Replies to

Interactive comment on “Effects of spatial resolution of terrain models on modelled discharge and soil loss in Oaxaca, Mexico” by Sergio Naranjo et al.

By Anonymous Referee #2

Received and published: 7 July 2021

We are grateful to the comments by the anonymous reviewer, which we largely agree upon. Replies and changes to the manuscript are shown below. Line numbers refer to the version of the manuscript released earlier in reply to the comments by Paolo Paron in June 2021.

Comment #1:

Topical subject as use of UAVs increases, but perhaps a little out of scope for HESS.

Reply:

We believe that soil loss and land degradation as influenced by human activities are central to the scopes of HESS (see website):

"1. [...] continental water in all its phases, including dissolved and particulate matter, at all scales[...]", "3. [...] the study of interactions with human activity of all the processes [...] and the options for influencing them in a sustainable manner, particularly in relation to floods, [...] land degradation […]"

A search on the HESS website for "erosion model" in the abstracts of revised papers and preprints between 2016-2021 gave 1705 hits. A search for "resolution DEM" gave 913 hits, many in context with Sentinel 1 and global models.

In this context, UAV-related methods are only means to address issues related to spatial resolution in erosion modelling.

Comment #2:

Figures OK, but I suggest thicker lines to show the study unit more clearly

Reply:

We agree and have increased the line width in Fig. 2a-e accordingly.

Comment #3:

Quite a big difference in resolution between the UAV approach and information from Modflow. Although only used to set initial condition for soil moisture, it is something stands out for me.

Reply:

Modflow data does not really have a spatial resolution. One can think of it as infinitesimal. It is more like a lookup table where you have a type of soil (texture) and a given land use and the modeling includes every combination plus precipitation and radiation.

Still, we fully agree with our reviewer that differences are significant and we cite three authors (Grum et al., 2017; Hessel et al., 2004, and de Barros et al., 2014), who also found that strong reductions in K_{sat} compared to MODFLOW values were necessary for calibration. We also discuss possible reasons why MODFLOW may overestimate K_{sat} (e.g. crusting, sealing not considered).

We changed the following sentence in line 354 f. omitting the term “slightly”: *This suggests that the model ~~slightly~~ over-predicts infiltration when parametrizing K sat values in normal ranges.*

Comment #4:

Interesting discussion on the bimodal hydrographs and the temporal resolution of the model allowing this to be assessed. I would like to see some reflection of the temporal resulution aspect. 1 min resolution was fixed, but increasing temporal resolution could also be a way of reducing required computer storage and processing time. Isn’t there a balance between spatial and temporal resulution to be found?

Reply:

It is very true that a reduction in temporal resolution could save CPU and storage, and for simulation modelling this would certainly be an important aspect. However, in this study we were exclusively interested in effects of spatial resolution and thus used the highest possible temporal resolution, which was the closest possible to real world field conditions.

We added the following remark in section 3.5 Selection of an appropriate spatial resolution, lines 493ff.: *In this study, the temporal resolution was 1 min, which provided the highest possible temporal resolution in LISEM, coming closest to field conditions. Our purpose for choosing this time step was to focus on aspects of spatial resolution. For scenario modelling exercises, temporal resolution may be reduced to economize computing power.*

Further remark by the authors:

The table “Difference in slope PDF between 1 m and lower resolutions” was indexed incorrectly as *Table 1*. We changed this to *Table 2*.

We added one institution (IFAD) to the acknowledgements section.