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Towards an improved understanding of the ASCAT Dynamic Vegetation Parameters: An analysis of spatial and temporal patterns over mainland France.

Susan Steele-Dunne (1), Sebastian Hahn (2), Wolfgang Wagner (2), and Mariette Vreugdenhil (2)

(1) Department of Water Management, Delft University of Technology (TU Delft) , Delft, Netherlands (s.c.steele-dunne@tudelft.nl), (2) Department of Geodesy and Geoinformation, Vienna University of Technology (TU Wien), Vienna, Austria.

Improved understanding of how vegetation regulates land-atmosphere exchanges of water, carbon and energy is essential to understand the role that vegetation plays in the earth's climate system. The goal here is to use spaceborne radar to monitor into the storage of water in the soil-vegetation continuum and its dynamics in response to environmental conditions.

This study is motivated by the potential value of the C-band Advanced Scatterometer (ASCAT) series as a climate data record for monitoring terrestrial vegetation and ecosystem dynamics. The ASCAT instruments currently onboard the Metop-A, -B, and –C satellites build on the success of the European Scatterometer (ESCAT) which flew onboard ERS 1/2 from 1990-2011. Plans to launch SCA on Metop-SG in 2022 mean that the combined data record from this series of satellites will extend for at least 40 years. This data record duration is unique in radar remote sensing and provides an opportunity to observe land surface processes from sub-daily to decadal scales.

The value of ASCAT for vegetation monitoring stems from its unique ability to monitor the incidence angle dependence of backscatter. Over land, this can be approximated by a 2nd order Taylor polynomial, the slope and curvature of which are dominated by vegetation rather than soil moisture effects [1]. Recently, a Kernel Smoother has been employed in the TU Wien Soil Moisture Retrieval approach to estimate the slope and curvature dynamically and hence to account for inter-annual variations [2].

Our latest research shows that variations in backscatter, slope and curvature together contain information on vegetation phenology and water dynamics over the North American Grasslands [3]. Seasonal variations in slope support its interpretation as a measure of vegetation density while curvature is also clearly influenced by vegetation phenology. Spatially contiguous anomalies were observed in both slope and curvature when prolonged drought eventually impacted vegetation.

Here, results will be presented from an analysis of the Dynamic Vegetation Parameters (DVP) over mainland France to improve our understanding of the DVP, both in terms of their determination, and the physical interpretation of the dynamic vegetation parameters and the bio- and geophysical drivers behind the observed dynamics. In particular, results will be presented to illustrate the degree to which the conclusions drawn over grasslands are applicable to a wider range of cover types.

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[2] Hahn, S., C. Reimer, M. Vreugdenhil, T. Melzer, and W. Wagner, 2017. Dynamic characterization of the incidence angle dependence of backscatter using metop ASCAT. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 10(5), pp.2348-2359.
[3] Steele-Dunne, S. C., S. Hahn, W. Wagner and M. Vreugdenhil, Investigating vegetation water dynamics and drought using Metop ASCAT over the North American Grasslands, Remote Sensing of Environment, 2019 (Accepted).