# Earth Remote Sensing of Vegetation Using GPS-Reflected Signals Collected From SMAP

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Mesoscale ocean altimetry, biomass monitoring and soil moisture determination remain a bottleneck in the Remote Sensing community. Recently the rise of Global Navigation Satellite Systems Reflectometry (GNSS-R) techniques [1] has paved the way for this novel passive-approach in Earth observation. Current GNSS systems operate in L-band which is the same part of the spectrum selected for Soil Moisture Active Passive (SMAP) mission [2] due to the sensitivity of this frequency band to soil moisture. In this study the effects of topography and vegetation in soil moisture retrieval are assessed. Additionally, recent experiments have shown the potential use of GNSS-R for biomass monitoring without indication of reaching saturation, and a promising sensitivity for polarimetric sensing over boreal forests [3]. On the other side, tropical rainforests biomasses deserve further evaluation since they account for approximately 50% of the remaining forested biomass, and recent studies suggest that 70% of the carbon sink resides there. Furthermore, GNSS-R could be used in a synergistic way with X-band InSAR and lidar [4] to characterize forest structure and to contribute to the estimation of forest aboveground biomass (AGB). The high gain of SMAP's radar antenna provides an unique opportunity to evaluate the achievable precision of this technique, and the near-polar orbit provides global coverage up to high latitudes. Since understanding of forward scattering mechanisms at L-Band requires further investigation, especially over land and forests, these data will be evaluated to derive empirical models useful to retrieve information from the radio-navigation signals after being scattered by vegetated terrain. At present we are focusing on this aspect of the GNSS-R research project and the results will be presented at the conference.

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[3] H. Carreno-Luengo and A. Camps, "First Dual-Band Multiconstellation GNSS-R Scatterometry Experiment Over Boreal Forests From a Stratospheric Balloon", IEEE Journal of Selected Topics in Applied Earth Observation and Remote Sensing, DOI: 10.1109/JSTARS.2015.24966611, 2016.

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