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# *Interactive comment on* "A segmentation approach for the reproducible extraction and quantification of knickpoints from river long profiles" *by* Boris Gailleton et al.

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Gailleton et al. present a method that automatically extracts knickpoints from longitudinal river profiles. The algorithms developed by the authors are well described and are implemented in LSD TopoTools, a terrain analysis software written and maintained by the authors. The algorithms are tested against hand-picked knickpoints and those derived with other software, and the code is publicly available. Overall, the manuscript is very well written and nicely illustrated. I have no concern about this paper being appropriate for the journal ESURF. To this end, I only have a few questions and some specific comments.



- Would it make a difference, if you first smooth the elevation values using the TVD-approach and then calculate ksn? The smoothness-parameter would then be independent of theta.
- Detecting knickpoints by identifying gradient-changes of ksn could also be achieved by calculating the profile curvature of the elevation data in chi-space. Similarly to $M_\chi$, this could be $C_\chi$ (or something similar). Of course, mathematically, this is the same. In addition, curvature is strongly affected by noise in the river long profile. However, using curvature instead of gradients of gradients is slightly more elegant and smoothing curvature might directly yield the peaks and troughs that you are looking for.
- Detecting changepoints in noisy data is a common topic in signal processing and statistics (see e.g. Truong et al., 2018). I wonder whether some of the techniques of knickpoint identification could actually be applied in a more formal statistical framework.

In conclusion, I think that the paper needs only minor revisions.

**Specific comments**

6, 25: Filling might cause problems, because it can generate some large steps. Carving might be a better alternative.

8, 12: How much does "combining knickpoints" (2.3.2) actually affect the objective to identify the precise location of transitions between segments? It seems to me that knickpoint merging will let you pick knickzones, rather than knickpoints.

Eq. 7: Denoising: The TVD algorithm (Eq. 7) is similar to the smoothing approach by Schwanghart and Scherler (2017), with the difference being the applied smoothness penalty. It would be interesting to know why you chose a gradient penalty instead of a curvature penalty. Wouldn't the gradient penalty require the horizontal distance in the denominator as the node-to-node distance may change depending on whether the node is a cardinal or diagonal neighbor?

12, 20: I was wondering about this error radius when reading through section 2.4. Consider to mention the radius also there. Did you use the same radius in the Brazilian test case?

References:

Schwanghart, W. and Scherler, D.: Bumps in river profiles: uncertainty assessment and smoothing using quantile regression techniques, Earth Surface Dynamics, 5(4), 821–839, doi:10.5194/esurf-5-821-2017, 2017.

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