Comment on gmd-2021-309
Anonymous Referee #2

Referee comment on "Nonparametric estimation method for river cross-sections with point cloud data from UAV photography URiver-X version 1.0 -methodology development" by Taesam Lee et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-309-RC2, 2022

This is a review of the manuscript “Nonparametric-based estimation method for river cross-sections with point cloud data from UAV photography URiver-X version 1.0 -methodology development” by Lee and Sung. The study explores the suitability of K-nearest neighbor local linear regression for estimating cross-sectional geometry from digital images collected by UAV. The K-nearest neighbor has been used extensively for interpolating/extracting information from point datasets. Also, the study has only implemented the methodology on two cross-sections at the same reach with similar river geometry characteristics making any conclusion highly localized and not generalizable in other locations.

I recommend rejecting the manuscript. What the authors need to do find multiple areas with different geomorphological characteristics and available bathymetry data, survey them using UAV and analyze the different regression techniques at multiple locations to come up with generalizable conclusions.

Major comments:

- UAV can only capture the water surface and not the actual bed if the river reach is not dry. Therefore, UAV surveys are more suited for ephemeral/dry river reaches or for capturing the overbank/floodplain geometry. For perennial rivers, additional information is required (either velocity measurements or bathymetry measurements) to further refine the cross-sections. The authors should clarify in Introduction what the intended application is for such cross-sections in this study and also note the drawbacks of UAV.
- Most of the study hinges on the premise that river cross-sections are trapezoidal which is not completely true. The assumption proposed by Chow (1959) is only reasonable in areas with sparse data and not where detailed surveys have been carried out. River
channels exhibit a wide variety of shapes, and depending on the intended application, they may need to be captured in lot of detail. As such, the authors should do the analysis for idealized cross-sections with different shapes such as triangular, trapezoidal, and parabolic shapes to see how the different regression techniques compare.

- The case-studies are highly specific cases in what looks like an engineered channel. It is imperative for the authors to incorporate more study sites with varied geomorphologic characteristics to make this study generalizable. At the moment, it looks like the conclusions are only true for that one river reach.
- The value of parameter “a” can not be set based on one idealized cross-section. The results show that the choice of “a” will change based on river characteristics and cannot be set to a particular value. As mentioned before, rivers exhibit a wide variety of shapes and they may also be a need to capture the riverine bedforms accurately. In such cases, the degree of smoothing will change based on river characteristics and therefore the value of “a” will change from case to case.
- Similar to the analysis for idealized cross-section, there should be a comparison of the differences between the cross-sections estimated using polynomial fitting and LOWESS. The differences should be analyzed not just using RMSE in elevation but also in area and perimeter curves for all regression techniques.

Some minor comments:

Given the overall drawback to the design of the study, I am not delving deeply into the minor corrections in the manuscript, but I have noted some of them.

- How do you decide on the in-stream variation in elevation?
- Define polyfit2 and polyfit4 in text.
- X-axis and Y-axis label and units missing in several of the figures