

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
<https://doi.org/10.5194/hess-2021-614-RC2>, 2021  
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## Comment on hess-2021-614

Anonymous Referee #2

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Referee comment on "Deep Learning Methods for Flood Mapping: A Review of Existing Applications and Future Research Directions" by Roberto Bentivoglio et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-614-RC2>, 2021

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This manuscript focus on the application of deep learning methods to flood mapping, including flood extend mapping, flood susceptibility mapping, and flood hazard mapping. There are some concerns in the manuscript. Below are my comments. I hope the authors find them useful.

Major concern:

1. I suggest the authors provide the time extent of these reviewed publications. Because studies related to deep learning in flood mapping are constantly updated.

2. It is better to introduce the three flood maps as follows: first to show flood extent or inundation maps, then to illustrate flood susceptibility map, and finally present flood hazard map. Because flood extent or inundation map can be viewed as preliminary work in mapping research. Then, the results of the flood extent maps can be used as training data to predict flood susceptibility. Finally, the flood susceptibility indicates the potential location of future floods. And flood hazard map can be viewed as an extension of a flood susceptibility map that not only considers the location of the flood but also integrate the depth and water extent.

3. A deep brief network is also an important part of deep learning, which has been used in the flood mapping field. Some studies are shown below:

[1] Shahabi, Himan, et al. "Flash flood susceptibility mapping using a novel deep learning model based on deep belief network, back propagation and genetic algorithm."

Geoscience Frontiers 12.3 (2021): 101100.

[2] Shirzadi, Ataollah, et al. "A novel ensemble learning based on Bayesian Belief Network coupled with an extreme learning machine for flash flood susceptibility mapping." *Engineering Applications of Artificial Intelligence* 96 (2020): 103971.

[3] Pham, Binh Thai, et al. "Can deep learning algorithms outperform benchmark machine learning algorithms in flood susceptibility modeling?." *Journal of Hydrology* 592 (2021): 125615

4. The application perspectives on different mapping scenarios are different. Therefore, the authors should provide specific limitations and future research directions on different mapping frameworks. For example, the deep learning methods for mapping susceptibility focus on predicting the location of potential flood areas by considering the historical location and environmental variables. Therefore, it is important to design an appropriate network to integrate heterogeneous environmental information. For flood extent mapping, it aims to find the continuous inundated areas based on satellite images or UAV images. Some deep learning methods such as semantic segmentation are more appropriate in flood extent mapping.

Minor concern:

1. Figure 1: the legend is overlapped in the main figure.

2. It is better to entitle Section 2.2 as "Deep learning method". Section 2.2.1, 2.2.2, 2.2.3 should be entitled "Multi-layer perceptron", "Convolutional neural network", and "Recurrent neural network", respectively.

3. Section 2.2, part 155: lack of related reference in the first sentence.

4. Figure 1: please provide the location information in the caption.

5. 5 (a) should be improved.

6. Section 5.3 belongs to the future direction, but data scarcity is a kind of limitation. Data enhancement may be a suitable title for this section.

