

ROLE OF GROUND AND SURFACE WATER IN TRIGGERING LANDSLIDES IN GREAT KABYLIA (TIZI-OUZOU, ALGERIA)



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INTRODUCTION

➤ The geomorphology of northern Algeria is essentially characterized by mountains and steep slopes.
➤ Landslides are one of the most famous natural hazards: Algiers (1942), Bejaia, Constantine (1972), Guelma (1992), Mila (1993), Medea, Jijel and Tizi-Ouzou.
➤ Landslides in unconsolidated formations are widespread in Algeria, particularly in great Kabylia. Indeed the morphology of the North of Algeria, often gives rise to landslide of variable intensity. Water play a central role in the landslides processes in this region; it exerts on these soils a special influence which translates into several instabilities.

METHODOLOGY

➤ This communication aims to the study of the impact of ground and surface water on the triggering of landslides in great Kabylia and numerical modeling of these instabilities caused by water in its various forms.
➤ Extraction and cartography of landslides in study area
➤ Field verification and confirmation of instabilities.
➤ Numerical modeling (Geostudio, 2012) of major instabilities with considering of presence of groundwater tables to prove the impact of this water on the landslides.
➤ Geological, Hydrological, geotechnical and Hydrogeological synthesis.

GEOLOGIC CONTEXT

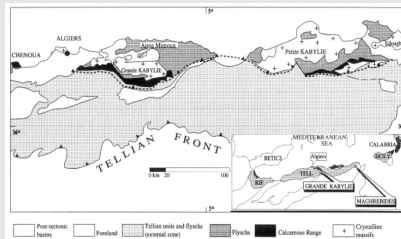


Figure 1. Simplified structural diagram of the central zone of the Maghrebides

➤ The region of Kabylia, which is located in the internal areas of the Maghrebides chain (Figure 1), is known for its geological diversity, it is a major element of a geological ensemble of the Maghrebides chain.
➤ Several regions of Tizi-Ouzou are affected by large-scale movements of land. However, this communication focuses only on case instabilities caused essentially by the presence of water (Figure 2)

STUDY AREA

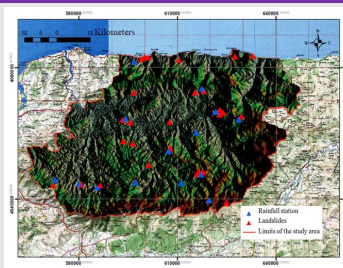


Figure 2. Distribution of landslides in the study area

HYDROLOGY AND HYDROGEOLOGY

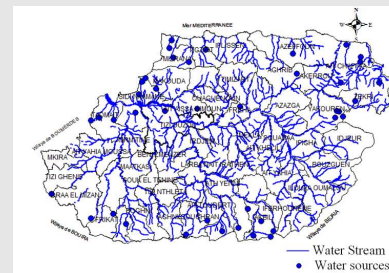


Figure 3. Water streams and in the study area

➤ Since the years 2000, significant rainfall has been observed in Greater Kabylia; the latter, gradually reloaded the groundwater tables.
➤ The important snow cover in winter 2011 to 2012 (over 1 m thick), which was followed by intense rains, completely saturated the terrain and led to the catastrophic reactivation of the landslides. Rainfalls in this region is irregular and torrential, reaching a maximum of 1200 to 1400 mm / year (ANRH data), with snow cover remaining for several months in the mountain summits.
➤ Landslides areas are fed by water of natural origin, (precipitation and the melting of the snow cover) and water of anthropic origin (leaks on the networks of drinking water and wastewater, direct discharges of these in the natural environment)

INSTABILITIES EXAMPLES AND RESULTS OF NUMERICAL MODELING



Figure 4. case and examples of landslides in great Kabylia: a), b) Azazga, c) Illiltén, d) Tizgirt

➤ Many types of instabilities (Figure 4) have been identified at Tizi-Ouzou. They are simple and translational landslides affecting the slopes of low inclination, composed of flysch (marl and clay); complex landslides that often develop in metamorphic schist land with steep slopes (over 25°) and affecting clays formations of the quaternary. In many of them the principal causes is the presence of groundwater especially the case of Illiltén earthflow.
➤ The results of the numerical modeling with Geoslope (Geostudio, 2012¹) show that there is a diminution in the safety factor (Fs) with the presence of water in the all cases of landslides considered.
➤ The main cause of the landslides in great Kabylia is the presence of groundwater which promotes landslides at the marl-clay matrix interface, through fractures in altered shales formations or along stratifications in flyschs formations.

CONCLUSION

➤ Observations and results of this study show that the landslides with its different types have an important relation with groundwater circulation, the modelisation in seepage in Geostudio show the diminution in the safety factors with the presence of circulation of water in the slopes studied especially on the Tizgirt landslides with steep slopes.
➤ These study have considered the geotechnical, hydrogeological, topographic parameters of landslides but it is possible to ameliorate it with a lot of parameters like seismicologic and geophysical parameters in the future.

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