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Agricultural Land Use mapping by multi-sensor approach for hydrological water quality monitoring

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The main objective of this study is to demonstrate potential of operational use of the high and medium resolution remote sensing data for hydrological water quality monitoring by mapping agriculture intensity and crop structures. In particular use of remote sensing mapping for optimization of pesticide monitoring.
The agricultural mapping task is tackled by means of medium spatial and high temporal resolution ESA Envisat MERIS FR images together with single high spatial resolution IRS AWiFS image covering the whole area of interest (the Czech Republic). High resolution data (e.g. SPOT, ALOS, Landsat) are often used for agricultural land use classification, but usually only at regional or local level due to data availability and financial constraints. AWiFS data (nominal spatial resolution 56 m) due to the wide satellite swath seems to be more suitable for use at national level. Nevertheless, one of the critical issues for such a classification is to have sufficient image acquisitions over the whole vegetation period to describe crop development in appropriate way. ESA MERIS middle-resolution data were used in several studies for crop classification. The high temporal and also spectral resolution of MERIS data has indisputable advantage for crop classification. However, spatial resolution of 300 m results in mixture signal in a single pixel. AWiFS-MERIS data synergy brings new perspectives in agricultural Land Use mapping. Also, the developed methodology procedure is fully compatible with future use of ESA (GMES) Sentinel satellite images.
The applied methodology of hybrid multi-sensor approach consists of these main stages: a/ parcel segmentation and spectral pre-classification of high resolution image (AWiFS); b/ ingestion of middle resolution (MERIS) vegetation spectro-temporal features; c/ vegetation signatures unmixing; and d/ semantic object-oriented classification of vegetation classes into final classification scheme. These crop groups were selected to be classified: winter crops, spring crops, oilseed rape, legumes, summer and other crops.
This study highlights operational potentials of high temporal full resolution MERIS images in agricultural land use monitoring. Practical application of this methodology is foreseen, among others, in the water quality monitoring. Effective pesticide monitoring relies also on spatial distribution of applied pesticides, which can be derived from crop – plant protection product relationship. Knowledge of areas with predominant occurrence of specific crop based on remote sensing data described above can be used for a forecast of probable plant protection product application, thus cost-effective pesticide monitoring. The remote sensing data used on a continuous basis can be used in other long-term water management issues and provide valuable data for decision makers.

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