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Monitoring the state of vegetation in Hungary using 15 years long MODIS Data

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Monitoring the state and health of the vegetation is essential to understand causes and severity of environmental change and to prepare for the negative effects of climate change on plant growth and productivity. Satellite remote sensing is the fundamental tool to monitor and study the changes of vegetation activity in general and to understand its relationship with the climate fluctuations. Vegetation indices and other vegetation related measures calculated from remotely sensed data are widely used to monitor and characterize the state of the terrestrial vegetation. Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI) are among the most popular indices that can be calculated from measurements of the MODerate resolution Imaging Spectroradiometer (MODIS) sensor onboard the NASA EOS-AM1/Terra and EOS-PM1/Aqua satellites (since 1999 and 2002 respectively). Based on the available, 15 years long MODIS data (2000-2014) the vegetation characteristics of Hungary was investigated in our research, primarily using vegetation indices. The MODIS NDVI and EVI (both part of the so-called MOD13 product of NASA) are freely available with a finest spatial resolution of 250 meters and a temporal resolution of 16 days since 2000/2002 (for Terra and Aqua respectively). The accuracy, the spatial resolution and temporal continuity of the MODIS products makes these datasets highly valuable despite of its relatively short temporal coverage. NDVI is also calculated routinely from the raw MODIS data collected by the receiving station of Eötvös Loránd University.

In order to characterize vegetation activity and its variability within the Carpathian Basin the area-averaged annual cycles and their interannual variability were determined. The main aim was to find those years that can be considered as extreme according to specific indices. Using archive meteorological data the effects of extreme weather on vegetation activity and growth were investigated with emphasis on drought and heat waves. Te relationship between anomalies of vegetation characteristics and crop yield decrease in agricultural regions were characterised as well. The mean NDVI values of Hungary during the 15 years reveal the behaviour of the vegetation in the country, where the main land cover types (forest, agriculture and grassland) were distinguished as well. NDVI anomalies are analyzed separately for the main land cover types. Deviations from the potential maximum vegetation greenness are also calculated for the entire time period.