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Landnutzung und Kohlenstoffhaushalt

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Titel
Spatio-Temporal Monitoring of Agricultural Land Use and Impacts on Soil Organic Carbon in Switzerland

Abstract
Land use conversions between grass- and cropland strongly affect organic carbon stocks in agricultural soils. Thus, spatio-temporal knowledge of land use rotation practices is required for a sustainable agricultural management and to mitigate climate change through soil carbon sequestration. In this study, we present an agricultural monitoring system to obtain annual land use maps of grass- cropland distributions on the agricultural area in Switzerland. Furthermore, we aim to detect impacts on soil organic carbon stocks due to inter-annual land use dynamics within a 15-year period. We used the Landsat archive, terrain and climate variables to set up a Random Forest land use classifier across multiple years. We applied the model for each year from 2000 to 2015 and stacked the classification grids to obtain a map of spatially explicit land use sequences. Finally, we grouped the sequences in six classes of prevailing management practices and attributed soil organic carbon observations, which were recently collected across Switzerland. The classifier shows an overall accuracy of 86% and a Kappa of 0.72 using out-of-bag data for evaluation. The classifications were evaluated using model-free data, showing overall accuracies between 80%-100% and Kappa between 0.6-0.8. Approximately 50% of the agricultural area in Switzerland is subject to rotations between grass- and cropland. The mean soil organic carbon content of permanent grassland use amounts to 3.6%, while permanent cropland use shows a decreased content of 1.8%. Moreover, management practices with increasingly dominant grassland use show higher soil carbon contents (2.9%-3.1%) than the equivalent practices of dominant cropland (2%-2.1%).