Leveraging geomorphometric data and statistical computing to gain complementary insights into complex Earth surface processes

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Novel analysis and prediction methods developed at the intersection between computer science and statistics have been gaining popularity in recent years in Earth surface process modelling using geomorphometric predictor variables. These newer approaches promise to improve predictive performances by overcoming the limitations of statistical models, making better use of highly correlated and interacting predictors such as terrain attributes calculated at different resolutions. However, these possible (yet not guaranteed) improvements come at the cost of potentially overfitting to the training data, making the interpretation of empirical relationships difficult, and all this at a high computational cost. This talk discusses the potential and pitfalls of novel statistical and machine-learning methods in the context of landslide susceptibility modeling based on (mainly) geomorphometric predictor variables. Spatial cross-validation and permutation-based variable importance measures are presented as key tools in this context. Their open-source implementation in the statistical software R and integration with GIS software are introduced. It is argued that traditional statistical and newer machine-learning techniques can provide complementary insights into complex environmental relationships.