



Understanding rockfall activity in terms of meteorological conditions – the case study from Tatra Mts.

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In mountainous regions rockfall is one of the major processes that can lead to visible changes in the natural environment and has geohazard potential. Active rockfall can be recognized on forested areas by dendrogeomorphic methods with particular emphasis on visible anatomical changes. Field research was carried out on Norway Spruce (*Picea Abies* L. Karst) in the Kościeliska Valley (Tatra Mts., Polish Carpathians). Detected Rockfall Growth Disturbances (RGDs) were visible in tree-rings as scars and traumatic resin ducts (TRDs). Statistical analysis (multi regression, ANOVA, Levene's test, Brown-Forsythe test, Snedecor's F-distribution, Scheffe's post-hoc test) were applied to recognize meteorological conditions causing rockfall in Tatra Mts. In analysed period 1950-2014 the weakest activity was observed during 1950-1970. There was a clear peak in the number of RGDs recorded per year in 1985. In our study area, there is more than one month with meteorological factors stimulating rockfall activity. Cumulative precipitation and temperatures for January, March, May, June, July, September and October are statistically significant as the periods of the year in which RGDs are activated in the Tatra Mts. Moreover, precipitation shows a greater correlation with the time of active rockfall and determines stochastically its frequency. In overall meteorological conditions explain 53% ($r = 0.73$) of total parameters causing rockfall activity in the Tatra Mts. Rockfall as one of the most complex process needs better understanding of local conditions and methodological uncertainties based on anatomical changes in tree-rings and meteorological data.