Natural Hazards and Earth System Sciences Discussions

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Reply on RC1

Michelle D. Spruce et al.

Author comment on "Social sensing of high-impact rainfall events worldwide: a benchmark comparison against manually curated impact observations" by Michelle D. Spruce et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-413-AC1, 2021

We thank the reviewer for their assessment of our work.

To address each comment in turn:

1. Additional literature review.

We have revised the Introduction section so that it now incorporates a 'Related Work' section. This expands the existing text in the Introduction which discusses other works to provide a more thorough literature review of similar studies which have used social media to analyse the impacts of extreme weather:

Related Work

A number of studies have explored the use of social media as a source of information about the impacts of extreme weather. Social sensing is an approach developed in recent years to analyse unsolicited social media data to detect real-world events of interest.

While social sensing is not specific to natural hazards and can be applied in a variety of contexts (Liu et al., 2015; Wang et al., 2012, 2019), social sensing has demonstrated usefulness for natural hazard events.

Twitter data was used by Sakaki et al. (2010) to detect earthquakes in Japan, with reports arriving in some locations before the shock had been detected by conventional seismography. Many studies have followed, using a number of different approaches to explore the use of social media as an information source during and following natural hazard events. Some studies have focused on the use of social media to better understand risk communication during an extreme natural hazard event. For example, Steward and Wilson (2016) explore the use of social media throughout the crisis lifecycle during Hurricane Sandy in the USA, building the STREMII model to better understand crisis communication during an extreme weather event; Rainear et al. (2018) used Twitter data collected during Hurricane Joaquin to explore the types of information communicated by state emergency management accounts to better understand the flow of risk communication during a crisis; Bossu et al. (2020) explored the use of crowdsourced information, along with Twitter data, in a bespoke application during the 2019 earthquake in Albania, finding that engagement of users with the app provided much more

information about the damage caused as a result of the earthquake than was available using conventional methods.

Other studies have explored the use of social media to better understand the impacts of extreme weather events. Many studies focus on individual events. For example Fang et al. (2019) use data from the Chinese social media platform, Sina Weibo, during the 2016 Beijing rainstorm, finding a positive correlation between social media activity and precipitation intensity; Sit et al. (2019) examine Twitter data collected during Hurricane Irma, using geo-located tweets to identify locations with a high density of affected individuals and infrastructure damage; and Han et al. (2019) use data from Sina Weibo during the 2018 Shouguang flood to analyse the changes in sentiment of social media users during the different development stages of the flood. Further examples of other studies examing the impacts of individual weather events at one particular location include: studies relating to specific hurricanes in the United States (Guan and Chen, 2014; Kim and Hastak, 2018; Lachlan et al., 2014; Morss et al., 2017; Niles et al., 2019; Wu and Cui, 2018; Zou et al., 2018) and specific flooding events (Aisha et al., 2015; Brouwer et al., 2017; Cervone et al., 2016; Kankanamge et al., 2020; Li et al., 2018; Rossi et al., 2018).

Some authors have begun to explore the use of Twitter for more wide-scale specific weather event detection, Arthur et al. (2018) use Twitter data to detect and locate flood events in the UK to produce maps of flood activity. De Brujin et al. (2019) compare Twitter activity relating to flooding and hydrological information with flood events in the NatCatSERVICE disaster database, finding a good comparison between these data sources. Boulton et al. (2016) use Twitter data collected during several time periods to detect and locate wildfires in the USA. Cowie et al. (2018) find that user reports on Twitter during the year can help to locate peaks in hayfever symptoms as a result of pollen levels in the UK. Furthermore, Spruce et al. (2020) examine Twitter data relating to named storms, wind and precipitation in the UK finding that it is possible to identify tweets which can be used to assess the impact of storms both temporally and spatially.

The following references will also be added as follows:

Bossu, R., Fallou, L., Landès, M., Roussel, F., Julien-Laferrière, S., Roch, J. and Steed, R.: Rapid Public Information and Situational Awareness After the November 26, 2019, Albania Earthquake: Lessons Learned From the LastQuake System, Front. Earth Sci., 8, doi:10.3389/feart.2020.00235, 2020.

Fang, J., Hu, J., Shi, X. and Zhao, L.: Assessing disaster impacts and response using social media data in China: A case study of 2016 Wuhan rainstorm, Int. J. Disaster Risk Reduct., 34, 275–282, doi:10.1016/j.ijdrr.2018.11.027, 2019.

Han, X. and Wang, J.: Using social media to mine and analyze public sentiment during a disaster: A case study of the 2018 Shouguang city flood in china, ISPRS Int. J. Geo-Information [online] Available from: https://www.mdpi.com/2220-9964/8/4/185, 2019.

Rainear, A. M., Lachlan, K. A., Oeldorf-Hirsch, A. and DeVoss, C. L.: Examining twitter content of state emergency management during Hurricane Joaquin, Commun. Res. Reports, 35(4), 325–334, doi:10.1080/08824096.2018.1503945, 2018a.

Sit, M. A., Koylu, C. and Demir, I.: Identifying disaster-related tweets and their semantic, spatial and temporal context using deep learning, natural language processing and spatial analysis: a case study of Hurricane Irma, Int. J. Digit. Earth, 12(11), 1205–1229, doi:10.1080/17538947.2018.1563219, 2019.

Stewart, M. C. and Gail Wilson, B.: The dynamic role of social media during Hurricane

#Sandy: An introduction of the STREMII model to weather the storm of the crisis lifecycle, Comput. Human Behav., 54, 639–646, doi:10.1016/J.CHB.2015.07.009, 2016.

2. Coverage of risk communication.

The reviewer raises two interesting questions of how social media is used for risk communication, and whether social media might have a preventive impact on extreme weather disasters. While these are important and worthy of study, they lie beyond the scope of this paper, which focuses on the utility of social media as a means of observing the impacts of weather hazards. Given the already lengthy nature of the paper, we feel any additional commentary relating to risk communication would take away from the key focus of the paper - which seeks to explore the use of social media as a tool for impact information curation, rather than an analysis of how social media data is used during a disaster. However we thank the reviewer for their comments and advice on this area and will certainly bear this in mind for future studies.

3. Analysis of risk perception.

Again, the reviewer has identified an interesting research topic. It is certainly possible that social media could be used to assess the public perception of the risks arising from extreme weather. But as with questions around risk communication and preventive effects, this is beyond the scope of our study. To make a proper assessment of risk perception would require establishment and validation of suitable metrics, collection of data, analysis, interpretation etc. Essentially, a whole other study. Therefore we do not feel able to give this subject the time and space it deserves within our current manuscript, where the focus lies elsewhere.

4. Comparison with other crowdsourcing experiments on natural disasters.

We thank the reviewer for the suggestion of Bossu 2020 as a relevant citation and have included that work in our literature review. Our expanded literature review considers social sensing experiments for a number of natural phenomena, including floods, wildfires, wind and storms, helping to establish the context for our current work.