Solid Earth Discuss.,
https://doi.org/10.5194/se-2019-22-RC1, 2019

Solid Earth
Discussions

Interactive comment on "Subsurface structures of a quick-clay sliding prone area revealed using land-river reflection seismic data and hydrogeological modelling" *by* Silvia Salas-Romero et al.

Anonymous Referee #1

Received and published: 27 February 2019

SUMMARY

The paper attempts the challenging task of integrating a large collection of geological and geophysical data to derive new insights on landslide formation in quick clays for a specific study area. Primarily using seismic reflection data, the study results in the mapping of the bedrock surface, and an overburden aquifer that may be associated with quick clay formation and landslide activity. However, the paper is poorly organized to the point that the results and their importance are obfuscated.

In particular, the authors do not clearly distinguish between established data and interpretation, and the links between the observed data and the process-based conclusions are not effectively demonstrated. The paper would be more impactful if, for example, the authors succinctly identified previously-published data and interpretations, and then demonstrated how new data and insights build on past knowledge to support their objectives. In this fashion, more focus could be placed on the novel aspects of the paper including the hydrogeological modelling, and testing the hypotheses (or supporting the interpretations) of aquifer-driven leaching and sliding mechanism.

Some editing for English is required throughout the paper.

DETAILS

p2,L2: Revise sentence.

p2,L4: Reference required.

p2: Consider revising/restructuring the introduction to improve focus and logical flow of ideas. Focus switches from geophysics to hydrogeology to site specific conditions all in the same paragraph without any transitions or linking of ideas.

p3: Consider reorganization of material into separate "Intro" and a "Study Area" sections. Geological maps, shot locations, and LiDAR data are not really introductory material. Clearly differentiate between legacy data, and new data. It is not apparent what the new contributions are.

p3,L13: The slide is of interest because it is in the middle of the study area?!

p.3,L27: Is this the hypothesis being presented? The objective of the paper is not yet clear at this point.

p.4: If all of these data sets are legacy data sets, they should be well described in the cited references. Much of this information does not seem necessary to support the objectives.

p.7: Velocity analysis was the "most important step" but receives less discussion than routine operations. How does the time-depth conversion velocity compare to the results of the velocity analysis?

p.7,L32: What is the nature of S1? In particular, does it have finite thickness relative to the wavelength? You refer to it as a layer, an interface and a horizon. How are you picking it? Because it could be interpreted as a compacted top of a reflection package, which seems to be supported by the mag. suc. that increases below S1 and stays high. More discussion of the interpretation logic and reflection facies is necessary. Core?

p.8,L19: If there is core, how come lithological logs are not part of the analysis?

p.9,L32: It looks like a decrease in penetration resistance.

p11,L6: The landslide scar is not apparent in Fig.11.

p.11,L11: The paper seems to have been comparing previous studies the whole time.

p.11,L15: It is unclear how this proposed mechanism works with infiltration "through outcrops and fracture zones" and how this is related to the coarse-grained layer. Consider more development of the hydrogeological conceptual model, and then provide supporting evidence.

p.11,L25: This is well below your quoted resolution. You have not show any frequency spectra, but it is likely well below quarter-wavelength as well.

p.12,L13: Where are the total sounding data with top and bottom of S1? The nature of S1 and the coarse layer (deposition, thickness, etc.) has not been discussed up to this point.

p.12,L13: Where are the data that go into this most important interpolation? How are you handling the multiple interpreted faults?

p.13,L13: There are more boreholes in Fig.2b than in Fig.14. Need to distinguish water wells from other holes.

p.13,L14: It is hard to tell from the figure, but it appears that 3 of 7 boreholes in the model domain (excluding the southern holes) are not fit by the model. This is a lot, and is attributed to "only one measurement" but these holes have not been distinguished from any of the other holes (do they have two measurements?) and the possibility of the model simply being wrong needs to be addressed. Consider presenting and discussing water well data.

p.13,L32: This needs to be explained.

p.14,L5: Explain this. You have "calibrated" the recharge area and the recharge transmissivity which will have a direct trade-off with the required recharge. The modelling requires some sensitivity analysis.

p.14,L8: What data?

p.14.L17: Groundwater velocity of 0.00015m/s or $\sim$13m/day is very fast.

p.14: Consider showing and analyzing the mag data with the rest of the data in the data section as opposed to in the discussion section.

p15,L21: Should be easy enough to test with a multivariate regression of mag, T and depth - or some combined variable of T and depth.

p.17: In my opinion, many of the conclusions from L16 down (and in the abstract) remain conjecture. The catchment area is prescribed without validation, it is not clearly demonstrated that there is aquifer-driven leaching, or that the coarse layer is a sliding surface, and the nature of the mag. anomaly is an interpretation.

Fig.1: Demonstrate value of this figure.

Fig.2: Shorten caption. Do not repeat what is stated in the text or what is evident from the figure (such as the legend). Improve figure clarity. Much of the text and symbols on the map are not easily legible.

Figs.3&4: Remove repetitive material from captions.

Figs.5&6: The captions are far too long and complicated. The borehole logs require scales and labels (other figures also).

Fig.12: While visually impressive, perspective images are not good for evaluating interpolated surfaces, particular with respect to potential bias introduced by spatially non-uniform data such as sparse boreholes combined with dense points along seismic lines. Contour plots should be used for analysis. What about coarse layer thickness?

Fig.13: b and c add nothing.

Table 2: For all but the LiDAR perhaps, these values are nominal resolutions, and the spatial sampling interval is not indicative of the resolution.

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2019-22, 2019.