Geophysical Research Abstracts
Vol. 21, EGU2019-1454, 2019
EGU General Assembly 2019

The assessment of crop evolution and soil classes based on Sentinel 2 time series

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In the coming decades, climate change and the expected increase in global population will have a great impact on the food sector, farmers being encouraged to ensure the maintenance of agricultural land in a "good farming" state. A mandatory condition regarding the efficient development of the agricultural management strategies is an accurate and updated cropland mapping for a sustainable implementation of the food supply system. The global coverage of the latest remote sensing data and its technical characteristics have significantly influenced the usage of satellite imagery for monitoring different cropland programs. Among other applications, the Sentinel 2 satellites generation is able to improve the observation, mapping and monitoring the dynamics of crops.

The main purpose of the paper is to accurately identify the crop types in relation with the soil taxonomic units. Based on a satellite earth observation methodology, in reference to traditionally applied manual vectorization methods of the orthophoto, cadastral data and the ALS point clouds, the monitoring of crop evolution follows after the implementation of geoinformation methods for processing and assessing the LULC changes in the last seven decades. The study was performed on a 4 order catchment, according to the Strahler classification. Located in the northeast part of Romania, a high proportion (85 %) of Valea Oii catchment is designated to agricultural land use, the soil underneath being mainly classified as chernozem (48%), soil complexes (18%) and phaeozem (7%). The different patterns occur due to differences in the history of agricultural land and the low correlation between soil class and crop type where as the catchment characteristics, including soil type, soil moisture and land use, affect the quantity and quality of the crops. For allocating a specific agricultural land use to a particular soil unit, it have been noticed that both, physico-chemical soil properties and soil class are equally important.

For crops and soil classification Random Forest algorithm was utilized due to its ability to handle categorical and numerical information, providing a higher overall accuracy and measures for most of the covariates included in the model. The environmental attributes taken into consideration are terrain data derived from ALS point cloud processing, multi-temporal Sentinel 2 imagery bands and indices, LULC CD. For crop monitoring and crop mapping applications have been used NDVI and NDWI, that involves the SWIR and NIR parts of the electromagnetic spectrum close related to the water content property of plants, while Soil and Vegetation Indices (VIs), such as BI, SI, HI, CI, RI, SAVI and PSRI, have the purpose to highlight the vegetation signal, by enabling accurate crop discrimination and minimization of the contribution of solar irradiance and soil background. Based on the ground truth data which consists in 42 soil profiles with known agricultural land uses and management, the overall accuracy of the model is high and provides good results for crop type mapping, making this research a particularly suitable approach when in-field adjustments are needed, as in the case of soil complexes classification.