Responses to the comments of Reviewer 1:

► Overall Comment

This paper concerns the nonparametric estimation of river cross-sections with point cloud data from UAV photography. Advances in structure from motion (SfM) methods have led to widespread use of photogrammetry in many environmental applications. In this application, the goal of the method is to reproduce the characteristics of natural and manmade channels, including abrupt changes, bumps, and lined shapes. The authors have proposed the use of a nonparametric estimation technique, called the K-nearest neighbor local linear regression (KLR) model, and compared its results to more traditional locally weighted scatterplot smoothing (LOWESS) model for two test cases in Korea. They found that the KLR model perform well to derive river cross section from point cloud data.

While I find the findings of this research relevant and interesting, I find this work reads more like a research paper than a 'model development' paper. While it is listed as a model description paper, it is not 'comprehensive descriptions of numerical models'. It has not been describing how the code is developed and can be used. So perhaps it is more suitable for a journal other than GMD, maybe in a quaternary science journal. I also feel the paper can be greatly shortened to be a methods and techniques paper or a research letter.

Response ◄

The authors appreciate this reviewer insightful comment. The current manuscript proposed the statistical model of KLR to apply it to the point cloud data taken from UAV. The authors believe that though the current manuscript is not related with numerical models, statistical models are critical as much as the numerical models to the geoscience community. The authors improved the manuscript to explain the code development and how it can be used. Furthermore, the figures were greatly shortened from 27 figure to 16 figures following this reviewer's comment. Hope the modification is satisfactory to this reviewer and the manuscript is suitable to GMD now.

► Major Comment1

There are a total of 27 figures in the main text. I wonder whether any of them can be consolidated to make the same points. Also, the results of KLR/LOESS/polyfit can simply be put in the same figure but with different line styles.

Response ◄

The authors appreciate this comment. The authors tried to overlap the results of KLR/LOWESS/Polyfit into one figure. However, its result were not clearly and difficult to recognize sometimes. Instead, the authors merge some figures with different panels. The number of figures were shortened to 16 figures. Hope this modification is satisfactory to this reviewer.

► Major Comment 2

It is not clear from the introduction why it is important to get the river cross section right. What are the issues if wrong cross section is imported to models (e.g. Neal et al 2015)? Is 2D cross-section useful enough? Why not produce 3D DEM of channels from the point clouds?

Response ◄

The authors appreciate this reviewer's critical comment. 2D cross-section has been mainly used in hydraulic engineering fields especially in bank design and risk assessment. The authors agree that 3D channels and the surface of rivers can be possible to be drawn with the proposed technique. The authors will plan to develop further 3D modeling from point cloud data. Also, the introduction was modified to present why it is important to get the river cross-section right. As the following.

In UAV aerial surveying applications for river management and flood analysis, the demarcation of cross-section of a river is critical. Accurate demarcation of the cross-section is mostly required to calculate peak discharge and flow amount. From this calculation, riverbank is designed to prevent overflow from the designed floods of the cross-section. Inaccurate demarcation of cross-section might lead overestimation or underestimation of the current flow amount.

► Major Comment 3

As can be observed in the point clouds, in most cases the point cloud captures the channel cross-section quite well. It begs the question why not use a hand-drawn best-fit line or simple parametric methods?

Response ◄

The authors totally agree the reviewer's opinion. However, as the results in the current study presented, the simple parametric model cannot address abrupt changes in cross-sections. Furthermore, the proposed technique can be applied in hydraulic fields to easily provide more accurate and detailed cross-sections so that more accurate hydraulic designs and assessment cab be made even in complicated shape cross-sections.

In addition, as discussed in Petikas et al. (2020), when a long body of a river should be studied and a large amount of cross-sections is needed, it takes long time to draw cross-sections including the main stream path, the left and right bank curves, flood plain curves with ensuring them perpendicular to the flow. This has been mentioned in the document accordingly.

Most of the existing studies were focused on drawing sections with low resolution DEMs and improving accuracy. Sanders (2007) tested several on-line public domain DEMs to parametrize 2D hydrodynamic models and concluded that those DEMs contains high vertical and horizontal biases. Gichamo et al. (2012) proposed an approach that simulates river cross-sections from ASTER Global DEM and discussed that the low resolution and the inadequate vertical accuracy could be improved by preprocessing the DEM. Channel widths of small and medium-sized rivers are too small to use DEM-based methods since the resolution of available DEMs are much coarse to draw cross-sections.

Meanwhile, UAV aerial surveying has been easily available and become very economic methods to acquire 2D data. A cross-sectional algorithm for the cloud point dataset of UAV aerial surveying has not been much tested in depth especially for deriving river cross-sections, since the characteristics of the point cloud dataset are far different from the DEM in that a study area for UAV aerial surveying is commonly smaller and many more points can be acquired from UAV aerial surveying.

► Major Comment 4

The paper shows a different use case of KLR, which was originally proposed in Lee et al. (2017) for climate dynamics. The paper needs to show more clearly the specific advances it makes in the delineation of channel from UAV photogrammetry, rather than a generic application of KLR.

Response ◄

The authors appreciate this comment. The manuscript was improved especially in section 2.1 by providing the detailed description of KLR for UAV aerial photogrammetry. Hope the modification satisfactory to this reviewer.