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Comparison of the remotely sensed start of the season and ground phenology observations of the cereal crops

Roman Bohovic (1,2), Petr Hlavinka (1,3), Daniela Semerádová (1,3), Jan Bálek (1,3), Mirek Trnka (1,3)

(1) Global Change Research Centre, Academy of Sciences CR, Bělidla 4a, 603 00 Brno, Czech Republic, (2) Institute of Geography, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic, (3) Institute of Agrosystems and Bioclimatology, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

Phenology monitoring such as start of the season of agricultural crops are important characteristics observed on the ground basis by the farmers and authorities already for the long time. Due to costs, coverage, site disparities and time demands of ground observations is remote sensing phenology an interesting option. Satellite observations enable monitoring of the ground vegetation already at sufficient resolution and in country and regional scale at the same time. However, ground and remote sensing phenology differ in nature of its object. First is focused on single species and limited individuals at the observation spot. Remote sensing is from its construction definition able to monitor area-wide vegetation communities. To understand these differences and to set the procedures to overcome it is the aim of this study.

Case study area covers Czech Republic in Central Europe with typical four season temperate climate that strongly influence the vegetation. Daily MODIS (Moderate Resolution Imaging Spectroradiometer) remote sensing data in 250 by 250 meters resolution were used to compute NDVI (normalized difference vegetation index). Iterative developed method for the filtering of NDVI time series since 2000 up till now is crucial for overcoming missing periods mainly due to atmospheric conditions. From improved curve of NDVI start of the season is derived as absolute threshold value of 50% NDVI.

Comparison of remotely sensed start of the season with observations of emergence of spring barley and beginning of leaf sheath elongation for winter wheat was done. Data were correlated at 90 ground stations across Czech Republic between the years 2000 and 2012. Correlations at original 250x250 meters resolution and aggregations of 5x5 km were investigated. Different land cover classes were considered for aggregated areas.

Correlation of start of the season shows lower results for spring barley caused by strong influence of winter signal and crop sowing date by farmers. Best correlation results were achieved for aggregated areas for winter wheat on agricultural and arable land. Evaluation verified the ability of remotely sensed data to provide area wide information on vegetation dynamics. Moreover, precisely tuned derivation of vegetation metrics can serve also to answer some site specific phenology questions.

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