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Discussions

Interactive comment on "Contributions of Catchment and In-Stream Processes to Suspended Sediment Transport in a Dominantly Groundwater-Fed Catchment" *by* Yan Liu et al.

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Though the demand on water use is ever increasing due to population growth, urbanization, and climate change, it is inevitable to accept the fact that the supply is limited. To compound this issue, the quality of water is also deteriorating due to human and natural activities. Among the activities that deteriorate the available water, sedimentation that is due to erosion, suspension, and deposition in rivers ranks at the top. Therefore, in this manuscript, the authors present an integrated sediment transport model to determine the sediment contribution from the Ammer River in Germany. Based on the review of this manuscript, the following points are highlighted:

1) The catchment input, bed erosion, and bank erosion increase with an increase in flow rates (See LN-18 P-1). Is this a generic statement? What is meant by catchment input? What is the expected relationship between the erosion and flow rate? What is mentioned in the literature? Is it possible to justify this statement (i.e., LN-18 P-1) using equation (10) and equation (11)?

2) Bed erosion and bank erosion are negligible when flow is smaller than the corresponding thresholds of 1.5 m3 s-1 and 2.5 m3 s-1, respectively (See LN-19 P-1). Is this statement about the rate? Moreover, the threshold values (i.e., 1.5 m3 s-1 and 2.5 m3 s-1) need to be normalized using some of the catchment properties to understand the authors' statement. The threshold value on bank erosion (i.e., 2.5 m3 s-1) is greater than the threshold value on bed erosion (i.e., 1.5 m3 s-1). What is mentioned in the literature?

3) Asper the authors, USLE and SEDD cannot estimate sediment generation by in-stream processes (See LN-15 P-2). Moreover, as per the authors, although SWAT/HSPF/HEC-RAS can simulate "physical processes", none of these models represent in-stream processes well, specifically in natural rivers (See LN-24 P-2). What are those instream processes? In think, the authors need to explain the way the sediment (e.g.., suspended) generation and transport is simulated in some of these models (e.g., SWAT) to understand the pitfalls of the existing models to solve the intended problem(s) in Germany.

4) The catchment-scale hydrological model is based on the HBV model (See LN-1 P-4). Does this statement need a reference? Moreover, the authors have added a quick recharge component and an urban surface runoff component to explain the special behavior of discharge in the Ammer catchment (See LN-4 P-4). The special behavior of discharge in the Ammer catchment and the reason(s) for including the additional components are not understood. Is the integrated sediment transport model applicable anywhere?

5) The HEC–RAS simulates hourly quasi-steady flow (See LN-15 P-4). What was the reason for not selecting the unsteady option in HEC-RAS? The details about the boundary conditions (e.g., Upstream/downstream) and initial states are missing in the manuscript. What types of boundary conditions you had in your model?

6) The distances between "computed" cross-sections range from 10 m to 100 m depending on the changes of river bathymetry (See LN-19 P-4). Are these the interpolated cross-section data. What was the interpolation algorithm? Did you use one of in-built(HEC-RAS) interpolation algorithms? Where did you have your observed cross-section data in your model? The details are missing in the manuscript. HEC–RAS model computes the hourly hydraulics for the all cross-sections of the main channel and two major tributaries of the Ammer River (See LN-18 P-4). Does this statement fit the section (i.e., model setup)?

7) The section 2.3 needs to be more detailed. Many details are missing in the manuscript. The modeled river schematization needs to be included in the manuscript. How did you include the tributaries in HEC-RAS? The details on the junctions/confluences are also needed.

8) The land use is classified into urban areas and non-urban areas (See LN-23 P-4). Impervious surfaces such as roads and roofs are regarded as urban areas, while non-urban areas consist of pervious surfaces such as gardens and "parks", agricultural areas, and forests (See LN-24 P-4). Does this statement contradict with your section 3.1(See Table 1)? Did you classify your LULC into urban and non-urban?

9) The sediment-generating model is used to obtain hourly sediments of different sources from the 14 sub-catchments (See LN-26 P-4). What is meant by different sources?

10) We use the urban-area algorithm of SWMM, which "performs well on particle buildup and wash-off for urban land use", to describe sediment generation from urban areas (See LN-28 P-4). Does this statement need a reference?

11) The variables in equation (1) need more description to understand the units (i.e., gm-2). The definitions of the variables need to include the area. Moreover, the variable M(t) is not found in the equation. Is equation (1) applicable only for urban areas? What is the reason(s)? Does the equation have a variable to show that it is applicable only for urban areas?

12) In equation (1), what is the value of "k" used in the model. What is the value of "Mmax" used in the model? The maximum buildup depends on the particle production and cleaning frequency, which is obtained through calibration (See LN-6 P-5). This statement needs more explanation.

13) In equation (5), what is the value of your critical stress? Does the value of critical stress vary with time? Don't you consider the particle accumulation in non-urban areas? Is equation (4) applicable for all non-urban areas? Moreover, sin(theta) is not the mean slope of the sub-catchment. Since theta is very small, you will end up saying sin(theta)=tan(theta)?

14) Is equation (11) formulated by the authors? Otherwise, the reference is required. In equation (11), what is the unit of bank erosion rate? This unit needs to be compared with the unit of bed erosion rate (i.e. equation (10)). Does the bank erosion rate vary spatially along the reach? Does equation (11) cover the bank erosion in the freeboard region? In equation (11), what is the value of your critical shear stress for bank erosion? Does the value of critical stress vary with time? In equation (11), what is the equation of your bank shear stress?

15) In equation (10), the units of bed erosion rate and the specific rates of particle and mass erosion are not understood. What is meant by "specific rate"? How do you compare this (i.e., specific rate) with the bed erosion rate? What are the values of the thresholds (i.e., mass erosion threshold and particle erosion threshold)? Does the bed erosion rate vary spatially along the reach?

16) Does equation (9) represent the "bank" and "bed" deposition rates? What is the

reason to condition based on the bottom shear stress of the river?

17) In equation (8), what is the assumption(s) made in formulating the first component of the right-hand-side of the equation?

18) Are your computations cells of equal size? As per LN-5 in P-6, the computation cells are formed by two cross-sections. However, your cross-sections are not equally spaced (See LN-19 P-4). Wont this influence your model outcome?

19) As per the title of the manuscript, the catchment is dominated by groundwater. However, the current version of the manuscript does not lead to understand this statement. Does the equations account in your suspended sediment transport model account for this statement (i.e., dominantly groundwater-fed catchment)?

20) The equation (7) needs to be derived from first principles. Does this equation account for sink (i.e., flow diversion)? Is this equation formulated correctly? Considering your equation (10) and equation (11), what is the unit of the third component in equation (7)? Did you use the equations (1-6) in your equation (7)? Which component of your equation (7) accounts for your equations (1-6)?

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