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ENVISAT.MERIS spectral bands and ENVISAT ASAR – discussion on applications of Sentinel 1 and 2 for agriculture in Poland.

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Presented studies were based on application of ENVISAT MERIS data for assessment of crop conditions in 04.05.2003; 26.04.2007 and 04.09.2004. Sentinel 2 will have better spatial resolution than MERIS and additionally short wave infrared band, but the results of LAI assessment were presented using various indices from MERIS and the same study will be repeated using Sentinel data. Also the indices derived from MERIS were correlated with the ASAR data to indicate the possibilities of LAI assessment using Sentinel 1.
The study has been conducted at agricultural region Wielkopolska located in the West part of Poland - The dominating crops are: winter and spring wheat, winter rye, winter and spring triticale, winter and spring barley, winter rape, corn, alfalfa, and sugar beet. Also, grassland area is presented.
For the test area ENVISAT.MERIS images has been obtained for the ESA projects: C1P.1427, AOALO.3677, and C1P.7389. Simultaneously to satellite overpasses ground measurement of various soil-vegetation parameters have been carried out including wet and dry biomass taken from 1 m2 (in the laboratory), LAI using LAI-2000 Plant Canopy Analyser, height of the vegetation, and soil moisture using TRIME-FM. These measurements were applied for statistical analysis of parameters with satellite-derived indices. In this article only data for biomass and Leaf Area Index have been used in order to find the relationship between measured and satellite derived index. There has been found the high correlation between biomass and LAI for each of the studied crops, the highest for beet root and alfalfa (R2=0.95 and R2=0.90), the lowest for rape For the statistical analyses between LAI and satellite data the following indices calculated from Meris have been taken into account: 2/8 (443/681), 5/12 (550/779), 10/5 (754/560), 10/9 (754/709), 12/5 (779/560), and using red edge (10-9)/(10+9), using blue spectrum (10-2)/(10+2), (12-8)/(12+8), (13-7)/(13+7). MERIS blue bands are 1-3, green 4-5, red 6-9, and NIR 10-15. Among considered indices, the best results for getting LAI has been obtained using index 12/5 – the ratio between NIR registered in band 12 and green registered in band 5. The highest correlation was for spring cereals, the lowest for corn (R2=0.81 and R2=0.43).
After statistical analyses of spectral reflectance of various crops, supervised classification of the following MERIS bands: 2, 3, 4, 5, 7, 10, 13, and 15 has been applied. From the classification of MERIS image acquired on 26.04.2007 the following crop types have been distinguished: spring cereals, winter cereals, rape, as well as grassland and bare soil, at which beet roots or corn were in germination or emergence phenological stage. The overall accuracy calculated from error matrix equals to 76%.