



FROM SATELLITE IMAGES TO AGRICULTURAL SYSTEMS MAPS: A REMOTE SENSING MULTI-LEVEL OBJECT-BASED APPROACH

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In response to the need of large scale spatial information for supporting agricultural monitoring, we present a new remote sensing object-based approach for objective and repeatable agricultural systems mapping at regional level. This approach is in two steps: 1. A segmentation of land units, based only on a remote sensing time series; These land units are assumed to be representative of the human activity and environmental conditions and thus of the in situ agro-ecosystems; 2. A semi-automatic land use classification, performed in each land unit with high-resolution images, to label the land units in terms of agricultural systems.

To produce the land units, a principal component transformation was first applied to an annual dataset of MODIS (MODerate Imaging Spectroradiometer) normalized difference vegetation index (NDVI) images. A series of segmentations were then performed on the principal component images that contain the essential information on the physiognomy and phenology of the cover. An unsupervised evaluation method was used for identifying the optimum segmentation which successfully delineates homogeneous units in terms of agricultural activity, discriminating the different cropland and grassland areas at regional level. Then, for each land unit, cropping systems maps were produced at a field level through object-based analysis of a Landsat8 30m resolution mosaic image, and spectral variables derived from the MODIS NDVI time series, and were validated with in situ data. Finally, a bottom-up spatial analysis of the extracted land use information at field level allowed definitive classification and characterization of the homogeneous regional level land units in terms of agricultural systems.

A map of the main agricultural systems of the Brazilian state of Tocantins, an agricultural expansion region, has been successfully produced for the year 2015 following this approach. This study shows the potential of multi-resolution satellite images to provide valuable baseline spatial information for supporting agricultural monitoring.