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The effect of landslide representation and sample size on susceptibility assessments applied to different landslide types and case study areas

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Abstract :

Statistical based landslide susceptibility models are widely used in medium to regional scale assessments. The two main inputs in these models are the landslide inventory of past events and the landslide caustative factor maps. In this study we assessed how the performance and prediction capability of the Weights-of-Evidence (WofE) susceptibility model is affected by the way we represent landslides in the pixel format, considering the entire polygon or only the landslide centroid. Influence of pixel density representing the landslide polygon was also taken into account. The second part of the research concidered the effect of the landslide model training and prediction sample sizes on the performance and prediction rates of the WofE model. Two case study areas were chosen to apply the representation and sampling tests: (1) the Fella River Basin (Eastern Italian Alps) containing debris flows and (2) the four times larger Buzau County (Romanian Carpathians) containing shallow landslides. Both areas are very different in terms of size, landslide types and geo-environmental factors, and were chosen in order to determine the applicability and flexibility of our analysis. Our results indicate that there is only a minor increase in performance and prediction when increasing the number of pixels to represent the entire landslide polygon. As the number of pixels increased from a single centroid to all pixels within the polygon, we found that the relative increase in pixels was similar within all classes (e.g. grass-land, forest, bare rock) of each thematic factor map like land-use or lithology. This indicated that the landslides have a similar size across the entire study area and is one of the causes of the lack of significant increase in model performance. The similarity in performance and prediction rates for different landslide representation tests was in contrast to their respective susceptibility maps, which did show significant differences among each-other. This requires further analysis in future studies to determine which susceptibility map should be chosen for decision making. As for the sample size analysis, we have found that using 10 to 20% of all landslides to train the WofE model in both case studies is sufficient to predict the remaining 80 to 90% of the landslides. Modeling with more than 20% of the landslides causes a “plateau effect” in the

performance and prediction rates. This indicates that only a small percentage of all the landslides in an inventory are needed for good prediction results, making it also unnecessary to map every landslide in the area for a sufficient performing landslide susceptibility analysis.