Review of paper

'A review of the (Revised) Universal Soil Loss Equation (R/USLE): with a view to increasing its global applicability and improving soil loss estimates'

By R. Benavidez et. al.

1. Scope

The paper provides a thorough introduction into the USLE model family, a group of empirical long term soil erosion models. This paper is of interest to the HESSD community, as the various USLE variants described in this paper are among the most used erosion models overall.

2. Summary

The paper gives an introduction into the motivation and method of using USLE models and describes the conceptual background for all individual factors needed to calculate the annual soil loss amounts with USLE models. This is being done by referring to different case studies as well as widely cited papers of variations of USLE models developed to adapt the model to other regions of the world and improve the model family. The calculation formulas of the USLE factors from those papers are provided in tabular form as well, giving a quick overview of these different approaches. The paper also discusses the limitations of USLE models and points at needed future improvements.

3. General evaluation

Scientific significance

The paper provides a good overview of the topic and goes in depth into the history and motivation of the various USLE models. This is especially helpful for someone just starting with soil erosion modelling. Although mentioned briefly, it is missing a contextualization of USLE models versus other soil erosion modelling approaches.

Scientific quality

While providing a useful overview over widely used USLE models and their respective equations as well as discussing the limitations, it could do a better service of evaluating each of the different approaches as well as USLE models performances in general. What is completely missing is any form of information regarding a validation of model results with measurements. Also the connection to surface runoff and sediment transport is missing completely, a very important part of the whole soil erosion process chain and an obvious weak point of the USLE model family. Related to that, the whole sediment delivery ratio (SDR) concept is absent, while being a necessity for most applications of USLE models that go beyond plot scale. Also the paper needs stronger precision and less vagueness in some terms, especially since the target audiences of the paper are newcomers to erosion modelling.

Presentation quality

The paper is structured well, but is lacking in visual descriptions of concepts and equations and instead relies too heavily on tabular listing of equations. Especially a visualization of the many (linear and non-linear) equations could make each concept behind it more understandable.

4. Specific comments

p. 1, l. 8-10: two minor things, USLE is not necessary the best tool to understand the driving forces behind erosion, due to its dependency on empirical relations and lack of physical based approaches.

Also “effectively manage” is a little presumptuous compared to the little effect some measures actually have when applied (or the little amount of measures that are being enforced in general).

p. 1, l. 23: rather small study cited for such a broad statement. Better or more citations?

p. 2, l. 4-5: “advances in technology” too unspecific.

p. 2, l. 9 + 13: redundant citation.

p. 2, l. 19: average over what precisely, space, time?

p.2, l. 6: contradicting statement regarding sediment transport.

p. 3, l. 10: “things”?! precision please.

p. 3, l. 11: None of the models are being extensively reviewed in this paper, it should be included like the others if this paper is supposed to be providing a complete overview. Also event scale, and the problems with modeling over long-term averages, need to be discussed in regards to the actual processes of erosion.

p. 3, l. 19: As the name suggests (“Universal”), the model in theory was developed for every type of soil, but parameterized for the United States. A noteworthy difference.

p. 3, l. 20: Context of citation should be not in regards to location, but scale.

p. 3, l. 22: first (?) mention of uncertainties with SE models. This needs a more general and honest introduction on its own instead of solely being mentioned at the limitations chapter.

p. 3, l. 22-26: Focus solely on one issue with data (length of data measurements) and is missing more important issues like time step interval length, spatial scale and the amount of variables needed.

p. 5, l. 13-18: noteworthy issue, but should be outside the R-Factor chapter due to its more general nature.

p. 5, l. 23-32: This paragraph reads more like an anecdotal narration of model appliances without any classification or judgement.

p. 5, l. 33-34: This paragraph makes it sound like that’s all that’s needed to go from annual to monthly time steps, that’s a bit misleading.

p. 6, l. 19: Unacceptable figure layout.

p. 11, l. 23-25: How would you test that?

p. 13, l. 20: what is high resolution in this context? Raster cell size is a very important aspect of USLE applications and it’s being tip toed around in most papers, so it would be nice to have specific comment to that in this review.

p. 13, l. 27-29: let’s be honest, that’s the absolute norm in my experience. And that’s why raster cell size or use of a proper LS factor calculation is so important and needs to be talked about more critically.

p. 13, l. 30: sounds good, makes sense, but does it improve the model results?

p. 19: very good and short summary of the P-factor, especially with the mention of using it for scenario analysis.

p. 19, l. 13-18: Would be good to comment a bit more on the values from the cited studies from table 10 in this paragraph as well.

p. 20, l. 1: Is there a citable metric behind the citation amount, or is this the expression of a subjective feeling of the author?

p. 20, l. 7: I think this is quite a significant fact which gets ignored most of the time. This should be the actual most common cited limitation…

p. 20, l 11-16: I get the point and it is correct, but I think it is misleading to divert the uncertainties of the USLE modelling results to the data quality or availability, when it is the biggest reason to use the USLE in the first place, over more sophisticated models. Most uncertainties of the USLE stem from the big division between the model design and the actual processes, even when using high resolution data.

p. 20, l 17+: this is such an important paragraph, it should almost be part of the introduction.

p. 21, l. 24: Grammar.

p. 23, l. 15: very true and should honestly be said much earlier in my opinion.

p. 24, l. 2: while the whole paragraph makes a good point, the mention of those conversion factors seems oddly specific at this section.

5. Additional comments

While out of scope for a literature review paper, it would have been very interesting to see the actual soil loss results from each of the presented models compared in a real world or virtual example. It would be quite eye opening, especially for newcomers to erosion modelling, to see the huge variations of results between some models and compared to measurements.