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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The application of Bayesian networks in natural hazard analyses" *by* K. Vogel et al.

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Referee

Abstract: Reads more like an introduction. I suggest that you include some of your conclusions here.

Authors: The main conclusion is the applicability of Bayesian networks (BNs) in natural hazard assessments. The benefits of BNs, i.e. the capturing of uncertainties, thus prove BNs to be a viable alternative to deterministic approaches.

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Referee

1. Introduction: Broadly well written and interesting but (a) Please review your English in the first paragraph. For example "despite of differing" [line 21] becomes "despite differing". The first sentence does not make sense as it is (the "model- and decision theoretic questions"?.)

Authors: OK. This will be checked.

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Referee

b) I suggest you add in some more in-text citations to substantiate some of your statements in the first three paragraph (you have just one reference), rather than 'just' have prose. Many of these statements stem from what others have written.

Authors: We suggest to add the following references:

"The various sources of uncertainty are e.g. pointed out by (Merz, Kreibich, Lall - 2013 - Multi-variate flood damage assessment a tree-based data-mining approach) in the context of flood damage assessments. The accumulation and non-trivial interaction of uncertainties is indeed one of the reasons why probabilistic approaches are often avoided."

"However, uncertainty is a carrier of information to the same extent as a point estimate, and ignoring it or dismissing it as simply an error would be wrong. (Bommer, Scherbaum - 2005 - Capturing and limiting groundmotion uncertainty in seismic hazard assessment) e.g. discusses the importance of capturing uncertainties in seismic hazard analyses to balance between the investments into provisions of seismic resistance and possible consequences if the resistance is insufficient."

"Yet, deterministic approaches are still the state of the art in many applications. [...] Recently developed models for flood damage assessments (i.e., the FLEMOps+r model) use classification approaches, where the event under consideration is assigned to its corresponding class and the caused damage is estimated by taking the mean damage of all observed events that belong to the same class (Elmer, F., Thieken, A. H., Pech, I., and Kreibich, H. - 2010 - Influence of flood frequency on residential building losses). In seismic hazard analysis the usage of regression-based ground motion models is common practice, restricting the model to the chosen functional form, which is defined based on physical constrains (Kuehn, Riggelsen, Scherbaum - 2011 - Modeling the Joint Probability of Earthquake, Site, and Ground-Motion Parameters Using Bayesian Networks)."

Referee

2. Bayesian networks: The audience here is a group of scientists, interested in natural hazards, who might not be necessarily familiar with Bayesian Networks, but want to learn about them. To make this a more widely read paper, I suggest that you take much more care to introduce the intelligent lay-person to the idea and notation of Bayesian Networks, from an intuitive view point, so that they might be able to then read this section. I suggest this include some more illustrations (you do include some), a couple sentences of history (not a complete set of history, you can and do refer to other sources), and most importantly, a table of mathematical notation used in the paper. As it reads now, it is a very jargon rich and mathematics heavy section, aimed at someone who already works with Bayesian Networks. If this is your audience, then probably it is not suitable for NHESS. If instead, you would like to introduce your audience to Bayesian Networks and their use for natural hazards, then please make this section much more accessible.

Authors: We agree, that this part could be worked over to grant easier access for an audience not familiar with BNs.

Referee

Sections 3 to 5 (Earthquakes, Floods, Landslides): These are interesting applications (and conclusions) based on the various data sets that you have worked with, and show a substantial amount of work and thought. I would like to see much more depth in describing the data themselves including the limitations. You already do this in parts, but for instance, I have no feeling for the landsides what they look like (spatially, individually), whether these are historical or recent landslides, the result of specific triggers (earthquakes, rainfall), and if recent landslides, over what years. Whether the data set is 'complete' over time, and whether these are small or large landslides. I did find some 'year' information in the Table 6, but it is definitely buried. In each case, if you are going to investigate a hazard, make sure that you do not gloss over the details of the data itself, and ensure a reader understands enough about the data so that when you examine it, they can understand where you are headed.

Authors: Concerning the flood damage data: The data result from computer-aided telephone interviews with flood affected households yielding 1135 records. They describe the flooding situation, building and household characteristics, precautionary measures and flood damage to buildings. The raw data were supplemented by estimates of return periods, building values and loss ratios and indicators for flow velocity, contamination, flood warning, emergency measures, precautionary measures, flood experience and socio-economic variables. For a detailed description of the data we would refer to (Thieken et al. 2005, Elmer et al. 2010) Information about the percentage of missing observations could be added in table 4.

Concerning the landslide data: The landslide data are taken from an inventory of $\sim$300,000 digitally mapped landslide deposit areas across the Japanese islands. These landslides were mapped mostly from stereographic image interpretation of air photos, and compiled by the National Research Institute for Earth Science and Disaster Prevention NIED (http://lsweb1.ess.bosai.go.jp/gis-data/index.html). The dominant types of failure in this database are deep-seated slow-moving earthflows and more rapid rockslides. The majority of landslide deposits cover 103 to 105 m2 footprint area, and many sustain vegetation. It is estimated that the inventory contains both historic and prehistoric slope failures. Smaller rockfalls or soil slips are not included. The inventory also does not feature specific trigger mechanisms (such as earthquake, rainfall or snowmelt), the dominant type of materials mobilised, or absolute age information for the bulk of individual landslides. In this context, the data nicely reflect common constraints that scientists encounter when compiling large landslide databases from remote sensing data covering different time slices. Yet this type of inventory is frequently used as key input for assessing and mapping regional landslide susceptibility from a number of statistical techniques, including BN. However, data-driven learning of BN containing landslide information has to our best knowledge not been attempted before.

Referee

Minor points: (a) Please ensure that all maps have scales and N arrows. (b) Figure captions in some cases need to be much more complete (including source of data/figures, enough text so one does not have to go to the main text to figure out what they are about).

Authors: OK

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 5805, 2013.