Interactive comment on "Citizen observations contributing to flood modelling: opportunities and challenges" *by* Thaine Herman Assumpção et al.

Thaine Herman Assumpção et al.

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SC1: The review of how citizen observations have been used in flood modelling research is useful and very timely. The main value of the review is in mapping out the different case studies, identifying trends, and pointing out research gaps. Minor revisions are recommended:

AC: Thank you for finding the paper timely and for the appreciation of the review paper. Authors would like to thank M. Moy de Vitry for taking time to review the paper and add to the ongoing discussion. The comments and suggestions received are of high value, and based on them we will make improvements to the manuscript. Please see below the answers to the comments.

Page 1 line 27:

SC1: Do the authors refer to the general need for data in modelling, or specifically to monitoring data used for calibrating the models?

AC: Authors are referring to general data needs for modelling floods, no special distinction for calibration is made. Thank you for pointing out the confusion. In order to clarify this issue to the reader an additional statement will be added to the manuscript (the added text is highlighted in bold):

"In order to have adequate representation of floods, most models require large amounts of data, **both for model building and model usage.**"

SC1: The example in the second sentence "This is especially true.." requires some explanation.

AC: More explanation will be added, by rephrasing the sentence (in bold):

"This is especially true for pluvial flood modelling **, where flooding may not occur in gauged rivers and hence, flow gauging stations outside of flooded zones may be of little use.**"

Page 3 line 26:

SC1: Effort is made to present two classification systems. However, these classifications are not used in sections 2 and 3.

AC: These classifications are not introduced for the purpose of further classifying other papers, but for opening the discussion and debate on the existing reviewed literature. The first classification system (i.e. level of engagement), aims to explicitly say that discussion on advantages/disadvantages of collection/analysis methods, as well as their purposes, is strictly addressing contributions in terms of quantitative data (i.e. contributions towards flood modelling); and it does not address the advantages/disadvantages

of contributions from other types of involvement. For example, it is out of the scope of the article to discuss tacit knowledge or social media mining having the (possible) disadvantage of not fostering awareness. For further clarification, the next version of the manuscript will be amended with the following text (the one highlighted in bold):

"The aim of the review presented in this current article is focused on the contribution towards flood modelling only, coming most prominently from the two lowest levels of engagement. **We do not discuss topics related to engagement in the generation of (quantitative) data.**"

The second classification system was made to provide a reflection of such components (implicitly/explicitly geographic and implicitly/explicitly volunteered) when data is obtained from citizens. Based on this and a follow-up comment, we will add a Figure where we place on the framework the studies cited in this paper; and we will provide an analysis of such result.

Page 4 line 10:

SC1: It is unclear why geo-tagged information is not explicitly geographic.

AC: For clarity, in the beginning of such paragraph the following phrase will be added (in bold):

"Another way to classify citizen science initiatives (within the context of VGI) is by setting them as implicitly/explicitly volunteered and implicitly/explicitly geographic (Craglia et al., 2012). **In this classification system, geographic refers to the main information conveyed through the contributed data, therefore, geo-tagged data is not necessarily geographic.**"

Page 4 lines 15-20:

SC1: It does not seem appropriate that SCENT is given a prominent position in this

review paper, which should review published literature and not ongoing projects.

AC: As mentioned in the acknowledgements, this review and research related to it are supported by the H2020 project, SCENT. Therefore, it is natural that the ideas generated within the project, which aims at covering scientific gaps, are properly acknowledged in the paper text as well. The inclusion of SCENT has as objective to illustrate the classification system, taking advantage of the fact that in the project the four classes are being covered. For clarity, it was not chosen to include published literature in this part of the article without analysing it first. As per suggestion of the reviewer, we will present the same scheme later on, where such literature will be included.

Page 5 Figure 2:

SC1: Fig 2 illustrates nicely how specific examples are classified within Craglia et al.'s definition, and therefore more examples would be beneficial. It would be even better if the examples were taken from literature.

AC: Thank you for this suggestion, we will take it into account and expand in the second version of the manuscript.

SC1: SCENT should be removed from the figure.

AC: The justification of SCENT's inclusion in the figure has been provided in a previous comment. This figure sets the scene for the second one that will be added based on the reviewer's suggestion.

SC1: it is unclear why the CAPTCHAs are neither implicit nor explicit.

AC: In the image CAPTCHA plugin is both implicit and explicit. The text will be modified for clarification (in bold):

"It lies in the middle of this quadrant as it encourages citizens to participate in gaming to

collect land cover/use data, in field campaigns to collect other implicitly geographic information (e.g. water level), and also aims to obtain implicitly volunteered contributions through a CAPTCHA plugin, in which citizens tag images **, e.g. of land cover/use or water level,** in order to access online content".

Page 6, lines 1-2:

SC1: Have studies such as Merkuryeva et al. (2015) been included in the review? please specify.

