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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A fluid-mechanics-based classification scheme for surface transient storage in riverine environments: quantitatively separating surface from hyporheic transient storage" *by* T. R. Jackson et al.

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Ross Woods, Editor

RE: Interactive comment on "A Fluid-Mechanics-Based Classification Scheme for Surface Transient Storage in Riverine Environments: Quantitatively Separating Surface from Hyporheic Transient Storage" By Jackson et al.

Dear Dr. Woods,

Please find below our responses to all comments and questions provided by Reviewer 2. All points have been addressed below and, where appropriate, revisions have been made to a revised version of the current manuscript. We would like to thank Reviewer 2 for his/her helpful suggestions and comments which will improve the quality of this manuscript.

Sincerely,

Tracie R. Jackson

Responses to Reviewer 2

This paper lays out a well-organized classification scheme of the in-channel features and locations that can cause water and solutes to be temporarily 'stored' or their downstream transport delayed, compared to the bulk flow in the thalweg of the channel. The authors go to great lengths to organize this scheme and to summarize what is known already from the hydraulics and river mechanics literature about the flow dynamics in these features. Thus, the paper's main contribution is to organize and present these findings in a single paper. The paper is very well-written and well-organized. I especially like the detailed figures that go with the descriptions of each feature. The impact of this paper will be to bring a hydraulics perspective to hydrologists who have ignored these details in past efforts (myself included), and possibly the inverse as well. Linking process to residence time dynamics (as inferred from solute transport studies) has long been a goal of hydrologists and ecologists, and this paper serves to significantly inform the in-channel portion of this grand conundrum. I look forward to this paper being published as I believe it will be a significant spark to inspire further research into linking environmental fluid mechanics with solute transport interpretations in streams.

Comment 2.1) While this is a huge step forward, I was a little disappointed that there was no further attempt to compare or contrast these features. I recognize that this is a first step, and that the paper is pretty long as it stands, and I appreciate the current state of the paper as it seems to fulfill the objective set by the authors. However, I'm left feeling like this is the introduction chapter to a book that contains subsequent chapters on each of these.

Response 2.1) We agree with the reviewer that the manuscript does read like "the introduction chapter of a book". However, for most STS types, no studies have been done to quantify mean residence times. We state in the introduction that: "the classification scheme described is a compilation of previous studies and is meant as a basis for future work and research directions to accurately quantify the effects of STS on stream solute transport". At the beginning of section 3 we also state that: "Current predictive relationships between STS mean residence times and stream hydraulic and morphologic features are presented (if known). For STS types that currently do not have predictive relationships, qualitative relationships are described for key parameters influencing mean residence time and areas are highlighted where further research is needed." To provide more depth to the revised manuscript, in section 4 and Table 3 we briefly compare and contrast differences in STS types. Table 3 categorizes parameters influencing mean residence time into "flow", "roughness", "constants", and "case-specific parameters" that describe the STS morphology. Table 3 illustrates that some parameters are the same, whereas other parameters are similar or different. More of the variables are added to the individual figures to help illustrate their definitions. We believe that these additions will aid readers in distinguishing among different parameters that influence mean residence time. Studies of each STS type (to be conducted by researchers in the future) will help provide information that further compares and contrasts these different features in different STS types.

Comment 2.2) I would encourage the authors to consider one or two additional (short) subsections that might explore the likely relationships between the parameters and residence times in the many equations presented. For example, will tau for lateral cavities increase or decrease with an increase in W, L, or u*? Many of the equations presented

are very general relationships. Which way should a change in each parameter influence residence time? I think that this could be done succinctly in table format and would provide another layer of complexity that could essentially provide hypotheses for how these parameters relate to or influence residence time in each feature type. That would be useful for hydrologists seeking to relate form to function in their streams, without having to develop exact equations (which are yet to be published, apparently).

Response 2.2) An additional table (Table 2 in revised manuscript) was added that lists whether each parameter varies proportionally or inversely to mean residence time. For each STS type and subtype in section 3, a paragraph was added that qualitatively describes relationships between case-specific parameters and mean residence time. Where data is not available, we provide hypotheses and justifications for direct and inverse relationships. Table 3 in the revised manuscript lists and categorizes all flow, roughness, and case-specific parameters for each STS type.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 4133, 2013.