18 months Post-Doctoral position on experimental geophysical/oceanographic fluid dynamics
Starting date: open

A physical model of the Gibraltar Strait: the Coriolis Platform experiment

SCIENTIFIC DESCRIPTION Buoyancy driven flows represent one of the key sub-mesoscale processes that drive energy transfer, impact the thermohaline structure and vertical exchange of water masses in the ocean, but their representation remains challenging for numerical models. The main objectives of this project are (i) to understand the processes underlying the energy transfer between the sub-mesoscale and dissipative scales, and the feedback of small-scale processes on the mesoscale using the example of the Gibraltar outflow; (ii) besides, it will contribute to quantify the impact of small-scale processes on the modulation of non-hydrostatic dynamics, the dynamics of localized exchange fluxes, and its feedback on the larger-scale synoptic dynamics.

These objectives will be achieved through high spatial and temporal resolution measurements in the first realistic physical model ever built of the Strait of Gibraltar with the adjacent Gulf of Cadiz and Alboran Sea. It will represent a region of 250km x 150km in the world's largest infrastructure dedicated to the study of ocean flows, the Coriolis Platform (LEGI), and will include all forcings: baroclinic, barotropic (tidal), rotational, and the realistic topography (see pictures below).

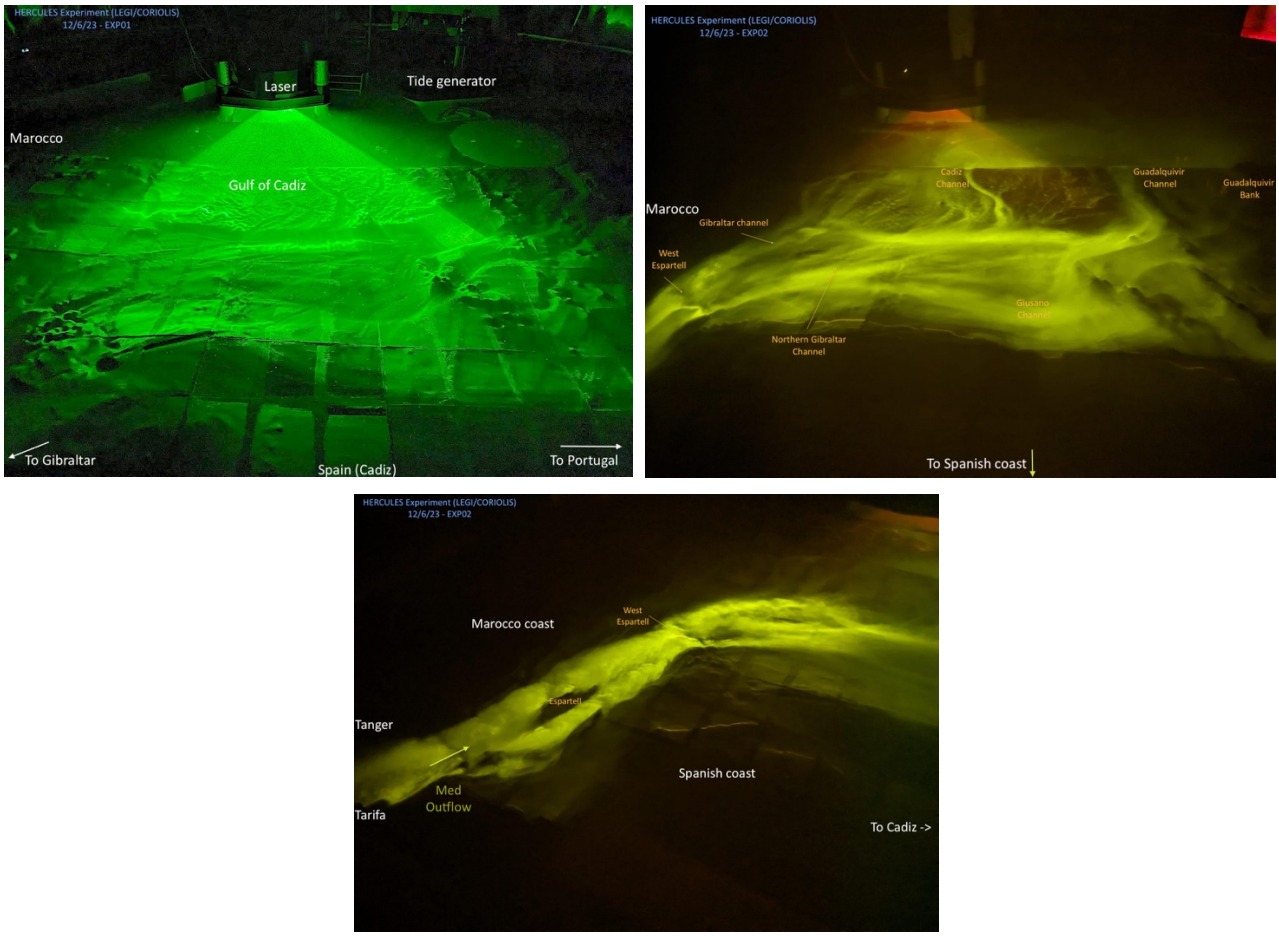

Figure 1: Top Images showing the recent first HERCULES experiments done at LEGI/Coriolis including all forcings (realistic topography, baroclinic, barotropic, rotation). Left picture on the top shows the global view of the Gulf of Cadiz and highlights the bottom topography. The picture on the right highlights the Mediterranean Outflow by use of fluorescent dye in the salt water and an orange filter on the camera, highlighting the propagation of the MOW in the different channels. A zoomed view further upstream on the last picture shows the Northern/Southern Majuan Banks surrounding the Espartell Sill and the West Espartell *Cascade* further downstream.

These data will be exploited in synergy with high resolution in situ observational data (SHOM) over several campaigns (2014, 2020) and numerical data (LES) mimicking the experimental physical model. Diagnostic tools will be developed to describe the small-scale turbulent processes necessary for the evaluation of the non-hydrostatic dynamics and its feedback on the mesoscale. The data and tools produced