Item number	Title/reference *(academic style) name initials (year) title, publisher, volume, pages*	Name of reviewer
17	See, L., 2019. A review of citizen science and crowdsourcing in applications of pluvial flooding. Frontiers in Earth Science, 7, p.44.	Cuiablue OÜ

Review of findings / main outcome

This paper is about Citizen science and crowdsourcing having a role in early warning systems (EWS) since they can contribute to provide data for validating flood forecasting models on pluvial flooding.

Over the period 1995–2015, 90% of disasters globally have been weather-related, e.g., due to floods, storms, and extreme temperatures **(CRED and UNISDR, 2015)**

Fluvial flooding occurs when river levels rise due to heavy rainfall, snowmelt, rain on snow, dam collapse or sudden ice melting due to volcanic activity or ice dam breaching in a partially frozen river in winter. Pluvial flooding is often only a few centimeters in depth but can cause considerable damage to houses and other assets.The involvement of citizens in data collection for environmental monitoring or scientific research is becoming increasingly common and is often referred to as citizen science or crowdsourcing.

Four main areas for data collection are highlighted in this paper. The first relevant area of research is automated flood detection through two sources: crowdsourced photographs and sensors in vehicles both to detect flooding. Another prominent area of research is in the analysis of data from social media, primarily Twitter along with mobile applications such as Ushaidi **(Okolloh, 2009)**. The final area in which research is taking place is in the development of systems that can integrate data from different sources, including crowdsourced data, for flood risk management.

There is clearly great potential for using data collected by citizens for model development and validation as evidenced by the papers on this topic. The amount of data collected in the different modeling examples was actually not that large yet can still provide an effective form of validation even though research must continue.

Quotes / very useful statements

(1) With climate change, the frequency and severity of extreme events and hence weather-related natural disasters will most likely increase (IPCC, 2014)

(2) Early warning systems (EWS) are one area of response where more efforts could be deployed, particularly in areas with vulnerable populations (CRED and UNISDR, 2015). Cools et al. (2016)

(3) Cools et al. (2016) recommend the need to engage local communities, both in the design of EWS but also in data collection, where the information can be

used to calibrate and validate flood forecasting models or to refine the thresholds of the early warning alerts issued.

Key references *(academic style) name initials (year) title, publisher, volume, pages*

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CRED and UNISDR (2015). The Human Cost of Weather Related Disasters 1995-2015. Available at: https://www.preventionweb.net/files/46796_cop21weatherdisastersreport2015.pdf

Okolloh, O. (2009). "Ushahidi, or 'testimony': Web 2.0 tools for crowdsourcing crisis information," in Change at hand: Web 2.0 for development Participatory learning and action, ed. H. Ashley (London: International Institute for Environment and Development), 65–70

IPCC (2014). "Climate Change 2014: impacts, Adaptation, and Vulnerability. Part A: global and Sectoral Aspects," in Proceedings of the Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, eds C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, et al. (Cambridge: Cambridge University Press), 1132