Nat. Hazards Earth Syst. Sci. Discuss., 3, C3218–C3219, 2016
www.nat-hazards-earth-syst-sci-discuss.net/3/C3218/2016/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Integrated statistical modelling of spatial landslide probability" *by* M. Mergili and H.-J. Chu

Anonymous Referee #2

Received and published: 11 February 2016

The article by Mergili & Chu proposes a novel approach to combined modeling of landslide release and deposition probabilities. This is, in principle, a very interesting research direction that has the potential to enhance the utility of landslide susceptibility maps. The proposed approach is based on numerically combining and spatially aggregating release and impact probabilities. Unfortunately the combination of probability distributions of random variables requires a thorough probabilistic treatment that goes beyond the computational steps proposed in this article. In the comments below I am trying to point out some specific points where a thorough treatment of probability distributions is required.

Overall, considering the methodological issues, I recommend to reject it in its present form. From my perspective resubmission would require a thorough revision of the

probabilistic model.

Detailed comments:

1. In numerous occasions probabilities are averaged or their maximum is taken in order to obtain some overall probability. No justification is given, and I cannot see how these operations can constitute valid probability estimates. In particular, P(A or B) is not max(P(A),P(B)) or (P(A)+P(B))/2, but in general P(A or B) = P(A) + P(B) - P(A and B); if I understand correctly, the authors sometimes use maximum or averaging to calculate the probability of OR combinations of random variables / events. Examples of where averaging, maximum or multiplication seem to be incorrect or at least lack a mathematical justification: P5685L21, P5685L25, P5686L16; also Eq. (6) and (7) not justified/derived; P5686L1 what is a "simple overlay" of probabilities?

2. Section 2.4 – "zonal release probability" is not well defined, and the proposed algorithm lacks mathematical justification

3. P5680L10-11 "by combining the two newly developed open source software tools" – The authors' phrasing of the proposed approach suggests that they consider it a merely computational step; it is important to realize that this computational step implements a stochastic model, which should therefore be firmly based on probability calculus.

4. Other than mentioning the r.landslide.statistics function in GRASS, the article does not provide any information whatsoever on the type of model used for spatially predicting landslide susceptibility, e.g. logistic regression or weights of evidence. The use of slope and aspect as the only predictors is rather unusual as many authors also include upslope contributing area, lithology or land use / land cover in their models. Especially upslope contributing area (in combination with slope angle) is meaningful from a physical perspective (compare physically-based slope stability models such as SHALSTAB)

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 5677, 2015.