



Evaluating modes of failure zones of the rock masses along Mudurnu Valley (Turkey) by using a unmanned aerial vehicle

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Rock mass characteristics, slope geometry, weathering, man-made activities and seismic activities are the main factors that can cause slope failure. Whatever the reason is, these instabilities can generate significant hazards. Rock mass instabilities in the Mudurnu County which is settled on a steep valley threaten people and settlements, and lead to regional hazard and risk. In order to overcome this problem, rock masses along the valley have to be characterized in detail. Instabilities are discontinuity driven at the west side of the Mudurnu valley and discontinuous limestone is susceptible to complex failures resulting from the combination of kinematic failure (i.e. planar, wedge, toppling failures). The aim of the study is to define possible modes of failure on discontinuous limestone and divide the valley into different geotechnical sectors, accordingly. In order to evaluate the geotechnical sectors, rock mass properties should be characterized spatially along the entire valley. However, physical evaluation of many problematic locations by field studies is impossible due to the quite wide and highly steep nature of the valley. In order to overcome this issue, a unmanned aerial vehicle which is a great tool for the natural hazard management studies was used. This methodology which has been used extensively in recent years was preferred to collect images from the inaccessible areas. In this study, the obtained images from the sectors by using unmanned aerial vehicles have been compared with the information gained by the scan-line field studies (i.e. rock mass characterization) where the outcrops were accessible and have been used to assess the modes of failure along the Mudurnu valley and to reliably determine the potential failure sectors. Later, remediation measures have been proposed based on the gathered aerial image and field study information.