

Developing a statistical spatial soil inference system with quantified uncertainty

Possibility of a Master internship (4-6 months) on a sub-topic of the thesis.



Background

In the framework of the EU-project [DeepHorizon](https://cordis.europa.eu/project/id/101156701) (<https://cordis.europa.eu/project/id/101156701>), we are looking for an excellent PhD candidate to develop statistical methods supporting the development of a spatial soil inference system for European soils. A soil inference system uses known measurements, each with a certain level of uncertainty, to predict related soil properties with minimal error, by applying a series of logically connected (pedo)transfer functions (PTFs). The PhD candidate will start with an inventory of existing soil pedotransfer functions relevant to European soils and to calibrate usual mechanistic biogeochemical models. A large part of the work involves the exploration, development and application of new statistical approaches relevant for the inference system. The approaches should handle missing data along with uncertainty quantification of the input soil properties and propagation of the uncertainty throughout the inference engine. The candidate is expected to collaborate closely with other PhD candidates of the project consortium and with a project partner in Belgium, for which temporary stay could be envisioned.

Tasks:

- 1- Make an inventory of existing PTFs developed in European soils for a set of soil properties along with their geographical domain of applicability.
- 2- Link all the existing PTFs with a statistical model. Develop and test statistical approaches relevant for building an inference system. The approaches could include graph theory, conformal prediction or Bayesian uncertainty analysis.
- 3- Use existing large-scale databases to develop approaches for missing data (multiple imputations) and incomplete PTFs using their domain of prediction.
- 4- Apply the model to a real-world case with the data collected within the project duration over 40 sites in Europe.

Expected profile:

We are looking for an ambitious, motivated and pro-active PhD candidate with a strong background in applied statistics or environmental/soil modelling. Applicant should have a Master or equivalent in statistics, environmental sciences or related discipline and skills in the following areas:

- Strong knowledge in statistical modelling
- Interest in soil science, specifically soil physics and environmental sciences
- Proficiency in R coding and familiarity with programming
- Good capacity for bibliographic analysis and synthesis

The contract will be for 3 years, starting in March 2025 or later. Salary and benefits are according to INRAE rules in France (monthly gross salary ~ 2,100 €).

The PhD will be supervised by Dr Alexandre Wadoux (INRAE) and Prof Tabea Rebafka (AgroParisTech) and hosted at the UMR Applied Mathematics and Computer Science at Palaiseau (France) <https://mia-ps.inrae.fr/>.

Interested candidates should send a CV and cover letter to Alexandre Wadoux (alexandre.wadoux@inrae.fr) and Tabea Rebafka (tabea.rebafka1@agroparistech.fr). One to two references will be asked to the interviewed candidates.