Review for manuscript "Mass balance, grade, and adjustment timescales in bedrock channels" by Turowski, submitted to ESurf

In this paper, the author investigated the adjustment timescales of width, slope, and bed cover for bedrock rivers, via theoretical framework and numerical computations. I think the idea is significant and interesting, especially he included the lateral erosion. The English is very good. I just have some comments below, one of which may affect the orders of magnitude of adjustment timescale, however. So please consider.

Seeing the exchanges between the anonymous reviewer #1 and the author, I went back and checked the paper by Chatanantavet and Parker 2008. In their figure 11 (especially comparing the subfigures 2 and 4), at first glance I thought the assumption by the author Turowski was correct, i.e. the bar wavelength decreases with decreasing fraction of alluvial cover. But I could be wrong since I have not done any direct research regarding alternate bars or meandering channels. In the last interactive comment, the anonymous reviewer #1 stated that "although the bar patch length has a positive correlation with both the bar width and the alluvial cover, the wavelength has no positive correlation." It is hard to assess quantitatively and would need a longer flume length. I leave it to the AE and the editor to digest.

Major comments:

- I really think you should include a factor of "flood intermittency" (a fraction of time duration in a year that has water discharge significant enough to do the majority of bedrock abrasion). This is commonly done in any morphodynamical modeling of such a temporal process involving high flow: see any papers done by the research groups of Chris Paola and Gary Parker (e.g., Chatanantavet and Parker 2009). For example, your Exner equation (eq.4 and then eq. 28, 34) does not have this factor and go on to derive the timescale for slope adjustment (eq 37). Say, if flood intermittency is equal to 0.05-0.1 in a particular location. Then your slope adjustment timescale could be missed by a factor of 10-20. That is significant and may affect your conclusion. I think it would make the adjustment timescale longer. In table 1, for example, you wouldn't expect that water discharge of 40 m3/s is present for the entire year in the Liwu river.
- The part where you talk about lateral erosion and alternate bars (i.e. section 2.2 and elsewhere); I think that it is worth or even very important to note to the readers that these morphological configurations occur only in a specific range of channel slope in natural setting, which is around S = about 0.1-3% per Montgomery and Buffington 1997, and other studies. Beyond this slope range, i.e. at S = 3% or higher until S = about 10%, steep-pool configuration dominates bedrock channels and its associated sediment transport differ quite significantly since there is strong coupling interaction between hydraulic jump hydrodynamics and sediment trajectory/movement (see any flume experimental work in step pool). Hence, in your paper

when you talk about lateral erosion and alternate bars, the conceptual model may be limited to slope of no more than 2-3% (or 0.02-0.03). Seeing that slope in your results span until 0.1 (figure 5D), it is a bit farfetched. This slope cutoff is eminent whenever I conducted flume experiments ranging slope from 0.1% to 5%; once the slope hit 3% the step pools were very obvious and the hydraulics and associated sediment transport were so much different from alternate bars (or pool riffle) or plane-bed feature.

- P12 L5; critical Shields stress also varies with channel slope (e.g., Lamb et al, 2008, JGR-ES; Chatanantavet et al. 2013, JGR ES). I know traditionally and simplistically people assume that it is constant, but it is an old concept. And this can affect your numerical results greatly because unlike alluvial rivers, bedrock rivers has varying slopes in a high value range (around 0.001-0.1, in which alluvial rivers don't touch but odd things happen here such as hydraulic jumps).
- Page 10; the response time ratios. Sorry, I don't get why you wrote up this section. I don't see its usefulness and you didn't explain why this needs to be done. You also did not use any of these to plot the results or discuss about it.
- There is a paper by Sklar and Dietrich 2006 (Geomorphology) titled "The role of sediment in controlling steady-state bedrock channel slope: Implications of the saltation–abrasion incision model". I think it is worth to check it out if you have not already. Actually their work is highly related to yours, along the same concept (i.e. their figure 6 vs your figure 4) and should be acknowledged. I understand that your work added lateral erosion and so on, which is cool. Actually looking at their figure 6, it reminds me that sensitivity analysis should be implemented with this kind of studies.
- If I understand correctly, your results in figures 4, 5, 6 are dealing with specific boundary conditions at any specific point/reach section in a channel. But I am afraid, as the figures stand now, the presentation might mislead some readers to think that slope and channel width (and cover) are spatially constant along a whole bedrock channel length. As you know, both slope and channel width are not spatially constant along bedrock channels. And we often see concave or convex or straight bedrock streams. When investigating steady state conditions of river channels, I think it would be cool to see plots of spatially distributed features of the variables in questions. OR at least **discuss** about it, or even mathematically. This is especially when you show "reach length" of 10 km in Table 1. So the readers may visualize and think you are talking about the whole channel length. I feel like the work is incomplete by having no spatially distributed results or talking/discussing about it. You have great math framework already and some initial results in figs 4-6. Having these additional figures would enhance the paper nicely (in that case, you might need to add some equations to implement).

Minor comments

P1, L9; an alluvial (use lower case after colon)

P1, L11, 14; "…a balance between channel incision and uplift" sounds better, I think.

P1, L13; I think "in the present work" sounds more formal and commonly used than "within the present paper"

P1, L19; if these are from your results, please indicate clearly by saying "My results show that …" or something like that.

P1 L29; various timescales

P1 L35; delete "for"

P1 L38; is temporally constant

P3 L6-L18; in this paragraph, I think you should explicitly state somewhere that you only investigate the bedrock incision process due to bedload abrasion, and NOT consider plucking, suspended abrasion, etc. Also in discussion section, you don't touch this topic.

P3 L1-L4; you may want to add a reference here such as Chatanantavet and Parker 2009 and/or a few other studies who used this equation to show how bedrock rivers approach a steady state. Readers who wish to read further in details can see how steady state profiles look like for bedrock channels.

P3 L23; this sentence is quite awkward. Consider reword.

P5; you have here 2.2.1 but then 2.3 . I think probably you better just delete sub-section 2.2.1 and merge the text with 2.2.

P10 L15-16; the font size here is different.