Geophysical Research Abstracts
Vol. 16, EGU2014-9865, 2014
EGU General Assembly 2014

Monitoring of the Spatial Distribution and Temporal Dynamics of the Green Vegetation Fraction of Croplands in Southwest Germany Using High-Resolution RapidEye Satellite Images

Kristina Imukova, Joachim Ingwersen, and Thilo Streck
Germany (Kristina.Imukova@uni-hohenheim.de)

The green vegetation fraction (GVF) is a key input variable to the evapotranspiration scheme applied in the widely used NOAH land surface model (LSM). In standard applications of the NOAH LSM, the GVF is taken from a global map with a 15 km×15 km resolution. The central objective of the present study was (a) to derive gridded GVF data in a high spatial and temporal resolution from RapidEye images for a region in Southwest Germany, and (b) to improve the representation of the GVF dynamics of croplands in the NOAH LSM for a better simulation of water and energy exchange between land surface and atmosphere. For the region under study we obtained monthly RapidEye satellite images with a resolution 5 m×5 m by the German Aerospace Center (DLR). The images hold five spectral bands: blue, green, red, red-edge and near infrared (NIR). The GVF dynamics were determined based on the Normalized Difference Vegetation Index (NDVI) calculated from the red and near-infrared bands of the satellite images. The satellite GVF data were calibrated and validated against ground truth measurements. Digital colour photographs above the canopy were taken with a boom-mounted digital camera at fifteen permanently marked plots (1 m×1 m). Crops under study were winter wheat, winter rape and silage maize. The GVF was computed based on the red and the green band of the photographs according to Rundquist's method (2002). Based on the obtained calibration scheme GVF maps were derived in a monthly resolution for the region. Our results confirm a linear relationship between GVF and NDVI and demonstrate that it is possible to determine the GVF of croplands from RapidEye images based on a simple two end-member mixing model. Our data highlight the high variability of the GVF in time and space. At the field scale, the GVF was normally distributed with a coefficient of variation of about 32%. Variability was mainly caused by soil heterogeneities and management differences. At the regional scale the GVF showed a bimodal distribution, which could be related to the different cultivation schemes of crops. We suggest to divide croplands according their distinctly different temporal dynamics of the GVF into "early covering - maturing" crops (winter rape, winter wheat, spring barley) and "late covering – non-maturing" crops (sugar beet, silage maize). Based on the achieved results we recommend that simulations with LSM should take into account this differentiation of croplands since it is to be expected that these two crop groups have pronounced differences with regard to energy partitioning at the land surface.