:10: You never define the subscript "ds" in Cobs,ds so far as I can tell, thought you do define QDS. Please make sure all symbology is explicitly defined to remove confusion. Also, should this be "Cobs,DS" with the DS capitalized to match other us-

Printer-friendly version

Discussion paper

CC BY

age? Pp 17: No reference to figure 3H, 3G is out of order. Fig 3. This symbology is difficult to interpret. I cannot distinguish symbology for the 4 streams from one another because the blues and greens are too similar, especially with the poor-resolution image of the submitted pdf. I suggest making all points translucent and making the colors of the non-synoptic samples more dissimilar. Also, I would recommend adding a curly bracket around the non-synoptic samples in the legend and labeling them as the stream-reach samples. The caption begins "for synoptic data" – please clarify caption to make it clear that the figures also include the non-synoptic data. Also clarify whether the line of "best fit" is for all data in panel or only for the synoptic data. Figure 4: Same comments as in figure 3. 20:4: "Hod" ⇒ "Hold" 20:13: you say "most previous studies" but only cite one study. Please add more citations or remove statement. 20:22: You spent a lot of time showing and describing univariate values, but then say a multivariate approach is necessary to make sense of this data. Did you consider including some multivariate stats to explore these relationships? 22:27: "Sens slope was larger for the fixed reaches. . ." I don't recall if this is explicitly discussed later. 23:10-13: Is the decreased QHEF a volumetric decrease or a relative decrease as a fraction of stream discharge? Fig 5: What are the vertical columns? The colored lines? The right-hand panel is very difficult to interpret. The lefthand panel benefits from the lines that extend to z=0, to show the footprint of each point, whereas I cannot tell where points in the righthand panel exist in XY space. Is there a better way to present this data? Same comment about the color scheme as in figure 3 and 4âĂŤI cannot differentiate between the points. 28:21-2:Was this multi-sensor approach described in the methods of this paper? I did not see any previous mention. 28:25: Where were these data/results presented/discussed? I did not see previous mention in this paper. Fig 6: I do not trust the lines on these plotsâĂŤI believe they are misleading and suggest they be removed. 31:10: Suggest removing "likely"

References: Clement, Prabhakar (2014). Authorship Matrix: A Rational Approach to Quantify Individual Contributions and Responsibilities in Multi-Author Scientific Articles. Sci Eng Ethics 20. 345–361. DOI 10.1007/s11948-013-9454-3

CC BY

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-108, 2019.

Printer-friendly version

Discussion paper

CC BY