in the framework of this project will also provide the necessary data to test the parameterizations and calibrate the CROCO code (https://www.croco-ocean.org/) under non-hydrostatic conditions. Although the project is focused on the Gibraltar Strait and the nearby environment, the methodology and approaches validated can be subsequently applied and extended to other locations with similar hydrological and dynamical characteristics and will thus offer a new way of modeling sub-grid processes and their integration into more global models, essential for a correct representation and forecasting of the ocean circulation.
The candidate will be in charge first of testing and optimizing the different forcings of the physical model in the Coriolis Platform. (S)he will contribute to the performance of the physical laboratory experiments in the Coriolis Platform including the challenging measurements (PIV/PLIF) in order to study sub-mesoscale processes and internal waves in the resulting rotating and stratified ambient (Negretti et al 2021, 10.1063/5.0058629). Data analysis to evaluate turbulence characteristics, energy transfers and diagnostic tools for turbulent mixing will also be part of her/his tasks. Regular meetings with the consortium researchers within the ANR Astrid (HERCULES) contract will permit comparisons of the experimental data with numerical/oceanographic observational data (SHOM, LOPS). The candidate may also participate to a sea cruise in 2024/25 and to the analysis of in situ data.
Restrictions: The candidate must be of European nationality only (including UK and Switzerland).

LOCATION AND PRACTICAL ASPECTS The successful applicant will be hosted by the laboratory LEGI (1209-1211 rue de la piscine, 38400 GRENOBLE France) within the team MEIGE and will work in close collaboration with ME Negretti, A Wirth and J Sommeria. The gross salary will be 2600 euros/months, equivalent to a net salary of roughly 2150 euros/month.

QUALIFICATION The post-doctoral candidate will need to master several techniques, as Particle Image Velocimetry (PIV), Laser Induced Fluorescence (LIF), image pre- and post-processing, data analysis and statistics. A solid background in fluid mechanics, image processing, and theoretical/numerical tools is a prerequisite. Curiosity, autonomy and willingness to develop new skills are also necessary.

APPLICATION Interested candidates should send their CV and cover letter to ME NEGRETTI (**eletta.negretti@legi.cnrs.fr)**. Applications will close as soon as a suitable candidate is found.