Evaluation of relationships between grain yield of cereals and vegetation indices based on satellite data from MODIS

Ewa Panek, Dariusz Gozdowski

Department of Experimental Design and Bioinformatics, Warsaw Univeristy of Life Sciences, Poland

Introduction

Remote sensing data acquired from satellite sensors can be useful for evaluation of crop monitoring at various spatial scale (Sakamoto et al., 2014). One of the satellite sensor which is used for worldwide monitoring of crop status and yield prediction is MODIS which operates on Terra and Aqua satellites. For evaluation of crop status vegetation indices are used. One of the most important vegetation index is NDVI (normalized difference vegetation index) which is calculated on the basis of red and near infrared spectral bands (Rouse et al. 1973).

Material and methods

For the analyses NDVI from MODIS at spatial resolution 250 m was used. Data from years 2012-2016 for period from beginning of March to the end of June at one week interval were used for the analyses. Grain yield of cereals was obtained from Central Statistical Office (GUS 2012-2016). Relationships between NDVI from subsequent measurements and grain yield of cereals were evaluated using analysis of correlation and regression on the basis of averaged data for 16 provinces (voivodeships) of Poland.
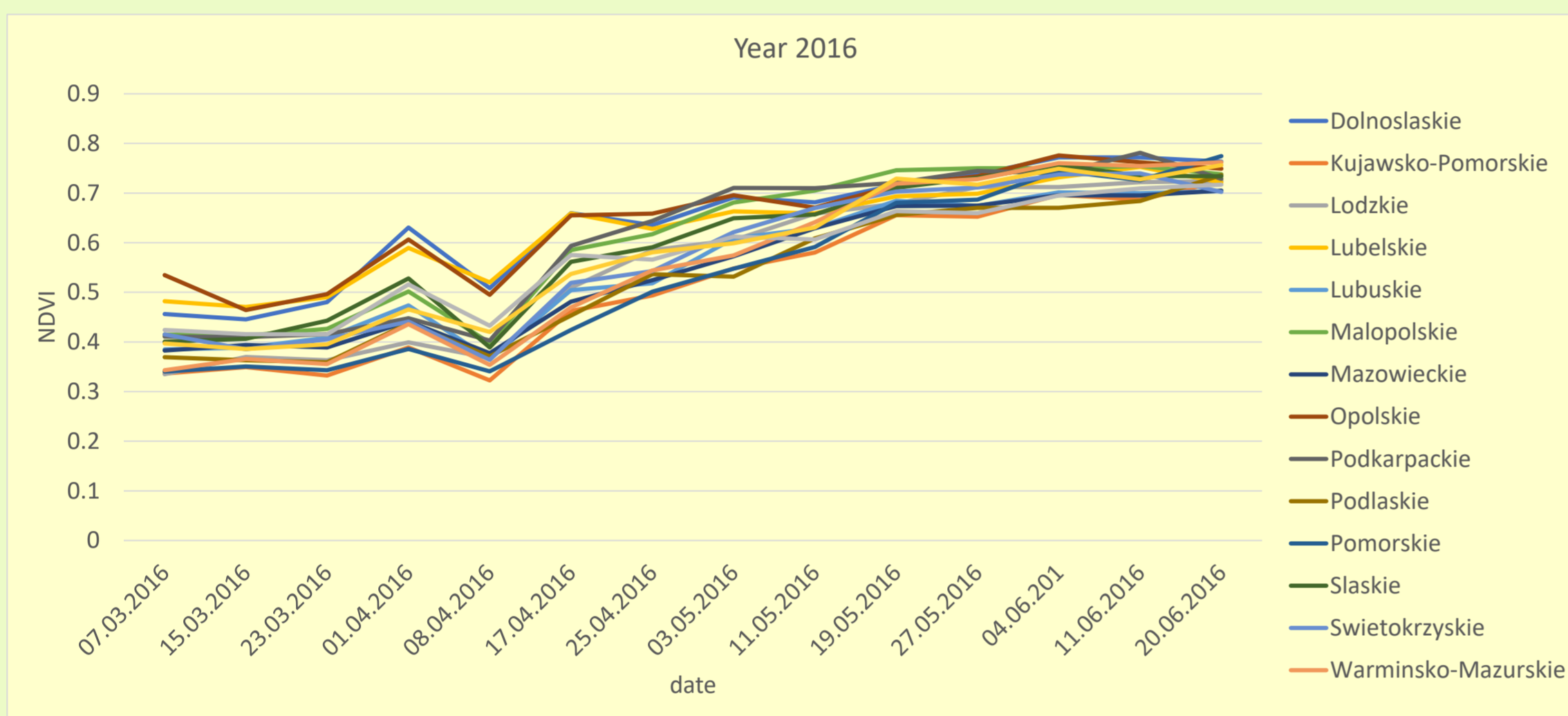
Results

