



**Internship - Master degree
LUSAC (Université de Caen – site de Cherbourg) :**

Meta-modeling for the propagation of uncertainties in a tidal model.

Dates: between January and September, in 2024

Duration: 5 – 6 months

Supervisors: Jérôme Thiébot (LUSAC), Anju Sebastian (LUSAC) et Julien Salomon (INRIA, Paris)

Laboratory: LUSAC / Ecoulements et Environnement (Cherbourg)

Numerical models simulating the tide are used for many applications, such as estimating the impact of human activities, monitoring water quality, predicting marine flooding, estimating the tidal resource, etc. In order to be able to make decisions using these models, it is necessary to estimate their uncertainties. As tidal models use a large number of input data (bathymetry, nature of the seabed, harmonic tidal components, etc.) which are available at different resolutions and levels of accuracy, there are many sources of uncertainty.

For this internship, we will be using a numerical model (Telemac2D) simulating the tide in the English Channel. The propagation of uncertainties in such a model requires a large number of simulations. These models are expensive in terms of computing time. One method is therefore to replace the numerical model with a much faster meta-model. Building this meta-model requires a good understanding of the relationships between the input data and the model results. The first objective of the internship will be to carry out a sensitivity study to better understand how each input affects the results of the numerical model. Based on the results of the sensitivity study, the second objective of the internship will be to test different meta-modelling techniques (e.g., Kriging, Polynomial Chaos Decomposition, Neural network, etc.) in order to propose a correct emulation of the Telemac2D results (water level and current speed predictions). The creation of the meta-model and the analysis of the data will be carried out in Python, in particular using the OpenTURNS toolbox.

The main stages are as follows:

- Bibliography
- Running the model of the English Channel
- Creation of a database
- Sensitivity study
- Meta-modelling
- Validation of the meta-model

To apply:

Send a CV and a cover letter to jerome.thiebot@unicaen.fr

Experience and skills required:

Interest in research work

Experience/training in data science, applied mathematics

Curiosity, autonomy, good level of English.