Dear Referees,

Thank you for your comprehensive and inspiring review. The interactive comments you wrote us had about the same content. However, the comments of Jeff Warburton were a bit more detailed and he mentioned also almost all things discussed by Tomaž Podobnikar, so mainly we used that as a backbone of the corrections.

Answers to the specific comments:

1.

The relationships between 'slope and sinuosity' and; 'slope, discharge and channel pattern' are described as background to the paper but this description is far from comprehensive and there is little coherence to the arguments which are developed. The introduction ends with a description of the quasi 3-D graph from Timár (2003) describing the relationship between bankfull discharge, slope and channel sinuosity. However, much of the preceding literature used as context describes the transition between channel patterns (straight, braided and meandering) rather than the range of sinuosity (meandering) per se – which appears to be the focus of the paper. It is noticeable that some of the classic literature relating sinuosity to these controlling variables and thresholds in channel pattern is not mentioned e.g. Chang (1985), Edgar (1984), Parker (1976), Schumm (1967).

Thank you for the recommended literature, it was very useful. Furthermore, one of the recommended authors (Chang, H. H) also studied some relation between the mean annual discharge and the bankfull discharge, so we could compare and verify our fitting method and results.

2.

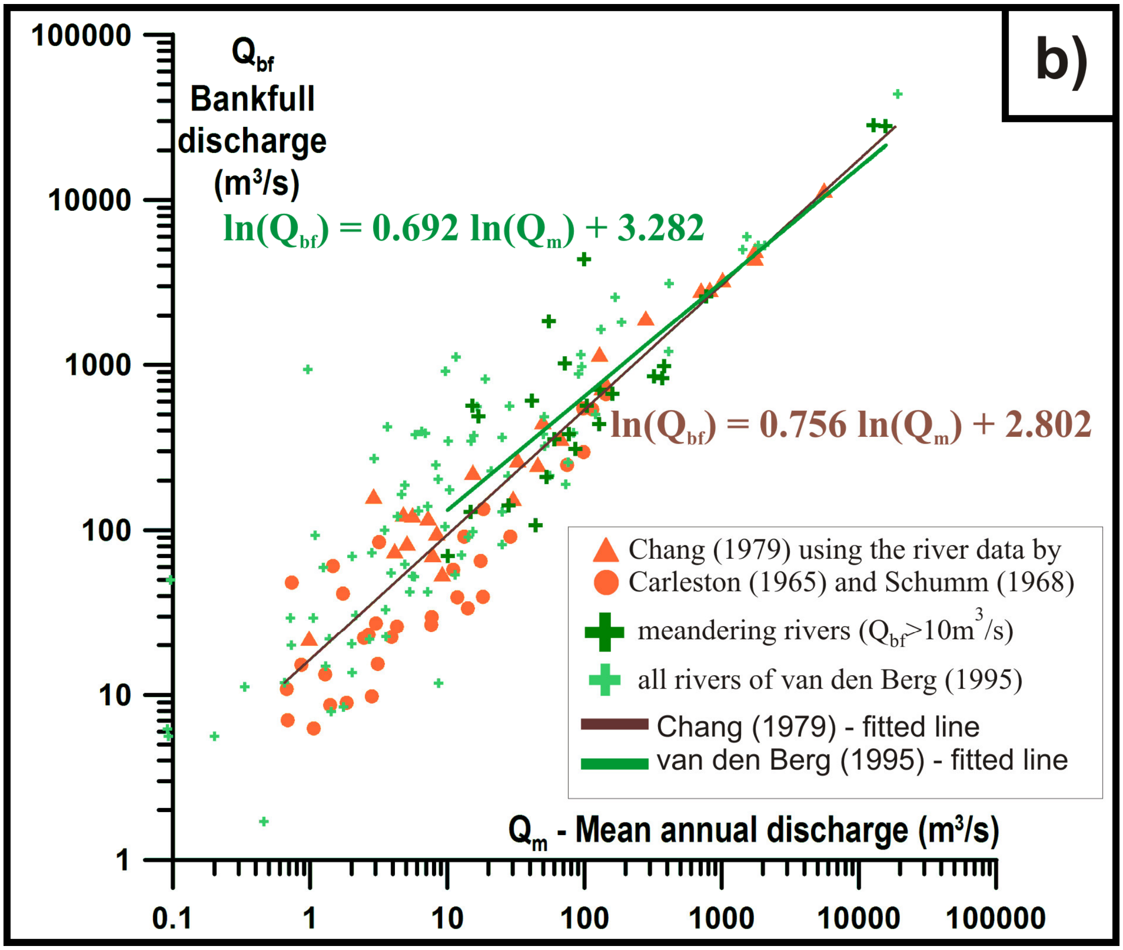
The basic data used in the analysis is described in a rather confused manner. It appears to be derived from historical maps (sinuosity), reconstructed from archival survey notes (slope) and derived from more recent discharge measurements (Lászlóffy et al, 1965). The compatibility of this data and in particular the potential incommensurate nature of the age ranges of the data is not adequately described.
This was also mentioned by Tomaž Podobnikar: It is not clear how the data of Viczián and Lászlóffy were combined

For a given point, the slope and discharge values were imported from the same dataset. However Viczián focused on the hilly area, so along the Great Hungarian Plain we needed other data, this was the survey of Lászlóffy et al. We completed the text with this description, (see 2.2 Slope and discharge values).

