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# Rainstorms as a landslide-triggering factor in Slovenia

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Rainfall plays an important role in landslide triggering processes. Analyses of landslide occurrence in the area of Slovenia have shown that in areas where intensive rainstorms occur (maximal daily rainfall for the 100 year period), and where geological settings are favourable, an abundance of landslides can be expected. This clearly indicates the spatial and temporal dependence of landslide occurrence upon intensive rainfall. To identify landslide occurrence, the intensity of maximal daily and average annual rainfall for the the 100 years period were analysed. Results have shown that daily rainfall intensity, which significantly influences the triggering of landslides, ranges from 100 to 150 mm, most probably above 130 mm. Despite the vague influence, if any at all, of the average annual rainfall, the threshold above which significant number of landslides occurs is 1000 mm.

For the purpose of understanding landslide spatial frequency, analyses of the locations of 2156 landslides were used. The problem with landslide data is the lack of information on slide type and on triggering factors. Nevertheless, the weather events in recent years have proved that intensive rainfall is the most important triggering factor for landslides in Slovenia. Also the data on lithology was used (Geological map of Slovenia at scale 1 : 250.000), where the 114 lithostratigraphical units were classified according to their engineering geological properties into the 29 units. The data on daily rainfall intensity for the 100 years return period, and the data on the average annual rainfall intensity were used. The spatial analyses were conducted on rasterised data of $25 \times 25$ meter resolution using the $\chi^2$ (chi-square) analyses.

In terms of average annual rainfall intensity, values above 1000 mm/year proved to be critical for the landslide occurrence in looser soils and 1600 mm/year in less resistant rocks. Taking into account all the landslides, the maximum daily rainfall intensity

above 150 mm proved to be critical for landslide occurrence, especially in looser soils and in less resistant rocks. When analysing specific lithological units, the triggering values were lower, beginning at 100 mm/24 h and above. The data on landslide occurrence during the intensive rainstorms in SE Slovenia in August 2005 indicate that the triggering values for 48-h period ranged from 130 to 180 mm. This shows that existing soil moisture pre-conditions the landslide occurrence and significantly lowers the necessary triggering rainfall values.

Due to the nature of the data analysed the exact triggering rainfall vaues were not assessible. Also the question that arises is when during the rainstorm exactly did the landslide occur? To answer the questions to these problems, more detailed data bases and further research are needed.