Natural Hazards
and Earth System
Sciences

Open Access

EGU

Discussions

Interactive comment on "A spatial Bayesian network model to assess the benefits of early warning for urban flood risk to people" *by* S. Balbi et al.

Anonymous Referee #2

Received and published: 26 December 2015

This manuscript proposes a methodology for assessing potential losses that are expected to occur in an area affected by flooding. The methodology is based on establishing a Bayesian network (BN) model based on expert opinion. As the case study, the losses expected for the lower part of the Sihl valley (Zurich, Switzerland) is considered. The losses for the region are estimated for the case of existing Early Warning System (EWS) are compared against those estimated for the case of improved EWS. Based on the results, the effectiveness of improving the EWS in mitigating flood losses, is assessed.

Main objective of the manuscript fits well in the scope of NHESS. The paper proposes

a novel alternative to the existing flood loss estimation methodologies. The manuscript is expected to suitable for publication at the Natural Hazards Earth System Sciences after revision.

[Section "2.2. Methods"] In this section, utilized approaches and the fundamental assumptions are explained. However, it seems that the critical issue of assumption of loss in each cell being independent from each other is not addressed. In the proposed approach, it is implicitly assumed that flood related losses within a given cell are only related to the "hazard rate" and the "vulnerability" of the cell. This assumption neglects the possibility of the exposures in a cell being affected by the losses in neighboring cells. Losses related to exposures in a cell may be triggered due to cutting of critical access paths or lifelines of the cell. In such cases, significant losses may occur in the cell even when the hazard and vulnerability of the cell itself is very low. It seems that the proposed approach does not take into account this phenomenon. This simplification is acceptable for a preliminary investigation however its potential limitations should be stated in the manuscript.

[Page 5, Table 1] Values provided in Table 1 represent the opinions of 4 experts on the performance of the EWS. Values provided in this table requires some additional justification. The likelihoods reported for the performance of the baseline case (i.e. 24% and 75%) in terms of "scope" do not sum up to 100%. Is this due to a typo? Furthermore, it is stated that "improved" system refers to a theoretical system with maximum performance. Assumption of maximum performance, is a major one. Justification for this assumption should be provided.

[Page 8, Line 32] It is stated that a large data set is utilized in the training of the network. This large dataset is reported to be generated from the expert panel results. The bootstrap sampling technique is reported to be utilized in the generation of the large data set. In order to train the network properly, causality characteristics of the generated data should match that of the original data. Authors should provide a discussion on how well this could be achieved in this study.

[Page 12, Line 8] It is stated that output of the BN is expressed as a probability distribution per cell. In Figure 4, the parameters of the distribution (i.e. mean and coefficient of variation) are presented for the case of probability of injury (per 50m2). However, the distribution function itself is not specified in the manuscript. The distribution function should be specified clearly. If the conventional normal distribution is assumed to apply to probability of injury and the minus one standard deviation values are evaluated, negative values are obtained. For example, for the district "24 - Werd" the mean probability of injury is reported to be around 5.8% and the coefficient of variation is around 1.23. In this case, minus standard deviation is obtained as - 1.3% (i.e. 5.8%-1.23*(5.8%)). This result contradicts with the fundamental axioms of probability theory.

[Page 13, Figure 4] In Figure 4a, the numerical value is only provided for the case of probability of injury being "High". The corresponding value for the "Low" is missing. It should be reported as well.

[Page 8, Line 28] The authors correctly note the possibility that the relationship between the risk and the exposure being nonlinear. In the present study, a linear relationship is assumed to perform a preliminary investigation. It would be highly useful for the readers, if the potential drawbacks of this assumption are stated. For the cells with highly dense exposure (e.g. high density of people, densely stored valuable goods), the probability of injury estimates provided by the experts for moderate exposure conditions may be exceeded. This may lead to underestimation of the potential risk associated with such high exposure cases.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 6615, 2015.