Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09663, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09663
EGU General Assembly 2008

Remote sensing based determination of percentage tree cover in West Africa

M. Machwitz (1), M. Schramm (1), T. Landmann(1), S. Dech (1,2)

(1) University of Wuerzburg, Department of Geography, Remote Sensing Unit, Germany, (2) German Aerospace Center (DLR), German Remote Sensing Center (DFD), Oberpfaffenhofen, Germany (miriam.machwitz@uni-wuerzburg.de / Fax: +49-931-888-4961 / Phone: +49-931-888-4797)

Percentage tree cover is an essential measure in many earth system sciences. For instance, tree biomass is required for climate modelling, because it plays a significant role as accumulator of carbon. However, spatial and temporal distribution of tree cover is varying especially in regions with high land cover dynamics such as West Africa. Land transformations endanger the tree vegetation, which can be understood as the most vulnerable carbon pool of this region. Nowadays remote sensing is widely used to quantify such land cover changes. But due to hard classification in combination with insufficient geometric resolution of the input data common tree density maps with a scale of 500 m, like the MODIS VCF product, are not considerate of the fine scaled land cover structures in West Africa. Especially for heterogeneous savannah regions these land cover products are still lacking an acceptable accuracy. But climate change research requires rigorous information about the spatial distribution and temporal dynamics of woody vegetation at a high quality level.

This study presents a remote sensing based multi-scale approach for consistently quantifying tree cover percentage in West African ecosystems. First, tree density is derived from 15m resolute ASTER data by multiple endmember spectral mixture analysis (MESMA), which produces continuous classes. This method calculates endmember proportions by means of their known spectra via parameter estimation with least squares adjustments. The algorithm uses target spectra, which are provided from USGS in spectral libraries and include soil, dry and green Vegetation. As additional

endmember, pure water spectrum was extracted directly from the satellite data. Spectral mixture analysis allows to estimate subpixel tree cover density in a more accurate way than standard classification methods.

In a second step, the tree cover maps based on ASTER spectral unmixing data were utilized as training samples for upscaling to subcontinental scale. The results of the spectral mixture analysis were rescaled via a Gaussian Kernel and a regression tree analysis was applied on MODIS remote sensing time series generated from 16-day MOD13 products at a scale of 250 m. These products comprise two vegetation indices, the Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI), and four bands ranging from the blue to the middle infrared spectra. The time series generation included a rigorous quality analyses. A segmentation of the time series in 3 seasonal parts was performaned to consider the annual phenology of vegetation. The three segments represent the end of dry season, rainy season and beginning of dry season. For the estimation of the tree cover, statistic features like mean, minimum, maximum and characteristics of first derivative as well of the segments as the whole time series were generated. In addition to these remote sensing features, information on land forms derived from the 90-meter SRTM elevation model data (CGIAR-CSI) were entered into the regression analysis.

A new high quality product resulted from this approach, which is distinguished from the current MODIS VCF product with 500 m resolution for this area by a more precise accuracy and a higher geometric resolution. Tree density maps of West African semi arid regions at a scale of 250 m allows a more accurate biomass modelling derived from the fine scaled land cover structures in West Africa.