NDVI Trends Observed over 30 Years for Different Land Cover Types and Biogeographical Regions in Europe Based on the TIMELINE NDVI Product

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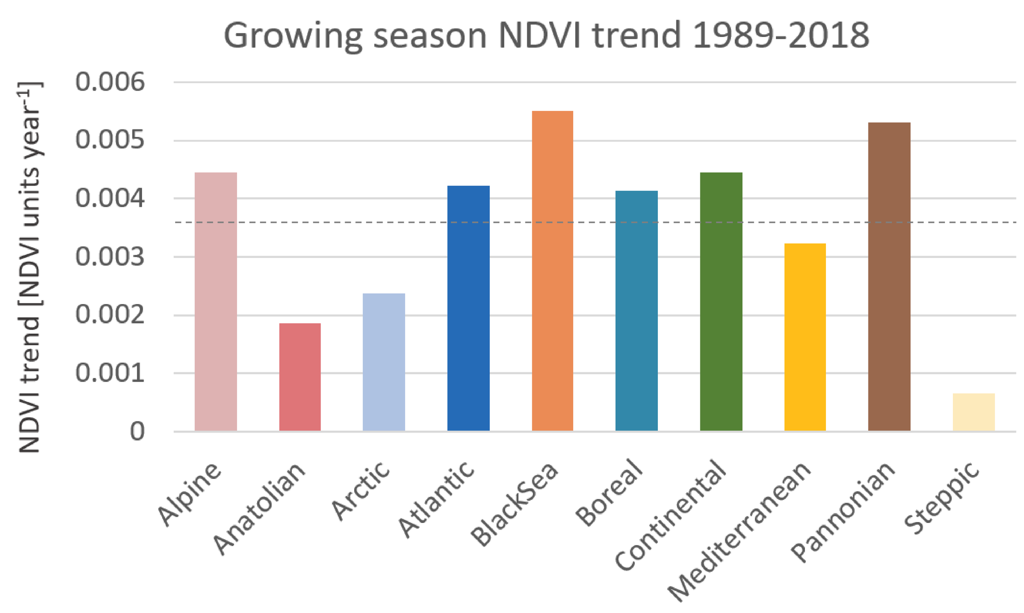
Introduction

Remote sensing allows for spatially and timely continuous monitoring of the Earth's surface. The analysis of remote sensing time-series can help to understand ongoing environmental changes. Especially the monitoring of past and current vegetation status and phenology allow to identify possible long-term patterns and trends. The availability of multi-decadal remote sensing time-series at high temporal resolution, such as from the Advanced Very High Resolution Radiometer (AVHRR), are essential to analyze long-term vegetation change over large areas and for investigating differences among specific regions or land cover types. In the TIMELINE project (TIMe Series Processing of Medium Resolution Earth Observation Data assessing Long-Term Dynamics In our Natural Environment) of the German Remote Sensing Data Center (DFD) at the German Aerospace Center (DLR), a novel time-series of daily, 10-day, and monthly NDVI composites based on AVHRR data at unprecedented 1 km resolution covering Europe and northern Africa has been generated (Dech et al. 2021, Asam et al. 2023). The NDVI product currently spans the time period 1981-2018. Reprocessing of the time-series and inclusion of more recent years is ongoing.

Methodology

In this study, we used the TIMELINE monthly NDVI composites from the 30-year period 1989-2018 to derive long-term vegetation trends using Mann-Kendall trend test and Theil-Sen slope estimator (Eisfelder et al. 2023). We analyzed trends for the growing season and seasonal trends for spring, summer, and autumn for different land cover classes (rainfed cropland, broadleaved forest, needleleaved forest, shrubland, grassland) within the individual biogeographical regions (as defined by the European Environment Agency) in Europe.



Growing season (March–November) NDVI trend for the period 1989-2018 within different biogeographical regions in Europe. The dashed line gives the average trend over all biogeographical regions in Europe.

Results

Our results reveal different NDVI trends for individual biogeographical regions and land cover classes in Europe. The trend for the growing season is positive for all regions, with strongest NDVI increases in the Black Sea and Pannonian biogeographical regions. For most regions, positive NDVI trends can be observed for all seasons and land cover classes. Strongest negative trends occur in the Steppic region, where cropland and grassland exhibit negative NDVI trends in summer and autumn. In the more western biogeographical regions, the positive trends are strongest in autumn. The regions in eastern Europe show higher positive NDVI trends in spring compared to summer or autumn. Further analyses are ongoing, which can assist to better understand European-wide vegetation dynamics and possible impacts of climate change on different land cover classes and within different regions in Europe.

Seasonal NDVI trends for the period 1989-2018 within different biogeographical regions in Europe. The diagrams show the NDVI trends for five land cover types (rainfed cropland, broadleaved forest, needleleaved forest, shrubland, grassland) for three seasons (spring, summer, autumn) within the biogeographical regions.

References

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EGU General Assembly 2024

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