

EGU2020-10931

<https://doi.org/10.5194/egusphere-egu2020-10931>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



Assessing the sensitivity of multi-frequency vegetation optical depth to biomass and canopy moisture content: towards an ecological-oriented evaluation

Luisa Schmidt¹, Matthias Forkel¹, Wouter A. Dorigo², Leander Moesinger², Robin van der Schalie³, Marta Yebra⁴, and Thomas A. M. Pugh^{5,6}

¹Technische Universität Dresden, Institute of Photogrammetry and Remote Sensing, 01062 Dresden, Germany

²Technische Universität Wien, Department of Geodesy and Geoinformation, 1040 Vienna, Austria

³VanderSat B.V., 2011 VK, Haarlem, The Netherlands

⁴Australian National University, Fenner School of Environment and Society, Canberra ACT, Australia

⁵University of Birmingham, School of Geography, Earth and Environmental Sciences, B15 2TT Birmingham, United Kingdom

⁶Birmingham Institute of Forest Research, University of Birmingham, B15 2TT Birmingham, United Kingdom

Multi-decadal records of global Vegetation Optical Depth (VOD) derived from spaceborne microwave sensors provide novel opportunities to observe and analyze both the current state as well as the temporal changes of vegetation. Theoretically, VOD is sensitive to the biomass and moisture content of vegetation. Past studies found relations between VOD and leaf area index (LAI), productivity, biomass, and vegetation water status. In addition, VOD has been used to investigate or estimate changes in biomass, vegetation isohydricity, and tree mortality. However, VOD is not directly measured with ground observations and therefore difficult to evaluate. Several VOD products exist that have been retrieved using different satellite sensors, microwave frequencies (e.g. Ku, X, C, and L-bands) and retrieval algorithms. These products show differences in both their temporal (e.g. short-term variability) as well as spatial dynamics (e.g. their relation with LAI). Hence from a user point-of-view, it is difficult to assess which VOD products might be the most suitable for a certain ecological application.

Here we aim to develop and present initial results of an ecological-oriented assessment of several VOD products. Based on the theoretical assumption that VOD is sensitive to vegetation biomass and moisture content, we assess the co-varying sensitivities of high- (Ku, X, C-bands) and low-frequency (L-band) VOD products to biomass and moisture content within a consistent evaluation framework. High-frequency VOD was taken from the recent developed VODCA products and low-frequency VOD from SMAP and SMOS retrievals. Biomass was derived from global above-ground biomass maps and MODIS LAI. Canopy moisture content was estimated from MODIS retrievals.

The first results confirm previous findings that VOD is both sensitive to biomass and moisture content. High-frequency VOD products are mainly sensitive to short-term changes in canopy biomass and moisture content and low frequency VOD to woody biomass. However, we also found that high-frequency VOD shows high sensitivity to aboveground biomass in Savannahs and

boreal forests. Also low-frequency VOD includes a clear signal of vegetation moisture that cannot be explained by biomass changes. This suggests that multi-frequency VOD products and estimates of vegetation biomass and moisture content should be integrated and jointly analyzed to provide a consistent picture of ecosystem dynamics.