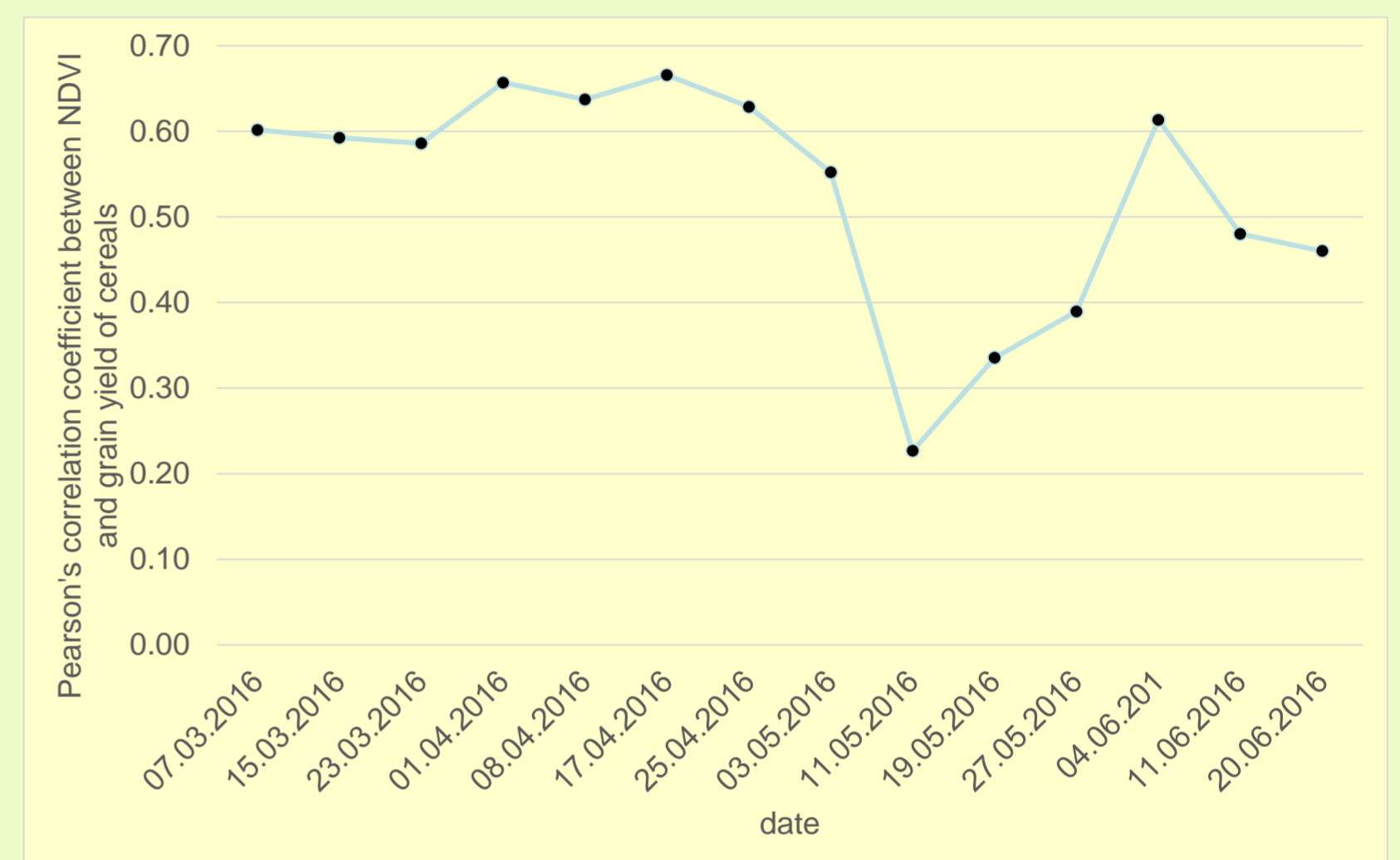Fig. 1. Mean values of NDVI for arable area of provinces of Poland

