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Interactive comment on "Erosional response of an actively uplifting mountain belt to cyclic rainfall variations" *by* J. Braun et al.

Anonymous Referee #2

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This paper by Braun and co-authors presents modeling results about the response of fluvial systems submitted to periodic variations in precipitation. The modeling approach is detachment-limited and based on the Stream Power equation, which is solved in three different ways, first using an analytical approximate solution and then with 1D and 2D numerical solutions. The key result of this study is the observation of time offsets in the response that can make the input precipitation forcing and the output erosion flux significantly out of phase. The amplitude of the lag is directly controlled by the period of the forcing, where very high-frequency oscillations do not induce delayed response, whereas the lag increases for longer forcing periods The authors argue that such systematic lag times could be used as an independent constraint to evaluate some of the parameters of the stream power model, and in particular the slope and discharge exponents, which still remain poorly characterized. I present below a number

of comments on specific points in the paper, but I consider that is a very interesting article with important results that will be of high interest for a large part of the Earth Surface Processes community. The ms is well written and illustrated, with a sound presentation of the results and discussion, and it will make a great contribution to E-Surf.

Page 976 : Even if it is clearly out of the scope of this paper it would be interesting to discuss (i.e. later in the discussion) the possible implications of introducing a transport limited behavior.

page 977Âă: ÂńÂăsmall periodic perturbationsÂăÂżÂă: in many contexts precipitation variations can be quite large actually. Same comment about ÂńÂăone tenth of the meanÂăÂż (page 979), that's a rather subtle fluctuation which is probably unlikely to make it to the sedimentological record in most situations.

page 978Âă: could you elaborate a little more about what could be the physical meaning of this m dependency

page 978Âă: I would expect a more systematic comparison of the analytical and numerical solutionsÂă: figure 1 and 2 are quite difficult to compare for that purpose, and actually figure 7 shows significant differences between the two solutions for similar sets of parameters. Can you isolate the reasons for this deviation, which seems to be larger for shorter periods?

Page 980Âă: As a reference, could you also show what would be the response for a more conventional set of parameters (m=0.5, n=1)

Page 980Âă: 100 m in amplitude could turn out to generate quite descent knickpoints. Are these perturbations generating knickpoints, and how do they propagate and eventually interact between different precipitation cycles

page 982: One thing which might be difficult to grasp when discussing the response of the river network to evolution in precipitation is that it is actually composed of two things

: (1) an “instantaneous” and local response at any point along the network associated with the change of discharge through time, and (2) the build up of a more complex evolving response that results from the integration of multiple upstream propagating signals, associated with these changes in discharge. I think it would be interesting to go a bit further in discussing these responses and their link with the dependency on the discharge exponent you mention.

page 983Âă: as far as I understand there is no description of hillslopes processes in in FastScape, so the actual impact of such oscillations on drainage density can not be accurately captured by this approach.

Page 983Âă: the catchment-scale denudation seen by cosmogenic nuclides in detrital sediments is mostly an hillslope signal, so the question of the impact of these perturbations will strongly depend on how the perturbations along the channel are going to be transmitted to the hillslopes.

Page 984: if I remember well Nd has a relatively short residence time in the ocean (much shorter than Sr for example), which make it difficult to use as global geochemical tracer. I understand that this study is local (i.e. focused on the Bengal fan, so quite close to the continental inputs) but could this property impact to some extent the conclusions (although this is something that might be rather discussed in the Gourlan et al. Paper rather than this one)?

Page 985Âă: I think that Lupker et al. (2012) argue in favor of a rather straightforward transfer of sediments across the Gangetic floodplain, without much storage or remobilization.

Interactive comment on Earth Surf. Dynam. Discuss., 2, 971, 2014.