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Geotechnical soil characterization is in need of a new statistical approach

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The cone penetration test (CPT) is a geotechnical investigation method to characterize soil profiles in the field and allows estimating the grain size and density. The soil characteristics vary vertically and horizontally because of depositional and post-depositional processes. In order to understand this variability in soil properties, commonly sparse sets of CPTs are processed with specialized statistical methods. However, till now the maximal distance and number of CPTs required to reach given level of statistical significance is not well understood. Here we show the significance of vertical variability in soil properties on the characterization of the soil profiles, being underestimated in previous studies. The cone resistance obtained from CPTs was used for the statistical analysis, since it is the geotechnically most important variable. A total number of 33 CPTs were performed in order to investigate the effect of different number of tests on the significance of the soil characterization results. We present a new statistical approach that takes in to account the effect of the vertical variations of soil properties. The new approach led to obtain more conservative characterization of soil properties presented by the cone resistance. Furthermore it recommends the minimum number of tests required for better soil characterization in the field.