

Laboratoire des Sciences du Climat et de l'Environnement (LSCE), INRAE Bordeaux, University of Copenhagen, and Kayrros are looking for a PhD candidate who will be based at LSCE.

## PhD topic

### New dynamic forest biomass carbon maps across Europe from high-resolution radar satellite data

#### Background

Carbon sequestration in forests is extremely important to reduce climate warming but extremely difficult to measure. The problem is that currently no suitable tool exists for a rapid assessment of forest carbon change at the fine scale. The advent of radar data from the European Copernicus satellite Sentinel 1 (S1) at daily time scale for all weather condition with a 20 m resolution, and covering the whole globe opens the opportunity to derive maps of biomass carbon and carbon changes of forests, related to growth, management, drought mortality and other disturbances. The proposed PhD subject will develop new maps of biomass and biomass change over Europe at annual scale by combining S1 radar data and spaceborne Lidar measurements of tree height and canopy density from the NASA GEDI mission, with forest inventory plots from national forest inventories. A semi-empirical model to retrieve above ground biomass from radar measurements will be used and calibrated using GEDI height measurements and national inventory plot-scale data. Methods will use an optimization of the model parameters through machine learning algorithms. Direct training and validation of machine learning models upon height and forest inventory data will be attempted.

#### Overall aim

Apply high spatial and temporal resolution Sentinel 1 satellite data in combination to LIDAR data sets to produce annual forest and carbon stock maps for selected regions in Europe. We propose to focus on France and Germany. If successful, other regions will be covered. The project will be done in collaboration with University of Copenhagen working on very high-resolution satellite imagery.

#### Specific aims and working steps

- Select a forest area in Europe with available plot data.
- Develop a framework based on a semi empirical model to relate radar-derived backscatter parameters and Lidar-derived height to above ground biomass on annual time scale for forested areas at high resolution. Machine learning will be used to optimize the parameters of these models
- Evaluate results against very high-resolution datasets

#### Requirements

- Programming skills, preferably in Python
- Basic understanding of satellite images, spatial analyses, statistics
- Knowledge on machine learning, preferably deep learning

#### Contacts

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