MICROWAVE SATELLITE DATA APPLIED FOR AGRICULTURE AREA - CASE STUDY POLAND

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The radar data have been used for establishing the proper crop information system in Poland. The objective of the study was to find an efficient method of crop classification based on satellite microwave data. There is a large demand of microwave images as due to often cloud effect these satellite data are available during a certain growth seasons. For the research the following satellite data have been applied: ALOS PALSAR and TerraSAR-X.
The study shows that the usage of multi-frequency polarimetric data ensures higher crop recognition accuracy that can be achieved with one band data. It is even possible to discriminate crops which are much alike.
Wielkopolska region located in western Poland was selected for the research works. This region, characterized by intensive agricultural practices and diversified agricultural pattern, was equipped with ground truth information, which enabled to make properly the whole classification process.

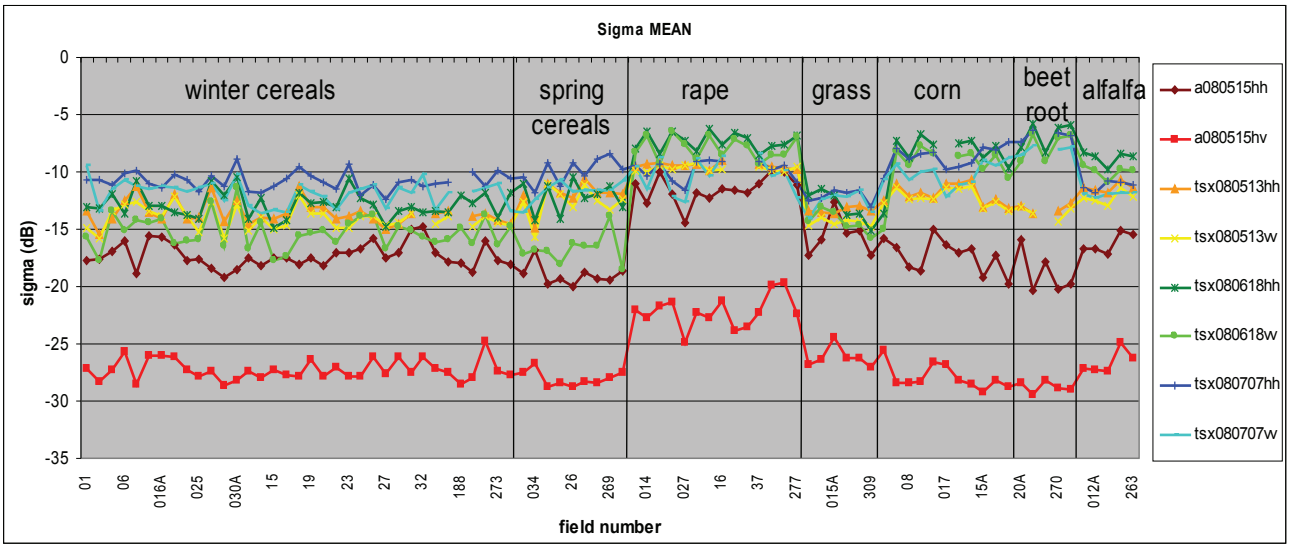

Figure 1. Backscattering coefficient of ALOS (a) and TerraSAR–X (tsx) for different crop types.

Figure 1 presents backscattering coefficients for the year 2008 for various crop types and dates. Rape was well distinguished from winter and spring cereals using ALOS VV and HV in the acquisition of 15th of May. The backscatter of HH varied significantly from backscatter of HV for all crops. Due to considerable difference in biomass of rape the backscattering coefficient in both polarization differed from the rest of crops. At this time the biomass of corn and beet root was the smallest. Backscattering coefficient from TerraSAR-X polarization VV and HH did not varied significantly in the May acquisition. However, for the rape was the largest. In the June acquisition backscattering coefficient from TerraSAR-X polarization VV and HH of winter cereals and spring cereals varied much more than in May. Corn and beet differed in backscatter from rape in May but not so significantly in June because the biomass of these three crops was comparable. In July backscatter of TerraSAR-X differed for beet root and corn (the largest biomass).
The article will present the description and variation of backscatter values of different wave length and polarization for different crop's parameters, bare soil and soil moisture for the different crops.

For the classification of agricultural land the following data have been used: ALOS HH and HV from 15th of May, TerraSAR-X HH and VV from 13th of May, TerraSAR-X HH and VV from 18th of June, and TerraSAR-X HH and VV from 7th of July. The following nine classes were selected to be distinguished in the course of classification: winter cereals, spring cereals, rape, corn, sugar beet, grass, alfalfa, woodland, and built-up land. The results of the classification are presented in the Figure 2.

