

Authors responses to reviewer 1 comments

Reviewer 1' comments	Authors response
	<p>We would like to thank both of our anonymous reviewers for their constructive comments and suggestions. We have provided our response and carefully addressed the issues raised by the reviewers.</p>
<p>Reviewer 1: General comments</p>	<p>Authors response</p>
<p>1. This paper provides a good overview of the components of early warning systems, identifies some gaps and provides recommendations how early warning systems can become more inclusive. The paper would benefit from clearly defining how inclusion/ inclusiveness is interpreted in the context of this research.</p>	<p>Thank you for your comment. We altered the text and written in page 1 (line 76-88) to define more clearly what is meant by “inclusion” in this paper.</p> <p><i>‘To generate such warning information for floods, systematic development of monitoring networks that utilise appropriate technologies are required. These systems should also consider social, cultural and political dimensions to ensure responses following appropriate decision-making chains (Mao et al., 2018; Acosta-Coll et al., 2018). Such an integrated and interconnected monitoring system requires science, policy and local community-led approaches that can bring engaged stakeholders together and generate knowledge to guide their decision to propose solutions that fit the local context (Buytaert et al., 2018; Kosow et al., 2022; Roque et al., 2021; Zulkafli et al., 2017). Despite this call for an inclusive approach for generating early warning alert system, the existing flood monitoring practices and designs are strongly technology-driven (i.e., information and communications technology [ICT]) and focus less on converging local socio-cultural and governance context (Mao et al., 2018; Westerhoff et al., 2021). There are still questions on how, where and at what level science, policy and society may converge and facilitate bottom-up initiatives for decision-making and develop innovative solutions to address challenges posed by floods.’</i></p> <p>We have added the lines in red into this paragraph to make it clearer and more specific:</p> <p><i>‘To generate such warning information for floods, systematic development of monitoring networks that utilise appropriate technologies are required. These systems should also consider social, cultural and political dimensions to identify context-specific understanding on inequality and its impacts on assessing vulnerabilities and exposure, so that it can ensure inclusiveness in responses following appropriate decision-making chains (Mao et al., 2018; Acosta-Coll et al., 2018). Such an integrated and interconnected monitoring system requires science, policy and local community-led approaches that can bring engaged diverse stakeholders (i.e., gender, sex, age, socio-economic status and physical abilities) together and generate knowledge to guide their decision to propose solutions that fit the local context (Buytaert et al., 2018; Kosow et al., 2022; Roque et al., 2021; Zulkafli et al., 2017). Despite this call for an inclusive approach for generating early warning alert system, the existing</i></p>

	<p><i>flood monitoring practices and designs are strongly technology-driven (i.e., information and communications technology [ICT]) and focus less on converging local socio-cultural and governance context (Mao et al., 2018; Westerhoff et al., 2021). There are still questions on how, where and at what level science, policy and society may converge and facilitate bottom-up initiatives for decision-making and develop innovative solutions to address challenges posed by floods.'</i></p>
<p>2. The paper advocates community engagement along each step, but it does not disaggregate the community and discuss how the unique capacities and needs of different (marginalised) groups such as women, girls, children, persons with disabilities, elderly and illiterate, need to be considered, engaged and utilised to make it more inclusive. This aspect should be recognised throughout the paper and especially within the SMART approach.</p>	<p>Thank you for pointing this out – we have now closely reviewed and subsequently revised line where its relevant. Please see author response to comment 1 and 9.</p>
<p>Specific comments</p>	
<p>3. The abstract would benefit from succinctly explaining the gap around inclusion in EWS and providing more details on how SMART fills the gap.</p>	<p>Please see the below revision in the Abstract.</p> <p>Floods remain a wicked-problem and are becoming more destructive with widespread ecological-social-and-economic impacts. The problem is particularly acute in modified formerly pristine, mountainous-river-catchments where plausible-assumptions of risk-behaviour relevant to flood exposure-and-vulnerability are crucial for robust early warning system development. In particular more Focused and inclusive approach is required to design an early-warning-system (EWS) to shift away from the existing technology-driven practices that are less-focused on converging with the local socio-cultural-and-governance context. We assess potential approaches for facilitating inclusiveness in designing flood EWS by integrating diverse contexts and identifying preconditions and missing-links. conversation with the community at risks is required. In such context, We advocate the use of a SMART-approach as a checklist for good-practice to facilitate bottom-up-initiatives that benefit the community-at-risk by engaging them in every-steps.to facilitate bottom up initiatives to facilitate development of inclusive and purposeful early warning systems that benefit the community at risk by engaging them every step of the way along with including other stakeholders at multiple scales of operations.</p>
<p>4. In Section 2, suggest drawing on literature/ experience around 'local knowledge' capacities of the communities and how a truly inclusive or co-produced EWS will utilise this knowledge e.g., Hermans et al. 2022 (link: https://pure.iiasa.ac.at/id/eprint/18112/1/)</p>	<p>Our brief communication focused on inclusiveness in designing an early warning system for flood and section 2 largely discuss approaches in water and disaster research to become inclusive in designing early warning system that build upon knowledge co-production and convergence platform where diverse and context-specific community knowledge intersects with knowledge derived from disciplinary experts. Therefore, we focus on identifying underlying principles and ethics for designing EWS. While the Macherera and Chimbari,</p>

