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Complementing boosted regression trees models of SOC stocks distributions with geostatistical approaches

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Soil organic carbon (SOC) plays a major role in the global carbon budget. It can act as a source or a sink of atmospheric carbon, thereby possibly influencing the course of climate change. Improving the tools that model the spatial distributions of SOC stocks at national scales is a priority, both for monitoring changes in SOC and as an input for global carbon cycles studies. In this paper, first, we considered several increasingly complex boosted regression trees (BRT), a convenient and efficient multiple regression model from the statistical learning field. Further, we considered and a robust geostatistical approach coupled to the BRT models. Testing the different approaches was performed on the dataset from the French Soil Monitoring Network, with a consistent cross-validation procedure.

We showed that the BRT models, given its ease of use and its predictive performance, could be preferred to geostatistical models for SOC mapping at the national scale, and if possible be joined with geostatistical models. This conclusion is valid provided that care is exercised in model fitting and validating, that the dataset does not allow for modeling local spatial autocorrelations, as it is the case for many national systematic sampling schemes, and when good quality data about SOC drivers included in the models is available.