Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2019-400-RC1, 2020

Natural Hazards and Earth System Sciences
Open Access
Discussions

Interactive comment on "Non-stationary extreme value analysis applied to seismic fragility assessment for nuclear safety analysis" *by* Jeremy Rohmer et al.

Anonymous Referee #1

Received and published: 13 January 2020

1. General comments

The authors present in this manuscript a methodology to derive low probabilities of failure for a nuclear plant, based on a simplified numerical model, by fitting a statistical distribution to the response. The paper propose several non-linear models to link the response to the different covariates and some model selection to derive the best estimation of failing probability, called here Fragility Curve.

The paper well expose the models used, however some of them could be better explained, and the results when the covariates uncertainties are taken into account are well presented. In comparison, the description of the construction of the database is

Printer-friendly version

Discussion paper

less clear to me, and as is would be difficult to reproduce.

The paper is well written, with relevant references and good quality figures. The methods used, if not the newest, have not been already used in the domain, as far as I know. The application is sensible and realistic. The problem addressed is worth being published.

2. Specific comments

2.1 Statistical methods

The description of variable selection method is rather crude and could be better explained. For example, the double-penalty procedure is not presented, and would better serve the paper than the description of the GEV distributions. Moreover, it could be interesting to compare the results with a dedicated variable selection algorithm such as boosting for example (e.g. with gamboostLSS package). As is, it is difficult to understand how the selection if done and in particular how variables are excluded from the figures 10 and 11.

I also have some concerns about the model selection : since here the authors are not interested in predicting new values, are AIC and BIC the best selection criteria to use ? In particular, for an explanatory model, the QQ plots can be a better tool and may leeds to different conclusion. For example, in the case of parametric uncertainty, I would go for the Gumbel model (figure 9). Could the authors precise why the use AIC and BIC in this case and how could they go further ?

2.2 Application case

The selection of the ground-motion records if not described precisely enough from my point of view, for example the scaling levels are not stated. E.g. return levels for with quantity ? The records are non-linear and non-stationary in time, so how the spectrum is computed and scaled ?

The computational time for running seems to be omitted, it might be interesting to give an idea if a more important database could be generated.

2.3 Results

The models compared here do not include parametric models (polynomials, non-linear...) and the selected models are the non-linear smooth models. One question is related to the ability of this models to extrapolate beyond the range of variation of the training set ? It might be interesting to compare to classical parametric models (if any) of with some polynomials models to also investigate the extrapolation ability.

If my understanding is correct, the uncertainties in the estimation of the marginal effects are neglected in computing the fragility curves, that is the reason why the are no uncertainties on figure 7. However, in figures 12 and 13, uncertainties linked to the variability of the input variables are shown. As is, it difficult to know which source of uncertainties is the highest and a discussion on this point would add a great value to the paper.

3. Technical remarcks

- Both formula, figures and tables should be centered to be easier to read; - in figures 10 and 11, some variables seems to be evenly distributed and some other (e.g. E_IC, \Xi_RC, e5 in figure 10) seems to be random : it seems that all of them should be uniform of the range of variation stated in Table 1 ? - The link functions are not stated precisely in table 2;

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2019-400, 2019.