

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2021-225

Anonymous Referee #1

Referee comment on "Evaluating and developing a model of specific degradation using geospatial analysis for sediment erosion management in South Korea" by Woochul Kang and Pierre Y. Julien, Hydrol. Earth Syst. Sci. Discuss.,
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General comments

This study proposed a method to predict sediment yields of soil erosion and sedimentation in South Korea. The authors first developed an empirical prediction model of specific degradation based on multiple regression analysis and tree data mining. In addition the also predicted gross erosion based on RUSLE and derived sediment delivery ratios by dividing gross erosion prediction estimated from RUSLE by sediment yield estimated with the empirical prediction model (Eq. 12) in order to validate the results of the empirical model.

I found the paper very difficult to read. To my opinion, it is mainly due to the fact that the objective of the paper is not clearly stated. As it stands, this paper gives the feeling of a confused compilation of the previous papers (Kang et al., 2019 and 2021) without the added value of this new paper being really defined and discussed. This feeling is reinforced by the fact that more than half of the discussion focuses on the effect of spatial resolution on the RUSLE results, although this is not a central objective of the paper.

Another major concern is the use of SDR to validate the empirical model (cf. chapter 3.3 Model validation using the sediment delivery ratio) when the authors do not have measured SDR data (nor gross erosion references). To my opinion, the use of SDR data from the literature does not allow any conclusion to be drawn on the validation of the sediment yield prediction (or specific degradation) model, especially as these SDR values are known to be strongly linked to hydro-sedimentary connectivity of the considered watershed, and therefore very site-dependent (see for instance De Vente et al., 2007, DOI: 10.1177/0309133307076485). As a consequence, there is little justification for the paper's general approach of articulating an empirical catchment model and a RUSLE approach to derive SDR values...

In addition, the discussion has to be completely rewritten in relation to the objective of the paper.

Specific comments

Line 20-21. You use "percent water" and "percent wetland and water" as distinct parameters of the empirical regression analysis. What about the collinearity of these 2 parameters ?

Line 22. Please clarify the sentence "Additionally, erosion maps from the revised universal soil loss equation (RUSLE) were generated to validate model variables". Which model variables are supposed to be validated by the RUSLE approach ?

Lines 92-93. Finally which values of the trap efficiencies were used in your studies ? Why don't you use Heinemann's formula or a similar formula to estimate them (Heinemann, H. G. 1981. A new sediment trap efficiency curve for small reservoirs. Water Resources Bulletin, 17, 825-830.)

Line 99-102. A more detailed presentation of the SD assessment procedure is required in this paper. For future works, I particularly suggest to provide a evaluation of uncertainties in your SD estimations, because this evaluation is necessary if you want to show that your new empirical model is better than the previous ones. In a scarce-data context as yours, it can be assumed that the uncertainties on the SD values will be large (as seen in Fig. 2a for the SY/discharge relationship) and that therefore a variety of models can give similar results when considering the uncertainties in the calibration/validation datasets.

Line 109. I am a bit surprised that some gauging stations were removed from this study whereas many of them were used in the previous ones... To what extent could this partly explain the improved quality of the regression?

Line 111 (section 2.2). Please consider dividing this section in several sub-sections to make this section easier to read and understand (At least on sub-section for the empirical approach and another for the RUSLE approach). Please also consider to provide more details on the regression model procedure and the parameters tested both for the regression model and the RUSLE approach.

Line 121. What is the signification of SWAT-K here ?

Line 124. Please clarify what you mean by "based on the RUSLE structure" in a more explicit way. The link is not obvious as the RUSLE structure was developed on a plot based scale and the regression model on a watershed-based scale.

Line 200. What is the signification of "W" in eq. 13 ? idem for "Sa" and "Hyp"...

Lines 200-201. As far as I can see, the main difference between the previous model (eq. 13) and the proposed new model (eq. 14) lies in the value of the exponent associated with the Hyps parameter (positive in Eq. 13 and negative in Eq. 14). How do you interpret this difference ?

Line 216. What is the signification of SA010 in Eq. 16 ?

Lines 248-249. "Thus, the results suggest that stream watersheds carry more sediment, and alluvial rivers provided more opportunities for deposition." Do you think this sentence provides useful new information ?

Line 254. Madiment, 1993 (or Maidment ?) has to be added in the final reference list.

Line 255. In the sentence "...as well as results of other studies", please provide the references of these other studies and discussed how their context is similar, or not, to yours...

Page 12. Please consider enlarging Fig. 1 as it is difficult to read as it stands .

Page 15. In legend of Fig.7, your aerial images (in 7 b-d) looks to be terrestrial (or ground) images

Page 16. Change ungagued into ungauged in Fig. 8 and explain what means WS, MR and MT

Page 18. Please consider adding a legend to Figure 11, or removing Figure 11.

Page 19. In Table 1, Have you an explanation for the very high dry mass density 1 for SR1 (value of 2.1).

Page 20. In Table 2, please explain why the SD values are not similar from those shown in your previous paper (e.g., Kang et al., 2019). And why some of the stations (e.g., NU4 and NU5) are marked as "discarded and/or unreasonable results) but still considered in Table 7.

Page 21. Several variables in Table 3 are not defined. What is the significance of "Line:total", "Main" ... What is the difference between "Middle relative height at middle relative area", and "elevation at middle relative area", and "middle elevation" ?

Page 22. Please explain why the conservation practice factors (P-value) for each land use type increase with slopes (Table 5). In general, the conservation practice factors do not have a direct systematic link with slopes. Moreover, the influence of slopes in RUSLE is already taken into account through the LS factor.