Models and Methods for Material and Environmental Sciences – XXXVII Cycle

Influence of climate change on the hydro-mechanical processes of triggering, reactivation and evolution of landslides in mountain areas

Landslides are natural hazards that can be defined as "*the movement of a mass of rock, debris or earth down a slope*" and their occurrence is strictly related to geological, geomorphological, anthropogenic and meteo-climatic conditions.
Nowadays what is widely known is that small-scale shallow landslides are mostly influenced by intense short-term precipitation events (be it rainfall or snowmelt etc.); thus, climate change is expected to lead to an increase in intensity and frequency of these phenomena. On the other hand, large-scale deep-seated landslides are influenced by long-term cumulated precipitation events; here climate change is not expected to lead to an increase in intensity and frequency.
However, this last consideration is still based on assumptions and little is known about the relationship between precipitation/temperature and displacement rates.
The relevant research question at this point is whether climate change is going to affect these phenomena and in what magnitude.
Therefore, the main objective of the project is to achieve an improved understanding of (1) how the mechanisms of initiation, reactivation and evolution of large-scale deep-seated landslides are related to rainfall and temperature regimes; in this case, continuous (and possibly long-term) monitoring is essential to understand if a cross-correlation exists between landslides displacement and meteo-climatic data time-series. (2) How climate change can potentially affect these natural processes in the future and how risk scenarios could be influenced by it (may it be positively or negatively). Here, physical modelling combined with climate change projections in terms of precipitation and temperatures are required instead.

In order to fulfil these two requirements, my three-year project will be focused firstly on bibliographic research and familiarization with the numerous case studies as well as with the different monitoring methods, aiming to build up a landslide monitoring database and a rainfall & temperature database.
Starting from these collected data, recurrent acceleration and deceleration patterns together with triggering and preparatory precipitation events need to be identified (if they exist) in order to conduct a cause-effects analysis (ID, NCC, PCA, ROC, etc.).
Particular attention will be paid on the difference between short-term and long-term precipitation events and on the role of evapotranspiration (effective precipitation).
Finally, the interpretation of cause-effects analysis could lead us to the elaboration of hydro-geo-mechanical processes schemes and numerical models as well as quali/quantitative influence of climate change on risk scenarios.