



Earthquake induced landslide hazard field observatory in the Avcilar peninsula

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Earthquake-triggered landslides have an increasing disastrous impact in seismic regions due to the fast growing urbanization and infrastructures. Just considering disasters from the last fifteen years, among which the 1999 Chi-Chi earthquake, the 2008 Wenchuan earthquake, and the 2011 Tohoku earthquake, these events generated tens of thousands of coseismic landslides. Those resulted in amazing death toll and considerable damages, affecting the regional landscape including its hydrological main features.

Despite a strong impetus in research during past decades, knowledge on those geohazards is still fragmentary, while databases of high quality observational data are lacking. These phenomena call for further collaborative researches aiming eventually to enhance preparedness and crisis management.

The MARSITE project gathers research groups in a comprehensive monitoring activity developed in the Sea of Marmara Region, one of the most densely populated parts of Europe and rated at high seismic risk level since the 1999 Izmit and Duzce devastating earthquakes.

Besides the seismic threat, landslides in Turkey and in this region constitute an important source of loss. The 6th Work Package of MARSITE project gathers 9 research groups to study earthquake-induced landslides focusing on two sub-regional areas of high interest among which the Cekmece-Avcilar peninsula, located westwards of Istanbul, as a highly urbanized concentrated landslide prone area, showing high susceptibility to both rainfalls while affected by very significant seismic site effects.

A multidisciplinary research program based on pre-existing studies has been designed with objectives and tasks linked to constrain and tackle progressively some challenging issues related to data integration, modeling, monitoring and mapping technologies.

Since the start of the project, progress has been marked on several important points as follows. The photogeological interpretation and analysis of ENVISAT-ERS DInSAR temporal series has been undertaken, providing global but accurate Identification and characterization of gravitational phenomena covering the area. Evaluation of the resolution and identification of landslide hazard-related features using space multispectral/hyperspectral image data has been realized.

Profit has been gained from a vast drilling and geological - geotechnical survey program undertaken by the Istanbul Metropolitan Area, to get important data to complete the geological model of the landslide as well as one deep borehole to set up permanent instrumentation on a quite large slow landslide, fully encircled by a dense building environment.

The selected landslide was instrumented in 2014 with a real-time observational system including GPS, rainfall, piezometer and seismic monitoring. Objective of this permanent monitoring system is three folds: first to detect and quantify interaction between seismic motion, rainfall and mass movement, building a database opened to the scientific community in the future, second to help to calibrate dynamic numerical geomechanical simulations intending to study the sensitivity to seismic loading, and last but not least.

Last but not least important geophysical field work has been conducted to assess seismic site effects already noticed during the 1999 earthquake. Data, metadata and main results are from now progressively compiled and formatted for appropriate integration in the cloud monitoring infrastructure for data sharing.