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Challenges within Monitoring and Risk-Oriented Analysis of Precipitation- and Hydraulic- Coupled Slope-Collapses

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Within the past years we investigated several catastrophic soil- and rock-slides along infrastructural and urban areas which are coupled to extreme weather phenomena. This contribution shall show examples, triggered by catastrophic rain-falls and anthropogenic influence. Further, the stress-field between the compliance with legal and economical requirements and the rising frequency of weather induced events shall be discussed from the geoengineers point of view. In the past, engineers were strictly confronted with the detailed geological and geomechanical or numerical analysis of the slope failures. Since the past role of the engineer as inviolable decision leader is increasingly weakened, due to economic control obligations - mostly operated from the far desk - new ways of conviction work had to be developed as well as effective forecasting and monitoring instruments. For this reason the requirement to engineers, regarding the ability to work multidisciplinary and to find more exact models, is risen, which is to be seen positively. In order to fulfill the increasing justification-requires when planning counter measures, several technical and economical aspects are to be described quantitatively now. This quantitative description is the basis for risk- analysis, which has to contain beside other aspects following: a) The shift of the probability of extreme events b) The expected harm at humans at the scenario put to reason c) The expected damage at structures d) The expected super-ordinate economical harm e) The expected costs of counter-measure variants f) The variant related residual risk, expressed in probable occurring costs While the description of the first aspect a) is mainly a geotechnical challenge, which is connected to very detailed knowledge of

the slope-failure characteristic, triggering mechanisms as well as related historical and future meteorological data, the aspects c) and e) concern exact technical cost investigations. The real challenges are sensitive, ethical questions like the expression of the economical worth of a human life. But in order to be able to perform and represent a true risk-calculation, beside performing intensive monitoring and forecasting one must intensively explain the correct context regarding worth of life, in particular while representing measures or no measures in front of persons, concerned by catastrophes. In the currently contribution, case studies will be discussed were we were able to investigate and improve as well the very basic data set, concerning extreme weather phenomena, geophysical monitoring of rock-slides, as well as economical aspects and performed several multi-disciplinary monitoring projects, risk-oriented dynamic investment calculations for countermeasures, considering also residual risks and their cost-related effects on operators of infrastructure, individuals and the public.