

Interactive comment on “Morphology of meandering and braided gravel-bed streams from the Bayanbulak Grassland, Tianshan, China” by F. Métivier et al.

Anonymous Referee #2

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General comments

The manuscript by Metivier and co-workers reports on channel geometry, discharge and grain size data collected from the Bayanbulak Grassland, China, during two field campaigns. The manuscript is generally well written and contains valuable data on gravel-bed rivers, complementing currently existing data. The data is presented in a smart format allowing for comparison to other datasets and systems of all sizes.

The manuscript could be significantly improved by defining key terms used throughout the manuscript. This includes the terms ‘meandering’ and ‘braiding’, which are distinguished throughout the manuscript, in the graphs, and also a conclusion hinges on

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this distinction, while it remains unclear to the reader how a meandering and braiding river is defined in this study. Other improvements may arise from a more detailed explanation of the measurement strategy and protocol, and the inclusion of a discussion section to better develop the ideas the authors may have on the key findings of this study.

Specific comments

The manuscript would benefit from a definition of the different terms used to describe channel forms throughout the manuscript. A plethora of terms describing channels forms such as ‘rivers’, ‘streams’, ‘channels’, ‘reaches’ and ‘threads’. A clear definition of all terms will help the reader understand what is meant exactly, how the terms link different hierarchical morphological forms (i.e. rivers and threads within rivers), and will ensure consistency throughout the manuscript. A graph with a visual representation of all the mentioned channel forms and their terms as used in the manuscript would be highly insightful for this purpose. This graph would be well placed in the beginning of the introduction where many terms are already mentioned, or could be placed in the Method section.

A crucial element missing from the current manuscript is a definition of meandering and braided rivers. What definition was used to determine whether a river was meandering or braiding? It seems likely to use the sinuosity to quantify the degree of meandering and a braiding index to quantify the degree of braiding. And how was this measured? For example, along what kind of basin length was the sinuosity measured? Was this done consistently for all reaches reported on? Also, how many transects were used to quantify the braiding index, and was this done consistently for all reported reaches? Such quantification of river pattern will be helpful to substantiate qualitative statements like ‘highly meandering’ on p. 1293, line 9. In addition, formal quantification of the reported river patterns may also provide additional understanding on the reported similarities between the termed meandering and braided rivers. For example, are only the statistical distributions for lower sinuous meandering rivers similar to braided ones, and

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maybe not the highly sinuous (sinuosity > 1.5) meandering rivers? This latter analysis allows for a more sophisticated analysis of the collected data and would also allow the authors to align their work with previous work on this topic where distinctions between river patterns could be made based on the degree of sinuosity, see for example Kleinhans and Van den Berg (2011).

A more detailed explanation of the measurement strategy and protocol would help the reader better understand the collected channel geometry, discharge and grain size data. A number of questions that a revised manuscript should answer at minimum are:

How many cross-sections were measured to represent a specific river?

What were the criteria to choose a cross-section, knowing that channel width variations along a river can be substantial. Were cross-sections always made at a similar location (e.g. middle of bend) in the river? Please motivate.

How were the reported average values on flow velocity, water depth and grain size calculated? Is this a stream cross-sectional average, or does it represent a single (maximum?) flow velocity in the middle of the stream? Please specify this for the two methods used (ADCP profiles and manual measurements).

How many counts of grain size were used to calculate a D50 and D90 for each cross-section?

Along which length were the long profiles and slopes of the streams measured? Does this align with the length across which an assessment of the degree of meandering and braiding was made?

The manuscript is currently lacking a discussion. The conclusion is currently partly functioning as a discussion, which is rather confusing and which also hampers a detailed reflection of the authors on how their results fit into earlier work. Such a discussion would allow the authors to expand on key findings of the study such as the observed geometrical similarities between meandering and braided rivers and the re-

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sultant lack of a transition from braided to meandering channels as reported in other work, and the extension of their findings from gravel-bed to sand-bed environments. Therefore, I encourage the authors to include a dedicated Discussion section in the revised manuscript in which they expand upon the aforementioned key findings. Other findings that may be expanded upon are the notion of the relationship between sediment load and channel aspect ratio, and how flume experiments and numerical models can be used specifically to further this work. Adding such a discussion will also involve a rewrite of the current conclusion section, which is highly speculative in nature as it stands.

Technical corrections

p. 1291, line 21: Much more work has been done on this topic and should be referenced here in addition to Schumm 2005. For example, Leopold and Wolman (1957), Ferguson (1987) and Kleinhans and Van den Berg (2011) to name a few.

p. 1291, line 21: 'supported by laboratory experiments' seems inappropriate here and is not supported by the listed references, which all focus on theoretical rivers or field data.

p. 1291, line 23: developed

p. 1291, line 23: pattern

p. 1292, line 2: What do the authors mean with 'sediment discharge'? Sediment load, sediment type, sediment concentration, or a combination of these? Please expand.

p. 1292, line 5: The authors may also want to refer to Braudrick et al (2009) and Van Dijk et al (2013) to cover recent work on the interaction between coarse-bedded rivers and vegetation.

p. 1292, lines 12-14: 'In sandy. ...same environment'. This sentence requires a reference.

