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Earth Observation for monitoring phenology for european land use and ecosystems over 1998-2011

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Long-term measurements of plant phenology have been used to track vegetation responses to climate change but are often limited to particular species and locations and may not represent synoptic patterns. Given the limitations of working directly with in-situ data, many researchers have instead used available satellite remote sensing. Remote sensing extends the possible spatial coverage and temporal range of phenological assessments of environmental change due to the greater availability of observations. Variations and trends of vegetation dynamics are important because they alter the surface carbon, water and energy balance. For example, the net ecosystem CO_2 exchange of vegetation is strongly linked to length of the growing season: extentions and decreases in length of growing season modify carbon uptake and the amount of CO_2 in the atmosphere. Advances and delays in starting of growing season also affect the surface energy balance and consequently transpiration. The Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) is a key climate variable identified by Global Terrestrial Observing System (GTOS) that can be monitored from space. This dimensionless variable - varying between 0 and 1- is directly linked to the photosynthetic activity of vegetation, and therefore, can monitor changes in phenology. In this study, we identify the spatio/temporal patterns of vegetation dynamics using a long-term remotely sensed FAPAR dataset over Europe. Our aim is to provide a quantitative analysis of vegetation dynamics relevant to climate studies in Europe. As part of this analysis, six vegetation phenological metrics have been defined and made routinely in Europe. Over time, such metrics can track simple, yet critical, impacts of climate change on ecosystems. Validation has been performed through a direct comparison against ground-based data over ecological sites. Subsequently, using the spatio/temporal variability of this suite of metrics, we classify areas with similar vegetation dynamics. This permits assessment of variations and trends of vegetation dynamics over Europe. Statistical tests to assess the significance of temporal changes are used to evaluate trends in the metrics derived from the recorded time series of the FAPAR.