"24-month Post-doctoral position: Development of a parameterization of the impact of sea spray on the Marine Atmospheric Boundary Layer"

O/Ref: FEM-SAS-2020-118

Company Description

FRANCE ENERGIES MARINES (FEM), is the French Institute for Energy Transition dedicated to Offshore Renewable Energy (ORE), supporting the nascent ORE industrial sector with the means and skills that increase competitiveness by mutualizing R&D costs, reducing risks and accelerating the acquisition of data and knowledge. FEM activities are founded on Research and Development projects and services. FEM collaborators are scientifically and technically involved in all activities thanks to their high level of scientific expertise. The headquarters of FEM are located in Plouzané (Brest area), France, along with additional offices in Marseille and Nantes. This allows FEM to be present on all oceanic facades and to build close relationships with most of the ORE value chain actors.

The association FEM was founded in 2012 while the recently created FEM joint stock company forms the basis of the newly labeled Institute for Energy Transition. The joint stock company is owned by 18 entities made up of private companies, ORE clusters, public bodies and local governments (Regions). This equilibrium between actors allows the institute to collaborate with a broad spectrum of experts and to prioritize development on challenges faced by the industrial sector as well as by concerned governmental agencies.

Position Description

The post-doctoral position is part of the CASSIOWPE R&D project dedicated to "**C**haracterizing the **A**tmosphere and **S**ea **S**urface **I**nteractions for the deployment of **O**ffshore **W**ind in the Gulf of Lion's **P**hysical **E**nvironment". This project is coordinated by FEM and aims, in particular to implement and improve an Ocean-Wave-Atmosphere (OWA) coupled system to refine the description of the Gulf of Lion meteocean conditions with future application to the wind resource assessment and design conditions of the Floating Offshore Wind Turbines, soon to be deployed in the area.

Within this project, the post-doctoral fellow will contribute to the improvement of the representation of the Marine Atmospheric Boundary Layer (MABL) and turbulent fluxes in atmospheric models by developing and testing a parameterization of the impact of sea sprays. An integrated approach is proposed to take advantage of our wave-atmosphere numerical coupled framework. Existing parameterizations of the impact of sea sprays on the turbulent fluxes are based on sea-spray generation functions. However, a large scatter exists on the current generation functions for large droplets exacerbating uncertainties on the sea-spray effect on heat and momentum air-sea exchanges (Veron, 2015). Most generation functions use wind speed as a proxy, but recent studies (Mueller and Veron 2009, Ovadnevaite et al. 2014) suggest generation functions built on more fundamental parameters like whitecap fraction, sea state or length of

breaking fronts. In this project, we will take advantage of new sea-spray measurements either in situ or in laboratory tanks made available by our partners (J. Piazzola at MIO, F. Veron at Un. Delaware) and of the parameterization of breaking wave statistics currently developed in other FEM projects to develop a new air-sea fluxes parameterization taking into account the effect of sea spray. This parameterization, based on a new sea-spray generation function will be implemented in the surface module SURFEX (Masson et al., 2013) used in operational and research models at Meteo-France. Then, the Meso-NH atmospheric model (Lac et al., 2018), which is coupled with SURFEX, will be used on case studies of strong wind and various wave conditions in the Gulf of Lion (GoL). Mistral and Tramontane winds generate short, steep waves with a large proportion of breaking waves while typical storm sea state consists in longer waves and swell (e.g. Sauvage et al., 2020). The successful post-doctoral fellow will benefit from the development of a specific configuration of Ocean Wave Atmosphere modelling system and a selection of case studies for testing and tuning the parameterization, a work performed in the CASSIOWPE project.

Missions

The missions of the post-doctoral fellow will be to:

1) review and evaluate the existing parameterizations using information from recent sea-spray observation datasets (collaboration H. Branger, with J. Piazzola, and F. Veron; this should include one or two short stays at MIO / Un. Delaware),

2) develop a sea-spray generation function fitting these datasets and including a sea-state dependency,

3) develop the corresponding parameterization (bulk algorithm) for air-sea turbulent fluxes, based on existing parameterizations, in the SURFEX module,

4) test and tune it off line first, then using the fully CASSIOWPE OWA coupled system on realistic case studies selected in the first part of the CASSIOWPE project,

4) analyze the results,

5) disseminate the results (write publications for research journals, participate to international conference).

FEM and LOPS (Laboratoire d'Océanographie Physique et Spatiale) are looking for a highly motivated candidate eager to develop an innovative air-sea fluxes parameterization and to interact with the other members of the consortium. The candidate will have the opportunity to work with a state-of-the-art OWA coupled system to perform kilometer-scale simulations of strong wind conditions (Mistral, Tramontane or Mediterranean storms) in the highly variable environment of the GoL. The OWA configuration used to test and tune the parameterization is based on the atmospheric model Meso-NH (Lac et al., 2018), the wave model WW3 (Tolman, 2016) and the ocean model CROCO/ROMS (Shchepetkin and McWilliams, 2005, Debreu et al., 2012) using the coupling interface developed by Voldoire et al. (2017). The proposing team has a strong expertise in using this type of coupling system, a very good understanding of the air-sea exchanges, wave effects and physics of the MABL, as well as a good knowledge of the GoL's environment.

Supervision

The post-doctoral fellow will be employed by FEM, and will mainly work at LOPS in the IFREMER site. Note that the offices of FEM and IFREMER are located on the same campus, at a walking distance. The post-doctoral fellow will be mainly supervised by:

- Marie-Noëlle Bouin, Meteo-France, CNRM hosted at LOPS/IFREMER, Research Scientist in Physics of the Atmosphere, WP leader for coupled OWA modelling
- Jean-Luc Redelsperger, CNRS, LOPS, Research Scientist in Physics of the Atmosphere and Ocean, Scientific leader of the project
- Fabien Leckler, FEM, coordinator of the CASSIOWPE project, strong expertise on wave breaking,
- Jean-François Filipot, FEM, Scientific Director at FEM, strong expertise on wave breaking

He/she will also interact with partners working with observations (J. Piazzola, MIO, H. Branger, IRPHE, F. Veron, U. Delaware) and other industrial and academic members of the consortium (e.g. EDF R&D, ENPC, ENSTA Bretagne).

Required Qualifications, Skills and Experience

This position is open to persons with disabilities.

Essential:

- PhD in atmospheric science, wave or mechanical physics, or equivalent,
- Good understanding of the physics of the atmospheric boundary layer and fine-scale processes,
- Programming experience (**fortran**, python, matlab, ...),
- Ability to write high level scientific reports and publications,
- Good ability to communicate in English,
- Scientific rigor.

Strongly desirable:

- Experience with numerical modelling, preferably of the atmosphere.

Practical Information

Expected starting date: **December 2020**

Duration: 24 month contract

Employer: France Energies Marines, 525 Av de Rochon, F-29280 Plouzané

The postdoc will spend about 80% of his time at LOPS/IFREMER:
1625 Route de Sainte-Anne, 29280 Plouzané, FRANCE

Final date for applications: October 17, 2020.

In case of an expected secondment of the candidate by a member of France Energies Marines, the application should mention the agreement of the present employer.

Please send your CV and cover letter to the following email address: contact@ite-fem.org.

For scientific information, please contact : nbouin@ifremer.fr, jlredels@ifremer.fr, fabien.lecker@ite-fem.org and jean.francois.filipot@ite-fem.org.

References

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