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Earth Surface Dynamics Discussions

Interactive comment on "Morphology of the Kosi megafan channels" *by* K. Gaurav et al.

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ANSWERS TO THE EDITOR

Dear Authors, There are now 3 excellent and well considered reviews of your article in ESURFD. Please provide a clear response to review and a suitably modified manuscript for consideration of publication in ESURF once discussion is closed.

Dear Editor,

We have now finalized our answers to the three reviews of our manuscript. All three were very useful to us, and we hope that the corrected manuscript that we present will be considered suitable for publication in Esurf.

Let us summarize the main points and concerns put forward by the reviewers:

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Interactive Discussion

Discussion Paper

1. Reviewers 1 and 2 ask us to justify the reason why the study of individual threads is usefull to the field of fluvial geomorpology
2. Although the dataset is new and might prove very useful to all reviewers, reviewers 1 and 2 comment on the small size of the dataset, whereas reviewer 3 finds our work "to the point".
3. Probably because of the first point the use of the threshold theory is not clear to reviewers 1 and 2.
4. The absence of sediment transport measurements is questioned
5. All three reviewers question the way individual threads were extracted from ADCP cross-sections of the Kosi River
6. Eventually reviewers 1 and 3 question the nature of residual channels

All these comments are legitimate and we try, in the corrected manuscript, to provide suitable answers to waive them. To shortly comment on the main points above:

1. Regime equations are of very wide use in fluvial geomorphology to compare braided and meandering rivers, understand the reasons behind these patterns, and assess discharge relationships from remote sensing. We show in the introduction that the physics of flow and sediment transport that sets the regime equations at the thread level in a braided channel is lost through the scale integration process. It is therefore of much interest to study the geometry of single threads from a braided channel and compare them to threads of meandering channels in order to see if the knowledge acquired during the last decades on hydraulic geometry of single thread rivers can be extended to braided threads. This is the purpose of our study.

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2. The dataset we provide is the first of its kind. None of the large databases available provide information for braided threads that can be compared to meandering threads. Performing measurements of width, depth, and discharge on individual threads of rivers such as the Kosi River and its residual channels is a long, tedious and time consuming effort. As such this database is limited in size. Despite this limitations, as we now show in the manuscript, important first order conclusions can be drawn, and their statistical significance addressed.

3. We show that the empirical regime equations for braided and meandering threads of the Kosi fan are statistically the same. Again this result is entirely new. We also show that, despite different regime equations for depth and width, the aspect ratio of threads is almost detrended. Because empirical relationships provide no insight into the processes at work we use the threshold theory, the only physical theory that is both fully analytical and grounded, to see if the trends we observe in the regime equations are predicted by this theory. This theory predicts the detrending of the aspect ratio. We also show that it predicts the width of individual threads both meandering and braided. Meandering and braided threads exhibit differences in depth and aspect ratio that are not predicted though.

4. Sediment transport of course is an important issue but recall that: (1) classical hydraulic geometry relationships of common use are derived from datasets that do not include sediment transport, and (2) we show that a first order analysis can still be proposed. Further work will include sediment transport but the primary component of bed evolution is bedload. At present the measurement of bedload in large sandy threads especially braided ones is still a matter of ongoing research and debate.

5. Our original thread extraction was visual and empirical. We have developped and automated extraction of threads that is now discussed in the text and does not lead to significant changes in the results.

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Interactive Comment

6. Single thread channels occupy former positions of the braided Kosi River. Whether their morphology is inherited is an important point raised by the reviewers. We now present sinuosity measurements for individual threads. We show that the distribution of sinuosities of threads from residual channel are significantly different from the distribution of sinuosities from braided threads. Furthermore, threads from residual channels have significantly higher sinuosity then the main Kosi threads. These residual threads have therefore developped a meandering pattern (clearly visible on satellite images) that is unambiguously different from the pattern of braided threads. Thus our comparison is legitimate.

We hope that the modifications clarify the text in many places, and that readers will appreciate the significance of what has been achieved in this paper.

Yours truly, The authors.

Interactive comment on Earth Surf. Dynam. Discuss., 2, 1023, 2014.