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- p. 1293, line 8: I suggest changing Figure 5 to Figure 2 as it is introduced here as the second graph.
- p. 1293, line 9: Please define 'highly meandering'. Is this a sinuosity above 1.5? Same holds for a braided pattern: how is it defined? What kind of braiding index is typical?
- p. 1293, line 10: Figs 2 and 3 show examples of a meandering pattern and braided stream, but not a transition from one to the other. I suggest to place the reference to the figures after the first part of the sentence.
- p. 1293, line 13: 'is certainly only mild'. Please change to 'is only mild'.
- p. 1293, line 14: Why is referred to Hey and Thorne (1986) here? Hey and Thorne (1986) do not specifically look at the influence of vegetation on the river morphology in the studied basin, and the reference therefore seems out of place. Please remove or expand to motivate why Hey and Thorne (1986) should be referenced here.
- p. 1294, lines 21-22: The maximum reported channel widths and discharges do not correspond with the data reported in Table 3 and Table 4. In these tables, the maximum channel width is only 35 m (not 77 m) and the maximum discharge is only 51 m³/s (not 100 m³/s).
- p. 1294, line 23: please change 'average' to 'median'.
- p. 1295, line 2: 'morphology' should be changed to 'geometry'.
- p. 1295, lines 2-3: Please clarify that this statement is derived from the threshold theory lines as depicted in Figure 6.
- p. 1295, lines 3-4: Please clarify where this can be seen and what is meant with 'isolated' here. Looking at Figure 6, I am assuming that 'isolated' refers to meandering but I am not sure.
- p. 1295, line 7: Please remove '(Sect. 4)'.

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- p. 1295, lines 8-9: This statement is true for the width and depth data, but not so much for slope where a lot of scatter is present and 'gathering around a straight line' seems an inadequate description of the presented data. This is confirmed later on when calculating fitting coefficient in Table 1.
- p. 1295, line 19: wider with respect to the grain size. Not wider in terms of absolute values. This could be made more explicit.
- p. 1297, line 12: The dashed lines on Fig. 6 represent Eqs. (2) – (4).
- p. 1298, line 18: supports.
- p. 1298, line 14: please change 'morphology' to 'geometry'.
- p. 1299, line 1: Which mean are the authors referring to?
- p. 1299, lines 7 - 8: This statement needs more clarification and motivation. At a minimum, it should be explained to the reader how 'meandering' and 'braiding' are defined and measured. Also, the term 'morphologically' may need to be changed to 'geometrically' because channel width, depth and are geometrical properties. In contrast, the morphological pattern of the provided examples of meandering and braided rivers from satellite images seem qualitatively very different.
- p. 1299, lines 11 - 12: There are no correlation coefficients reported in Table 2, in contrasted to what is suggested here.
- p. 1299, line 19: please change morphologically to geometrically.
- p. 1299, lines 23 - 25: This sentence signals a large extension of the results from gravel-bed systems to sand-bed systems and should be expanded to better develop the authors' reasoning here. The reference to the sand-bed systems is based on work on the Kosi megafan, so does it only apply to these fan environments or do the authors see application in other sand-bed systems as well? I believe that this sentence is not suited for the conclusion but would be well placed in a Discussion section, which is

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currently lacking. This may also provide a better place to develop the authors' ideas on the similarity between the geometry of meandering and braiding channels, rather than making it part of the conclusion.

p. 1299, lines 26 – p 1300 line 2: it would be very helpful to know what the authors mean exactly with the terms 'a braid', 'individual threads', and 'isolated channels' in this sentence. The aforementioned definition graph of channel forms may be useful.

p 1300 line 18: Bertoldi and Tubino (2007) is not mentioned in the main text.

p 1300 line 20: Bolla Pittaluga et al (2003) is not mentioned in the main text.

p 1301 line 6: Devauchelle et al (2011) is not mentioned in the main text.

p 1301 line 28: Mackin (1948) is not mentioned in the main text.

p 1302 line 3: Paola (2001) is not mentioned in the main text.

p 1303 line 9: Zolezzi et al (2006) is not mentioned in the main text.

Figure 1: Could the writing in the white rectangles be enlarged to aid the reader? Also, the smaller rectangles are hard to see, a larger contrast or different colour may be needed.

Figure 2: Could the corresponding meander bend in the satellite image be indicated? Also, what is the location of the braided stream picture within the satellite image?

Figure 4: Please change 'normed' to 'normalised'.

Tables 1-4: I suggest introducing Tables 3 and 4 before Tables 1 and 2, mainly because Tables 3 and 4 contain the actual data while Tables 1 and 2 contain variables derived from the data reported in Tables 3 and 4.

Interactive comment on Earth Surf. Dynam. Discuss., 3, 1289, 2015.