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Clustering the apparent electrical resistivity data of permanent ERT monitoring

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Landslides have been studied for several years thanks to electrical resistivity tomography (ERT). This technique allows to image the internal structure and discontinuities of the land-sliding bodies (fractures, layers, base…). The dynamic of such objects is mainly influenced by fluidification phenomena of the medium, mostly due to meteorological precipitations (high rainfall regime, snow melt). Water infiltration then plays a key role in the dynamic of landslides.
Furthermore, we know since Archie's works (1942) that resistivity data are influenced by water content of the investigated soil. The ERT acquisition then help to evaluate and understand the water content within the studied slope.
In this work, we use apparent resistivity data (to avoid inversion uncertainties) from two monitored landslides in the French Southern Alps (La Clapière rockslide and Vence landslide). Permanent electric lines have been installed for many years now on the two unstable slopes (3 and 9 years respectively). This has permitted us to (1) identify different internal areas within the ERT profiles (surface, base, aquifers, faults…) and (2) observe and appreciate fluids' flows between the interpreted areas. To do so, a separation had to be made between the apparent resistivity data in terms of values (conductive Vs resistive) and variability (stable Vs changing) for each point of daily pseudo section.
Associated with the stability changes recorded on these moving areas, we looked at the signals of these different clusters corresponding to different areas of the ground. From this, we observed a decoupling between a shallow and a deep signal, responding with a certain delay to atmospheric solicitation (rapid and delayed respectively). Infiltration time has to be invoked here to explain this difference. We also show that landslide's movement accelerations are associated with changes in the signal of the deeper cluster.
In this study, we observe the interactions that exist between masses dynamics and complex internal circulation of fluids. This new study images the major role of the water flow in destabilization of a massif. This allows a better understanding of the complex dynamic of such problematic objects.