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Analysis of sub-surface groundwater level and precipitations relations in connection to their role in triggering shallow landslides.

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The Northern Mediterranean region is the place of many mass movements triggered by climatic events that affect populations and infrastructures every year. These events are largely linked to intense rainfall events that affect the region during the autumn-spring period. They are the cause of catastrophic floods and hundreds of shallow landslides (less than 10000m3). The rain/slip relationship is observed and studied with great interest, the authors easily agreeing on the fundamental role of the "water" variable in triggering gravity instabilities. Indeed, the fluid content of the geological formations determines their geomechanical behavior (increase of the pore water pressure and total mass of the formations) and thus conditions the stability of these formations. In the context of the European INTERREG ALCOTRA AD-VITAM project, particular attention has been focused on the dynamic of sub-surface groundwater and its use in stability calculation models. The relationship between precipitation/sub-surface groundwater/shallow deformation is poorly documented for the long term observation and it is through the analysis of 18 piezometers located in the northern Mediterranean region (France and Italy) representative of sub-surface groundwater as well as meteorological data that we propose an analysis of this relationship. All these piezometers are located in geological layers composed of silt, sand, clay or/and marl highly subject to shallow landslides and alteration processes, an aggravating factor in slope stability. The observed data show very seasonal evolutions of the various piezometric measurements, both in terms of dynamics and periods of ground water level variations. Cross-correlation analyses show a good correlation between precipitation and groundwater dynamics for most piezometer/rainfall gauge pairs and a rapid interaction (max 2 days) between these two variables. We also observe a strong correlation between rainfall and groundwater level with a simple hydrological reservoir model (GARDENIA). The analyses carried out show the essential role of precipitation in the dynamics of sub-surface aquifers. As part of the AD-VITAM Project, these observations will allow calibrating slope stability models where the ground water level observations, which are essential, are not always available or with insufficient time period of acquisition.