Geophysical Research Abstracts
Vol. 20, EGU2018-12206, 2018
EGU General Assembly 2018

Modeling soil organic carbon with Quantile Regression: Dissecting predictors' effects on carbon stocks

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Soil Organic Carbon (SOC) estimation is crucial to manage both natural and anthropic ecosystems and has recently been put under the magnifying glass after the Paris agreement 2016 due to its relationship with greenhouse gas. Statistical applications have dominated the SOC stock mapping at regional scale so far. However, the community has hardly attempted to implement Quantile Regression (QR) to spatially predict the SOC distribution. In this contribution, we test QR to estimate SOC stock (0-30 cm depth) in the agricultural areas of a highly variable semi-arid region (Sicily, Italy) by using topographic and remotely sensed predictors. We also compare the results with those from available SOC stock measurement. The QR models produced robust performances and allowed to recognize dominant effects among the predictors with respect to the considered quantile. This information, currently lacking, suggests that QR can discern predictor influences on SOC stock at specific sub-domains of each predictors. In this work, the predictive map generated at the median shows lower errors than those of the Joint Research Centre and International Soil Reference, and Information Centre benchmarks. The results suggest the use of QR as a comprehensive and effective method to map SOC using legacy data in agro-ecosystems.