Fig. 2. Correlation coefficients between NDVI in subseqent measurements and grain yield based on the data for provinces of Poland in year 2016
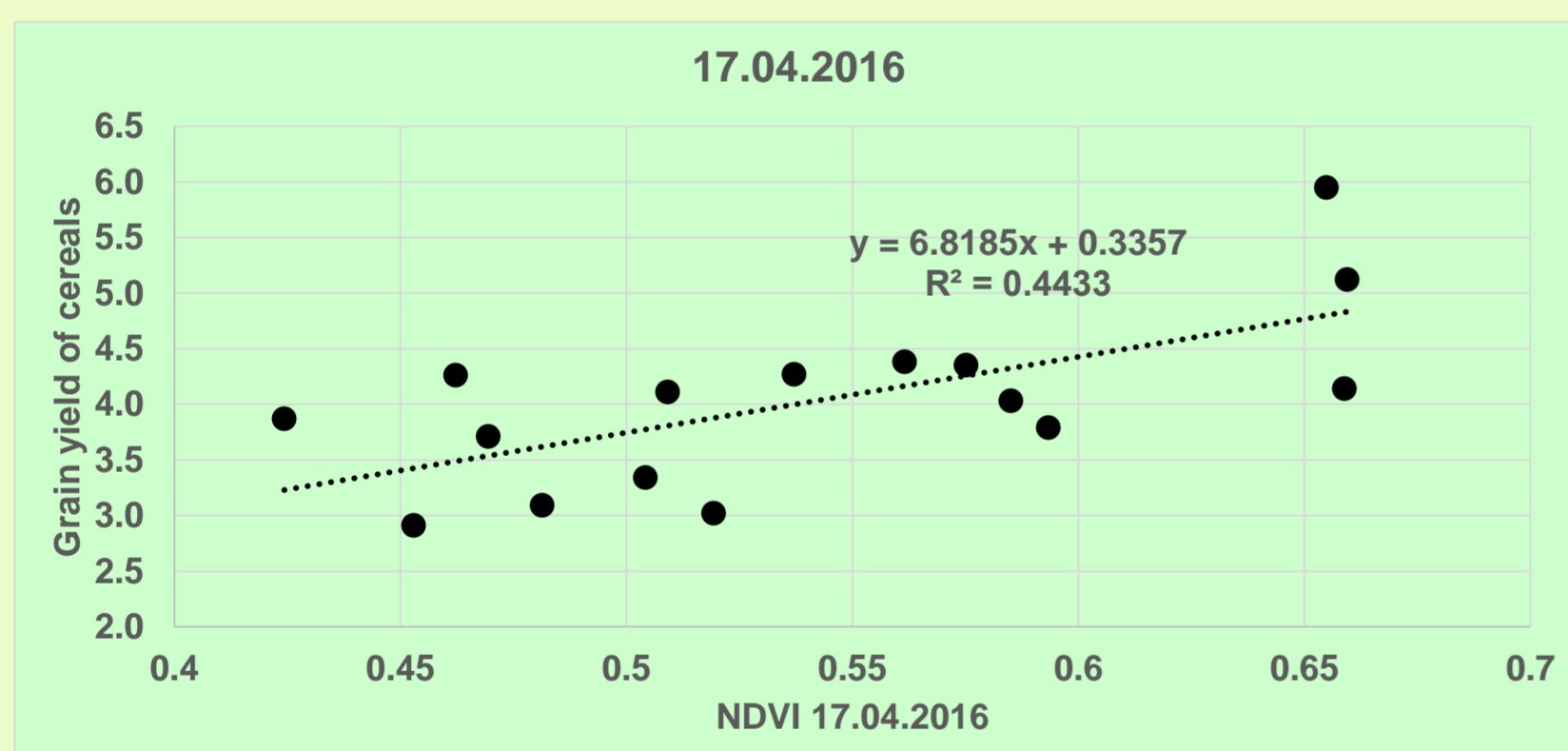

