RÉPUBLIQUE FRANÇAISE
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INRAE

PhD proposal

PhD Position in Earth Sciences: (F/M) :

Title : *Standardization and enhancement of the assessment of soil organic carbon dynamics models within the MRV framework: advancing towards more rigorous selection criteria*

INRAE (French National Research Institute for Agriculture, Food and Environment) is a public research organization with 12,000 staff members across 18 centers in France. It brings together more than 270 research, service, and experimental units. INRAE is internationally recognized in agricultural and food sciences, plant and animal sciences, and ecology–environment. Its research focuses on developing solutions for sustainable agriculture, quality food, and the management of natural resources and ecosystems.

Work environment, missions and activities

Scientific context and objectives of the PhD

In the context of climate change, soils play a central role in mitigation strategies through their capacity to sequester carbon. Governments are supporting sequestration projects and defining certification frameworks. To support these initiatives, models of soil organic carbon dynamics (SOC) are essential tools, as they estimate storage potential and monitor progress towards targets.

At present, the absence of standardized evaluation procedures makes it difficult to assess the scope of applicability of these models and to quantify the uncertainties linked to specific combinations of site, model, and data. This PhD project will address these challenges using multi-site and multi-scale datasets (experimental sites, workshops, and national soil monitoring networks), as well as recent standards for ecosystem model evaluation.

The research will build on European projects (e.g., MARVIC, CAFAMORE) and national initiatives (PEPR FAIRCarboN) to carry out comparative simulations across multiple models and scales, focusing on arable cropping systems and grasslands. A key part of the work will be to examine the balance between model cost and accuracy, where cost is largely determined by the data required as input.

Operational objective

To develop methodological tools and reference frameworks that can guide model selection for carbon certification schemes and national inventories.

Work environment

The PhD candidate will join the Info&Sols Research Unit (INRAE Orléans), under the supervision of Manuel Martin and Hocine Bourennane. The unit's scientific activities are structured around three main themes: (1) state, functioning, and monitoring of soils; (2) soil quality, health, ecosystem services, and impacts; and (3) management of environmental data.

Main missions

The candidate will work on developing a robust methodological framework for evaluating and selecting SOC (Soil Organic Carbon) models applied to carbon sequestration projects and MRV systems. Tasks will include:

- Designing a methodological protocol based on a critical literature review.
- Defining approaches to characterize and model errors and uncertainties.
- Identifying model validity domains and applicability limits.
- Building and sharing an evaluation dataset in line with FAIR data principles.
- Testing and validating the proposed framework using real-world case studies from national and European projects.

Application process

Shortlisted candidates will be interviewed between October 18 and October 30, 2025.

The PhD candidate will be enrolled at the University of Orléans, within the EMSTU Doctoral School.

Additional information
Some travel, including international, will be required as part of the associated projects.

Education and skills required

Recommended education: Master's degree (M2) in engineering sciences, data science, applied statistics, or environmental sciences. Specialization in modeling is highly desirable.

Desired knowledge: Background in soil science, climatology, or biogeochemistry. Proficiency in modeling tools and data analysis methods.

Appreciated experience: Prior experience in environmental modeling or spatial data processing. Participation in interdisciplinary or collaborative projects in soil or environmental sciences.

Key attributes: Strong interest in modeling and data analysis. Good writing and synthesis skills. Scientific rigor, autonomy, and ability to work effectively in a team.

Life at INRAE

By joining INRAE, you may benefit from, depending on the type of contract:

- Up to 30 days of annual leave plus 15 additional leave days days (for full-time contracts)
- Parental support: childcare services (CESU), leisure benefits
- Professional development opportunities: training, career guidance
- Social support: counseling, financial aid, and loans
- Vacation and leisure benefits: holiday vouchers, discounted accommodations
- Access to sports and cultural activities
- Collective catering facilities

Host unit details

- Host unit: UR Info&Sols
- Location: 45000 Orléans, France
- Type of contract: PhD position
- Duration: 3 years
- Start date :December 1, 2025
- Salary : from €2,200 gross per month

How to apply

Applications should include a cover letter, CV, and the contact information of a reference who may be contacted if necessary, to
manuel.martin@inrae.fr and hocine.bourennane@inrae.fr

Application deadline : **October 18, 2025**

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