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Spatiotemporal dynamics in remotely sensed soil moisture and their impact on the carbon cycle

Wouter Dorigo (1), Franziska Albrecht (2), Jonathan Barichivich (3,4), Bernhard Bauer-Marschallinger (1), Simon Blessing (5), Luca Brocca (6), Mathieu Depoorter (7), Ralf Giering (5), Richard De Jeu (8,9), Thomas Kaminski (5), Wolfgang Knorr (10), Christoph Köstler (11), Diego Miralles (7,8), Stefan Schlaffer (1), Marko Scholze (10), Gregor Schuermann (11), and Michael Vossbeck (5)

(1) Vienna University of Technology, Department of Geodesy and Geoinformation, Vienna, Austria (wouter.dorigo@tuwien.ac.at), (2) Geoville GmbH, Innsbruck, Austria, (3) Laboratoire des Sciences du Climat et de l'Environnement, CEA CNRS, France, (4) Climate Research Unit, University of East Anglia, UK, (5) FastOpt GmbH, Hamburg, Germany, (6) National Reasearch Council, Perugia, Italy, (7) Ghent University, Ghent, Belgium, (8) VU University, Amstredam, Netherlands, (9) Transmissivity BV, Netherlands, (10) Lund University, Sweden, (11) MPI for Biogeochemistry, Jena, Germany

Global warming is expected to accelerate the global water cycle, leading to an increase in the frequency and severity of extreme events like storms, floods, and droughts. However, to date observational evidence of the intensity and spatial impact of such acceleration is inconsistent among studies, mostly due to a lack of direct long-term observations of the moisture status of the land surface. Moreover, regional signs of water cycle acceleration are often masked by natural multiyear climate variability induced by ocean-atmosphere oscillations like El Niño Southern Oscillation, especially over areas where moisture is the main climatic constraint of plant growth. Yet, the anticipated changes in moisture availability are expected to modify species composition and ecosystem function through multiple interacting pathways. This would in turn affect vegetation production and the efficiency of ecosystems to sequestrate atmospheric carbon dioxide, thus potentially influencing the pace of global warming. However, the impacts of climate change on vegetation predicted by models are uncertain as the link between soil moisture variability and vegetation is only poorly understood.
This presentation gives an overview of the potential of remote sensing for studying a) the dynamics and changes in soil moisture availability worldwide, and b) the impact of soil moisture variability on vegetation growth and, hence, the carbon cycle. We will discuss strengths and limitations of current state-of-the-art datasets of soil water availability and present various methods to link water availability to variations in vegetation condition, including regression analysis, tree ring based approaches, and assimilation of earth observation data into carbon models.