Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2018-153-AC3, 2018
© Author(s) 2018. This work is distributed under
the Creative Commons Attribution 4.0 License.

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Geophysical and Geodetical Investigation of A Landslide Area (Koyulhisar-Sivas, Turkey)" *by* Sevda Özel et al.

Sevda Özel et al.

svd.zel@gmail.com

Received and published: 28 September 2018

REVISIONS Dear Editor

I rearranged and revised the comments and correcitons for the article. I submitted the article.

With kind regards, Sevda Özel Corresponding writer

RESPONSES:

10 and 10-11 I removed "basically" I added "(SRT-seismic refraction tomography, GPR-ground penetrating radar) and geodesic (GNSS-global navigation sattelite system)" and "of investigation depth three layers."

Printer-friendly version

Discussion paper

12 I removed “has understood” and I rearranged as “was determined”

15-. . .-21 and 22 I rearranged “Furthermore, in geophysical sections, it was determined that the depth of the sliding surface which is the upper limit of the bedrock varies between 7-10 m. The geophysical results permitted to identify the landslide type as planar sliding, with the sliding direction in S-SE, and the tilt of the layer being orientated in the same direction as the topography slope (mostly bigger than 5°). In addition, according to geophysics and geodetical results, it was observed that the deformations in the landslide mass were occurred from the geological unit, the layer or topography slope, and precipitation. Therefore, it was thought that landslide activity may continue in the study area. These results were showed that precipitation and deformations within the layer can be effective in triggering the landslide in the future. Therefore, the study area contains the risk and the natural hazards, and these threaten the settlement area and the buildings and other constructions there.”

For 24-...-31: I rearranged. 24-25: I deleted this sentence 26: I rearranged “mass movement” and “effective” 27-28: I rearranged “The Koyulhisar landslide area is one of the most important large landslide areas in the country and mass movements there typically occurs in the form of debris or mudflow (Tatar et al., 2007; Duman et al., 2005).”. 29 and 29-30-31: I rearranged and I added to the references, as “. . .and for the past 17 years, there has been observed an increase in landslide activity (Tatar et al., 2007; Över, 2015).” I wrote it as the first sentence to in the “introduction section”. “A landslide is a mass movement and can occur in the different forms. Koyulhisar landslide area, the subject of this article, is one of the largest landslide areas that significantly lead to serious loss of lives and property as in throughout Turkey.” 36-37-38: I rearranged “In addition, researchers ...”

For 24-...-58: I rearranged. 42-43-44: I removed this sentence. 44-...-50: I rearranged “The triggering mechanisms of landslides are often complex and further understanding is needed to facilitate the prediction of mobilizations as well as adequate stabilization and remediation measures. Therefore, it is important to investigate the reasons that

CC BY

affect the formation mechanisms and the formation of landslides. Different engineering (geology, geophysics, geodetic, etc.) disciplines have great role and importance especially in decreasing the landslide effects. They can help to prevent damage by prediction and early warning. In this context, Koyulhisar landslide area was examined in a wide area with detailed GNSS (Global Navigation Satellite System) methods and the studies of other disciplines (geology, chemistry, seismology, meteorology, remote sensing) (Sendir and YÄślmaz, 2002; Tatar et al., 2007; HatiboÄ§lu, 2009; HastaoÄ§lu and ŞanlÄś, 2011; YÄślmaz, 2009; HastaoÄ§lu, 2013; Türk, 2013; Topal and HatiboÄ§lu, 2015; HastaoÄ§lu, 2016).” It is not a reference “HastaoÄ§lu, 2015”. So I removed this reference. It has been forgotten. Because, this reference is a project report and it was HastaoÄ§lu, et al. (2015)”. 51: I remowed “In this studies”. I rearranged “It has been determined that ...” 56-57-58: I split up the references and I rearranged “These studies are in geology, tectonics (Toprak, 1989; Uysal, 1995; Sendir and YÄślmaz, 2001; Sendir and YÄślmaz, 2002; YÄślmaz et al., 2005; GökçeoÄ§lu et al., 2005b; Demirel et al., 2016; Demir, 2018), and geotechnics, geomatics/remote sensing, geochemistry and geomorphology (Toprak, 1989; Uysal, 1995; Duman et al., 2005; Ulusay et al., 2007; HatiboÄ§lu, 2009; YÄślmaz, 2009; Demirel et al., 2016; Demir, 2018).” 58-...-61: I rearranged “The results of all these studies have been associated with geophysical results at the interpretation stage in this article and the geophysical studies were carried out for a limited area being the subject of this article and had the distinction of being the first geophysical studies.” Contiune... 62-...-65 I linked as “In the geophysical study, the hazards that would be caused by the landslide geometry of the last section in the close south of Koyulhisar landslide area and would affect the settlement area were investigated (Fig. 2 and 9)”

69 and 70: I rearranged “...preferred methods in landslide studies. The structural geometry of the landslide area was delineated based on an interpretation of the collected geophysical data.”

70-71: I deleted “with appropriate software” and I rearranged

CC BY

71: I rearranged “tilt and direction of the layers”. I have observed by looking at the two dimension parallel profiles (like three dimensional).

