Digital mapping of soil drainage classes using multitemporal RADARSAT-1 and ASTER images and soil survey data

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Abstract

Discriminant analysis classification (DAC) and decision tree classifiers (DTC) were used for digital mapping of soil drainage in the Bras-d’Henri watershed (QC, Canada) using earth observation data (RADARSAT-1 and ASTER) and soil survey dataset. Firstly, a forward stepwise selection was applied to each land use type identified by ASTER image in order to derive an optimal subset of soil drainage class predictors. The classification models were then applied to these subsets for each land use and merged to obtain a digital soil drainage map for the whole watershed. The DTC method provided better classification accuracies (29 to 92%) than the DAC method (33 to 79%) according to the land use type. A similarity measure ($S$) was used to compare the best digital soil drainage map (DTC) to the conventional soil drainage map. Medium to high similarities ($0.6 \leq S < 0.9$) were observed for 83% (187 km$^2$) of the study area while 3% of the study area showed very good agreement ($S \geq 0.9$). Few soil polygons showed very weak similarities ($S < 0.3$). This study demonstrates the efficiency of combining radar and optical remote sensing data with a representative soil dataset for producing digital maps of soil drainage.
Discriminant analysis classification (DAC) and decision tree classifiers (DTC) were used for digital mapping of soil drainage in the Bras-d'Henri watershed (QC, Canada) using earth observation data (RADARSAT-1 and ASTER) and soil survey dataset. Firstly, a forward stepwise selection was applied to each land use type identified by ASTER image in order to derive an optimal subset of soil drainage class predictors. Digital soil mapping (DSM) approaches relating soil data (responses) to environmental data (covariates) face the challenge of building statistical models from large sets of covariates originating, for example, from airborne imaging spectroscopy or multi-scale terrain analysis. The heterogeneity of legacy soil data resulted from several standards of soil description and soil classification, different data keys, different analytical methods and, particularly, often missing metadata for a proper interpretation of the datasets. Therefore, we elaborated a general harmonization scheme that covers all steps required to merge different legacy soil data into one common, consistent database (Walthert et al., 2016). RADARSAT-1 and ASTER Images and Soil Survey Data. Mohamed Abou Niang,1 Michel Nolin,1 Monique Bernier,2 and Isabelle Perron1.

1 Pedology and Precision Agriculture Laboratories, Agriculture and Agri-Food Canada, 979 de Bourgogne Avenue — soil drainage class predictors. The classification models were then applied to these subsets for each land use and merged to obtain a digital soil drainage map for the whole watershed. The DTC method provided better classification accuracies (29 to 92%) than the DAC method (33 to 79%) according to the land use type.