2-year of a post-doctoral position in coastal numerical modelling (ANR MORHOCH'2 project)

Duration: 24 months
Start date: 03/01/2022
Application deadline: 30/10/2022
Location: M2C lab., Caen (Campus 1), France
Collaborations: MIO, Shom, LEGOS, Océanide, LUSAC-Intechmer

Context:
The MORHOC'H 2 research project is a follow-up to the ANR ASTRID MORHOC'H project, which focused on studying processes that have a significant impact on wave propagation in the presence of a vertically sheared current. Indeed, it is not uncommon to encounter such currents in coastal areas, since the combined effects of wind and bathymetry can profoundly modify their vertical profile. However, the modelling, both physical and numerical, of such areas is a strategic challenge, both in the civilian field (coastal security, renewable marine energy, etc.) and in the military field (landing, rescue, naval applications).

Two outcomes, resulting from the project, are the focus of our attention here. Thus, the MORHOC'H project lead us developing a particularly robust experimental device aimed at experimentally controlling the vertical structure of a hydrodynamic channel current. In addition, a new model has been developed, named CMS, to extend the scope of wave propagation models with resolved phase to take into consideration configurations involving high current vorticity.

The MORHOC'H 2 project therefore aims to increase the degree of maturity of these two results, bringing them closer to use in real conditions. First, the current profile control device will be extended to larger configurations and will become applicable in three-dimensional basins. Many industrial actors, operators of hydrodynamic test tanks, will then have access to it. In addition, the CMS propagation model will be coupled with the Community coastal hydrodynamic circulation code CROCO, developed by SHOM, IRD, CNRS, IFREMER, and INRIA, to make it usable under realistic conditions. Thus, the improvements resulting from the initial project will become accessible to realistic environments. The two approaches in coastal modelling, physical and numerical, will thus become more efficient and will be able to describe more realistic situations.

Activities:
This position focuses on the realistic environment, the Alderney Race, where the stronger tidal currents of western Europe (up to 5 m/s) are located. The Alderney Race current is sheared by marine turbulence (Mercier et al., 2020 ; Bennis et al., 2021a) and ocean wave effects (Bennis et al., 2020, 2021b). The successful applicant will be responsible for evaluating the CROCO model (hydrostatic and non-hydrostatic versions) enriched with CMS using the one-year of *in-situ* data (ADCP, wave buoy, tidal gauge) and numerical simulations obtained with the wave-averaged coupled model (CROCO-WAVEWATCH-III). Due to the large amount of *in-situ* data (Furgerot et al., 2020), not all of the data has been post-processed yet. Therefore, the post-doctoral researcher will need to post-process the required data.

- A.-C. Bennis, L. Furgerot, P. Bailly du Bois, F. Dumas, T. Odaka, C. Lathuilère, J.-F. Filipot. Numerical modelling of three-dimensional interactions in a complex environment: application to Alderney Race. *Applied Ocean Research*, 2020.
- A.-C. Bennis, F. Adong, M. Boutet, F. Dumas. LANS-alpha turbulence modelling for coastal sea: an application to Alderney Race. *Journal of Computational Physics,* 2021a.
- A.-C. Bennis, L. Furgerot, P. Bailly du Bois, E. Poizot, Y. Méar, F. Dumas. A winter storm in Alderney Race: impacts of 3D wave-current interactions on the hydrodynamic and tidal stream energy. *Applied Ocean Research (submitted)*, 2021b.

- L. Furgerot, A. Sentchev, P. Bailly du Bois, G. Lopez, M. Morillon, E. Poizot, Y. Méar, A.-C. Bennis. One year measurements in Alderney Race: what did we learn ? *Phil. Trans. R. Soc. A.*, 2020.
- P. Mercier, M. Grondeau, S. Guillou, J. Thiébot, E. Poizot. Numerical study of the turbulent eddies generated by the seabed roughness. Case study at a tidal power site, Applied Ocean Research, 2020.

Competences and skills:
- Strong background in marine and coastal hydrodynamics, especially wave-current-turbulence interactions,
- Strong skills in numerical modeling for coastal seas using HPC (High Performance Computing),
- Good knowlegde of field data post-processing,
- Good writing and communication skills,
- Contribution to reports, conference proceedings and peer-reviewed publications.

Person specification:
- The applicants should own a PhD in any related field.
- As the project is funded by the French “innovation and defense agency”, the applications will be restricted to candidates owning the citizenship of a European Union country only.

How to apply:
Please send a CV, a letter of motivation (up to one page long), and the names of two potential referees, to anne-claire.bennis@unicaen.fr and pascal.baillydubois@lecnam.net