<p>Hermans2022_Article_ExploringTheIntegrationOfLocal.pdf). Furthermore, the paper does not draw on Community-based EWS literature and practical experiences, for example Macherera and Chimbari, 2016 (Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6014131/).</p>	<p>2016 review paper is focused on community-based early warning systems for human diseases; therefore, it is not highly relevant to this short communication. However, we will include Hermans et al., 2022 in the revised paper as reference and we will revise associated text accordingly.</p>
<p>5. Additionally, suggest explaining ‘knowledge co-generation’ already in section 2 seeing as this is the foundation for the framework.</p>	<p>We have now added explanation on ‘knowledge co-generation’ in section 2, page 3 (line 103-106) – making reference to previous literature for more in-depth explanation</p> <p><i>‘More recently, citizen science has emerged and emphasises on “knowledge cocreation and co-generation” (refers to the interactive processes across science, policy and implementation to generate knowledge for supporting environmental decision-making and is adopted from two distinct paradigms: (1) science-society interaction and (2) collaborative knowledge production, see further details in Buytaert et al., 2018) with limited focus on action and development but more on new technologies, especially ICT.’</i></p>
<p>6. In Section 3.1/2, suggest including some discussion/reference around impact-based forecasting (IBF) which focuses on generating information on what the weather will ‘do’ (by fusing exposure and vulnerability information with hazard forecast info) instead of what the weather will ‘be’ (traditional forecast). You can find guidelines from WMO (https://library.wmo.int/?lvl=notice_display&id=21994#.YvN5LnbMKUk) and the Met Office/ Climate Centre (link: https://www.anticipation-hub.org/download/file-58). IBF strongly advocates for partnership and multi-stakeholder engagement.</p>	<p>Thank you for your suggestion. We have now added lines on page 5 line (215-221).</p> <p><i>‘All these questions are also important for emerging disaster risk management paradigm where leading humanitarian organisations (i.e., World Meteorological Organisation (WMO), International Federation of Red Cross and Red Crescent Societies) are suggesting moving towards impact-based forecasting and anticipatory humanitarian actions so that context specific risks could be identified and necessary relevant action plan could develop on time (please see further details in https://www.anticipation-hub.org/download/file-58; https://library.wmo.int/?lvl=notice_display&id=21994#.YvN5LnbMKUk.’</i></p>
<p>7. Section 3.3 could draw on experiences of understanding communities’ preferences for different warning communication technologies and designing the format of the message to ensure it is understandable and actionable by different groups in the community. See for example Cumiskey et al. 2015 (link: https://www.emerald.com/insight/content/doi/10.1108/IJDRBE-08-2014-0062/full/html)</p>	<p>Thank you for your comment. Actually, previous literature covers this in very traditional ways, as we mentioned in, page 5, line 245-253. Therefore, through our commentary we have raised that it should need more consultation and understanding of the context and need to focus on what community along with other responsible authorities prefer as for communicating alert messages.</p> <p><i>‘Several questions arise in this step including a strategy to ensure the alert levels reaches to all those who are at risk, the risk information is easy to understand and there is a desired reaction to such information. Previous research highlights different visualisation techniques to showcase alert levels such as text, colour coding, graphics, audio mobile messages, and showcasing locational maps (Acosta-Coll et al., 2018; Pandeya et al., 2019). What may be missing in this step is what would be the best possible methods to communicate with the community at risk and understanding how they perceived and responded to such forms of alerts or warnings? Here, communication not only with the communities but also with the</i></p>

