Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-59-RC1, 2020

Earth Surface Dynamics Discussions
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Interactive comment on "Modelling impacts of spatially variable erosion drivers on suspended sediment dynamics" *by* Giulia Battista et al.

Anonymous Referee #1

Received and published: 13 January 2020

The manuscript describes a new suspended sediment flux model which is then used to analyze sediment dynamics and sources in a mid-size catchment. The paper is well written. Unfortunately, I have great reservations about the model novelty and the interpretation of the results. I recommend Major Revisions as I think that the manuscript can be of interest once it is more properly framed.

General comments: The authors all but ignored existing large-scale sediment flux models (see a most relevant review paper and a couple of examples below). This is a major emission that must be corrected; their model should be framed in reference to these models.

The authors greatly over-sell the novelty and capabilities of the sediment model. While it is true that the hydrological framework is physically-based, the sediment model is a

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simple empirical equation (Eq. 2) that predicts sediment as a function of discharge, slope and a spatially variable (alpha) coefficient. Alpha is calibrated using USLE parameter combination. Sediment transport (Eq. 4) is a simple cell-to-cell and time-step balance. I see very little novelty in this model. The authors must make the argument of why this model is novel if they wish to continue claiming it is (this is a cornerstone of the manuscript at the moment).

The evaluation of the sediment model is odd - referring to the relatively low scatter in the SSC-Q plot (Fig 3) as an argument for strong model performance. A standard model performance analysis is offered for the model's hydrological predictions (Table 1). It seems that the observed sediment is used for model calibration so we actually left with little knowledge about how well the model is doing.

Given the relative simplicity of the model and the way it was calibrated, the interpretation of the model results extends much beyond the model's ability to represent the discussed processes. The authors need to frame their analysis within the model's capabilities to represent the relevant processes and drivers. Some examples of overreaching are 1st sentence in the Discussion, sentence starting in lines 300, 311 & 315.

Example of references to consider: A review paper which evaluates 14 models: De Vente, J., Poesen, J., Verstraeten, G., Govers, G., Vanmaercke, M., Van Rompaey, A., ... & Boix-Fayos, C. (2013). Predicting soil erosion and sediment yield at regional scales: where do we stand?. Earth-Science Reviews, 127, 16-29.

Cohen, S., A.J. Kettner, J.P.M. Syvitski, B.M. Fekete (2013). WBMsed, a distributed global scale riverine sediment flux model: model description and validation Computers & Geosciences, 53, pp. 80-93

[cited in the paper but not in reference to the model] Pelletier, (2012). A spatially distributed model for the long-term suspended sediment discharge and delivery ratio of drainage basins. J. Geophys. Res., 117 (F2), p. F02028

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Syvitski, J.D. Milliman (2007). Geology, geography, and humans battle for dominance over the delivery of fluvial sediment to the coastal ocean. J. Geol., 115 (1) (2007), pp. 1-19

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