Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2017-21-RC2, 2017
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Earth Surface Dynamics Discussions

Interactive comment on "Geomorphometric delineation of floodplains and terraces from objectively defined topographic thresholds" *by* Fiona J. Clubb et al.

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Received and published: 10 May 2017

This paper is a strong contribution to ESURF and a clear step in the right direction towards a mapping floodplains and terraces. I am particularly pleased about the idea of using the quantile–quantile plot approach, which provides a null hypothesis (in this case, normally-distributed topography) against which the landscape may be tested. The majority of my comments are in the paper itself, an annotated version of which is attached. However, I will include some more general points here:

1. First, I will echo the first reviewer in writing that there needs to be a more clearly-defined line between "fully automated" and "semi-automated". In other words:

define the realms within which your model is automated or is not. Currently, the lack of a well-defined separation undercuts the advances that you really have made by making it seem as if you overstate the work and making the focus on the "it isn't that far" rather than "it is a big step beyond prior work". I have read that Clubb et al. have responded to the first reviewer already in response to this general concern, so I will go on to a couple more specific points:

   (a) One arbitrary piece is the decision about how wide of a swath should be used to search for terraces. To me, this highlights something that has long been on my "to do" list: a tool to automatically compute the widths of river valleys (see Shaw et al., 2008, for an analogous problem in coastlines). So I think that your use of an user-defined parameter is due to the lack of a tool that is outside your current scope, making this a placeholder for a better method!

   (b) Your wording hints that there are problems in terrace identification when a river exists below a high plateau surface, and that these require some special parameter choices. This could also be aided by a tool to identify valley widths, but a more satisfying explanation about possible failure modes and ways around them – especially considering the range of upland topogrpahies from steep lands with ridges to flat upland plateaus – would be more satisfying.

2. Second, and related: I wonder why you chose a Gaussian distribution as the "landscape null hypothesis" from which you search for variations. I see the power in its simplicity, but do wonder whether you could replace the Gaussian distribution with the distribution expected from a stream-power-erosion plus hillslope-diffusion (I'll write it in a linear way here) simple model: $\partial z/\partial t = -k_{SP}A^mS^n + k_{HS}\nabla^2 z$. By integrating through time (e.g., numerically with a landscape evolution model), one can generate a non-Gaussian "landscape null hypothesis". This to me would seem a more powerful approach insofar as it represents what

is expected on the landscape in absence of floodplains and terraces, but does have sensitivity to the k values chosen (or calibrated to the given landscape with another automated procedure). Nevertheless, I think that some of the by-hand "tweaking" with the quantile–quantile plots could be reduced by comparing the measured landscape against a more physically-based elevation distribution. To be clear: I am happy to see this paper published without changing its entire basis, but would feel remiss to not leave a record of this idea as a potential future avenue for improvement.

In both of these cases, I think that your approach is the right set of steps towards a process that is fully automated, and think that the places in which it is not fully automated serve to highlight areas in which advances are needed; such advances can lie outside of the scope of this paper.

References

Shaw, J. B., M. A. Wolinsky, C. Paola, and V. R. Voller (2008), An image-based method for shoreline mapping on complex coasts, Geophys. Res. Lett., 35(12), L12405.

Please also note the supplement to this comment:
http://www.earth-surf-dynam-discuss.net/esurf-2017-21/esurf-2017-21-RC2-supplement.pdf

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