75: I added “. . .„Hu and Shan (2016), Su et al. (2016) and (Popescu et al. 2016)”

83: I rearranged “bedrock depth or sliding surface depth”

87-. . .-99: I added to “However. . . and “In this article, these issues were examined and discussed separately and together with geophysical and geodetic results.” 122-. . .-128 and 128: I removed this paragrphy and I added “However, HatiboÄ§lu (2009) and HastaoÄ§lu et al. (2015) generally observed two geological units in the drillings in the study area. They observed that the upper unit was silty sandy clay and sand interbedded silty clay in some places up to about 10 m, and advanced as sand interbedded silty clay and sand interbedded clay in some places towards deeper than 10 m. The first unit consists of light-dark brown colored, medium-very stiff, low-high plasticity, silty clay. The second unit consists of light-yellow white colored, low-high plasticity, silty sandy clay interbedded with sand (HastaoÄ§lu et al., 2015). When the drilling logs are examined, there is generally the second unit in east of study area (HastaoÄ§lu et al., 2015). Furthermore, it was observed that the content of the second geological unit did not change even if the depth of the drilling increased. Therefore, the second geological unit was taken into consideration in the interpretation of geophysical sections.” I added to the references “HastaoÄ§lu et al. (2015)” and it is “HastaoÄ§lu, K. Ö., Türk, T., Koçbulut, F., BalÄśk ŞanlÄś, F., Poyraz, F.: “GNSS ve PS-InSAR Yöntemleri KullanÄślarak HeyelanlarÄśn Ärzlenmesi ve Afet Bilgi Sistemi TabanlÄś Risk Analizlerinin Gerçekleştirilmesi: Koyulhisar (Sivas) HeyelanlarÄś” Final Report, TÜBÄřTAK Proje Number: 111Y111, www.tubitak.gov.tr, Turkey, 2015 (unpublished).”

131-...-134: I rearranged “The SRT and GPR methods which are applied in tomography format were used in the geophysical study. The high-frequency electromagnetic waves can reach deeper in the environments with low conductivity like sand. However, the conductive units such as clay and shale decrease the penetration depth of the signal

CC BY

transmitted and lead to absorption (Annan et al., 1988; Davis and Annan, 1989). Firstly, SRT and GPR data were collected along multiple transects in two different areas of the study area named A and C (see Fig. 2)" I added to references "Annan et al., 1988."

139-140: I deleted this sentece.

140-141: I removed and I rearranged "The profile shooting technique in the field, hammer and iron plate of 8 kg weight as the source P geophone of 14 Hz (the total number of geophones is 12) and Geometrics branded seismic device as the receiver was used while collecting the SRT data."

146 and 146-. . .160: I rearranged

161: I rearranged "Results and interpretation"

162-. . .-164: I rearranged

164-165-166: I added "geophysical survey"

168: I rearranged and I added""geophysical survey".

176: I wrote "500"

180-. . .-209: I rearranged 180-181: I deleted this sentences 185: I deleted "On the other hand" and I rearranged 186-187-188: I rearranged "Results and interpretation"section 192: I rearranged "Results and interpretation-GPR:"section. 194-. . .-198: I rearranged "Results and interpretation-GPR:"section. I removed this sentences and I added to "conclusion" section 199: I rearranged "Results and interpretation-GPR:"section. 200-. . .-203: I added to "methods" the sentences and "Annan et al. reference 203-. . .-206: I added to "geology" 208: I rearranged "Results and interpretation-GPR:"section.

215-216: I recorded this data from the internet in 2016 and I controlled again on 2018 this data. There was only data until 2015 on web page. Therefore, I wrote this reference as "(UDÄřM, 2016)".

CC BY

259-...-262: I rearranged

264: I rearranged “Geodetic surveys and results” section

273: I rearranged

277: I rearranged Fig. 10

289: I controlled

294-...-297: I rearranged

321: I deleted “provide” and I wrote “show”

326-327-328: I rearranged “On the other hand, it was thought that studies such as blasting and excavation performed by human intervention can trigger the landslides due to geologically loose unit and hence the landslide area can a potential area which is open to natural/artificial hazards. I rearranged “conclusions” section.

Comments on the figures Response for Figure 4 I have tried. But, its image wasn’t good.

Response for Figure 7 I wrote “Geology and Methods” section. I arranged Figure 8, added “Results and interpretation-GPR” section and interpreted “Results and interpretation-GPR” in section

Response for Figure 8 and 10 I rearranged Fig. 8 and 10. I named as Fig. 9-10-11 all of them -the figures after Fig. 8. I rearranged the figure numbers in the article text. Other corrections:

I controlled and rearranged “References” section

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-153, 2018.

CC BY

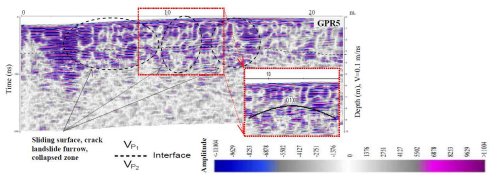

Figure 8. EM wave velocity calculated for reflection surface in GPR5 in the C-east area cross section as representing all the GPR profiles.

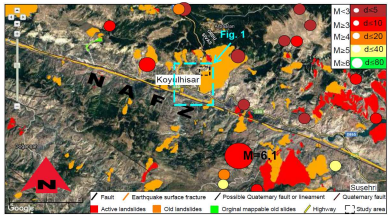

Figure 9. Seismic activity of the study area and its surroundings by the data between 1900-2015 and the landslide areas (UDIM, 2016; MTA, 2018).

Fig. 1.

CC BY