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Soil depth is an important property for estimating crop production potential and soil water availability. Direct estimates of soil depth from destructive boreholes and pits are too costly for being extended to large areas. Geophysical methods are often cited as possible alternative. However their ability to provide reliable estimations of soil depth are known to be highly dependent on local site characteristics. Therefore combining geophysical methods based on different physical parameters generally enhances the probability to obtain a better prediction. This study, partly supported by the FP7-Digisoil project, examine the ability of the Spectral Analysis of Surface Waves (SASW) method combined with classical high resolution Electrical Resistivity Tomography (ERT) one to predict soil depths in a 500 m ranged Mediterranean hillslope (Southern France) with increasing soil depths along the slope. SASW was performed from data measured in the field with classical seismic equipment (impulse source and geophones along a profile). In the same place, 8 transects of ERT (Wenner-Schlumberger array, 1 meter electrode spaced) were measured in wet conditions and in dry one. In order to calibrate geophysical measurements, observations of 130 boreholes (4 meters deep) were made to determine the soil depths, defined here as the occurrence depth of an heterogeneous marine Miocene uncemented sandstone with centimetrical laminations. Firstly ERT and SASW sections were analysed separately. This showed that each geophysical method was not sufficient to predict soil depth along the whole hillslope (lower part with calcaric Cambisol / upper part with calcisol). SASW predicted well soil depth in the lower part of the hillslope (with calcaric Cambisol) whereas data from ERT were disrupted by shallow permanent groundwater. Conversely, soil depth was well predicted with ERT in the upper part of the hillslope whereas a high variability of SASW data near the topsoil provided difficulties in soil depth prediction. Significant differences in bedrock hardness along the slope explained a part of this high variability. From these results, it was possible to define a new estimator of soil depth that is a weighted mean of the estimations given by each methods, the weights being defined as varying along the slope so that more importance is given to ERT estimates in the upper part of the hillslope and more importance is given to SASW in the lower part. This study shows the interest of such a fuzzy logic based sensor combination to estimate soil properties when the uncertainty of prediction are variable between locations and geophysical methods.