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Interactive comment on "Development of a statistical tool for the estimation of riverbank erosion probability" *by* E. A. Varouchakis et al.

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The manuscript predicts the probable presence or absence of erosion by combining a physically-based bank erosion model and regression analysis. The bank erosion model computes the eroded area at 12 location using bank material properties and fluvial conditions at specific times. The regression model correlated the simulated bank eroded area and two independent variables, channel width and bank slope. The article is well written and has presented a unique approach in identifying vulnerable areas for erosion. However, I would like the authors to address the following issues:

We would like to thank the anonymous reviewer for his positive comments and for the time he devoted on reviewing this manuscript in order to provide useful suggestions.

1) Although BSTEM is considered a physically-based model, simulated values are still subjected to a huge amount of uncertainty brought about by several assumptions for instance the material property. I would like the author to show a comparison of the simulated and measured eroded areas. Quantification of the error in the simulated area vs the measured will give readers an idea of the uncertainties in the predictions. Stating that BSTEM's results are "reliable" (page 10; lines 5-9) is not sufficient especially if results are used for prediction. "Reliable" has to be expressed in terms of some measure or metrics.

Response#

The BSTEM model was validated for the predicted erosion (m2) after a field investigation that was performed at the end of the wet period of the hydrologic year of 2013-14 (page, 653 lines 25-29, page 654 lines 1-4, page 658 lines 1-8). Photographs were taken at some locations where the 50 cm scaled stick was placed showing the eroded area. The eroded area at each location was successfully predicted as the observed affected area was quite similar. Especially, at the location (KI) with the most significant effect, the predicted eroded area was equal to 2.043 m2 and the affected area measured at the field (and represented in the modified photo) was roughly 2.08 m2. Similarly occurs for the other locations too. However, because the purpose of this work was to use BSTEM results (at the 12 locations) in accordance with the field inspection to setup the statistical model and to provide validation points, quantified measurements at those points were not performed but only field inspection was performed to validate that the BSTEM results are consistent and close to reality. Therefore, only at the point with the most intense erosion, a close photo was taken and analysed to quantify the erosion.

The BSTEM predictions at the 8 validation points were then characterized as reliable (page 658 lines 9-11) because they are located in between of the 12 points that were successfully validated by the field inspection.

The photo (Figure below) and the above text will be added appropriately in the final manuscript.

Fig. Photo highlight of the riverbank location (KI) with the most intense observed erosion accompanied by the appropriate scaled tools to provide a rough estimate of the eroded area.

2) One of the most important factors affecting streambank erosion aside from channel geometry are bank materials (soil texture, geotechnical properties, roughness etc.). These should have been included as independent variables in LWLR. I suggest the authors perform additional analysis that at least consider a representative of the bank material as independent variables

Response#

This work presents the framework of a methodology that can be applied in order to estimate the probability of erosion at specific riverbank locations considering explanatory and easy to determine secondary variables. Channel geomorphological characteristics such as cross section and bank slope are relatively easy to be determined at unmeasured locations by using a digital elevation model. On the other hand, bank material requires extensive field measurements in order characteristic bank material variables to be considered as secondary information. Such measurements did not take place during our field campaigns but only at the 8 specific locations during the 1st campaign to set up the BSTEM model. However, the grain size was only determined. Considering the location of the 12 measurement points, which was at the same river section and the similar grain size measured at the 8 locations, the 2nd BSTEM model was set with soil characteristics similar to the 1st one. Therefore, estimation with LWLR in different riverbank locations cannot be applied. However, this is an idea to be applied in a future campaign as the primary aim of this work was to present the methodology and to test its efficiency only using geomorphologic variables. Furthermore, a second aim was to present the methodological framework

so others with similar data or with bank material data to test it at their study basin.

Please also note the supplement to this comment:
http://www.soil-discuss.net/2/C507/2015/soild-2-C507-2015-supplement.pdf

Interactive comment on SOIL Discuss., 2, 647, 2015.

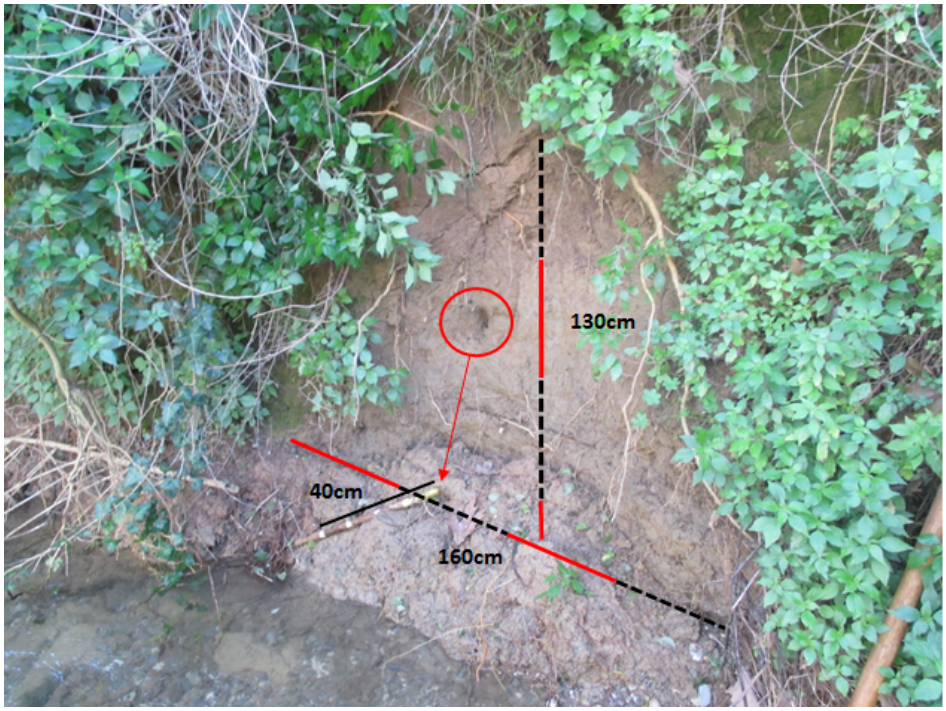

Fig. 1. Photo highlight of the riverbank location (KI) with the most intense observed erosion accompanied by the appropriate scaled tools to provide a rough estimate of the eroded area.