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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The influence of soil on the impacts of burst water mains on infrastructure and society: A mixed methods investigation" *by* Timothy S. Farewell et al.

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This manuscript investigates the consequences of burst water mains for society by means of a mixed methods approach. The topic of bursts in water mains is an interesting issue of cascading events and their consequences for society. The manuscript is clearly written. I think the manuscript would benefit from some reframing of the hypotheses and improvements in the presentation of the data and results. Also, if possible, some further analysis and discussion of the results would be appreciated to make sure the manuscript really adds to the existing literature. After revisions I think the manuscript is suitable for publication in NHESS. In the following sections I first present

my main comments, followed by some minor issues.

Main comments General framing: The manuscript is currently presented as a scoping study which has two, very distinct hypotheses which require very different methodologies. On the one hand it is said that the authors want to investigate the relation between soil texture (sand) and the frequency of cross-infrastructure failure. On the other hand they want to test and evaluate a mixed methods approach for this kind of studies. I think these two objectives are too different to fit into one research paper, and certainly so if this research paper does only present the result of a scoping study. The current analysis does not test the second hypothesis. I therefore suggest dropping this second hypothesis and just mention that the purpose is to investigate the influence of soil on the consequences for society by combining different methods. Doing so the manuscript illustrates the value of mixed methods approaches, but does not test a hypothesis as to whether a mixed method is better or worse than another approach. It still allows you to discuss the merits of such an approach in the discussion and conclusion of your research paper.

Alternatively, the objective could be to investigate the value of a mixed method approach to study this kind of things. The technical analysis of the correlation with soil can then be presented as one of the different methods or as a case study.

It would be good if the objectives and research questions were made explicit. Now, I did only find the hypotheses and had to deduce the objective of the manuscript from it myself.

Introduction

Page 3, line 15: How is this hypothesis tested? By presenting this as a hypothesis it is suggested that the value of this approach will be tested. That is currently not being done.

Methods

Page 3, line 19: I would appreciate a section on the data, or more information on the data at least. How many bursts do you have for your study region (on the map we currently only see those that have led to a cascading event)? How many of these are in sandy soils? What percentage of those that are not on sandy soil have led to cascading events? This comment also holds for the news items. You mention 30+ reports, but is this for 30 different events? How many of these were on sandy soil?... After the section 'methods' I remain with the question whether you have information about all bursts or only about those that led to a cascading event. Do you not have a problem of selection-bias in your sample (eg soil types that have a better water evacuation not leading to cascading events being underreported in the number of bursts)?

Page 4, line 5: I am a little surprised about this sand map. First, at several places in the manuscript it is mentioned that a soil map was created (abstract, or page 20, line 2), while I guess soil maps were already existing. For this manuscript a reclassification of soil groups was just ran based on sand content. I might be wrong, but this does not seem very new to me and it shouldn't be presented as a main contribution of the manuscript. The manuscript makes other contributions. If more than that was done, this should be mentioned here.

Page 5, line 2: It is mentioned that for consistency sand content at 80 cm depth was used. But were other depths also tested during robustness checks? In other words, are the results robust to alternative classifications of the sand map? If so, please mention this. If not, in the discussion please elaborate on why this is not the case and explain why 80 cm depth is the most relevant depth.

Page 5, line 8: As mentioned earlier, I find it hard to understand and evaluate this section because I do not have a clear overview on the data that were used. Why was it chosen to limit method 1a to Lincolnshire only?

Page 5, line 22: It is not clear to me how the road can be improved by a burst water main. Except due to good reparation of the road.

This section (as well as the section on page 6, line 11) also causes some confusion to me because it reads as if changes in RCI were used to identify bursts of water mains. From later sections I understand that information on burst water mains is available from other sources as well, but I think that this section (page 6) should be rewritten.

Page 7, line 3: What about the directionality of causality here? How can we know that it is the previous burst that causes the next one, and not a common cause, like for example pipes being old, or slow onset landslides? This could be a problem inthe current approach.

Page 8, line 1: Like for the two other methodologies, it is important to mention the sources of information here. How many workshops were held, with how many participants? What were their roles and functions and what is the gender balance? Which questionnaire, or form to guide the discussion, has been used? Could this form be added to the appendix?