AC: No, they have not been included. The text will be modified for clarification (in bold):

"It needs to be noted that there are studies **that were not included in the present review because** they just mention the use of crowdsourced data and do not provide more relevant information on collection, analysis and quantity of data, such as Merkuryeva et al. (2015). **The same is the case of** studies that evaluate variables qualitatively, in ways that cannot be directly associated with modelling (Kim et al., 2011)."

SC1: The citation is not necessary.

AC: We acknowledge that the citations do not serve a purpose other than being examples. However, as a review paper, we consider that different aspects of the literature should at least be exemplified, in a way that the interested reader may wish to explore topics not covered in the review.

Page 6, line 18-20:

SC1: It is unclear why the text example is provided in the same paragraph as the images/videos and not in the previous paragraph.

AC: Thank you for bringing up this misunderstanding. The text examples are related to non-quantitative text that is converted to quantitative measures. As the section's first

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paragraph is about quantitative crowdsourced data and the second is about qualitative ones, this information fits better in the second paragraph. For clarity, the paragraph will be rephrased as follows (in bold):

"In other cases **, the citizen provides qualitative data that will be compared to references by researchers**. Mostly during flooding situations, citizens provide pictures (Fohringer et al., 2015; Kutija et al., 2014; Li et 15 al., 2017; McDougall, 2011; McDougall and Temple-Watts, 2012; Smith et al., 2015; Starkey et al., 2017) or videos (Le Boursicaud et al., 2016; Le Coz et al., 2016; Michelsen et al., 2016). In the case of pictures/images, the water level is compared with objects in the images that have known or approximately known dimensions. For videos, although water level was estimated, the main goal was to obtain discharge values, via estimates of flow velocity. In two cases, texts from citizens were used **(e.g. water over the knee)**, to **calculate** water level values or assuming a certain value when no value was provided (Li et 20 al., 2017; Smith et al., 2015). This sort of data (text, pictures and videos) was mostly collected through social media and public image repositories, requiring mining of the relevant material and dealing with uncertainties in the spatio-temporal characterization of the data of interest."

Page 7, Table 1:

SC1: It would be good to split the column 'case study' into two columns 'location' and 'flooding type'

AC: The columns will be split and studies with flood-related crowdsourced but without floods will be classified as 'No flooding'.

SC1: What ordering is used in the table? publication year might make sense.

AC: The ordering used in the table was done by grouping papers with similar measurement/analysis methods, followed by the order monitoring, mapping and modelling.

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This is similar to the way the analysis is done.

Page 12, Figure 3:

SC1: The review extends to April 2017 - has the publication count for the year 2017 been normalized?

AC: No, it has not been normalized. We understand your reasoning, but our focus is on the content and interpretation, not on a precise, numerical analysis of the contributions. Thus, because of the small numbers of contributions per type of publications, for simplicity, we decide not to normalize.

Page 13, line 7:

SC1: Flickr and Picasa are products, it is better to refer to photo sharing services.

AC: We will change to the proposed terminology.

SC1: what is exactly meant with 'mining', and how does that entail low-quality data?

AC: Mining refers to the extraction of specific data from a dataset. For example, tweets can be mined from Twitter for a certain period of time and for tweets that contain the word 'flood'. We will expand the first appearance of this term to include such qualification and make it clearer (page 6, lines 20-22, in bold):

"This sort of data (text, pictures and videos) was mostly collected through social media and public image repositories. **Gathering data from such sources requires** mining of the relevant material **(i.e. extraction of specific data from the overall dataset)** and dealing with uncertainties in the spatio-temporal characterization of the data of interest."

Crowdsourced mined information has the possibility of not having a precise time-stamp

or geotag. Thus, there is uncertainty related to it. We consider that the higher the uncertainty, the lesser the quality of the data.

Page 18, lines 19-25:

SC1: The discussion on reliability and volume of data is interesting and necessary, but the statements do not seem to make good of the review that was conducted. Do none of the papers attempt to quantify uncertainty?

AC: Yes, some of the papers do. We will expand this discussion to include more information.

SC1: Is the volume of data per type (water level, velocity, etc.) available comparable to the number of case studies?

AC: We have not computed the volume of data for each data type. At the moment we estimate that they are directly proportional to the number of case studies. Unfortunately, it is not possible to get the exact number as in some cases more than one variable is collected and no distinction in the overall count is provided.

Page 19, lines 20-26:

SC1: The language used is imprecise.

AC: The language will be rephrased. See below.

SC1: "interactions between citizen science and water resources"

AC: Will be rephrased as (in bold):

"There are aspects of **the integration of crowdsourced data in flood modelling** that are still challenging."

SC1: "Deal with uncertainty"

AC: Will be rephrased as (in bold):

"**Quantification of** uncertainty"

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