

Measurement uncertainties in regression analysis with scarcity of data

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Abstract. The evaluation of measurement uncertainty, in certain fields of science, faces the problem of scarcity of data. This is certainly the case in the testing of geological soils in civil engineering, where tests can take several days or weeks and where the same sample is not available for further testing, being destroyed during the experiment. In this particular study attention will be paid to triaxial compression tests used to typify particular soils. The purpose of the testing is to determine two parameters that characterize the soil, namely, cohesion and friction angle. These parameters are defined in terms of the intercept and slope of a straight line fitted to a small number of points (usually three) derived from experimental data. The use of ordinary least squares to obtain uncertainties associated with estimates of the two parameters would be unreliable if there were only three points (and no replicates) and hence only one degrees of freedom.