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Geophysic data interperetation of Passo della Morte landslide: Eastern Italian Alps

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The Passo della Morte block-slide covers a relative large area in the Carnic Alps, along the left side of the Tagliamento River, between Forni di Sotto and Ampezzo (N-E of Italy). The high seismicity and the presence of the landslide increase the risk associated to the interest area. Moreover the large volume of material involved in the landslide (a few million of cubic meters), the presence of important infrastructure such as the road and two tunnels which cross the landslide, as well as the presence of the Tagliamento River that flow at the foot of the landslide, make the area very vulnerable.
This study concerns with the western part of the Deep Seated Gravitational Slope Deformation (DSGSD). It focuses on the potential instability of a rock slope (crossed by road tunnels) and its connection with the DSGSD activity. The main objectives of this study are: monitoring the rock mass movement, studying the seismic site effect and defining the stratigraphic and geological characteristics of involved materials.
Two vibration sensors have been installed inside the potential landslide: a short-period seismometer and a piezoelectric transducer. The microseismic activity recorded by the sensors has been analyzed, with particular regard to periods characterized by rapid changes in recorded seismic signals, and then correlated with the precipitation trend to evaluate the existence of a possible correlation between these phenomena. The microseismic activity study has highlighted the existence of a close link between microseisms and acoustic emissions recorded respectively by the seismometer and by the piezoelectric transducer. In addition, the comparison with the rainfall pattern has shown a direct relationship between different rainfall events and the sharp increase of microseismic activity detected by the two instruments. The correlation is good, even if acoustic emissions appear to be more sensitive than microseisms to short duration and low intensity rainfall events.
The seismic site effects and the directivity in seismic site response of the rock mass have been investigated through the use of Nakamura (1989) method. In particular have been estimated the resonance frequencies and the polarization directions of seismic energy in three selected sites. All sites have shown a clear evidence of polarization in the direction of N/NW-S/SE and E/NE-W/SW, compatible with the maximum slope inclination and with the limestone stratification direction outcropping in this area.
In order to define the stratigraphic and geological characteristics of the materials involved, have been performed a GPR investigation and an active seismic survey. The first has been useful to identify vertical and horizontal variations of the lithotypes present, most associated with different degrees of rock fracturing and fluid content. The seismic investigation has permitted to identify a reflective layer and to determine the propagation velocity of compression and shear waves of the two layers found.