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Application of Principal Component Analysis on geoelectrical recordings.

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The geophysical imaging is nowadays able to furnish a global reconstruction of the main features of the buried structures, at the scale of interest, in a faster and economic way. One of the most employed techniques is the Electrical Resistivity Tomography (ERT). It is a controlled source technique and so it results less sensible to noise with respect to other geophysical methodologies. However, in order to perform deep imaging (more than a few hundreds of meters of depth) it requires a notable electrical power to be supplied. Strong problems are presents in the case of high source receiver distances, when the component of the voltage drop recorded at the measurement electrodes, which is induced by the direct current injected into the ground, is overwhelmed by other signals, both of natural and atrophic origin. Such is the major limit to the depth of the obtained tomographies. Modern resistivimeters permit the simultaneous recording of multiple signals. Taking advantage of this characteristic, the use of the principal component decomposition as filtering tool is tested on geoelectrical data. Signals acquired in volcanic areas are processed through a totally original statistical procedure and the results are compared with more typical estimators, as the stacking and the maximum likelihood ones. Adopting a windowing of the contemporaneous recorded signals, the amplitude of the deterministic signal is estimated reiteratively, a visual check is proposed in order to evaluate the data goodness and a final estimate of the parameter is obtained also for source receiver distance of several kms.