

## PHD POSITION TO APPLY TO THE SPANISH FPU PROGRAM

### Research Project – MEL

Multifractal Eddy viscosity for Large eddy simulations

**PhD Supervisors:** Dr. Jordi Isern-Fontanet

**Centre:** Institut de Ciències del Mar (ICM-CSIC)

### Project description

Turbulent flows, such as oceanic motions, are characterized by the transfer of energy from the scales at which energy is injected towards smaller scales, where energy is converted to heat. Understanding such transfer of energy between scales has been a central problem in physics for over a century and it bears important implications for the prediction of the evolution of ocean currents, transport and, ultimately, Earth's climate. In particular, understanding of the energy cascade remains necessary to properly parametrize the energy dissipation occurring at scales non-resolved by ocean and climate numerical models. A common approach consists on adjusting an effective viscosity of the fluid, known as eddy viscosity, to bring the scale at which dissipation dominates to the resolution of the model. The problem becomes more challenging when the smallest scales resolved by the model are dominated by the energy cascade. This is the case of state-of-art ocean and climate models. In these cases, the eddy viscosity has to be consistent with the energy cascade. The central idea of this project is to develop and test a new approach to compute the eddy viscosity taking into account the properties of the energy cascade in a stratified and rotating flow. In particular, the Multifractal Theory of Turbulence will be used to develop the required parametrization for the non-hydrostatic equations. This multifractal-based eddy viscosity will be implemented in a common ocean model framework such as CROCO.

### Requierments of the candidate

Graduated in Physics or similar.

### Hosting research team

The ICM, a recently recognized as a Severo Ochoa Excellence centre, has a demonstrated commitment towards training junior researchers in ocean sciences. In recent years, an average of 15 PhD theses have been supervised at ICM. Always achieving the highest qualifications and have generated a remarkable number of international publications. The new advisory units being implemented at ICM under the umbrella of the Severo Ochoa

award, the broad diversity of research groups and topics at the ICM, and the international scientific collaborations described in this proposal, will provide the necessary human and academic support to the Ph.D. candidate. At ICM level, the novel *Talent Development and Work Environment Unit* and the *Professional Development Task Force* will manage the internal training program. As such, after joining ICM, the *Talent Development and Work Environment Unit* will help on the design of a suitable *Career Development Plan* adapted for the PhD candidate, who will also become a member of the ICM Young Researchers Association. Moreover, ICM will offer courses on scientific and technical aptitudes, as well as soft skills. The internal ICM training offer will be completed by CSIC course portfolio and Career Development events.

The Physical Oceanography and Technology Department (DOFT), which is the host department of the researchers leading this proposal, has a long tradition in the formation of research personnel, providing specific training in physical oceanography that is lacking within the Catalan university system. The DOFT group was the first CSIC group to participate in an Erasmus graduate program, starting in 1988. For over 25 years, our researchers have collaborated with doctoral programs in Marine Sciences with the Universitat de Barcelona, Universitat Autònoma de Barcelona, the Universitat Politècnica de Catalunya and the Universidad de Las Palmas de Gran Canaria, among others. At the time of this proposal, DOFT is composed of 12 researchers with a permanent position working on Physical Oceanography (from submesoscales to large scales), Geophysical Fluid Dynamics, Geophysical Turbulence, Remote Sensing and Marine Technology. DOFT has several students doing short stays (at the undergraduate or Master's level) and five official doctoral students (four of them with a part- or full-time contract). At DOFT, students are encouraged to share their research advances in public seminars, to both increase the collaboration with other students and researchers and to acquire the communication skills necessary in research. This training is complemented with activities on scientific dissemination.

## How to apply

- At the first step, the applicant will be evaluated based on the university degree. If appropriate, selected candidates could be invited for an interview. In case you are interested, please contact ASAP the PI of the project attaching your CV and your transcript record.
- At the second step, selected applicants, together with the PhD project, will be evaluated for a final selection.
- Applications to the FPU scholarships must be submitted through [the following official link](#). The period of application is **from 22 November to 17 December 2020**.



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*Interested candidates, please contact the Principal Investigators:*

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