GNSS-R Biomass Call for Ideas

Call Overview

To explore the commercial potential of GNSS-Reflectometry for biomass, the present call for ideas goal is to short-list potential projects in the context of forest biomass mapping. The proposals should consist in no more than 3 pages and should make use of the GNSS-R concept (GNSS sensor and tools) developed within the GSA H2020 COREGAL initiative [RD-1]. Successful ideas should aim at demonstrating practical use biomass measurements collected from a device installed onboard a UAV (e.g. biomass for paper industry; carbon stock estimation for weather modeling).

Finalists will be invited to attend COREGAL seminar in mid-May, where the best idea will be announced. The winner will be invited to present its idea to the Consortium and the European Commission during the COREGAL final review in Prague by the end of May. Moreover, the winner will also be invited to participate in a forthcoming project for exploring the commercial potential of GNSS-R.

Proposal contents, instructions and timeline

Proposal should be written in English or Portuguese and sent in pdf format with font letter larger than 11 points and sent to deimoscoregal@gmail.com no later than 28th of April. Results of evaluation will be published in May.

Proposal should not be longer than 3 pages and should contain the following main elements:

1. **Contact person**(s) (name and email and phone number) and name of organization associated to that person;
2. **Description of the overall idea** on the use of GNSS-Reflectometry for biomass measurements collected from a device installed onboard a UAV (1 page maximum)
3. **Duration of project**, **high level tasks and target start date** (1 page maximum)
4. **Funding required and required effort including infrastructure**
5. **List of the targeted end-users** (e.g. paper industry forest owners, climate change scientists)

Any requests for clarifications should be sent to deimoscoregal@gmail.com.

Background

Global Navigation Satellite Systems (GNSS) are used for a range of applications. For example, GNSS-Reflectometry (GNSS-R) can be used to measure geophysical and biological properties of terrestrial environments. Due to their physical properties, GNSS signals are well-suited to remote sensing applications.

GNSS-R is conceptually similar to RADAR remote sensing systems, in particular, bi-static RADAR. In traditional GNSS-R systems, GNSS satellites transmit electromagnetic radiation toward the Earth's surface. As these signals reflect off of the incident surfaces, they acquire additional information about surface properties. Specifically, the received signal is altered in terms of power and correlation function. The GNSS-R instrument – a GNSS receiver designed to process

direct and reflected signals – can estimate several important geophysical and biological parameters of the incident surface.

Forests are a key socio-economical element, and critical to the functioning of ecological, and biogeochemical processes, ultimately having a clear beneficial feedback to the climate system [RD-1]. Aboveground biomass (AGB) is a key indicator for each of these aspects. Forests cover about 30% of the Earth's land surface, making AGB monitoring efforts difficult and expensive to maintain. Space borne remote sensing is uniquely capable of addressing such challenges of coverage and extent, yet often lacks the spatial precision necessary for accurate large-area AGB estimates. COREGAL project aims to facilitate precise large-area AGB mapping by combining the precision of local measurements with the repeat coverage and extent of space borne measurements through the use of statistical and physical models.

COREGAL Project

In COREGAL, the GNSS-R technique is studied as an attractive biomass measurement solution for its accuracy, availability, and cost, when compared and complemented with other remote sensing systems, such as earth observation satellites.

COREGAL developed a small unmanned aircraft system (sUAS) and integrated payload for precise local AGB mapping in forests, for later fusion with large-area space borne measurements. This work ranges between lower density forests of Mediterranean ecosystems (Portuguese case study) and heavily forested nations that require wall-to-wall AGB maps to meet local, national, and global policy targets, with a special focus on the Brazilian context of sustainable forest management.

Unmanned airborne mapping is approximately an order of magnitude lower cost than traditional manned missions, while GNSS-R can be seen as a bi-static RADAR, replacing expensive, heavy, power-hungry systems. Thus, integrating positioning and reflectometry in a single device aboard a sUAS offers a unique value proposition. Furthermore, GNSS-R signal properties allow for lower saturation in signal backscattering compared to traditional RADAR systems. The increased dynamic range allows for improved sensitivity, important for high-biomass regions, such as tropical forests in Brazil.

COREGAL has developed a GNSS-R sensor that generates raw measurements, which are then calibrated using a dedicated software tool (SAVERS). Such measurements are at a local scale that can then combined with satellite data using another dedicated tool (BIOMAR). In the current call for ideas, is it is desirable than these three components are used: GNSS-R sensor, SAVERS and BIOMASAR. Refer to [RD-1] for more details.

Reference Documents

[RD-1] G. B. Bonan, "Forests and climate change: Forcings, feedbacks, and the climate benefits of forests", Science 320, 1444–1449 (2008)

[RD-2] *"COREGAL: Exploring Galileo E5 Reflected Signals for Biomass Applications",* T. Peres et al. Proceeding of ION GNSS 2015, Portland Oregon