	<i>responsible state authorities and how they are supporting or involving with the decision-making processes to respond in a timely manner.'</i>
<p>8. Figure 1 does provide a good overview of the different stages in an EWS but it is missing details on how each component can be inclusive apart from broadly showing that the community should be engaged in each step. The pictures within the diagram could refer to specific inclusive approaches/ activities e.g., activities like engaging women or schools in water level data collection, involving them in the risk assessments design of early action plans, working with local leaders, disseminating warnings in multiple ways to reach different groups. Some of these approaches are mentioned in the text for the SMART approach but I'm still missing a clear overview of all the tools/ guide on how to actually realise the 'co-production of actionable knowledge'.</p>	<p>Figure 1 represent a schematic of an idealised EWS based on literature review - with particular attention towards flood early warning. The various participatory techniques, such as stakeholder meetings, interviews, focus group discussion includes diverse stakeholder to be inclusive. However, as the descriptions of the three steps in this schematic further focus on the gaps and questions that need answer to become inclusive. Based on these discussions later in this commentary we proposed SMART approach as a checklist for good practice and a layer to add with this EWS developmental steps so that it could become inclusive. In the revised version we added few lines in the proposed SMART approach (please see response to comment 9) to make it clearer on how this will ensure inclusiveness in designing EWS.</p>
<p>9. The title of Figure 2 specifies inclusiveness in disaster risk management not early warning systems. Many components of the figure are not well explained in the short text. In my opinion for the purposes of this paper, it would be more useful to expand the details of the SMART approach and focus on inclusiveness for EWS rather than half of the figure being about the top-down approach with the overall goal for redefining adaptation and resilience rather than inclusive EWS.</p>	<p>We have now revised figure 2 and rewritten section 4 in page 6 (line 262-279).</p> <p>We highlight crucial steps for multi-disciplinary team (disaster risk manager, hydrologist, engineer, and social scientist) to follow when exploring risk architectures and planning response actions (Figure 2). These include Firstly, S representing 'Shared understanding of the risks' providing a scope for including diverse stakeholder engagements (irrespective to their gender, sex, age, socio-economic status and physical abilities) in different data collection as stated in step-1 (Figure 1). This knowledge generated from the community will help the expert group to better understand context specific risks with more focused portfolio to map out risks' factors through exposure and vulnerability analysis. This further helps to identify common goals and anticipate damage from the natural hazards. Secondly, M representing 'Monitoring of the risks' aligned closely with establishing alert system and forecasting hazard information as stated in step-2 (Figure 1). This includes an intersection of generated knowledge that will lead towards practicing collaborative activities, such as through knowledge co-production and collaboration (i.e., trust-building, exchanging critical risk information, providing feedbacks, forming small groups for maintaining forecasting system. Thirdly, A as in building Awareness (i.e., training and capacity development activities, understanding weather and alert information in real time) is critical for this approach and is a continuous process throughout the development and utilisation of early warning system. Finally, RT indicating and pre-planning Response actions on Time (i.e., comprehensive disaster management plan, evacuation plan) is crucial to minimize risks from the anticipated damages from the hazard information and will inform the existing community and responsible agencies to take effective action.</p>
<p>10. An option could be to merge the SMART component of Figure 2 into an expanded Figure 1. This way one could just focus what the SMART approach tangibly means for each component/step of the EWS to make it</p>	<p>Thank you for your suggestion. We have revised Figure 2 to make it clearer and more specific to our paper objective. We have highlighted and added description in figure 2. Please see responses to comment 9 and 14</p>

<p>inclusive. Having one useful figure to explain inclusion in EWS and the SMART approach would elevate the value of the paper.</p>	
<p>11. The title of Figure 1 using ‘natural disasters’ should be changed to ‘natural hazards’.</p>	<p>Thank you. Revised accordingly.</p>
<p>12. The SMART approach specifies ‘response actions’ but if these are taken ahead of the impact of the hazard then these should be ‘early or anticipatory actions’ as implemented by NGOs, Red Cross Red Crescent and UN agencies. Tozier de la Poterie (2021) provides more insights into anticipatory action planning which may be useful for the authors to explore (link: https://www.tandfonline.com/doi/full/10.1080/17565529.2021.1927659). There is also growing interest into making anticipatory action programmes within the humanitarian sector more inclusive. See for example FAO, 2020 (link: https://www.fao.org/3/cb1072en/cb1072en.pdf), and there is a dedicated related protection, gender and inclusion resource page on the Anticipation Hub (Link: https://www.anticipation-hub.org/learn/emerging-topics/protection-gender-and-inclusion-inanticipatory-action) which may be of interest to the authors.</p>	<p>Thank you for your suggestion. We have revised and added a few lines on this. Please see author response in comment 6.</p>
<p>Technical corrections</p>	
<p>13. There are several typos and grammatical errors in the paper. I have noted some of these below, but this list is not exhaustive and suggest that the authors thoroughly check the paper for errors to improve the readability of the paper.:</p> <p>Title – use either ‘an early warning system’ or ‘early warning systems’</p> <p>Abstract: Communities-at-risks – remove ‘s’ after risk</p> <p>Introduction: Live and property (page 2 line 70) – add ‘s’ to live</p> <p>Page 2 line 75 – historically underfunding to ‘underfunded’</p> <p>Page 2 line - line 83 ‘an’ early warning alert system, line 85 ‘with the’ local... 89/90 – add</p> <p>‘a’ flood early warning system, line 91 title – suggestion ‘current approaches facilitating’</p> <p>Page 3 – line 103 add ‘ships’ to working relation</p> <p>Page 5 – A SMART ‘way forward; 253 ‘involving with’ change to ‘engaged in’</p>	<p>Thank you for these corrections. Revised and corrected accordingly.</p>