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A new combined wavelet methodology applied to GPR and ERT data in the Montagnole experiment (French Alps)

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Ground Penetrating Radar (GPR) and Electric Resistivity Tomography (ERT) methods are well assessed and accurate geophysical methods for studying subsurface geological sections. These methods were jointly applied at the Montagnole (French Alps) experimental site with the aim to study effects of possible catastrophic rockslides in transport infrastructures. The main goal of the experiment was a careful geophysical imaging of subsurface structure before and after of iron ball on the ground impact series. It is known that factors as ambiguity of geophysical field examination, complex geological media, and unfavourable "useful signal"–to–noise ratio in some situations do not permit to construct reliable physical-geological models of the studied subsurface structure. Here, we applied for the GPR and ERT methods at the Montagnole site, the recent advances in the wavelet theory and data mining. Wavelet approach was specifically applied to achieve enhanced (e.g., coherence portraits) images due to the integration of different geophysical fields; in fact, the methodology based on the matching pursuit with wavelet packet dictionaries enabled us to extract desired signals even from strongly noised data. Such tools as complex wavelets were employed to the coherence portraits, combined GPR–ERT coherency orientation angle, to name a few, enable performing non-conventional operations of integration and correlation in subsurface geophysics. These parameters can be used not only for location of buried inhomogeneties, but also for a rough estimation of their electromagnetic and related properties. The combination of the above approaches has allowed to set-up a novel methodology, which enhances reliability and confidence of each individually geophysical method and their integration.

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