

## ***Interactive comment on “Assessing the large-scale impacts of environmental change using a coupled hydrology and soil erosion model” by Joris P. C. Eekhout et al.***

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First of all, I would like to congratulate the authors for the effort and dedication developed in this work. Any proposal of erosion modeling that goes beyond the estimation of potential annual erosive rates is an appreciable step forward for the scientific community, managers and, hence, the society. Reading the document has been easy, interesting and instructive to me. My general concerns are the following

1) Studying the configuration of the model, with a clearly hillslope nature, I see its particular strength more related to the temporal scale of simulation, not so much with the spatial scale, and also with the role of vegetation on sediment transport and erosion

C1

processes. That is, both the considered  $dt$  and the adopted spatial resolution with its consequent limitations for the modeling of processes in Mediterranean environments can be justified by the model's ability to generate long time series based on processes and distributed information under different land use or climate scenarios. This is not reflected in the current manuscript and, in my opinion, its limitations are then not sufficiently justified.

2) The limitations of the model have to be declared and analyzed more in depth. Especially, I see problematic the modeling of extreme events, which are important in Mediterranean environments with frequent sub-hour time pulses. What is the implication of the runoff model proposed in the results?, as they indicate a considerable increase in this type of events in the considered future scenario. Has sub-hour rainfall data been analyzed? Could the model be modified to include these cases, ( $\alpha = 1$  at  $t = n$  and  $\alpha = 0$  at  $t \neq n$ ?), I see an attenuation effect by the model for this cases. Also, I see inconsistencies, or I do not understand, the units in this part of the model ( $\alpha$  in  $h^{-1}$ ?,  $Q_{surf}$  mm/day?), please clarify. Another limitation is related to the selected cell size (200m grid size), Why this resolution?. Is it related to the computational cost of the model? (I would like to know something about this issue), or is related to the remote sensing images?. What limitations does this present from the point of view of the observed erosion processes in the study area, the forcing agents and their spatial distribution from the obtained results?.

3) Fluvial vs hillslope contributions: the authors declare limitations of the model for modeling fluvial transport, which, in my opinion, should be assessed in the future from a fluvial sub-model that includes the basic erosion and transport processes (bedload + SS), integrating what that comes from the hillslopes (water and sediment) at different points. However, if I'm not wrong, the calibration/validation has been made from SSY estimated from reservoirs, what fraction corresponds to fluvial/hillslope contributions based on reservoir measurements?, this analysis is important and should be addressed given the process-based nature of the model.

C2

4) Although the document is well written and easy to read, the introduction seems too long and could be summarized. On the contrary, more detailed information about the validation, calibration data, especially of the selected reservoirs (bathymetries, topographies, sediment grain sizes, ...) and SSY assessment is missing. It may be interesting to incorporate a section of uncertainty analysis. Please, check the citation format of the entire document.

In general, I encourage the authors to highlight the most interesting aspects of the model, taking into account the spatial and temporal scales adopted, as well as reasonably stating of the associated limitations in order to evaluate not only the model, but all the related challenges. Some minor comments are reported in the attached file.

Please also note the supplement to this comment:

<https://www.earth-surf-dynam-discuss.net/esurf-2018-25/esurf-2018-25-RC2-supplement.pdf>

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2018-25>, 2018.