Job description for a fixed-term contract on the ALBEDO-Prairies project

The ALBEDO-prairies project led by IDELE (Institut DE l'ÉLEVage) focuses on climate mitigation issued from the radiative forcing of the surface. It is measurable at the scale of the territories from the Essential Climatic Variable (ECV) 'albedo' which is observable by satellite sensors. Indeed, it has been demonstrated locally that the reflective power of solar radiation from grasslands is a potential means of slowing down global warming. This is an interesting complement to the better known mitigation means of reducing greenhouse gas (GHG) emissions and carbon storage. Ruminant farming contributes to climate change through its enteric methane emissions, but this is largely offset by the use of grasslands, which are carbon storage factors.

Better characterizing the spatio-temporal variability of grassland albedo in France is the primary objective of the ALBEDO-prairies project led by IDELE. For this purpose, measurements are carried out on 7 experimental farms according to different methods of grassland management and pedoclimatic situations. The project aims to strengthen the arguments in favour of a sustainable herbivorous breeding based on an optimal use of the grasslands.

A major component of the project is the extension of the plot measurements to the territorial scale. To do this, we will rely on the measurements made by the Sentinel-2A & -2B satellites, which offer resolutions - depending on the bands - between 10 m and 30 m, thus fully compatible with the size of the agricultural patch. The average 5-day revisit - under clear sky conditions - of Sentinel-2 (S2) allows to acquire regular observations compatible with the dynamics of grassland vegetation. The achievement of an S2 albedo product requires the accumulation of S2 data over time to invert a BRDF (Bidirectional Reflectance Distribution Function) model describing the radiative anisotropy of grasslands.

The project is part of a larger initiative through the Scientific Expertise Center (CES) "Albédo" of THEIA's Continental Surfaces cluster. A calculation chain for the HR (High Resolution) albedo has been developed (in Python and Fortran) using the MAJA product (https://logiciels.cnes.fr/fr/content/maja) based on an adaptation of the Copernicus chain (https://land.copernicus.eu/global/products/sa).

The work required includes four tasks:

1) Rewriting in Python the routines in Fortran and managing the input-output of the S2 albedo chain (projection, conversion to direct/diffuse solar albedo, inversion of the BRDF model, necessary auxiliary data) ;

2) Establish maps of the S2 albedos around the experimental farm with determination of mowing/grazing practices by selecting grassland pixels according to an established classification ;

3) Validate the S2 albedo products with in situ albedo measurements and MODIS satellite products;

4) Estimate seasonal time series of the radiative forcing of the studied grasslands and its CO2 equivalent from albedo dynamics to establish a comparative balance of carbon storage and GHG (estimated by IDELE) for the grasslands of the 7 experimental farms.

The position corresponds to a profile of a post-doc or a research engineer with skills in computer science, particularly in the Python programming language. Knowledge of environmental physics, remote sensing, and data analysis is suitable. She/he will work closely with project participants. Field missions are to be planned.

The proposed gross salary is between 2200 € and 2500 € depending on the level of experience. The duration is 1 year renewable for 8 months. Recruitment will be carried out by the University Paul Sabatier of Toulouse (UT3).

Host laboratory: CESBIO (Centre d'Etudes Spatiales de la BIOsphere), Toulouse.
Names of project leaders: Jean-Louis Roujean, Eric Ceschia

Possible start date: February 1, 2021.

Candidates are invited to send their CV and a cover letter to the following email address:
jean-louis.roujean@cesbio.cnes.fr