L. McGuire and his co-authors present a revised and improved manuscript of their investigation on channel profiles shaped by debris flow and fluvial processes. The authors provide a careful replies and revisions in response to my comments and suggestions. They largely modified the text, and added new figures in the main body and mostly in supplementary information.

One of the major points that I had underlined in my previous review concerned the fact that in most of the proposed models the slope increases downstream in the part dominated by debris flows whereas the natural examples of the San Gabriel Mtns showed the opposite. The authors now recognise this misfit more widely, and discuss it more extensively, in particular by insisting on the role of the volume aggregation parameter or the frequency of downstream debris flows. This discussion is now partly supported by a simplified analytical formulation. This does not necessarily make the models more convincing but it does help to better define the limits of these models, to better highlight the controlling parameters and the important aspects to be implemented for future developments. From that scientific point of view, I have no further concerns that should prevent the publication of this study.

These modifications and improvements to the scientific approach have nevertheless been made slightly at the expense of clarity and fluidity of the reading. The addition of remarks, caveats and arguments ahead of the discussion tends to disrupt the rhythm of the reading in some places.

Some adjustments would make the reading more fluid. As a matter of examples:

Line 23-24: this precision appears a bit like a digression in the state of the art. Either the authors should modify the sentence to insert it better, or move this sentence further on in the manuscript.

**R: We moved the text to a later paragraph in the introduction. It now reads:**

**"….where A denotes upstream drainage area, and Sdf, a1, and a2 are empirical coefficients (Fig. 1). Here, we use the term channel in a general sense to refer to an axis of concentrated erosion along valley bottoms, but which may or may not reside within banks made of deposited sediment. The coefficient…."**

Line 50-55: the two sentences seem to me to provide more or less the same message. This could be simplified.

**R: We have chosen to keep the current text because there are differences in methodology and conclusions in the cited studies that would be challenging to communicate as well in a single sentence.**

The fact that one can vary an equivalent of "gamma" for the process-based routing model is mentioned in sentences scattered throughout the text without this being clearly explained except in the appendix D. The text would gain in clarity (e.g. the sentence on line 208 "An increase in slope with drainage area near the channel head, however, is not an inevitable consequence of using the process-based routing model (Appendix D)" is rather cryptic) if the main text had more explanation on this point. I understand the overall approach because I was aware of this point from the start. However, I am not sure that all readers will be able to follow the line of the argumentation.

**R: We have added a sentence (in italics below) to the methods section that helps set up the results in Appendix D. "When using the process-based debris-flow routing model, we assume that debris-flow volume is fixed and does not change along the flow path, although we do explore the effects of spatial variations in debris-flow volume with the empirical routing approach described later.** ***In addition, we***

***perform a set of numerical experiments with the process-based routing model where we scale debris-flow frequency with drainage area to account for an increase in the total volume of sediment transported by debris flows as drainage area increases.*** **Regardless of which routing approach is used…"**

Just as the content of Appendix D is poorly explained and little used in the main text, the same applies to Appendix B: the values of the coefficients "kw" and "b" seem to fall out of the air, whereas Appendix B and Fig. B1 are there precisely to allow empirical values to be proposed. The authors should build on this. Otherwise, Fig. B1 is of little use and might as well not be included.

**R: We made a modification where Figure B1 is cited to indicate that this figure provides data that help constrain kw and b:**

**"Motivated by the geomorphic importance of debris flows in the San Gabriel Mountains (Lavé and Burbank, 2004), parameters related to channel geometry, including kw and b that are related to width-area scaling (Fig B1), and ….."**

The use of Sfit(A0) in fig. B2 is confusing. Is it different or the same as Sch ?

**R: Sfit(A0) is different from Sch. We do not attempt to precisely quantify the location of the channel head from the actual data.**

On the other hand, if the discussion reads relatively well, I find that the justification (in the introduction and presentation of the models) and especially the correspondence (in the discussion) between the two models are not sufficiently explored. Even if the authors recognise that it is complicated to compare them (and describe how one could move from one to the other) because of the very different parameters, there is probably more that could be done to enlighten the reader on the relative pertinence of and correspondence between these models. In the end, one is left with the impression of having explored two models in parallel and not knowing which one to use, or with the impression that the model at the bottom does not really matter: basically, you have just to push the alfa exponent to high values so as to guarantee a quasi-constant slope in the debris flow domain, and then to modulate this slope by playing on Kdf.

**R: We provide guidance on when to use the two models in the discussion section: "The process-based routing model may be best suited for modeling 1d channel profiles where changes in flow volume can be neglected and debris-flow constituents are sufficiently well known to allow for estimates of the model parameters, thereby minimizing the number of numerical experiments needed to characterize model behavior. The empirical debris-flow routing algorithm provides an efficient framework for investigating the effects of different debris-flow bulking relationships and exploring large parameter spaces"**

Table 1: the threshold factor used in equation (5) should be added

**R: Done.**

Figure 1: in the equation of the figure caption, the exponent "p" must be replaced by "a2". In addition, optimal "a2" value could be indicated for each profile.

**R: p has been changed to a2 in the caption of figure 1.**

Figure 2: It is a bit strange to indicate on the figure "gamma=0" knowing that this parameter does not appear in the process-based routing model formalism. The reader should have read first appendix D (fig. D1) to understand the relationship that can be established with gamma. This is part of the vagueness mentioned above about gamma and the process-based routing model.

**R: We have removed "gamma=0" from Figure 2. In the text, we state that setting gamma equal to zero is equivalent to neglecting changes in debris flow volume with drainage area.**

Figures 2, 3, 4, 5 and in sup info: it is a personal appreciation, but I found the blue to red color scale, used in the initial draft, easier to read.

**R: We have opted to keep the current color scheme.**

Figure 4: This figure has been added compared to the initial version. It is useful to show at which value of gamma the maximum slope of the channel is located at the channel head and not farther downstream. Nevertheless, given the presence of figure B2 with channel data from the San Gabriel, it would have been more interesting to represent S(A0) - S(Adf), to see for which values of gamma, we will find values between 0 and 0.2 as on the histogram of fig. B2

**R: We have kept S_max-S_ch in Figure 4 since we use this quantity as a model performance metric.**