Natural Hazards
and Earth System
Sciences

Discussions

# Interactive comment on "A new approach to flood loss estimation and vulnerability assessment for historic buildings in England" *by* V. Stephenson and D. D'Ayala

**Anonymous Referee #4**

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The paper describes a scoring or rating procedure to vulnerability assessment for historical buildings according to flood impact, and their application to three test sites in UK. The approach of a vulnerability index is an interesting and relevant topic for the vulnerability assessment, which is the basis for the loss estimation in the future development of the method.

The approach is interesting and reasonable. From engineering side, the relevant vulnerability related parameters are considered in the procedure. The Authors are aware of general problems of scoring methods, if these cannot be aligned on real observations. Nevertheless, there are some remarks necessary.

Considering the current state of the method, the title of the paper is somewhat misleading, because the calculation of losses is not yet included in the paper.

The authors introduce a scoring procedure considering 5 vulnerability related parameter. The vulnerability rating for each of the parameter has a range from 10 to 100. Although the individual parameter are based on a different number (3-5) of parameter-attributes, that means all of the parameter have more or less an equal weight in the total vulnerability index. But it is hard to imagine, that all of the parameter should have the same importance for the vulnerability.

The vulnerability rating regarding the floor numbers is discussed in the paper. The argument of the higher settlement risk with increasing of the floor numbers for typical UK flooding characteristics can be followed only with restrictions. The settlement potential depends also on the soil type and the preload under dry conditions has an influence on the remaining settlement risk in case of flooding. Taking into account the international literature (HAZUS®MH MR4 Technical Manual; Smith, D.I. 1991; USACE, 1985), it can be concluded that single-storey buildings usually have a higher vulnerability than multi-storey buildings. Sure, these studies are related with the additional impact of the flow velocity, nevertheless the assumption in the paper should be checked in the future on the basis of real observations for the UK flood characteristics.

The Authors are aware of these problems and the weighting of the individual factors and attributes should be reviewed in the further developing process of the method, especially if typical regional characteristics are assumed.

In Figure 7 it makes sense, but in Figure 3 continuous lines between only few discrete data points on an ordinal scale are somewhat misleading. It remains also unclear, why the log-normal distribution is used for the fitting in the limited definition range of the vulnerability index.

In Figure 3 the cumulative distribution reaches only in case of the parameter "Construction System" f(x)=1 for the highest vulnerability rating. In case of a cumulative

distribution normally all considered buildings should be included by the highest vulnerability rating, and that means f(x)=1. This should be checked or explained.

A map with the location of the study areas would be helpful for international readers. The comments of the other referees regarding information such as the "listed status" and the assignment of UK building periods should be considered.

The understanding of the Tables 2-4 and the informative value of the statements of the photos 4a-6b could be increased, if the tables are combined with the photos: e.g. the table on the left side and the photo on the right side. Otherwise the amount of information should be increased in the captions of the tables and figures. Here especially the related vulnerability index should be inserted.

Best regard's

References:

Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division: Multi-Hazard Loss Estimation Methodology, Flood Model HAZUS$^{®}$MH MR4, Technical Manual, 2009

Smith, D. I. (1991): Extreme floods and dam failure inundation implications for loss assessment. Proceedings of a Seminar "Natural and Technological Hazards: Implications for the Insurance Industry", 1991. pp. 149-165.

USACE (1985): Business Depth-Damage Analysis Procedures, U.S. Army Corps of Engineers, Institute for Water Resources.

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