3.

Calculating bankfull discharge using the van den Berg (1995) relationship and extrapolating this to the current study area is fraught with difficulties. How is this justified?
This was also mentioned by Tomaž Podobnikar: The description in the section "Data and methods" is quite unclear at many points. I suggest more detailed description, possibly with support of some visual material, if possible.

Unfortunately, we did not have enough data to calculate the bankfull discharge with a commonly used method. But our results were compared to the graph of Chang (1979; using the data of Carleston, 1965, and Schumm, 1968). In our new version, Fig.2b shows the two dataset and the fitted lines, with their fitting equations.



4.

In the results section it would useful if brief table was included showing the descriptive statistics of the three key variables: sinuosity, bankfull discharge and slope.

We added the new Table 1, as follows:

	S_c	Q_{bf}	$P^{original}$
Minimum	0.000052	11.03	1.11
Maximum	0.0058	2216.28	2.50
Mean	0.0013	245.53	1.54
Median	0.00081	131.06	1.48
Dispersion	0.0012	310.52	0.24

S_c, Q_{bf} and $P^{original}$ means the channel slope, bankfull discharge and the sinuosity values, respectively.

5.

The rationale for fitting a surface of the form described in Figure 3 is not clearly articulated. In particular the transformation of the abscissa axis of Figure 2e to a linear scale (Figure 2f) and subsequent surface modelling is not convincingly justified. Furthermore it is not clear how the degree of fit as shown in Figure 3 provides a rigorous test of the modelled surface. It is important that the authors indicate which of the modelled surfaces is most appropriate – the parabola or quadratic? For example in the conclusion it is stated three methods were used but there is no clear recommendation as to which one should be followed.

This was also mentioned by Tomaž Podobnikar: You wrote that different interpolation methods were tested, but which are these methods in relation to the finally selected one? You mentioned a RMS error of the model that remains under 15. Conclusions are not clear: For example they do not explicitly answer to the question in the title.

In the present study, our goal was to describe more precisely the fitting methods, and their characteristics. Using different methods, our aim was to show the ways to generate these surfaces, from the easiest to the more difficult. Comparing the three methods, the quadratic polynomial fitting seems to be most accurate.

The conclusions were rewritten to be not only a short summary of the results, but to answer to the question in the title.

The RMS error of the model remains under 15%: Using the least squares regression, we build up a mathematical model. This model estimates a sinuosity value for a given slope and discharge value. We compared the model and the original sinuosity values; calculated the RMS, and compared them to the original sinuosity values. We used 202 sinuosity-slope-discharge triplets to determine the quadratic model.

RMS error, in % of the original sinuosity	Number of points
0 – 0.1%	33
0.1 – 0.5%	52
0.5 – 1%	33
1 – 2%	30
2 – 5%	32
5 – 10%	19
10 – 15%	3

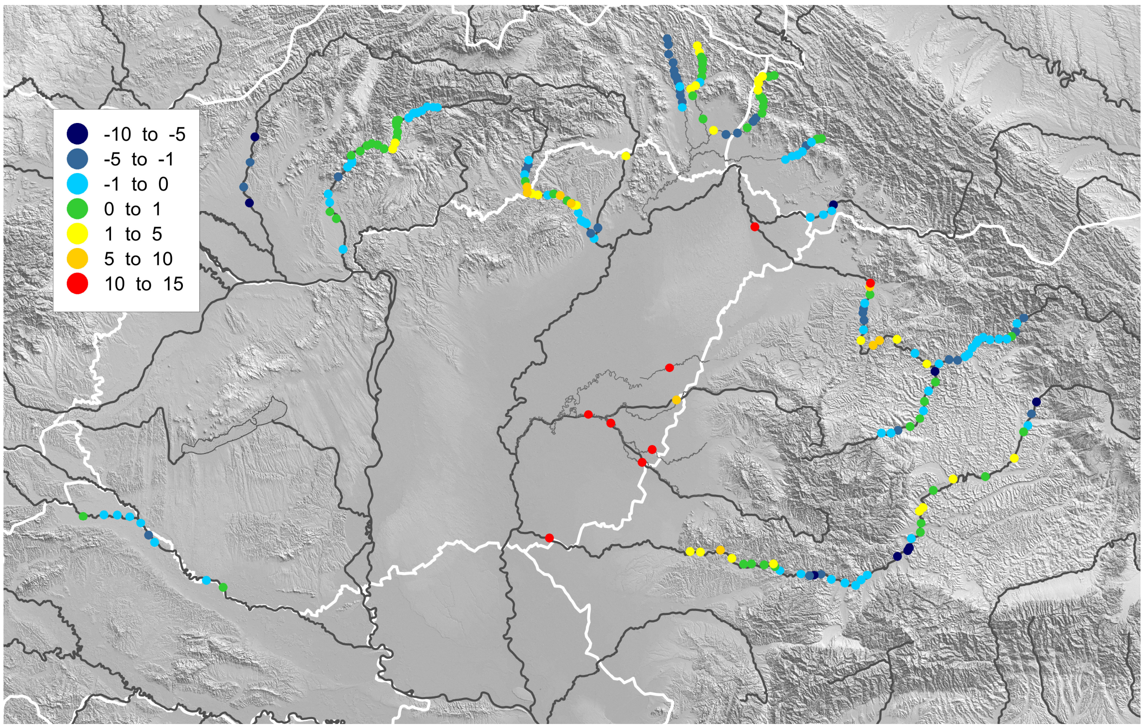
We have 5 more points, but we did not use them during the fitting method. These points can be found along the Körös River System, in the Great Hungarian Plain. Here, the area is very flat, but the water discharge is quite big. These points should belong to the straight pattern (see the slope and discharge values of Ackers and Charlton), but their sinuosity is around 3. In this area, neotectonically active faults can be found, which can locally change the channel slopes.

