Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2017-50-RC1, 2017


Earth Surface Dynamics
Discussions



# *Interactive comment on* "Bumps in river profiles: the good, the bad, and the ugly" *by* Wolfgang Schwanghart and Dirk Scherler

**Anonymous Referee #1**

Received and published: 30 August 2017

In this paper, the authors propose an innovative method to smoothen the longitudinal profiles derived from digital elevation models (DEMs) using a quantile-based statistics, called constrained regularized smoothing (CRS). The work is well presented, and the manuscript is ready to follow with an appropriate number of figures in good quality. The authors demonstrate extensive analysis on the proposed method using various kinds of global DEMs to find the pros and cons of the DEMs themselves, as well as to test the applicability of the smoothing method (CRS) to the noisy, DEM-derived channel profiles of both mainstream and tributaries. I believe this work is worth being published in the journal Earth Surface Dynamics, subject to some minor corrections.

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Discussion paper

{General comments}

# CRS-derived gradient:

I think the paper would be strengthened if some additional demonstrations are provided. The authors show the nicely smoothed channel profiles, but do not provide the derivatives of the along-stream elevation (slope gradients). In the discussion, the authors state that "CRS-smoothing of river profiles can decrease differences to actual river elevations and gradients" (P10 L4), but the along-stream gradients after the CRS processing are not really provided. Furthermore, they mention that the CRS method will be useful for the analyses of knickzones and hydrolodynamics that often use stream gradient, and the representation of gradients can be highly of interest for many researchers working on fluvial (and other) processes. It can be more clearly demonstrated if they could show some examples from their own datasets – even just a visual representation (not a strict statistics) would help readers to understand the advantage of the CRS method in calculating the derivatives of elevation. I would, therefore, recommend adding a figure that shows not only the elevation profiles but also the slope (and curvature, if applicable) derived from the original and CRS-applied datasets.

# Title:

The title sounds attractive, but not fully informative. Particularly, "the good, the bad, and the ugly" is vague. It would be better to include the key terms (such as global DEMs, quantile carving, and/or constrained regularized smoothing).

# Objectives:

At the beginning of "4. Methods and data", the authors provide an explicit description of the goals of this study (P6 L22-L24), but these were not so clearly shown in the Introduction section (P2 L5-8). Please rewrite the objectives more clearly in Introduction.

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{Specific comments}

P7 L4 "ellipsoidal heights (WGS84)" Which geoid was applied for each dataset (or the same for all)?

P7 L5 "resampled... resolution" To what resolution? How? (nearest neighbor?)

P10 L16 In this section the authors seem to discuss some sorts of errors. I do not figure out why they mention each error type as "good", "bad", and "ugly". I am sorry if I am missing some, but it would be better clarified – the differences of goodness, badness, and ugliness of each error.

P11 L6-7 Although I did not find any detailed descriptions of the smoothing method in Bricker et al. (2017), if the CRS algorithm (or a similar one) has already been presented in the previously published article, I think it should be explicitly shown prior to the methodological descriptions in this paper.

P11 L17 "other variables" such as...??

Table 4 It would be better to show that the values of RMSE are the deviations from the ALS data in this caption (not only in the main text).

Fig. 8 Please explain "Topographic shielding" in details. Does this corresponds to the "hillslope gradients adjacent to river within 1000 m distance"?

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{Technical corrections}

P6 L13 The details of the place name appears later, but here please provide, at least, the region name "(San Gabriel Mountains, USA)" where "Big Tujunga catchment" locates.

P13 L11 "Eq. (11)" does not seem to appear elsewhere in the manuscript.

P14 L11-12 The numbering of the equation may be A12.

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