

Statistical analysis of rockfall frequency-volume relationship in Ticino (Switzerland) based on historical data

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Rockfall is the most frequent type of slope movement in the Ticino area, Southern Switzerland, particularly in zones of subvertical valley slopes composed of orthogneisses, e. g. in the Leventina valley.

The main highway and railway lines connecting Southern and Northern Switzerland are exposed to a large number of rockfalls and rockslides. Continuous maintenance of these traffic lines is necessary to reduce the risk and minimize costs.

Quantitative risk analysis requires data on the distribution of magnitude and frequency of these hazards, whereas the assessment of the temporal aspect (frequency) generally presents the problematic aspect. The rockfall inventories of Canton Ticino contain the volumes of more than 150 events from 1950 to 2004 in different geological settings, including metamorphic, igneous and calcareous rocks.

The statistical analysis of the rockfall inventory, done on granitic gneisses according to [1, 2], yields the average number of rockfalls, which may be expected in the area for a given period of time and a given volume range. The data is used to determine the frequency-volume statistics of rockfall and to estimate the annual frequency of rockfalls, providing the temporal component of the hazard. Rockfall volumes of the analyzed events range from 0.5 to more than 10'000 m³. The data is fitted with a power-law distribution, giving a curve for the medium and large rockfall events above 8 m³. The resulting curve allows us to give the return period of a rockfall of a certain volume.

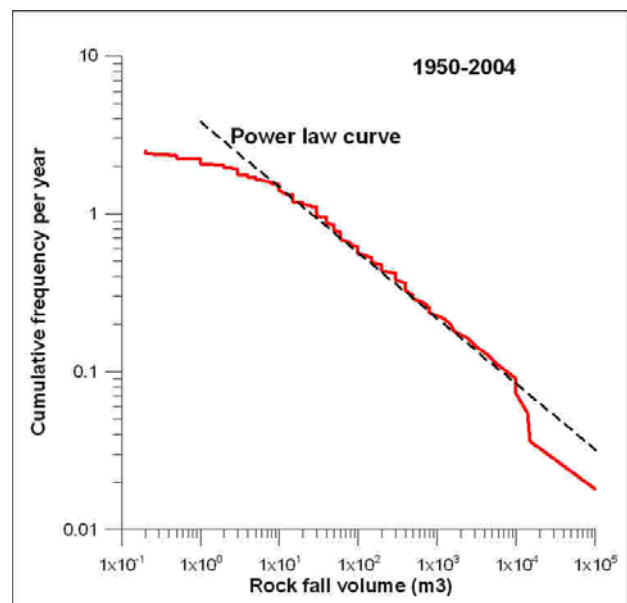


Figure 1. Cumulative frequency vs. rockfall volumes in the studied area.

REFERENCES

- [1] Gutenberg B., Richter C. F. (1954): Seismicity of the Earth and associated phenomenon. Princeton University Press.
- [2] Hungr O., Evans S. G., Hazzard J. (1999): Magnitude and frequency of rockfall along the main transportation corridors of South-Western British Columbia. *Can. Geot. J.* 36, 224-238.