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Automated monitoring and forecasting of rock fall danger in space and time: practical field experience

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Rock fall hazard management is always a multidisciplinary task. On one hand, management methods should be based on the latest results from various field of geoscience. On the other one, results of sometimes high-sci analyses and deductions have to be transformed into a simple and definite form to be understandable and ready-to-use for final users – deputy of municipalities and other decision-making entities.

An automatic system for monitoring of unstable slopes and processing of deformation events has been tested to secure traffic and settlements in NW Bohemia. Because of the safety need, readings with high frequency measurements have to be used, so the system produces enormous data flow. In spite of it, all data must be immediately assessed to provide actual stability information and, eventually, to launch an early warning in time.

That assessment is not possible to do manually. Hence the current, successfully used empirical-phenomenological models cannot be implemented due to impossibility to convert those models into computer algorithms. To overcome that serious obstacle, new, mathematically soundly described methods from the tool-box of nonlinear science has been applied in the analytical-prognostic module of the tested system in NW Bohemia. They have been based on recognizing and classifying of topological patterns of time series dynamics using portrait of system dynamics in N dimensional phase spaces. Case histories of high sensitivity to tiny changes of time series patterns which had enabled earlier identification of significant instability increase were given.

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