Object-oriented approach, based on analysis of image objects, proved to be more successful solution than pixel-based approach using supervised classification. It was decided to use for final classification Standard Nearest Neighbour classifier, based on backscattering coefficient values derived for particular classes from all four bands (two dates and two polarizations). The resultant classification image was evaluated using test areas. The general degree of recognition of the main crop types: rape, corn, sugar beets, winter and spring cereals were acceptable. Nevertheless it was found that some classes still are mixed. It concerns mainly built-up land, which is sometimes confused with bare land (and in case of dispersed housing with woodland). Also grasses and fodder crops (like alfalfa) are characterized by some class overlap.

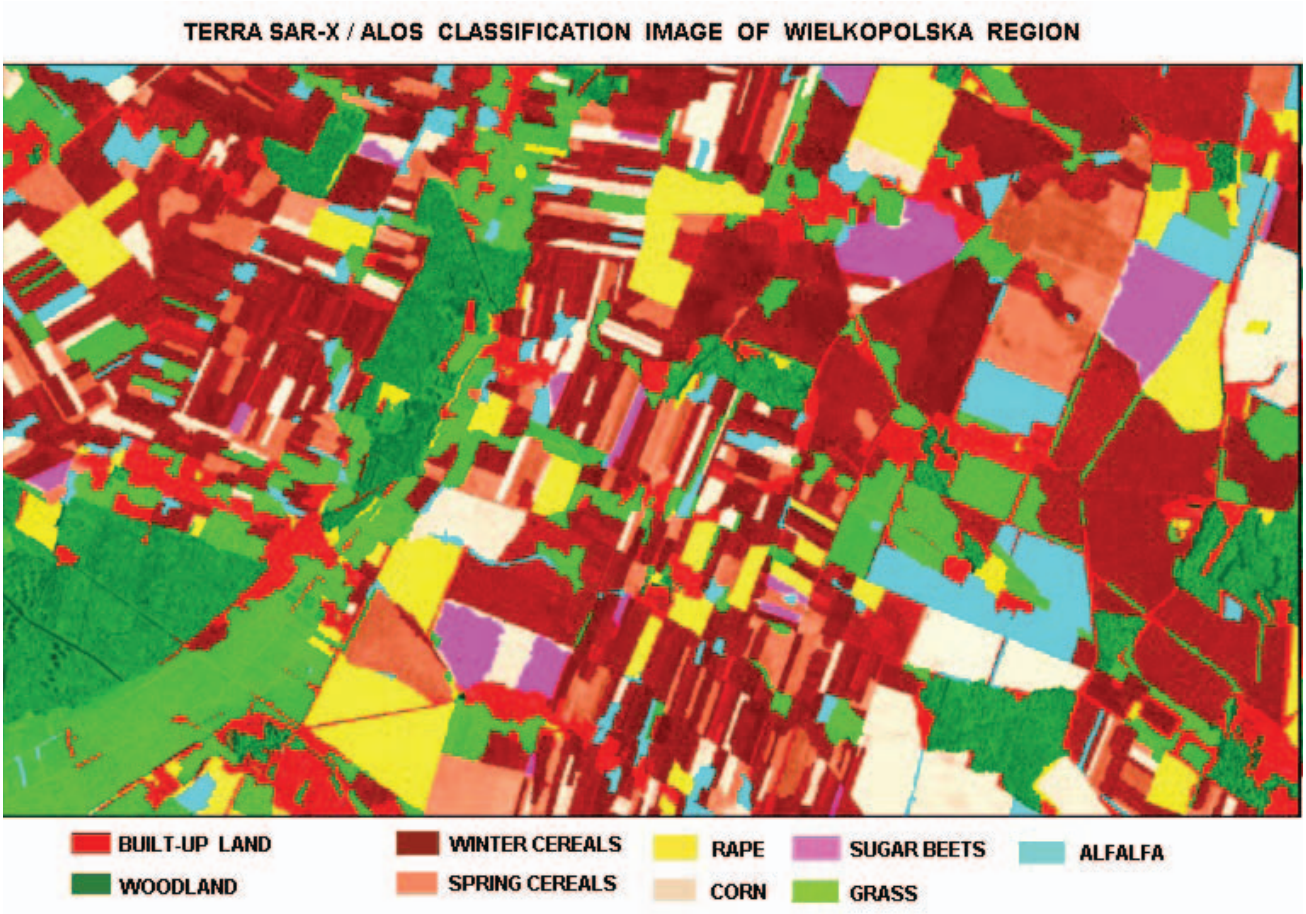

Figure 2. Map of crop classification based on TerraSAR-X and ALOS data.

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