Geophysical Research Abstracts
Vol. 20, EGU2018-2425, 2018
EGU General Assembly 2018


# How to link the Sentinl-2 FAPAR product to FAPAR ground measurements in a mixed coniferous forest considering different scales

Birgitta Putzenlechner (1), Philip Marzahn (1), Ralf Ludwig (1), and Arturo Sanchez-Azofeifa (2)

(1) Ludwig-Maximilians-Universitaet, Department of Geography, Munich, Germany, (2) University of Albera, Earth and Atmospheric Sciences Department, Edmonton, Alberta, Canada

The distribution of Photosynthetic Active Radiation (PAR) in forests controls growth and competition. The Fraction of Absorbed Photosynthetic Active Radiation (FAPAR) links available Photosynthetic Active Radiation to the absorption of plants and is needed for calculating carbon balances of forest ecosystems. ESA's satellite mission Sentinel-2 (S2) now offers a FAPAR product with decametric spatial resolution to monitor vegetation productivity and dynamics on single forest stands. Previous studies on the validation of satellite-derived FAPAR products have found large discrepancies in forests and highlighted the need for independent ground observations. However, FAPAR ground observations obtained from direct PAR measurements are still scarce and approaches on how to link different spatial and temporal scales between point measurement and satellite-derived product and temporal scales have not been developed. The aim of this study is to develop a strategy to validate the S2 FAPAR product with FAPAR ground measurements considering different spatial and temporal scales.

Therefore, permanent synchronized PAR measurements were carried out between 2015 and 2017 at Graswang TERENO monitoring site, Southern Germany, within a conifer-dominated forest using a Wireless Sensor Network (WSN) with a sampling interval of 10 min. From the ratio of transmitted PAR obtained from 16 sensors (area approx. 0.2 ha) and incoming PAR measured outside the forest, a two-flux FAPAR estimate was calculated. S2 cloud-free images were atmospherically corrected and processed to retrieve the L2B product (S2 toolbox). Spatial variability is evaluated by comparing variograms and probability distributions of ground estimate and S2 FAPAR product. The influence of different spatial scale on the product difference is investigated by choosing different resampling in the pre-processing of the S2 FAPAR product; the role of temporal scale is investigated by comparing daily averages of ground-based FAPAR vs. FAPAR at the time of the satellite overpass.

Despite the dominance of spruces within the forest stand, FAPAR ground measurements exhibit considerable seasonal variability (0.85 to 0.95 $\pm$ 0.04), following the phenology of beech trees. Spring leaf unfolding and autumn senescence is well reflected in the S2 product, even on the scale of single pixels. Our results show that the choice of temporal aggregation of ground measurements has a large impact on the difference between the S2 product and FAPAR ground estimates. For a decametric FAPAR product, we found that the number of ground samples available within one pixel of the S2 FAPAR product (20 x 20 $m^2$) is limited by the footprint of PAR sensors (approx. 10 m) to avoid autocorrelation. Instead, a higher number of ground samples as it is possible with a WSN is urgently required, covering multiple satellite pixels, for upcoming validation activities.