We also did not use the points along the River Olt, because here multiple bedrock-controlled reaches occur. We tested our model along this river. The model values are quite similar to the original sinuosities, except the bedrock controlled reaches.

6.

It is hypothesised that differences between the modelled surface (Figure 3c) and the original data are largely due to differences in the sediment discharge regime and bed material grain-size distribution. However, there is no real discussion of this or attempt to relate this back to the field setting.

Thank you for this comment. We rearranged our Fig.3 and put a new map, comparing the RMS errors not only to the river patterns but to the coordinates of the points. Analysing this map, we can conclude, along the rivers, the higher errors appear near the points, where the tributaries arrive, and change the water- and sediment discharges.



7.

The complex surface developed in Figure 3 bears some resemblance to the complex response threshold models used to describe channel pattern instability (Thornes, 1980). For example the cusp catastrophe model has been used to relate stream power and resistance to a responding variable like sinuosity e.g. Graf (1988) used this to describe the transformation between straight, meandering and wandering river patterns. Although this is not the same situation as reported here such a comparison is useful for context and possible extension.

Thanks for this suggestion, proposing an interesting direction to continue our research towards. Threshold, and especially catastrophe models are considered as an important part of the sinuosity evolution, e.g. in case of sinuosity decrease (with a slightly different context, see Turcotte, 1992 and Stoelum, 1996). The tight time frame to provide the revised version does not let us to work on this issue. We see, however, a real potential to complete our analysis to this direction in the future.

8.

Finally, a major issue with this paper is clarity of the text and Figures. The written style is not particularly strong and poor expression leads to ambiguity in many of the key paragraphs of the paper (which may be partly responsible for some of the issues outlined above). The paper requires a very careful proof editing to improve this aspect of the presentation and also correct some duplication and repetition which occurs in the text. Furthermore there are too many Figures. The paper would be more effective (many of the diagrams are too small) if only a few key diagrams were selected. Currently the written text is accompanied by three composite Figures which consist of 19 individual graphs and two data tables. I would encourage the authors to be more selective. An appropriate selection might be: 1a, 1d, 2b, 2e, 2f and one of the models in 3.

This was also mentioned by Tomaž Podobnikar: The English grammar needs further improvement. Figures: The text is too small to read, and the graphs too.

Text:

All of the suggested technical corrections were made.

The abstract was rewritten.

The appendix was deleted, and the methodology was described in the text (see: 2.7. Least Squares regression).

A linguistic review was also made on the text.

Figures:

The structure of the figures was simplified. The unnecessary ones were deleted (Fig. 1.b; 1.c; 2.c; 2.d; 2.e; 3.a; and 3.c from the original version), but there are some new pictures which can help for the better understanding (1.c; 2.b; 3.b).

Fig. 1.c – calculating the sinuosity with moving window method (Technical corrections: P12276, L15; Tomaž Podobnikar: short definition/description/principles or formula is needed – for example, how to calculate the sinuosity)

Fig.2.b – This graph compare the mean annual discharge to the bankfull discharge.

Fig.3.b – This map shows the RMS errors along the rivers (in the % of the original sinuosity)

The legends and colour scales are displayed.

Answers to the other comments:

All the chapters were rewritten. All the unnecessary paragraphs were deleted from the Introduction, so it became shorter. The definition of the sinuosity and a short description of the calculation method were added. All individual comments/suggestions were followed in the final text.

Thank you your productive criticism, suggestions and comments, which helped a lot to improve our work.

Budapest, 9 February, 2015.

With special regards,

Judit Petrovszki, Gábor Timár and Gábor Molnár