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Earth Surface Dynamics Discussions

Interactive comment on "Short communication: Significance assessment of historical surfacic planform changes of mid-sized rivers: A Monte-Carlo based approach" *by* Timothée Jautzy et al.

Anonymous Referee #2

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This manuscript outlines a new method to quantify errors in measurements of channel change calculated from repeat aerial image overlays. The method is a valuable contribution in that uncertainty in measurements of channel change are estimated from polygons of erosion and deposition; this makes the method generalizable to multiple river types (e.g., braided). However, the methodology fails to retain the spatial variability of geometric error, which previous studies have demonstrated to be an important source of uncertainty. The proposed methodology uses a spatially variable error to calculate geometric error statistics (e.g., mean and standard deviation) and generate a

distribution of geometric errors that are randomly sampled and applied uniformly over each sub-reach. Thus, the proposed methodology assesses how the variability of geometric error influences measurements of channel change, and this differs from the stated aim of the manuscript: to create a generalizable spatially varying error assessment method. While I appreciate that the authors developed a method that can be applied to polygons of erosion and deposition and I believe the use of a Monte Carlo approach as merit, I have significant concerns with the proposed methodology.

Technical comments:

Page 2 Line 9: Image co-registration does not affect measurements of channel width because the images do not have to be overlaid to calculate the width.

Page 2 Line 30: Why are medium-sized rivers more prone to digitization and co-registration error? I would think that small-sized rivers might be more prone to these issues because the digitization and co-registration error potentially accounts for a larger portion of the active channel.

Page 3 Line 2: You need a sentence defining the channel polygon method.

Page 3 Line 7-10: Using the methodology proposed in this manuscript, I believe that you can only test hypothesis 1. This is because the spatial errors are aggregated to estimate a population of uniform errors which are sampled in the Monte Carlo framework. What you are actually testing is how the variability of error affects polygons of erosion and deposition (i.e., the effect of changing the mean and standard deviation of the populations of errors in a reach).

Page 3 Line 8: "the higher the SV-error is, the less significant the measured changes are." More description is needed for the word "higher". Do you mean the larger the mean of the SV-error, the larger the standard deviation of the SV-error, or a combination of both?

Page 3 Line 29: What was the discharge on the day each image was collected?

Page 4 Line 10: Note that the RMSE of a single GCP is the Euclidean distance between the two points. See equation 1 verses 2 in Lea and Legleiter (2016).

Page 4 Line 14: The sentence starting with "First, Lea and Legleiter (2016) showed" is incorrect. Lea and Legleiter (2016) simply stated that linear and nearest neighbor reduced the spatial extent of large co-registration errors. The authors did not evaluate which interpolation method should be used.

Page 4 Line 21: What is the length of each sub-reach?

Page 4 Line 25: The method to determine the LSE needs to be more clearly stated. Is the LSE calculated using the SV-errors extracted from each channel boundary vertex or all SV-errors within the sub-reach?

Page 5 Lines 4-6: These sentences seem to contradict one another. In one sentence the authors state that MC simulations are useful because the method assumes "spatial continuity and a relatively spatial homogeneity of the error", while in the second sentence the authors note that the method can improve the "generalization of methods for calculating planform changes and spatially variable uncertainty. . .". This is a major problem with the proposed method. Lea and Legleiter (2016) and Donovan et al. (2019) demonstrated the importance of using a spatially varying co-registration error to estimate uncertainty at individual points; however, the authors use the SV error to estimate the mean and standard deviation of the co-registration error population in each sub-reach.

Page 5 Line 8: Have you tested whether the distribution of raw LSE values is normal? Would another distribution better model these values?

Page 5 Line 30: Note that the metric "erosion/deposition", as shown in Figure 1, does not always required erosion and deposition (e.g., channel avulsion or meander cutoff).

Page 6 Section 3.4.3: Virtual Surface of Detection (SoD) is not an appropriate description and this is NOT equivalent to the LoD in Lea and Legleiter (2016). In my opinion,

the SoD cannot be used to distinguish significant from non-significant changes. The SoD is simply a statistical description of the MC results. Because the authors adjust the channel delineations by the registration and digitization error for each MC iteration (equations 1 and 2), the individual iterations already take into account uncertainty and therefore should be significant. The SoD simply shows the variability of channel changes based on the distributions of error in the x and y directions for each image.

Page 6 Line 24 to page 7 Line 2: It is not appropriate to directly compare results from each sub-reach without a normalization, such as by sub-reach length. The difference between sub-reaches could be caused by reaches being smaller or larger.

Page 7 section 4.3: The method cannot show the percentage of individual measurements of erosion or deposition retained because each MC iterations is treated as a single value, so sentences like: ". . .significant change globally increases from 17% using the raw-SoD to 37% using the 95-SoD" are incorrect.

Page 7 Line 20: The authors state, "This emphasizes the need to take the SV-error into account. . .", yet their method does not include a SV-error.

Page 7 Line 25-31: The authors were not able to test their second hypothesis because the error ultimately did not vary spatially. In addition, the authors cannot identify the number of channel change measurements statistically retained and the results are not comparable to Lea and Legleiter (2016) or Donovan (2019).

Page 8 Line 1-10: I do not believe that the authors successfully tested the third hypothesis because they did not directly include the SV-error nor was the significance of channel change measurements accurately determined.

Page 9 Line 1: What is the appropriate sub-reach size and how sensitive are the results to the sub-reach size? How do you recommend users delineate sub-reaches for different channel types? General editorial comment: The manuscript has numerous sentences that are awkwardly worded and could benefit from line-by-line edits to im-

prove the readability. In addition, citations need to be checked (e.g., Wesley Lauer et al. (2017) should be Lauer et al. (2017)).

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