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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Going beyond the Flood Insurance Rate Map: insights from flood hazard map co-production" *by* Adam Luke et al.

Adam Luke et al.

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Comment 1: My only (moderate) remark is the lack of a discussion regarding the uncertainty of flood hazard maps and how uncertainty can be communicated to end-users. At page 20, lines 10-12, the Authors state that "... flood probabilities and corresponding frequency are inherently uncertain...". While I fully agree with such a statement, the same can be said for all the hazard variables included in flood hazard maps. To give an example: even if the use of historical flood events as reference may reduce uncertainty, not all the original boundary conditions may be determined with precision (e.g. river channel morphology or rainfall distribution). Please note that this is not a criticism to the methodology, which is in my opinion up to the current state of the art. However, it would be interesting to know how the accuracy (and the uncertainty) of the hazard

maps is perceived by end-users: For instance, what is the precision assumed by end users for the numerical variables (e.g. +/- 10 cm for flood depths)? Does this value agree with the precision expected by the Authors? How did the Authors communicated the assumptions used for flood simulations? If these topics were not addressed within the focus groups, maybe the authors could still include them in the discussion.

Author's response: Thank you for commenting on this important issue. While we did not explicitly address this issue in the focus groups, the discussion now includes a paragraph on uncertainty and the conclusion section has been updated as follows:

Author's Changes to Manuscript:

Expanded discussion (insert at line 14, page 20 of original submission): Indeed, all hazard variables illustrated in flood maps are inherently uncertain, however it is remarkable that perhaps the most uncertain and complex characteristic of floods is also the primary descriptor.

Uncertainties associated with flood mapping products are rarely quantified let alone communicated, and in this study, we did not address the important issue of communicating uncertainty in flood maps to end-users. In one of the few studies that has explicitly addressed communicating uncertainty in the FEMA FIRMs' floodplain boundaries, Soden et al. (2017) showed that providing end-users with contrasting information (i.e. the 1% AEP flood extent versus an observed flooding extent) led to important flood hazard discourse and curiosity regarding flood mapping methodology. While it may seem counterproductive to purposefully expose the limitations of floodplain delineation, such innovative communication strategies force end-users to confront the deterministic standards that our institutions require for regulatory purposes. Confrontation with the limits of science promotes contemplation and is certainly worth further investigation in the context of flood hazard mapping and communication.

Reference to uncertainty in conclusions (insert at line 15, page 22 of original submission): Online formats offer the opportunity for causal experiments - do different hazard

variables make a user more (or less) likely to seek vulnerability reduction measures? How do different presentations of uncertainty in mapped data influence end-users' desire to seek further information? These questions could be answered with so called "A/B" testing, where subjects are presented different web pages and their interactions on the web site are recorded.

Comment 2: What is the extent of the two areas analyzed in the paper? Does the extent correspond to the areas shown in Figure 1A and 1C, or are these just a sample of the areas?

Author's Response: The extent of the area analyzed in the paper includes the Los Laureles catchment in Figure 1A and the Tijuana River Valley shown in Figure 1C.

Comment 3 This is not completely correct. Even if pluvial flood hazard is not explicitly mentioned in the EU Floods Directive, several European countries did include pluvial floods in their national risk assessment, as it was considered a relevant component of the overall flood risk. For more details, please see the reports regarding the status of the implementation of the Floods Directive and available here: http://ec.europa.eu/environment/water/flood_risk/overview.htm

Author's Response: Thank you for bringing this to our attention!

Author's Changes to Manuscript (insert at line 2, page 21): Neither European, Australian, nor US flood mapping guidelines explicitly require or recommend maps characterizing pluvial flood hazard, which were of keen interest to both LL and TRV end-users. However, many EU member states have included pluvial flood hazard assessments in response to the Floods Directive (Nixon et al., 2015). The Australian technical guidelines for engineers allude to direct rainfall models that can be used to produce pluvial hazard maps (McCowan, 2016), but because these techniques are relatively new, guidance documents do not require the production of maps depicting the pluvial hazard or intense storm-water runoff. Since techniques for estimating pluvial hazards continue to advance, formal guidelines and requirements for mapping the pluvial hazard zone

should be developed, especially in the US. As demonstrated by end-user requests in this study - and the largely pluvial nature of the flooding disaster caused by Hurricane Harvey in the US - pluvial flooding can dominate in urban areas and needs to be considered in future mapping efforts.

Author's references:

Soden, R., Sprain, L., and Palen, L.: Thin Grey Lines: Confrontations With Risk on Colorado's Front Range, in: Proceedings of the 2017 10 CHI Conference on Human Factors in Computing Systems, pp. 2042–2053, ACM, 2017.

Nixon, S., Horn, J., Hödl-Kreuzbauer, E., Harmsel, A. t., Erdeghem, D. V., and Dworak, T.: European Overview Assessment of Member States' reports on Preliminary Flood Risk Assessment and Indentification of Areas of Potentially Significant Flood Risk, Tech. rep., European Union, 2015.

McCowan, A.: Flood Hydraulics: Numerical Models, Chapter 4 of Book 6 in Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia, 2016.

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