Monitoring of land surface dynamics across Ukraine from 1982 to 2013 using GIMMS NDVI3g time series

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Land surface dynamics are induced by anthropogenic and/or climatic drivers and can have a major impact on ecosystem functioning. During the last decades, Ukraine has experienced immense institutional and environmental changes. Considering the importance of land surface dynamics, this research aims to explore long term and seasonal trends and variability of land-use and land-cover across Ukraine for over three decadal time span (1982-2013). To analyse and evaluate the temporal trends of inter-annual and seasonal changes, this study was conducted in two consecutive steps. First, Global Inventory Modelling and Mapping Studies (GIMMS) Normalized Difference Vegetation Index (NDVI) time series were used for the trend analysis at different aggregation level. Second, variation of essential phonological variables (start/end of the season, peak and small integral of the season) over the whole area of Ukraine were studied. We tested several most used methods for trend analysis including Mann-Kendall trend analysis, Breaks For Additive Season and Trend (BFAST).

The obtained results were different depending on used method. Based on annual trends, around one third of the area was characterised with positive trends. Meanwhile, the use of breakpoints increased the number of detected significant negative trends. Around 26 % of the area was characterised with negative breaks. The breakpoints with negative magnitude were mainly pronounced in Chernihiv, Zhytomyr, Sumy and Kiev regions. The analysis of phenological metrics revealed the shifts in seasonality. This was particularly evident in the south eastern regions of the country (Odessa, Mykolayiv, Crimea). In order to relate the detected changes with disturbances and to check the robustness of temporal distribution of breakpoints, the validation is carried out based on reference areas of changes.

Trajectories of these vegetation metrics derived from a full-length remote sensing datasets can lead to better understanding of land surface dynamics in general and specifically of vegetation degradation and recovery, the potential causes of these dynamics and their underlying processes. In addition, the use of different methods (e.g. parametric and non-parametric trend analysis, change point analysis) enables a more reliable identification of ecosystem dynamics.

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