Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2017-29-RC2, 2017

Earth Surface Dynamics Discussions
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EGU

Interactive comment on "Model predictions of long-lived storage of organic carbon in river deposits" *by* Mark A. Torres et al.

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Received and published: 5 July 2017

This is a very interesting paper, an initial effort to determine the influence of storage on carbon dynamics of large river systems. There is little doubt that the approach is perhaps oversimplified, and many of the model parameters are poorly constrained, but this is a thought-provoking initial analysis of a neglected and potentially important problem. The manuscript is generally well-written and clearly presented, and the methods and results reasonably convincing and easy to follow.

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Some specific comments, keyed to the text:

1. Line 102 - Please indicate here that you are establishing the usage of an important

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term. “Transit time” usually refers to the time spent in a “reservoir”, which here would represent time spent “waiting” in an alluvial deposit. Here, however, the term is used to describe how long it takes for a particle to traverse a specified distance along a river corridor. I prefer the term “delivery time” for this concept, but whatever term is used should be defined clearly when introduced to avoid confusion. 2. Line 119, equation (2). Please explain where the dt/dC14 term comes from. 3. Line 245. What does this mean? Transit time usually refers to the time spent in a reservoir. So why do they increase downstream? Or does this refer to the number of storage events as one moves downstream,? Either way, additional explanation would be desirable. 4. Line 252. The Pizzuto et al. reference was published in 2017, not 2016. 5. Line253. The authors might note that Lauer and Parker quote a much larger range in the number of storage times. Also, Pizzuto et al. (2017) note that x_tran increases with transport distance (scale). Might be worth noting here. 6. Lines 320-330. I didn’t really understand the description of the mathematics here. More, and clearer, explanation is needed if readers are expected to really understand what the authors are doing here. 7. Line 355. Values selected for these parameters seem pretty arbitrary and perhaps not too well justified, but. . .ok. 8. Line 415. Please discuss the assumption of a steady state in the methods section. It is common in reservoir theory modeling but a rather extreme prediction for natural fluvial systems. In the rivers intended for this paper to represent, what is the characteristic time scale for a steady state to be achieved? Is this a reasonable assumption? Likely not. Perhaps this merits some discussion. . ..in the discussion section of the manuscript, as well as in the methods section. 9. Line 563. How is Qs assessed? From stream gaging station records? Are these estimated given in a table somewhere in the manuscript? They should be. More discussion of these data is warranted, also. Generally, useful estimates of Qs are not available. 10. Line 573. “though geometric constraints temper or limit the distribution.” This is not DEMONSTRATED in the manuscript, it is really simply assumed. The text should be modified to reflect this – it is not a RESULT obtained either from data analysis or computations, but an assumption of the author’s approach. 11. Line 919. Pizzuto’s name is misspelled here.

12. Line 927. Correct citation year is 2017, not 2016. 13. Figure 1. Isn't the length of the valley reach an important variable to consider? How about the geometry of the meandering river domain simulated, perhaps in units of river widths or something? Please explain and clarify. It is also possibly worth noting that the storage time distribution as defined here cannot be measured using observations, unless suspended particles in transport could be "tracked" and dated in some way. It is more elegant to determine the ages of particles as they leave a storage reservoir by dating eroding bank deposits, for example. This definition of storage time can actually be defined by field measurements. 14. Figure 2, panel 2. The range of x_tran quoted by Pizzuto et al. 2017 is much larger than the data illustrated here. This should be noted in the manuscript. 15. Figure 3. It is odd to show the storage duration data in red, but then present the legend associated with these data in black. Please keep the color scheme consistent. 16. Figure 6. Great figure!

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