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Statistical description of large datasets of Cumulated and Duration values related to shallow landslides initiated by rainfalls

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Empirical rainfall thresholds are a well established method to draw information about Duration (D) and Cumulated (E) values of the rainfalls that are likely to initiate shallow landslides. To this end, rain-gauge records of rainfall heights are commonly used. Several procedures can be applied to address the calculation of the Duration-Cumulated height and, eventually, the Intensity values related to the rainfall events responsible for shallow landslide onset. A large number of procedures are drawn from particular geological settings and climate conditions based on an expert identification of the rainfall event. A few researchers recently devised automated procedures to reconstruct the rainfall events responsible for landslide onset. In this study, 300 pairs of D, E couples, related to shallow landslides that occurred in a ten year span 2002-2012 on the Italian territory, have been drawn by means of two procedures: the expert method (Brunetti et al., 2010) and the automated method (Vessia et al., 2014). The two procedures start from the same sources of information on shallow landslides occurred during or soon after a rainfall. Although they have in common the method to select the date (up to the hour of the landslide occurrence), the site of the landslide and the choice of the rain-gauge representative for the rainfall, they differ when calculating the Duration and Cumulated height of the rainfall event. Moreover, the expert procedure identifies only one D, E pair for each landslide whereas the automated procedure draws 6 possible D,E pairs for the same landslide event. Each one of the 300 D, E pairs calculated by the automated procedure reproduces about 80% of the E values and about 60% of the D values calculated by the expert procedure. Unfortunately, no standard methods are available for checking the forecasting ability of both the expert and the automated reconstruction of the true D, E pairs that result in shallow landslide. Nonetheless, a statistical analysis on marginal distributions of the seven samples of 300 D and E values are performed in this study. The main objective of this statistical analysis is to highlight similarities and differences in the two sets of samples of Duration and Cumulated values collected by the two procedures. At first, the sample distributions have been investigated: the seven E samples are Lognormal distributed, whereas the D samples are all distributed Weibull like. On E samples, due to their Lognormal distribution, statistical tests can be applied to check two null hypotheses: equal mean values through the Student test, equal standard deviations through the Fisher test. These two hypotheses are accepted for the seven E samples, meaning that they come from the same population, at a confidence level of 95%. Conversely, the preceding tests cannot be applied to the seven D samples that are Weibull distributed with shape parameters k ranging between 0.9 to 1.2. Nonetheless, the two procedures calculate the rainfall event through the selection of the E values; after that the D is drawn. Thus, the results of this statistical analysis preliminary confirms the similarities of the two D,E pair set of values drawn from the two different procedures.

References

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