Page 8, line 6: Did you do these workshops before or after the previous analyses? I.e., did you yourself already have information about the topic during these interviews? How did you make sure not to influence the outcome?

Page 8, line 9: What is meant with a 'thematic analysis'? How was this analysis done? More care needs to be given to the collection and interpretation of the data if social sciences methods are to be used.

Results and discussion

Given the current objective of this manuscript (i.e., the second objective being to test whether a mixed method has an added value), in this section I would not present the results of all methods confounded because that prevents us from appreciating and evaluating the added value of a mixed method approach. I would start by discussing what was learnt from each of the methods, then what would be missed out if the other methods had not been used. Then discuss your overall finding from the integration

of the different methods and use this as an illustration of the value of mixed method approaches.

Page 8, line 16-line 24: Some of these would better fit in the materials and methods section, I think. These lines are still providing information necessary for the interpretation of the results, not yet the results themselves.

Page 9, line 6: It is not clear to me why different scales have been used for the different methodologies. If this one is over whole of England and Wales, why is the other only on one tiny subsection? Please discuss how the difference in scale has a consequence for the comparison of the different methodologies.

Page 12, line 5: Could it be that what is actually measured here is the quality of the reparation works, rather that the impact of the bursts? What is the relevance of this? Wouldn't it make more sense to use municipal data on the costs related to reparation works as a measure of the impact? Secondly, I am not sure about how the spread in road quality after a burst in sandy soils indicates that greater remedial work is required... Also it is not clear whether the difference in spread is significant.

Page 13, line 2: It is not clear to me how you come to this. I think that from the data it is not possible to conclude that the roads are being repaired to a lower standard. the averages did not differ. To my understanding, the following result is also not warranted by the data: "Trenching will also provide preferential hydrological pathways for water compared to the surrounding ground.". How has the analysis led to this result?

Page 14, line 1: It is not clear whether this has been observed in the study, whether it comes from other reports or whether it was mentioned during the workshops. Also the added value to the study is not clear.

Page 14, line 18: I think the findings in this section are worth further elaboration and further study. This could be an interesting added value to literature!

Implications:

Page 18, line 19: To me, it seems that a qualitative assessment was done of the impact, rather than a quantitative assessment.

Minor issues

Title: I would slightly change the title, because its current form is not easy to read. By writing "the influence of . . . on . . . of . . . on . . ." it is not immediately clear the influence of what on what is being studied. After rereading it is clear that you measure the influence of soil on the relation between burst water mains and consequences for society, but this should be clear from the start.

Page 2, line 10: I would appreciate additional explanation for this term which is new to me: "siloed approach".

Page 2, line 21: I am not sure whether this paragraph perfectly fits here. Maybe move it up, just before previous paragraph.

Page 2, line 27: Add apostrophe: organisations'

Page 3, line 13: While I am not an expert in this, I am surprised by this first hypothesis. I would expect a sandy soil to be more porous to water, thus more easily evacuating leaking water and less likely to cause cascading events.

Page 6, line 7: I don't understand what is meant with "To mitigate this spatial inaccuracy, a count of these polygons was used in this context simply to calculate a change in condition."

Figure 4: Please mention total amounts somewhere, not only rates. Also report confidence bars in two subgraphs. In the caption, mention which of the subgraphs is national A, B and unclassified.

Page 13, line 22: (300, 400, 800 homes in media reports) = What is meant by these numbers and could it be possible to add a reference?

Page 16, line 3: "A large water company invested a large amount of money cleaning

sand from the sewers in Lowestoft, only for the sewers to fill up with sand again following the next storm surge." This is an interesting fact, but it doesn't seem relevant for the case study at hand.

Page 19, line 6-9: It is also not totally clear to me how this information helps us to test the hypotheses that were proposed in the introduction.

Page 17, line 17: "This research identified mixed levels of awareness of sand washout risk from infrastructure operators." This is an interesting finding, but it seems to fall outside the scope of the objectives of the manuscript, I think.

Page 18, line 1-2: I wonder, after this study, whether you could say whether it is worth, from a cost-benefit point of view to collect such detailed information?

Page 18, line 31: This was not totally clear to me from the results.

Page 19, line 15: The study did not focus on the UK, but on a much smaller area, I think.

Page 20, line 2: No soil maps were created, to my knowledge.

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