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Cluster analysis as tool to integrate univariate geophysical models.

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Post-inversion statistical techniques integrate distinct geophysical models in order to improve the characterization of a target area.

Information obtained through seismic, gravity and electromagnetic imaging bring knowledge about the Earth interior, but the complexities of the rocks physical conditions can block attempts to correlate directly the distinct models into a unified framework. Often the discordance between the various geophysical imaging is thought as related to the weakness of the single inversion model. We consider, instead, that a certain degree of independence between individual observables remains necessary due to the high variability of physical conditions in the subsoil and that a correct integration is reached when the univariate parameters result correlated in a unique quantitative frame.

A clustering approach, based on the partition of the multi parameter dataset in high correlation zones, could provide a quick, simple and elegant way to satisfy such task, without the needs of poor based and often rather arbitrary a-priori or empirical relationship between measured parameters. Through such approach, regions of the subsoil that share homogeneous physical characteristic can be identified. Further analyses allow the structural features of the single region to be distinguished. The physical state of the rocks can be defined, the interfaces between these regions can be characterized and a local link between the various physical parameters (resistivity, P-wave velocity and mass density) can be provided.

We present application of such procedure to both synthetic and experimental dataset, related to several structures at very different scales presents in the Campanian district (southern Italy). In this way, we investigate whether cluster analysis could furnish an operative outline of the physical information hidden in the dataset.