

CED : « Engineering Sciences and Techniques »

THESIS DEFENSE

«NIZAR EL MORTAJI»

CANDIDATE FOR DOCTOR SCIENCES AND TECHNIQUES

« Evaluating the performance of C-band Synthetic Aperture Radar Sentinel-1 time-series in land cover mapping and crop type classification: Application to Loukkos Watershed in Northern Morocco »

Date :	Saturday 21 october 2023
Time :	10 am
Location :	Conference Room, Building F, FST - Tangier

<u>Committe Members</u>		
Pr. Mustapha MAATOUK	FST - Tangier	Chair & Examiner
Pr. Ali ESSAHLAOUI	FS - Meknes	Reviewer
Pr. Abdelilah FEKKAK	FS - El Jadida	Reviewer
Pr. Hakim BOULAASSAL	FST - Tangier	Reviewer
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ABSTRACT

Effective crop monitoring has become increasingly challenging amidst growing populations and inadequate water resources in several countries. Its purpose is to recognize cropland and its geographic extents, serving as the foundation of the agricultural monitoring framework. It serves as a vital instrument for governments to track food security, comprehend natural circumstances, and make informed choices. Integration of spatial data to obtain information on vegetation status in agriculture presents an opportunity to optimize productivity and agricultural techniques. Remote sensing is an important tool for mapping land cover and monitoring agricultural activities in countries with large farmland areas. Optical remote sensing data is commonly used for this purpose. However, in Morocco, active remote sensing data is not being utilized to its full potential despite its significance in monitoring changes in land cover and crops even during cloudy weather. This under-utilization warrants further attention and investigation in the field of remote sensing research. The objective of this research is to investigate the feasibility of utilizing C-band Sentinel-1 radar data for creating a precise land cover map and classifying crops in the irrigated Loukkos watershed agricultural region in northern Morocco. To accomplish this, a time series of 33 dual-polarized images was obtained, comprising of both vertical-vertical (VV) and vertical-horizontal (VH) polarizations. These images were collected during ascending orbits from April 16 to October 25, 2020, to capture the backscattering characteristics of the main crops and other land cover classes within the study area. The research findings indicated that the backscatter increased in correlation with the phenological growth of the monitored crops - rice, watermelon, peanuts, and winter crops. This increase was strong particularly in the VH and VV bands, and slightly for the VH/VV ratio. However, it was observed that the remaining classes - water, built-up, forest, fruit trees, permanent vegetation, greenhouses, and bare lands - did not display noteworthy variation during the same period. A Random Forest Classifier (RF) algorithm was utilized to conduct a supervised classification based on the backscattering analysis and field data. The outcome of the study demonstrated a high classification accuracy (between 74.07% and 75.19%) using time series dual-polarization images with Radar Ratio (VH/VV) or Radar Vegetation Index (RVI) and textural features. The radiometric features and 6-day time resolution provided by Sentinel-1 constellation were instrumental in achieving these high accuracy values. These results highlight the potential usefulness of Sentinel-1 data for multi-temporal crop monitoring and reliable land cover mapping for various applications.

Keywords: Land cover; Sentinel-1; Crop classification; Time series; Loukkos watershed.

