Internship position 2021

Applied Mathematics and Engineering Sciences

(Possibility to pursue with a PhD)

Expected profile

- 3^{rd} year master student in applied mathematics, physics or mechanical engineering
- Good experience in data analysis (statistical analysis, sensitivity analysis)
- Fluent in English

Optional competences

- Knowledge in fluid dynamics, meteorology
- Knowledge in geophysics, meteorology/oceanology
- Knowledge in programming (any of Fortran90, C, C++, Python, Matlab)
- Rigorous, autonomous and creative thinking
- Interest in environmental applications

Duration and period : 5-6 months (between February and September 2021).

Host Laboratory : CaliSto Team at Inria Sophia Antipolis - Méditerranée

Supervisor Mireille Bossy

Topic

High resolution of wind downscaling simulation
Evaluation of the SDM–WindPoS model for use in water sports

Key words: modelling & simulation, meteorology, downscaling, short term wind forecasts, sports sailing basin

Context

Weather forecasting is a field of expertise based on a numerical model that solves the equations of the physics and dynamics of the atmosphere, fed by observational data. The numerical model produces forecast data for periods of several days on a large scale (25 to 50 km) over the entire globe. Then, a numerical processing chain known as downscaling refines the spatial and temporal resolution of the forecast over a particular geographical region.

In this project we are particularly interested in forecasting wind conditions in the boundary layer of the atmosphere, where the effects of atmospheric turbulence are most prevalent and where the description of terrain conditions (topography and type of surface, urban, sea, vegetation) can provide much greater accuracy and better capture the variability of predicted wind conditions on a local scale.

WindPoS is an innovative wind simulation method based on the Lagrangian formulation of turbulence equations to propose a numerical solver that supports hight spatial resolutions. This numerical solver can be used in the domain or sub-domain relevant for wind analysis, the dynamics at the boundary of this domain being driven by a larger scale meteorological simulation.

In particular, WindPoS is designed to be used in conjunction with the outputs of a weather solver providing a wind forecast in the first hundreds of metres of the atmosphere, and refines only in the area where local wind information is decisive for the intended application. Refined topographic information can also be adjusted to the larger scale data, to better capture the effects of relief and terrain producing local variability.

Description. The objective of the internship is to analyse the performance of the WindPoS model on very high spatial resolutions. The target area for this downscaling is the sailing basin of Marseille. The terrain elevation data at the shoreline of the coastal basin will be fed into the WindPoS simulation using IGN topographic information. This topography can potentially be refined up to a resolution of 5 m.

- The first step will be to define a catalogue of wind situations, by sector and strength from the WRF model up to 1km resolution over the Marseille region.
- To produce refined WindPoS simulations in the sub-domain of interest.
- To propose some analysis methodology to apply to the produced results on this set of situations, to evaluate the impact of intermediate nested WindPoS simulations, as well as the impact of a more detailed topography and terrain. This analysis could in particular be based on the Lagrangian solver method to extract local information on speed and direction distributions.

To apply

Please send an email to mireille.bossy@inria.fr

Applicants are required to send a cover letter, a CV, transcripts of their Master grades, and at least one recommendation letter to the above address.