Large-scale validation of fractional vegetation cover maps using high-resolution RGB-UAV videos.

Kevin Kühl[1], Peter Schwind[1], Paul Karlshöfer[1], Uta Heiden[1]

[1] German Aerospace Center (DLR), Earth Observation Center (EOC), Weßling, Germany

Keywords: EnMAP, fCover, Validation, U-Net, UAV,

Fractional Vegetation and Soil Cover (fCover) is an important land surface parameter especially, in agricultural systems. It provides quantitative cover of photosynthetically active vegetation (PV), non-photosynthetically active (NPV), and bare soil (BS) to serve the data needs for soil parameter modeling, soil erosion monitoring and the identification of land degradation. Further, it supports the observation of the impact of climate-friendly tillage practices on carbon stocks in agricultural systems (farming practices).

Validating fCover at a large is challenging because so far ground data/in-situ availability is very limited and fragmented. Nevertheless, for operational L3 processors, large-scale validation approaches are necessary and required to provide reliable accuracy and uncertainty measures for the land product. At the same time, the validation approach should be easy to implement, operate globally and should be cost and time-efficient. The flexibility and simplicity of use of the proposed methodology offers the possibility to provide a comprehensive large-scale validation methodology based on conventional user friendly high-resolution RGB-UAV videos. It is suitable to validate fractional vegetation cover derived from e.g. EnMAP data on subpixel level.

The validation framework is designed to validate individual EnMAP pixels according to a) segmenting each input image in Vegetation and Background via two trained U-Net models. In the subsequent step, a support vector machine is trained to further distinguish the vegetation mask to PV and NPV per pixel and finally, a histogram-based threshold classification is done, taking advantage of different color spaces if segmentation fails due to too homogeneous surface structures. In the result, UAV videos/images can be autonomously classified into the three fCover components PV, NPV and BS.

One of the principle ideas is to overcome the time-consuming manual labelling of ground data by introducing deep learning models. The developed procedure will be presented on Belgien and gerany This consequently facilitates the processing of large amounts of data and thus the validation of large areas. The proposed methodology underlines the reliability of the fCover processor develop at the Earth Observation Centre at DLR and the possibility to eliminate current gaps of small-scale and scattered validation data.