

## ***Interactive comment on “Invited perspectives: How machine learning will change flood risk and impact assessment” by Dennis Wagenaar et al.***

### **Anonymous Referee #2**

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Foreword This invited perspective paper provides views and perceptions on a topical aspect of flood risk management, thus, a critical subject of interest for this journal. Authors provide a critical analysis on the upcoming scientific and practical breakthrough brought by machine learning (ML) to flood risk and impact assessment studies. The paper is structured into an introductory section and a second core part (referring to sections 2, 3 and 4) where the three main core concepts - exposure, hazard and impact – are analyzed with specific focus on descriptive versus predictive assessments related to flood exposure, hazard and impact studies. Authors discuss in the second core part how to date flood exposure/hazard/impact knowledge frameworks and predictions are developed as respect to how they will be made in the near future thanks to ML in particular. Afterwards, in section 5, the perspective part of the manuscript is provided with

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Common challenges (Transferability of data, Ethics and Bias) and Future predictions (categorized upon the potential of the changes to happen). For example authors conclude that “automatic detection of building footprints” is very likely to change/happen soon supported by ML, while “unlikely changes” due to ML include the ML-supported development of better numerical physically based models of flood dynamics. Authors has surely knowledgeable and experienced on the topic, but the manuscript seems to miss to be adequately structured and supported by solid reasoning’s, references and results. As a result, I’d suggest to improve this paper with a more in-depth description, critical analysis and discussion of the main conclusion of this work before publication. I’m sure authors have much more to give to the readership as respect to this first submission that seems to only scratch the surface. I’m also concerned by the lack of sound arguments and more extended referencing of published research studies to support the main findings, that are only somehow supported by general reasoning and insightful comments that has to be captured behind the lines. A more explicit description of outcomes from a larger number of key reference papers shall be integrated to better support this work, as requested to perspective papers, especially considering the case of ML for flood risk management has already matured in recent years with hundred of papers in the specific topic. Along the line of what I just stated in the foreword, I’ll try to summarize in the following general and specific comments/remarks the points that authors should address to improve the paper to achieve the expected goals of this invited perspective.

General comments 1) Lack of adequate referencing. Key references of this work are the following: a. Bishop, C. M. (2006), Pattern Recognition and Machine Learning, Springer, ISBN 978-0-387-31073-2 b. The two works: Solomatine, D.P., Ostfield, A. Data-driven modelling: some past experiences and new approaches. Journal of hydroinformatics, 10 (1), 3-22; Dibike, Y.B., Solomatine, D.P., 2001. River flow forecasting using artificial neural networks. Physics and Chemistry of the Earth Part B: Hydrology, Oceans and Atmosphere. Volume 26, Issue 1, Pages 1-7. c. The ebook “GFDRR. 2018. Machine Learning for Disaster Risk Management. Washington, DC: GFDRR.

License: Creative Commons Attribution CC BY 3.0. May be others are also included, but I do believe a much wider bibliography is needed to support this work. In fact, the first two are surely crucial supporting references, but are not adequately representing and supporting the submitted research/perspective, considering that after 2001 and 2006 tremendous advancements and scientific production was developed not only for ML in general, but within the topic of ML for floods specifically (see quick search on SCOPUS below in Figure 1 and Figure 2).

SEE PDF Figure 1. All journal papers filtered by TITLE-ABS-KEYWORDS using search criteria “Machine learning” AND “floods”

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Figure 2. All journal papers filtered by KEYWORDS using search criteria “Machine learning” AND “floods”

2) Summary and review of state of the art ML.

I'd suggest authors to better introduce and categorize major concepts, procedures and tools of ML. In the introduction the reference to Bishop's book is then followed by few specific examples (see also specific comments). I'd see here a flow chart or summary table to improve the manuscript while addressing this general remark. I'm sure authors can benefit and extrapolate the work already done and cited within the GFDRR book on the topic. Additional scientific referencing can further strengthen this important part of the manuscript where the reader will be guided with key concise definitions and adequate referencing on state of the art ML for earth/geo/water science and flood risk management in particular. Please see this general comment as a further extension of general comment n.1, a surely expected contribution by authors to better support and introduce the final findings/perspectives of this work.

3) Structure of the manuscript Sections 2, 3 and 4 should be merged into a Section 2 with subsections. I see the three components “exposure, hazard and impact” as a

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unique core section with subsections related to descriptive versus predictive assessment models and related comments.

#### 4) Scientific soundness of the “Perspectives” section

Section 5 seems to be a bit general. As requested to Invited perspectives my opinion is that authors miss to explicitly include in the paper sound arguments, facts, published research studies to support the conclusive remarks. Those remarks remain, in fact, general and simplistic relying on few selected, yet relevant, references (mostly the GFDRR that is not even a research work). I understand this paper, as written in the Acknowledgement section, is the result of a “2 week long intensive collaboration during the Understanding Risk Field lab on urban flooding in Chiang Mai, but “Out of the context” and the intent is to share these ourcomes with the scientific audience, but the submitted manuscript seems not to capture the surely significant value of authors’ knowledge and experience as well as the value of the Understanding Risk Field lab workshop discussion and reasoning.

Specific comments See attached commented PDF.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-341/nhess-2019-341-RC2-supplement.zip>

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2019-341>, 2019.

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