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# *Interactive comment on* "How does the downstream boundary affect avulsion dynamics in a laboratory bifurcation?" *by* Gerard Salter et al.

**Anonymous Referee #2**

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The paper by Salter et al. reports on two sets of experiments designed to investigate bifurcation dynamics. The first set reproduces depositional and equilibrium sediment configurations, whereas the third one involves only sand (and no water) to assess the role of downstream conditions, without the upstream effect of bar migration. The experiments are well designed and monitored, the results are relevant and well explained, and the paper is written clearly with informative figures. Overall, I think that the paper is very good and I have only a few minor comments. I really like figure 7, which to my knowledge is an innovative way to present the dynamics of fluvial bifurcations and figure 8, which reports on one of the few quantifications of bifurcation timescale.

My main comment is about the length of the upstream channel and the formation of bars (Page 3, line 21-23). The length of the upstream channel is 9 times its width. This



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Discussion paper

means it is probably too short to observe free alternate bars formation and migration. There is probably space only for maximum one full wavelength. Could this have an impact on the bifurcation dynamics you observe? Did you observe migration of free alternate bars? The large bar closing one of the bifurcates is a steady bar forced by the bifurcation and I imagine it does not migrate, right? This steady bar formed also in the experiments reported in Bertoldi and Tubino, 2007. I think this issue should be discussed with more detail in the paper. Other minor comments and suggestions: Page 3, line 24. 16 degrees is a low value for the angle between the two branches. This value was probably forced by space constrains, that are often impossible to overcome. Do you have any idea whether (and how) this could impact the observed dynamics? Page 5, line 6-8. I do not understand this sentence and procedure. What is the center 0.2-0.3 m o of each branch? Page 7, line 12. The length of these cells is a crucial parameter in the model. Maybe it is worth introducing it here? Now you only find them at page 15, line 30-31, but their meaning is probably a mystery for anyone not knowing the model. Page 7, chapter 3. I miss a detail form the model. During the depositional and transitional phases, the longitudinal slope in the upstream branch is increasing. As a result the width to depth decreases and the shear stress increases, meaning that the bifurcation should increase its asymmetry (as predicted by BRT model). Does the SVP model take these changes into account? Or did you consider only the final value of the slope? Moreover, could this effect explain (at least partly) the observed differences between the transitional and the by-pass phases and the shift towards more asymmetrical configurations? Page 12, line1-13. This is an interesting observation. I wonder whether you can provide an estimate of this longer timescale. Probably it was not easy to observe many cycles, but still, it would be ggod. Are these longer cycles visible in figure 8? Is the small peak at 2^8 minutes for exp. 4 - bypass related to this process? Page 15, line 22. There is no indication on how many switches you observed.

Page 15, line 22 and following paragraphs on time scale estimation. I have two observations about this. First: from your estimations it looks like roughly the time scale for exp. 5 (both considering bars and downstream control) is 2-4 time that of exp. 4,

mainly due to the lower sediment flux. It means 1-2 steps on your log scale in figure 8. It is difficult to tell (and the statistical test you performed do not allow for a quantitative assessment), but it looks reasonable, looking at the plots. Maybe you could add a comment about that. Also, would that mean that the long switching scale for exp. 5 could be 2ˆ9-2ˆ10 (and therefore that the experiments were not long enough?) The second point is about the timescale related to alternate bar migration. Did you really observed bar migration on the order of (a few) minutes during the experiments? As for the main comment above, with a relatively short upstream channel I do not expect formation (and migration) of free alternate bars.

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