Fig. 3. Relationships between NDVI for two dates and grain yield based on the data for provinces of Poland in year 2016
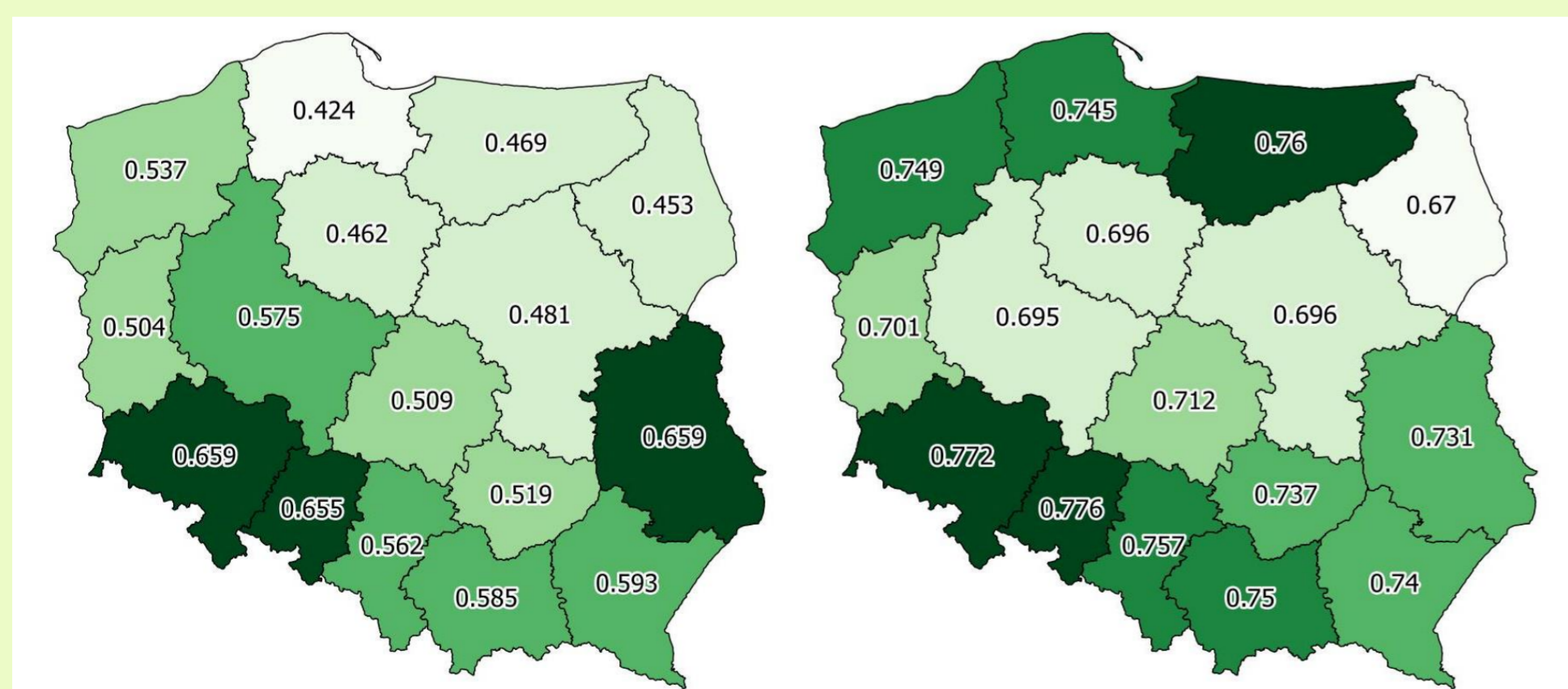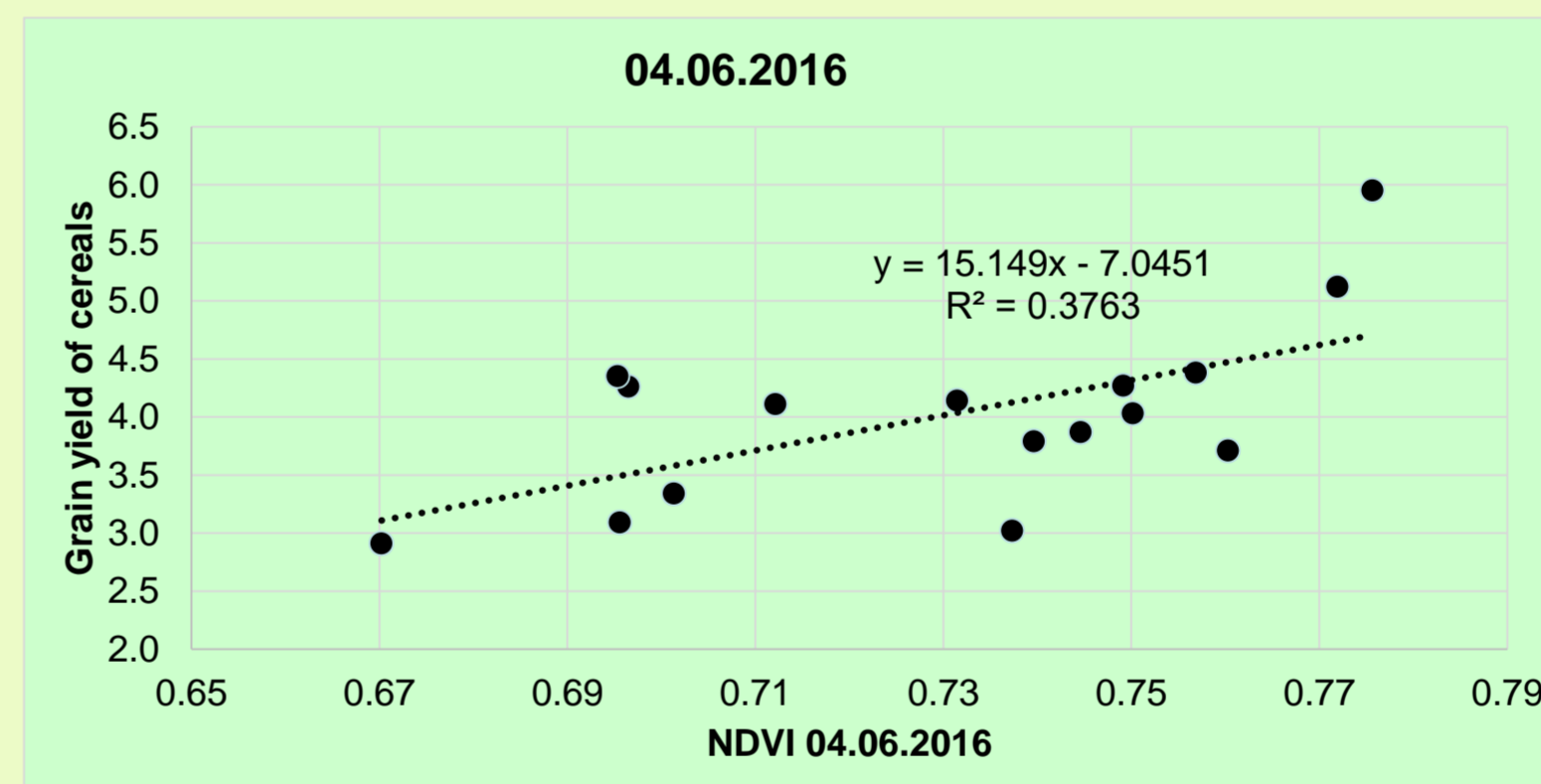

