Geophysical Research Abstracts
Vol. 12, EGU2010-11124, 2010
EGU General Assembly 2010

Evaluation of methods to derive green-up dates based on daily NDVI satellite observations

Daniel Doktor

Helmholtz Centre for Environmental Research, Department of Computational Landscape Ecology, Germany, daniel.doktor@ufz.de

Bridging the gap between satellite derived green-up dates and in situ phenological observations has been the purpose of many studies over the last decades. Despite substantial advancements in satellite technology and data quality checks there is as yet no universally accepted method for extracting phenological metrics based on satellite derived vegetation indices. Dependent on the respective method derived green-up dates can vary up to serveral weeks using identical data sets. Consequently, it is difficult to compare various studies and to accurately determine an increased vegetation length due to changing temperature patterns as observed by ground phenological networks.

Here, I compared how the characteristic NDVI increase over temperate deciduous forests in Germany in spring relates to respective budburst events observed on the ground. MODIS Terra daily surface reflectances with a 250 m resolution (2000-2008) were gathered to compute daily NDVI values. As ground truth, observations of the extensive phenological network of the German Weather Service were used. About 1500 observations per year and species (Beech, Oak and Birch) were available evenly distributed all over Germany.

Two filtering methods were tested to reduce the noisy raw data. The first method only keeps NDVI values which are classified as ‚ideal global quality' and applies on those a temporal moving window where values are removed which differ more than 20% of the mean. The second method uses an adaptation of the BISE (Best Index Slope Extraction) algorithm. Subsequently, three functions were fitted to the selected observations: a simple linear interpolation, a sigmoidal function and a double logistic sigmoidal function allowing to approximate two temporally separated green-up signals. The green-up date was then determined at halfway between minimum and maximum (linear interpolation) or at the inflexion point of the sigmoidal curve. A number of global threshold values (NDVI 0.4,0.5,0.6) and varying definitions of the NDVI baseline during dormancy were also tested.
In contrast to most past studies, I did not attempt to identify matched pairs of geographically coincident ground and satellite observations. Rather than comparing on an individual grid-cell basis I analysed and compared the statistical properties of distributions generated from ground and satellite observations. It has been noticed that remote sensing provides a statistical distribution of a random variable, not an exact representation of the state of the land surface or atmosphere at a particular pixel. The same holds true for ground observations as they sample from biological variability and landscapes with heterogeneous microclimates.

First results reveal substantial differences between the applied methods. Based on the assumption that the satellite captures predominantly the greening-up of the canopy - which occurs about 2 weeks later than observed budburst dates – the double sigmoidal function combined with the BISE filtering procedure performed best.