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Spatial and temporal variability of landscape phenology based on EVI data

Márta Hunkár (1) and Ildikó Szenyán ()

(1) University of Pannonia, Georgikon Faculty, Economic Methodology, Keszthely, Hungary (hunkar@georgikon.hu), (2) Hungarian Meteorological Service (szenyan.i@met.hu)

Increasing number of climate change studies in the 1990s evolved the interest in phenological research and thus the demand for phenological observations has increased substantially. Mainly, rising air temperatures in recent decades and the clear phenological response of plants and animals to this increase have caused the growing interest. Monitoring phenological phases is carried out in many European countries. Each country has its own database, in some cases still on paper, mostly on databank-systems, going back in many cases to the 1950s. Recently remote sensing phenology, the use of satellites to track phenological events can complement or in some cases substitute ground observation networks. Satellites provide a unique perspective of the planet and allow for regular, even daily, monitoring of the entire global land surface. Because the most frequently used satellite sensors for monitoring phenological events have relatively large "footprints" on the land surface, they gather data about entire ecosystems or regions rather than individual species. Remote sensing phenology can reveal broad-scale phenological trends that would be difficult, if not impossible, to detect from the ground, and because data collection by satellite sensors can be standardized, the data are reliably objective. Obviously remote sensing data are not the traditional phenological phases but they are reflectance () in different spectral channels. The status of the vegetation is in close connection with its reflectance especially in the near infrared and red spectrums. In our study we used “Enhanced Vegetation Index” (EVI) to characterize the status of vegetation on a sample area with the size of 5 km x 5 km inhomogeneous terrain NW corner: 46o 19’ 33,6”N, 17o 42’ 38,52”E , NE corner: 46o 19’ 33,6”N; 17o 46’ 15,96”E; SW corner: 46o 17’ 3,84”N; 17o 41’ 50,28”E, SE corner: 46o 17’ 3,84”N; 17o 45’27”E. EVI data are available from MODIS placed at Terra and Aqua satellites. High resolution (250m x250m pixels) composite data with 8 day frequency for the last ten years will be analysed. Spatial variation of EVI data is analysed by the variation coefficients of that 400 pixels of the sample area. Temporal variation in EVI data are modelled using piecewise sigmoid models. Each growth cycle is modelled using two sigmoid functions: one for the growth phase, one for the senescence phase. To identify phenological transition dates, the rate of change in the curvature of the fitted logistic models is used for each year. Specifically, transition dates correspond to the times at which the rate of change in curvature in the EVI data exhibits local minima or maximums. For each growth cycle, four phenological transition dates are recorded based on the approach described above. The corresponding phenological transition dates are defined as the onset of greenness increase (F1), the onset of greenness maximum (F2), the onset of greenness decrease (F3), and the onset of greenness minimum (F4). The dates of that four “landscape phenological phases” are compared with the daily meteorological data derived from the closest meteorological station.