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Interactive comment on "Climate, tectonics or morphology: what signals can we see in drainage basin sediment yields?" *by* T. J. Coulthard and M. J. Van de Wiel

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Coulthard and Van de Wiel present modelled grain-size and sediment yield changes to increased precipitation and uplift in an upland drainage basin. Their numerical experiments, run on the well-established CEASAR model for a well constrained basin, suggest quite variable basin response to precipitation and uplift changes. This paper tackles an important and timely topic which is well suited to ESurfD. While the conclusions are justified by these results, a bit more space could be given to the potential influence of model assumptions on the observed trends.

General Comments: The introduction could be expanded to include a wider discussion

of basin stratigraphy models (e.g. Paola et al., 1992; Heller and Paola, 1992, etc.) and sediment yield from LEMs (Tucker and Slingerland, 1996, among others). I have a general question about the model assumptions. If I understand correctly, there is an unlimited depth of mobile regolith in the model. Under 'normal' conditions, this is probably quite valid for this basin, however when uplift of 5+ metres occurs, there is bound to be bedrock cropping out either along the offset or upstream. The best case scenario would be to model the system with a known depth to bedrock. If this is not practicable, it would be good to see a discussion of the effects of bedrock vs. sediment with respect to total sediment yields (bedrock is harder to erode) and grain-size distributions (the bank material here is quite fine grained). There is a question of the importance of timescales here. The results presented here are for 900 years whereas channel response times can be much longer (Crosby and Whipple 2006 on similar spatial scales, and Whipple and Meade 2006 on a large spatial scale). This is particularly important with respect to typical depositional timescales. The importance of the transient state of this system can be seen in the relative sediment yield plots (Fig 8), that are >1 for S2 but <1 for S3 in each scenario. Does the 'sediment pulse' at S2 ever make it down to S3? Finally, how much are the results here due to the difference between a point source (faults are linear in the basin, but point source for the stream) perturbation versus a diffuse (precipitation) perturbation? This may not be a topic for this paper, but I would be interested to see a discussion of this.

Specific comments: P69L5 – Schumm, 1979 does not appear in references list. P69L8 – Tucker and Whipple, 2002 does not appear in references list. P73L9-16 – This section contains some of the key concepts in the paper and could be expanded to stress this. P75L23-25 – Note that the increased delivery of fines is due not only to bank erosion but most likely also to increased delivery from the hillslopes (assuming constant regolith supply). P76L5-10 – It would be good to see this in a table. What are the mean and s.d. before and after the uplift? Figures – the axes are difficult to read in many of the figures. Please increase the font size.

Technical corrections: P68L11 – Shouldn't this be conditional ('can' be instead of 'is') since the authors have not examined all possible landscape scenarios? P69L9 – "...how post uplift..." change wording P74L7 – 'fewer' instead of 'less' P74L10-11 – repetition, delete "for the 5m uplift event". P76L13 – delete 'both' P76L16 – change 'is' to 'us'? P76L24 – yr-1. P77L18 – 'expanding' not 'expaning'? P78L5 – delete 'a' P79L9 – 'are' not 'is'. Hancock et al., 2010 not cited.

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