

Interactive comment on “Landsliding near Enguri dam (Caucasus, Georgia) and possible seismotectonic effects” by Alessandro Tibaldi et al.

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Reply to Anonymous Referee #1 We thank Referee 1 for his/her constructive comments. We accepted all of them and changes are detailed below. Also please look at the attached pdf of our updated paper that shows all changes made.

<The geophysical survey is not adapted to the scale of the site – and not this kind of mass movement investigation. GPR is commonly used in paleoseismic studies - where only one fault scarp is analysed. In this context here, it does not provide any useful information and the results are unclear (and even contradictory for one site)> REPLY: Our intention was just to confirm the presence of slip planes with a steep dip at the

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landslide head scarps. Anyway, due to the complex logistical conditions, we were able to make only a few Georadar surveys. Since the investigated depth is very shallow, we agreed to delete all the text and related figures.

<The numerical modelling is most likely not a 'numerical modelling' but just a pseudostatic analysis of stability of a slope section performed with a software. So, these two parts are quite weak (look like results of a contractual study, not of a scientific analysis), while the description of the site, and of the deformation monitoring is fine.>

REPLY: We deleted the word "numerical modelling" from the text. Apart this, we used different softwares and developed three types of analysis: static, pseudostatic, and Newmark. These analyses consider different possible scenarios and have been done along a section trace centered in the axis of the landslide body facing the reservoir (the most dangerous one). Since this is the first time that this landslide is presented in the international literature, and since we had to collect all the relevant data during three years of work (geological, geomorphological, structural, geotechnical, DEM reconstruction incorporating also bathymetric data, etc.) and then develop the various slope stability analyses, we retain that the amount of work is enough for this first preliminary publication. Further modelling with 3D software is underway but it deserves a new publication.

<Also, I do not understand why the HVSR results that should be quite interesting for defining the subsurface structure are not presented (... instead of the relatively useless GPR data). REPLY: Thank you for this useful suggestion. In the new version, we incorporated the results from HVSR analyses, as text and a new figure.

<Then, the discussion is not a discussion but a new part of the paper with additional information - most of which should have been included in the main part of the manuscript. Therefore, my conclusion is that parts of this paper should be dropped or presented elsewhere, parts from the Discussion included in the main part (... establishing a link between local structures and general tectonics).> REPLY: We thank the reviewer also for this comment; we modified the Discussion as suggested, by moving the data on

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local structures and general tectonics in Chapter 2, by moving previous Figure 16 in Chapter 2 (now it is Figure 2), by moving to Chapter 3.3 other data on the height of the head scarps and on the small lake of the eastern landslide. In the Discussion chapters now there is no additional information.

<More detailed comments are included in the attached annotated manuscript.> REPLY: We inserted all the suggestions included in the annotated pdf. Here we detail them:

Figures 3 and 4 <I would use a semi-transparent filled polygon to outline the lake level> REPLY: As suggested, we added a semi-transparent filled polygon (in grey) to outline the lake level.

<Figure 7: Paleo-landslide debris not shown in geological map above> REPLY: Thanks for this useful observation. We added the deposit in Figure 3.

<Aside from the abstract - eastern landslide is not introduced above - especially the geological map should show it.> REPLY: We introduced now the eastern landslide by adding the following section in Chapter 3.1: "This road is also affected by deformations related to the presence of the active head scarps of the two landslides that characterize the opposite slopes of the 9-km-long mountain ridge. The main head scarps of the landslide facing west, towards the Enguri reservoir, is represented in the upper part of Figure 4. The head scarp of the other landslide is represented in the same Figure 4 on the slope facing east.". Moreover, we modified Figure 4 and related caption.

<All the preceding was very interesting - but applying GPR to deep-seated landslide investigation is not very practical - and your results are absolutely not clear. Especially, for the W landslide (Fig 11) I would see a Sackung to the East and not to the West. Your slip arrow is not indicative for the shift of the reflecting layers. On the Eastern landslide some more interesting features can be seen - but here the problem is the orientation of the GPR profile .. in most parts almost parallel to the main scarp and only near the northern end perpendicular to it. This makes interpretation hazardous (unless you have other profiles). REPLY: We deleted all this Chapter 3.4, originally

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devoted to Georadar, and related figures.

Page 17 <On the section they dip to the NE!> REPLY: Thank you, you are right. We corrected this error.

Line 33 at page 17 REPLY: Corrected

Line 34 at page 17 <for which event?> REPLY: Now we added all infos of this event (time, depth, place, et.).

Line 41 at page 18 REPLY: Corrected as suggested.

Line 42 at page 18 REPLY: Corrected as suggested.

Line 60, page 19 < here, I cannot follow anymore - this paper must be understandable without reading other papers. Include results in the annex - if needed. E.g. if there are HVSR measurements - why haven't they been used to establish the model geometry?> REPLY: we rewrote this part of the text in order to make it clearer. We added also the HVSR data.

Figure 12 <here the landslide layer clearly seems to be thicker than indicated in the sections above.> REPLY: Many thanks for this useful comment. We embedded in the previous text an older version of this figure. Now we put the correct figure.

Line 95 page 22 <this part logical as in continuation with the geological-geomorphic analysis - while the geophysical-calculation part is very 'slippery'.> REPLY: as mentioned before, now we improved the description of geophysical calculations.

Discussion < this is not discussion - here, you present new information ... present a geological section at a scale that has nothing to do with the site scale ... here, a total restructuring is needed.> REPLY: As already replied before, we moved elsewhere the new data from the Discussion. Now the Discussion does not present any new information, apart from referring to literature as usual.

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Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-186/nhess-2018-186-AC1-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2018-186>, 2018.

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