Bayesian back analysis for dynamic CPTu strain-rate correction.

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Dynamic Cone Penetration test (CPTu) is a cost and time efficient way of collecting in situ geotechnical parameters (i.e. cone tip resistance, sleeve friction and total pore pressure) of near-surface marine sediments for submarine slope stability analysis. Conventional-established correlation for geotechnical parameters estimation from CPTu are built on static CPTu data, requiring correction of dynamic CPTu sounding records mainly due to strain-rate effects (i.e. increasing of soil resistance due to the increase of applied strain-rate). Empirical correlations have been proposed to overcome this issue, nevertheless, their application requires the quantification of correlation's coefficients for which no general regression has been derived yet, arising strong uncertainty in data conversion and consequently geotechnical parameter prediction. Moreover, dynamic CPTu parameters are also uncertain due to their inherent variability and instrument precision. In this framework, this study proposes a multivariable Bayesian back-analysis for probabilistic conversion of dynamic CPTu parameters into static CPTu profile. Inherent variability of soil properties, instrument measurements error and uncertainty introduced by correlations used are modeled as random variables and updated within a Bayesian framework. Equivalent samples are randomly generated from established proposal distributions and integrated with parameter's prior knowledge through a hybrid Markov-chain MonteCarlo procedure. The proposed approach is tested for 20 dynamic CPTu tests, characterized by different impact velocities, performed at Trondheim Fjord. The method applied aims to provide an improvement of strain rate correction with respect traditional data conversion. Preliminary results well match with ones computed from back-calculation employing both static and dynamic CPTu profiles. Results should be further validated for mechanical soil delineation and geotechnical parameters prediction from CPTu.