Natural Hazards and Earth System Sciences

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Discussions

Interactive comment on "Using rapid damage observations from social media for Bayesian updating of hurricane vulnerability functions: A case study of Hurricane Dorian" *by* Jens A. de Bruijn et al.

Anonymous Referee #2

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The manuscript at hand presents a Bayesian approach to the updating of vulnerability functions for the rapid forecasting of natural catastrophe damage. Based on social media, the authors demonstrate the adaptation of generic vulnerability functions to Hurricane Dorian. The manuscript is well written and describes the novel approach in great clarity. The presented framework is highly relevant, in particular for practitioners in the field. With a strong deviation in terms of damage estimates, the results of the analysis provide a good argument for further investigation into the adaptation of vulnerability curves.

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Discussion paper

Unfortunately, the manuscript lacks a deeper analysis of the obtained results and does not create further scientific insight beyond the presentation of the framework. The approach could have been easily applied to a historic event for which empirical damage estimates were already available. These could have served as a benchmark for damage estimates from both the generic and the adapted vulnerability curves, providing evidence for the otherwise hypothetical improvement.

While I tend to follow the author's claim that the proposed Bayesian framework will deliver improved damage estimates, some factual evidence should be given. This could be either in the form of quantitative validation or comparison with comparable vulnerability curves. Given the likelihood of substantial bias in social media accounts, the author's should demonstrate that the updated vulnerability functions are in fact closing and not unintentionally widening the gap between model and reality.

Further comments:

Lines 70 ff.: The authors state that they aim to improve existing vulnerability functions. However they fail to produce evidence of this claim. In lines 215 ff. the authors explain that the calibration of the prior is based on expert judgement. Due to lack of reference, the reader does neither know how accurate damage estimates based on the prior, nor how accurate those based on the posterior vulnerability curves are.

A key feature for the proposed framework is the use of the zero-one inflated beta distribution. Yet, the results cover only the mean of the beta distribution, no results for ϕ are given. A posterior distribution should be given. It would be interesting to see a plot of uncertainty intervals around μ_y based on the precision of the beta distribution. The authors could discuss how this information could be leveraged to provide meaningful uncertainty bands for regional damage estimates.

Lines 263 ff.: The authors argue that adherence to building codes is one reason why the posterior vulnerability curves for medium- and high-quality building are considerably lower than the prior. But shouldn't it be the key assumption for the prior belief that

buildings conform to publicly known building codes? Doesn't it first of all suggest that the prior belief was too high?

Appendix D: It seems impossible to reconcile the values shown in plots 1-3 for $\Theta_1, ..., \Theta_6$ with either the prior or posterior curves. According to Figure 5 the median capacity Θ_1 (equivalent to α in Eq. 2) should be somewhere between 200 and 250 km/h for low-quality buildings. However D1 gives a mean of roughly 80-90 (unit?). The authors mention that for Gibbs sampling v and all inputs were re-scaled by the maximum observed velocity, but in this case, one would expect $0 < \Theta_1 < 1$. It is similarly impossible to reconcile the parameters of the logistic curves π_0 and π_1, where a probability of 0.5 should be reached at $v_{1/2} = -\Theta_3/\Theta_4$ or $v_{1/2} = -\Theta_5/\Theta_6$, respectively. Values for $\Theta_1, ...\Theta_6$ should be corresponding to the the results shown and be given on an interpretable scale.

Minor comment:

Lines 56 ff.: The authors write that the Bayesian approach is an example for methods to improve vulnerability curves from observations. What other methods?

Figure D3: Figure is barely readable due to very poor image resolution. Please provide publication-grade quality

Lines 323 ff.: Please explain which mean you refer when setting the standard deviations. Presumably μ_Θ.

Typo in line 264: 'designed to be designed'

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-282, 2020.