

Sentinel-1 Land Applications based on Multi-temporal Data Acquisitions

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Abstract

The availability of reliable land-use information is crucial for a wide range of applications, like for example monitoring of land-use change and land degradation as well as administrative matters. Compared to optical remote sensing data, radar sensors can provide datasets with regular coverage of a specific area without suffering from missing images because of cloud cover. The regular coverage is crucial for the mapping of land-use characteristics using radar. The availability of a multi-temporal dataset allows high accuracy in mapping basic land-use classes and change, phenological stage of crops and biomass of crops and forests.

This paper gives an overview of state-of-the-art methodologies for large area mapping of land cover characteristics with the radar sensors on board ERS-1/-2 and ASAR. Focus is on natural, vegetated surfaces excluding urban and built-up areas. The examples given demonstrate the added value to existing land cover products based on optical data when radar Earth observation is being introduced.

The continuous acquisition of C-band data since 1991 with ESA's ERS-1/-2 and ASAR satellites represents a great resource of information about very specific vegetation parameters only radar sensors are able to detect: height of cereal crops and grassland, structure of crops (grain vs. large leaf types), moisture conditions, height and density of forest. These parameters are especially crucial when time-relevant information is needed and cloud cover is an obstacle. This is the case for crop monitoring in the temperate climate zone and forest monitoring in the tropics and boreal region.

Recent results from the RADARCOVER project, a new study in order to contribute to the consolidation of Sentinel-1 mission and system requirements to produce land-use mapping products from C-band, will be presented. RADARCOVER includes 1) Calibration, geo-coding and topographic normalization, 2) Filtering, and 3) Classification.

The temporal change of radar backscatter in different polarizations will be used for the classification of different land-use types together with ratios of the ENVISAT APP polarizations. The basic classes to be mapped are 'Water', 'Forest', 'Settlement' and 'Agriculture / Pasture'. Further discrimination of crop types, based on their multi-temporal signature, will be investigated. Key acquisition times for the specific crop types will be analyzed. For the delineation of settlements textural measures will be applied. Pixel and object based segmentation will be tested with respect to their suitability for Sentinel level-2 products.

This paper encourages the land cover community to explore the existing ESA C-band archives for the generation of enhanced value-added products and demonstrates the benefit of future Sentinel-1 data products.