Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-201-AC1, 2020

Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "Dynamic maps of people exposure to floods based on mobile phone data" *by* Matteo Balistrocchi et al.

Matteo Balistrocchi et al.

m.balis@unimore.it

Received and published: 21 October 2020

We thank Referee #1 for her/his general evaluation of the paper and her/his supportive comments. All requested revisions has been implemented in the revised paper. Individual replies are listed below.

Q1: "Abstract: The last sentence mentions the application of the method in real-time rescues and reliefs. However, this has not been demonstrated and the application in real-time lacks of a real-time data access. A1: Actually the proposed exploitation of mobile phone data to estimate people exposed to floods is completely novel and it has not found verification during real-world episodes of inundations, yet. This issue will be remarked in the final sentence of the abstract (lines 18-20) that, in order to

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Discussion paper

make this item clearer, has been rewritten as follows: “This novel methodology still deserves verification during real-world flood episodes, even though it appears to be more reliable than crowdsourcing strategies, and to have potentials to better address real-time rescues and reliefs supply”.

Q2: “Moreover, real-time hazard maps (dynamic flood maps) are not available yet. Please discuss this need for dynamic hazard and exposure data and its accessibility in realtime in the discussion or conclusion section.” A2: A general need for a dynamic approach to flood risk assessment has been underlined by many authors, for instance those who authored the publications reported in the references below. Reasons are manifold and are related to the dynamic behavior of decision makers, exposed people or rescuer actions, and to the dynamic nature of climate and urbanization. For instance, effective campaigns devoted to increase people awareness to flood risk or their capability to undertake water proofing practices, as well as, the implementation of waring systems can dramatically diminish the flood risk over time, without adopting structural strategies to decrease the flood hazard. Furthermore, accounting for urban development trends could be beneficial, in order to assess the future increase in flood risk. A discussion on these aspects has been added in the introduction (lines 89-97) and the reference list will be improved with these updated references. Dawson, R. J., Peppe, R., & Wang, M. (2011). An agent-based model for risk-based flood incident management. Natural Hazards, 59(1), 167-189. doi:10.1007/s11069-011-9745-4 Di Baldassarre, G., Viglione, A., Carr, G., Kuil, L., Salinas, J. L., & Blöschl, G. (2013). Socio-hydrology: Conceptualising human-flood interactions. Hydrology and Earth System Sciences, 17(8), 3295-3303. doi:10.5194/hess-17-3295-2013 Haer, T., Botzen, W. J. W., & Aerts, J. C. J. H. (2016). The effectiveness of flood risk communication strategies and the influence of social networks-insights from an agent-based model. Environmental Science and Policy, 60, 44-52. doi:10.1016/j.envsci.2016.03.006. Viglione, A., Di Baldassarre, G., Brandimarte, L., Kuil, L., Carr, G., Salinas, J. L., . . . Blöschl, G. (2014). Insights from socio-hydrology modelling on dealing with flood risk - roles of collective memory, risk-taking attitude and trust. Journal of Hydrology, 518(PA), 71-82.

doi:10.1016/j.jhydrol.2014.01.018

Moreover, the approach proposed in this paper does not need data in real-time, since the exposed people assessments can be carried out of emergency periods. Once functional box plots of exposed people are derived, as those reported in Figure 6 and in Figure 7, an assessment of people affected by floods can be expressed in terms of typical spatio-temporal patterns and their uncertainty, independently of the availability of real-time data. Thus, the main aim of the paper is to pursue risk prevention by enhancing preparedness. The exploitation of mobile phone data in real-time will become more feasible after a widespread use of 5G and GPS technologies. A brief remark of this issue has been added to the final part of the conclusion section. However, examples of almost real-time applications already exist, but in different contexts. For instance, Florence municipality uses mobile phone data to assess tourist crowding and citizen mobility (daily, weekly and monthly). In general, mobile phone data accessibility is getting easier, as mobile phone providers are more conscious of their market value (an example is given by API developed by TIM, the largest provider in Italy, which allows stakeholders to download data in almost-real-time).

Q3: "Line 105: Please explain the term "Erlang mobile phone measures" or give a reference to it." A3: Raw data description at lines 107-112 has been improved as follows: "The proposed geo-statistical approach relies on Erlang mobile phone measures. An Erlang is the unit of measure for traffic intensity in a telecommunication system or network and it is widely used for measuring load and efficiency. The name is a tribute to A. K. Erlang (1878-1929), Danish mathematician and statistician who firstly worked on traffic engineering (Erlang, 1909). In this study, Erlang measures consist in two-dimensional matrices which provides the spatial distribution of the average number of mobile phone users (MPU) bearing a SIM connected to the network, within a temporal interval and inside a spatial region. These data are collected by mobile phone providers and recorded at constant time steps with reference to a georeferenced grid of square cells." This citation has been added: Erlang. A.K (1909). The theory of probabilities and telephone conversations. Nyt Tidsskrift Matematika, B.20, 33-39.

Q4: “Figure 5: The figure is hard to understand. Figure 5a is referred in the figure caption as days a week but shows the months. Moreover, e.g., green color is refereed to days from July to September but the figure shows green also in October. The same is for blue and yellow. Please revise the figure accordingly or add an additional explanation.” A4: The caption of Figure 5 has been corrected and improved. References to panels in Figure 5 were inverted in the first version of the caption. The cluster names refer to the period that they mainly, but not exclusively, belong to. Thus, the green cluster indicates days mainly belonging to the period July-September, even though a few days of this cluster can be observed in October. The illustration of the spine plots have been improved in section 4.1 (lines 365-368) and in the figure caption, to precise this aspect.

Q5: “Lines 1-61 can be shortened remarkably.” A5: Indeed, the first part of the introduction (lines 20-61) reports preliminaries which introduce known concepts. In our opinion this part is beneficial to place the work in a comprehensive-historical framework. On the other hand, considering the additional discussions required by reviews and the short comment, a better balance could be achieved by giving more room to the specific issues and research advances faced in the paper. Thus, we simplified this part by removing very well-known concepts and ancillary discussions and by shortening some paragraphs. More precisely: lines 21-23: shortened; Lines 23-26: deleted; Lines 33-35: shortened; Lines 39-45: shortened; Lines 48-57: shortened; Line 58: deleted (references were deleted consistently). In the revised version, the preliminary part of the introduction involves lines 22-51. This should be beneficial to shift the discussion focus towards the main aim of the paper and to better set the work in the most recent literature.

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