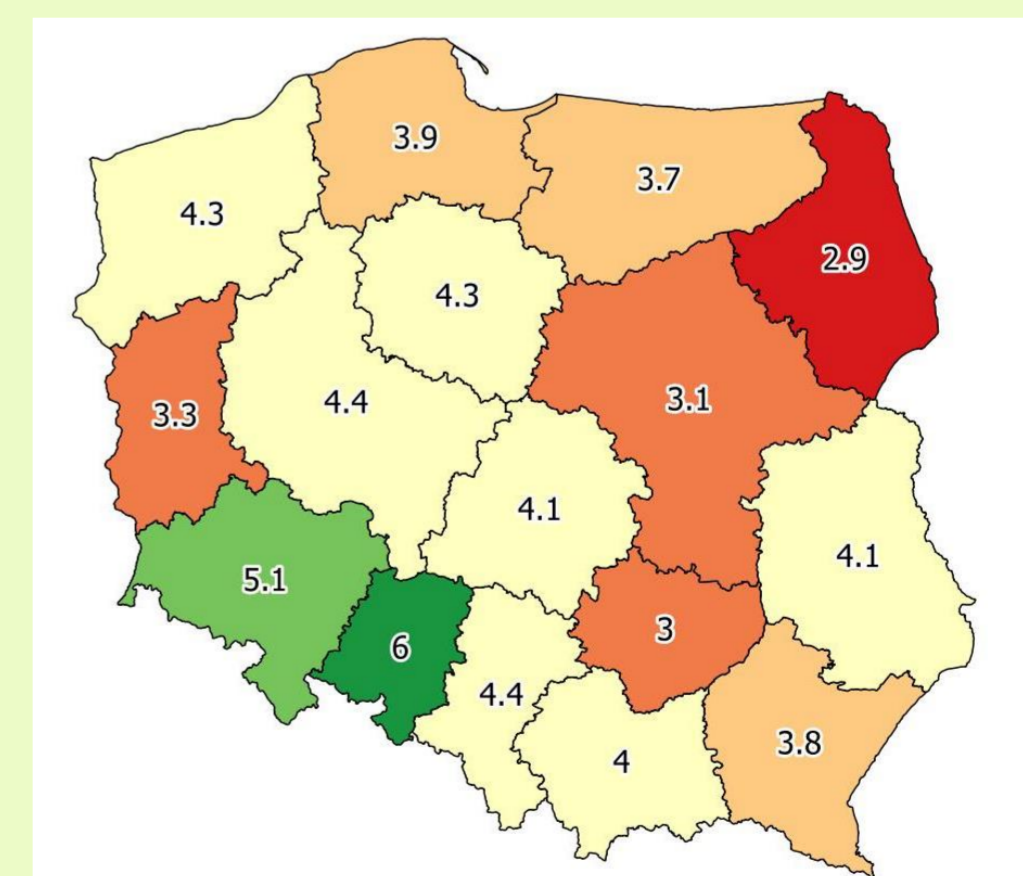Fig. 4. NDVI for two dates (17.04.2016 and 04.06.2018) for provinces of Poland

Fig. 5. Grain yield for provinces of Poland in 2016

References

- Rouse J.W., Haas R.H., Scheel J.A., Deering D.W. 1973. Monitoring Vegetation Systems in the Great Plains with ERTS. Proceedings, 3rd Earth Resource Technology Satellite (ERTS) Symposium, 1: 48-62
- Sakamoto T., Gitelson A.A., Arkebauer T.J. 2014. Near real-time prediction of US corn yields based on time-series MODIS data. Remote Sensing of Environment 147: 219-231.
- GUS. 2012-2018. Local Data Bank. https://bdl.stat.gov.pl

Conclusions

The strongest relationships were observed for NDVI acquired during intensive growth of plants but the resuts were different in years. Relationships for NDVI acquired in early spring or in the end of June were usually weaker. The most accurate forecasting of grain yield of cereals using satellite data for Poland is possible for May and beginning of June.