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Natural Hazards and Earth System Sciences
Discussions

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

Anonymous Referee #1

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Invited perspectives: How machine learning will change flood risk and impact assessment, by Wagenaar et al. – submitted to NHESS

Overall evaluation:

The manuscript reflects the result of the effort of a 2 weeks long collaboration during the Understanding Risk Field lab on urban flooding in Chiang Mai, Thailand, in June 2019 and intends give an overview of the principal developments and applications of machine learning methods in the flood risk field. It analyses the current and future role of machine learning for each component of the flood risk, taking also into account ethics and bias of this topic. The context is in line with the scope of the Journal and the aim of the manuscript is very interesting and useful for all scientist (and not only), who works on flood risk and are quite new with machine learning approaches, but want to

discover their potentialities and applicability contexts. I surely consider the manuscript suitable for publication, although I think it needs be even more improved by means of some minor revisions, that I'm reporting hereafter.

Minor comments:

Terminology: as general assumption of our community (e. g. Merz et al., 2010, de Moel et al., 200), and following what authors write at P2 L43-46, flood impact is one of the three components of flood risk. Therefore, I would avoid to use the statement "flood risk and impact assessment", because flood impact is somehow included in flood risk. Please, go through the manuscript (include title) and correct these cases.

Introduction: I would add some more detailed explanations of the different machine learning methods. Just some sentences, but it can help in order to have clear in mind, in the rest of the manuscript, what decision trees, neural network, etc. are. In addition, as general comments, I would add some sentences (and references) which state that machine learning methods can really improve estimations, in case of large datasets available: up to now, this concept is taken for granted, but citing some studies that demonstrate it could improve the manuscript, in my opinion.

Structure: in order to be consistent with the definition of flood risk at P2 L43-49, I would suggest to analyse hazard (current Ch. 3) before exposure (current Ch. 2).

Ch. 5: I would add, as an issue, the difficulty to use machine learning methods: they require a quite high degree of knowledges in order to really appreciate improvements in flood risk estimation and to avoid errors, that can easily be done by not-experts.

P3 L89-90: Why traditional process models were not displaced by machine learning methods? Please explain, or refer to specific following Sections.

P11 L352-353: I would suggest to remove the sentence.

P12 L383-384: please add reference for this statement.

Table 2 is never cited in the text. Please correct.

As suggestion, I list some recent papers I found, which use machine learning methods in the flood risk assessment, and can be useful to cite in order to strengthen some concepts: - Amadio, Mattia; Scorzini, Anna Rita; Carisi, Francesca; Essenfelder, Arthur H.; Domeneghetti, Alessio; Mysiak, Jaroslav; Castellarin, Attilio (2019): Testing empirical and synthetic flood damage models: the case of Italy. In Nat. Hazards Earth Syst. Sci. 19 (3), pp. 661–678. DOI: 10.5194/nhess-19-661-2019. - Campolo, M., Soldati, A., and Andreussi, P.: Artificial neural network approach to flood forecasting in the River Arno, Hydrolog. Sci. J., 48, 381–398, https://doi.org/10.1623/hysj.48.3.381.45286, 2003. - Carisi, F., Schröter, K., Domeneghetti, A., Kreibich, H., and Castellarin, A.: Development and assessment of uni- and multivariable flood loss models for Emilia-Romagna (Italy), Nat. Hazards Earth Syst. Sci., 18, 2057–2079, https://doi.org/10.5194/nhess-18-2057-2018, 2018. - Chinh, D., Gain, A., Dung, N., Haase, D., and Kreibich, H.: Multi-Variate Analyses of Flood Loss in Can Tho City, Mekong Delta, Water, 8, 6, https://doi.org/10.3390/w8010006, 2015. - Giacinto, G. and Roli, F.: Design of effective neural network ensembles for image classification purposes, Image Vis. Comput., 19, 699–707, https://doi.org/10.1016/S0262-8856(01)00045-2, 2001. - Heermann, P. D. and Khazenie, N.: Classification of multispectral remote sensing data using a back-propagation neural network, IEEE T. Geosci. Remote., 30, 81–88, 1992. - Kreibich, H., Botto, A., Merz, B., and Schröter, K.: Probabilistic, Multivariable Flood Loss Modeling on the Mesoscale with BT-FLEMO, Risk Anal., 37, 774–787, https://doi.org/10.1111/risa.12650, 2017. - Spekkers, M. H., Kok, M., Clemens, F. H. L. R., and ten Veldhuis, J. A. E.: Decision-tree analysis of factors influencing rainfall related building structure and content damage, Nat. Hazards Earth Syst. Sci., 14, 2531–2547, https://doi.org/10.5194/nhess-14-2531-2014, 2014. - Wang, Z., Lai, C., Chen, X., Yang, B., Zhao, S., and Bai, X.: Flood hazard risk assessment model based on random forest, J. Hydrol., 527, 1130–1141, https://doi.org/10.1016/j.jhydrol.2015.06.008, 2015.

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