

## ***Interactive comment on “Flood Impacts on a Water Distribution Network” by Chiara Arrighi et al.***

### **Anonymous Referee #1**

Received and published: 24 July 2017

#### GENERAL COMMENTS

The manuscript proposes an operational methodology aimed at analysing both direct and indirect damages to a drinking water supply system due to a flooding event with a defined probability of occurrence. The methodology involves the combination of a flood model and an EPANET-based piping network model. The latter is developed with a pressure-driven approach, that allows to consider fully or partially non-operating nodes. The global impact of the flood on the network is evaluated considering both the number of inhabitants experiencing lack of services and the network damages due to pipe contamination.

The methodology is simple and allows to operationally evaluate the damages of a flood with a comprehensive approach, increasing the accuracy of the estimates considering also the indirect damages. The importance of taking into account the indirect costs

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is clearly explained in the introduction of the manuscript and supported from the outcomes of the reported case study, that concerns the application of the methodology to the Water Supply System (WSS) of the city of Florence (Italy). The reported metrics, obtained considering inundation maps related to various return periods, are simple and adequate to demonstrate the significance of the damages to the WSS in the analysis of the flood-related hazard. The worst considered failure scenario leads to a percentage of affected population approaching 50% and an estimated cost of about 21 Mio €

The manuscript does not suggest new methodologies, but focuses on a relevant question related to the evaluation of the flood risk, exploiting consolidated instruments to provide a comprehensive operational framework. The combination of inundation maps and EPANET maps results in a useful operational tool for the assessment of the hazard related to the interaction between flood and WSS, fully compatible with the scope of NHSS. The manuscript is quite well-structured and all the steps of the procedure are clearly explained and easily replicable. Results are analysed in a deep and exhaustive way. Some minor suggestions related to the structure of the manuscript and the exposition of the results are pointed out in the “Specific comments” section.

Writing style and use of English should be improved. Sometimes unclear language structures hinder the readability of the manuscript. The work would benefit from extensive English editing by a native speaker.

## SPECIFIC COMMENTS

1) Many flood models are available in the literature, amenable for different levels of complexity and different spatio-temporal resolutions (e.g., Fewtrell et al., 2011). The authors themselves state that inundation maps from local and national water authorities could be used, if available with an adequate spatial resolution (L 145-148). The inundation model adopted in the case study (Arrighi et al. 2013) is briefly described in section 2.1. Considering that the definition of the inundation map is a crucial step of the whole procedure and that the work aims at providing a complete and replicable tool

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for the flood hazard assessment, the authors should explicit the reasons behind the choice of the inundation model. In general, they should provide some consideration on the applicability of this step to a generic case study (e.g., the proposed model can be applied as it independently from the local condition? Are there any framework in which different methodologies could be required? How can the “adequate spatial resolution” for the following steps of the procedure should be identified?)

2) The results section looks quite fragmented, with many short sub-sections and many separated figures. Some significant topics (e.g, the tank dynamics and the sensitivity to the tank levels) are just briefly introduced for the first time at the end of the section. The author should try to review the structure of the section trying to make it more fluent and readable, with some editorial improvements. E.g., the “Results” section would probably benefit from adding a short introduction describing the different analyzed aspects and trying to merge together some of the figures (e.g. figure 5 – 6 -7 – 8) using panels and subfigures.

3) The comparison with the results of the analysis carried out considering only the direct cost is crucial for explaining the scientific relevance of the proposed methodology and the importance of the problem. In the manuscript, it is limited to some lines (LL. 345-349) in the “Results” section. Even if a description of the direct damages can be found in Arrighi et al. (2016), as reported in line 349, due to the importance of the topic some more information and comparison should be provided in the manuscript (e.g., referring not only to the economic cost but also to the number of affected people, etc.).

## REFERENCES

Arrighi, C., Brugioni, M., Castelli, F., Franceschini, S., & Mazzanti, B. (2016). Flood risk assessment in art cities: the exemplary case of Florence (Italy). *Journal of Flood Risk Management*.

Arrighi, C., Brugioni, M., Castelli, F., Franceschini, S., & Mazzanti, B. (2013). Urban micro-scale flood risk estimation with parsimonious hydraulic modelling and census

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Fewtrell, T. J., Duncan, A., Sampson, C. C., Neal, J. C., & Bates, P. D. (2011). Benchmarking urban flood models of varying complexity and scale using high resolution terrestrial LiDAR data. *Physics and Chemistry of the Earth, Parts A/B/C*, 36(7), 281-291.

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2017-205>, 2017.

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