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Predicting field N2O emissions and controlling factors in a Swiss grassland using a mid-infrared spectrometer

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Infrared reflectance spectroscopy, alternative to conventional analysis methods, is used to analyze soil physical and chemical properties. The objective of this study was to evaluate the potential of mid-infrared (MIR) spectroscopic technique to determine the spatial and temporal changes and variability in controlling factors of soil N2O emissions under various management practices. In this study, we selected an intensively managed grassland in Chamau, Switzerland as a pilot site. The perennial grassland is situated in the pre-alpine lowlands of Switzerland at 400 m a.s.l., and managed for forage production. Management practices include 4 to 6 times mowing per year. One to two weeks after mowing, the grassland is fertilized with cattle slurry. Gas and soil (0-20 cm depth) samples were collected from April to September 2013. The soil samples were air-dried and ball-milled for spectrum measurements in the MIR (= 4000-400 cm-1). We developed and tested a site-specific calibration model to quantify soil factors affecting daily N2O emissions, namely mineral N concentrations, dissolved organic carbon, pH, and gravimetric water content. Soil MIR databases could be applied to large-scale biogeochemical modeling of N2O emissions to improve our understanding of related mechanisms, encompassing its high spatial and temporal variation. We also discuss potential MIR spectroscopy applications in regional soil assessment and GHG accounting under climate change.