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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Forecasting flood hazards in real-time: A surrogate model for hydrometeorological events in an Andean watershed" *by* María Teresa Contreras et al.

Anonymous Referee #1

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General comments:

The authors develop a numerical tool for predicting flood hazard in real-time in an Andean watershed. The tool is based on a data-driven surrogate model of a physically-based hydrological-hydraulic modelling cascade. The topic is interesting and well-suited for NHESS.

The performance of the surrogate model in predicting water depth is however lower than I would have expected, and calls into question the application of this method in an operational version. As acknowledged by the authors, some storms are predicted with very significant errors. In my view, the paper falls short in explaining the reasons

behind this and the possible ways to improve the model performance. In section 4.2, the authors do not observe that the surrogate model does especially good or bad depending on the characteristics of the storms (understood here as the values of the 4 input parameters), but many other relevant aspects are not explored, such as: (1) the choice of input parameters itself, (2) the type of surrogate model, or (3) the number of events in the database. The later point is mentioned in the discussion (page 18, lines 9-11), but is not tested and shown in the results. Please find below some suggested readings that can provide insights into these questions:

Berkhahn, S., Fuchs, L., Neuweiler, I. (2019). An ensemble neural network model for real-time prediction of urban floods. Journal of Hydrology, 575, 743-754.

Bermudez, M., Cea, L., Puertas, J. (2019). A rapid flood inundation model for hazard mapping based on least squares support vector machine regression. Journal of Flood Risk Management, 12(S1), e12522

Jhong, B.C., Wang, J.H., & Lin, G.F. (2017). An integrated two-stage support vector machine approach to forecast inundation maps during typhoons. Journal of Hydrology, 547, 236– 252.

Razavi, S., Tolson, B. A., & Burn, D. H. (2012). Review of surrogate modeling in water resources. Water Resources Research, 48(7), W07401.

Even if depths are shallow, it is relevant to accurately predict flood extent for operational purposes and for extending the methodology to other sites (Page 17, lines 11-13 /Page 20, lines 5-7 of the manuscript). An additional step might be needed in the tool: a first binary classification model to predict when flooding occurs, and a second one to calculate its magnitude.

I suggest to evaluate the agreement between the surrogate and the physically-based depth maps obtained (ideally for all storms) by means of metrics such as the flood area index (a revision of commonly used metrics for this purpose can be found in: Stephens

et al. 2014. Problems with binary pattern measures for flood model evaluation. Journal of Hydrology 28 (18), 4928-4937). (Page 17, lines 14-18 / Page 21, line 19 of the manuscript).

Minor comments:

Page 4: Information on lines 9-10 seems to be repeated in lines 30-31.

Page 8: How are buildings represented in the mesh of the flood inundation model of the urban area? Is it a building block method?

Page 9, Lines 16-17. "...the zones where the sediment concentration produces significant changes on the velocity and flow depth of the flood" It's not clear to me how this is shown in Figure 5.

Page 14, line 22: Please write "event" in full for clarity.

Page 16, line 9: It would be useful to indicate the CPU time to simulate in the physically-based model, for comparison purposes.

Page 19, lines 21-22: Is this filter applied in this work?

Page 21, line 21: "we recommend using values of water depth in surrounding points as parts of the inputs for a specific point". As this possibility has not been tested in the paper, I suggest to remove this recommendation.

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