Geophysical Research Abstracts
Vol. 15, EGU2013-2266, 2013
EGU General Assembly 2013

GAM & RF for 3D mapping of multinomial peat properties.

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Different statistical methods have been proposed for fitting the empirical quantitative function linking the soil information to the scorpan factors, while taking into account the spatial structure of the data . Regression kriging extends the methods of kriging and co-kriging and it has been further extended by the use of GAMs (Generalized Additive Models) with the estimation of uncertainty. When multinomial data are modelled, advanced non-parametric methods, such as CART (Classification and Regression Tree), can be used. CARTs have been used widely to estimate soil properties. Bagging trees and Random Forest (RF) approaches have among the best performances among CART methods. CARTs have been used in DSM applications, While RF have often been used in ecological modelling, fewer examples exist in DSM, such as soil erosion occurrence, soil types prediction and soil organic carbon content. In this paper we propose a methodology to map multinomial peat properties in 3D space with a combination of GAMs and RF. The methodology was applied to the humification (according to the VonPost classification) classes in a bog (18 km2) in the north-east of Scotland. A large survey campaign was carried out in 1955 and humification information were collected at 125 points. In order to integrate the information from the GAM in the RT, a series of binary GAMs were fitted using DEM-derived information as covariates. The binary GAMs were fitted assigning 1 if the class considered was present at the location, 0 if the class considered was absent. The probability predictions resulting from the binary GAMs, were included in the pool of covariates used for the RT together with other ancillary covariates. The model diagnostics had a fair to good agreement between measured and modelled values (K statistics). The probability predictions resulting from the binary GAMs proved to be important variables, increasing the agreement of the model. The obtained spatial distribution of values on the surface of the bog presented higher humification degree in the northern part and where the peat is shallower. The lowest values are in the steeper regions and on the borders of the bog, while intermediate classes can be found in the area of the raised basin. The study was implemented using open source software, in particular GRASS and R.