Replies to reviewer

Dear Paolo,

many thanks for your very constructive and helpful comments on our paper on all of which we agree and which we addressed as follows:

With respect to your general comment #3) *You don't provide much literature on the UAV aspect. A very important point here is the use or not of ground control points (GCP) in the generation of DEM. What could happen without GCP is the bowl effect which could inficiate the whole experiment. In your case, from a visual inspection of Figure 7a, you have not had this problem.*

Reply: We agree with your observation and added details about how we used GCP and on our PPK correction process, which we inserted, together with 3 references, before Figure 2:

For both flight campaigns, high-accuracy corrections of the geolocation data measured with the UAV global navigation satellite system (GNSS) were calculated in the post-processing stage using the position of a fixed pre-established real-time kinematic (RTK) base station as a reference. Post-processing kinematic (PPK) correction was then implemented during imagery geotagging processing (Benassi et al., 2017; Forlani et al., 2018, Volpato et al., 2021).

Regarding the detailed comments in the attached supplements pdf file:

Line 33: *perhaps a list of acronyms at the beginning would help*

Reply: We have uploaded a list of abbreviations and added the missing explanation (*1 Pg = 1bn Mg)* in the text. The list comes as a separate file, but can be integrated in the main manuscript, if the editors agree.

Line 38: *perhaps some reference would be useful here.*

Reply: Many thanks for your suggestions, of which we added the ones by Batista et al. (2019) and Pandey et al. (2016).

Line 43: *a DTM is not a special case of DEM, it is a different product, or if you wish it is derived from DEM. But this depends on the technique used for data aquisition: if you use LiDAR DTM is directly derived from the filtering of the data, if you use sterophotography then you first generate DEM and then derive DTM*

I would suggest to remove this part of the sentence

Reply: As suggested, we drop the part "a special case of a Digital Elevation Model (DEM)".

Line 45: *which publicly available DEM at 10 m with almost global coverage do you refer to? Both SRTM and ASTER DEMs, are offered at 1 arc-second spatial resolution that is on average equal to 30 m pixel size.*

Reply: True. This should have been 30 m and we changed it accordingly.

Line 48: *better to avoid 'etc'*

Reply: We replaced etc. with "among others"

Line 50: *only for the freely available ones. The commercial sat data reach o.3 of a meter in pixel size.*

Reply: This is probably a misunderstanding as "tenths of a meter" (not *tens*) and "0.3 meter" is not a contradiction.

Lines 54f.: *Reference/s is needed here*

Reply: We added the paper "Resolution vs. image quality in pre-tsunami imagery used for tsunami impact models in Aceh, Indonesia" by Laso et al. 2015, where we discuss resolution in context with LULC images.

Line 77 (caption Fig 1): *the inset with the location of the study sites is not legible and should be presented at higher resolution. Also the labels not in bold are too small and not legible*

Reply: We have changed the font size and symbols accordingly.

Line 81: *as you have added few words explaining the Lepto- and Vertisols, for consistency would be good to add few words also here for the Luvisols*

Reply: We added: [Luvisols (INEGI, 2014)], "soils with Bt horizon of clay illuviation and relatively high base saturation".

Line 85: *what is the meaning of this and the following acronyms?*

Reply: We added an explanation in the text: "Five soil erosion monitoring study units *(SU)* represented the four main land covers (Fig. 1): Forest (SUFO), [...]"; see also list of acronyms.

Line 95: *I would bring table A1 here in the text instead of relegating it in the Annexes*

Reply: We agree and moved the table here.

Line 154: *not cropped*

Reply: Changed accordingly.

Line 156: 65 % lateral (*sidelap?*) and 75 % longitudinal *(frontlap?)* overlaps

Reply: Yes, within low altitude imagery surveys lateral overlap means 'sidelap' and longitudinal overlap means 'frontlap'. We chose to keep the nomenclature widely used throughout the literature and software (see references below) and added *sidelap* and *frontlap* in brackets for better understanding:

https://www.frontiersin.org/articles/10.3389/fpls.2019.00552/full

https://www.frontiersin.org/articles/10.3389/fpls.2021.591587/full

https://www.stars-project.org/en/knowledgeportal/magazine/uav-technology/flight-planning/determining-flight-parameters/

Line 162 (caption Fig. 2): *what is the meaning of the arrow in these images?*

Reply: We added "arrows indicate the main flow direction" to the caption.

Line 193: *what is the meaning of the * in each data input class?*

Reply: The asterisks are just bullet points in an unlucky format. We have changed them to conventional bullet points.

Line 201: *maybe a few words to explain what ROSETTA is would help the reader*

Reply: We agree and added: [...using Rosetta (Schaap et al., 1998)], a software to estimate soil hydraulic parameters [, which required…]

Line 292: *resampled*

Reply: We have added "resampled" as suggested to the caption of Fig 8.

With kind regards,

Carsten Marohn on behalf of the authors

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.