

## PhD POSITION TO APPLY TO THE SPANISH FPU PROGRAM

### Research Project - **Climate Change, Ocean Warming and Blue Carbon in Antarctica: Atmosphere-Ocean Coupling, Ecosystem Responses and Earth-System Feedbacks**

**Reference:** FPU-ANTCLIM-01

**PhD Supervisors:** Enrique Isla, Jordi Solé

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

### Project description

The Antarctic continent and the Southern Ocean play a fundamental role in regulating Earth's climate through their influence on ocean circulation, heat uptake, carbon storage and marine ecosystems. Recent observations reveal significant warming of Southern Ocean waters, increasing intrusions of Circumpolar Deep Water onto the Antarctic continental shelf, ice-shelf melting, and major changes in sea-ice dynamics (Gille, 2002; Turner et al., 2020). These processes are altering long-established physical and ecological interactions across Antarctic marine benthic environments (Isla & Gerdes, 2019). The physical-chemical characteristics of Antarctic continental shelf sediment store information that may improve our knowledge on these environmental changes.

This PhD project aims to investigate how climate-driven changes in atmosphere-ocean coupling and ocean warming may affect Antarctic continental shelf ecosystems, with special emphasis on the Weddell Sea and the Antarctic Peninsula. The project will analyse the links between ocean warming, sea-ice variability, ocean circulation, organic carbon fluxes and benthic ecosystem responses, using marine sediment, water temperature and modelling as a platform to assess these relationships (Isla, 2023).

Particular attention will be devoted to:

- Southern Ocean warming and heat transport.
- Intrusions of Circumpolar Deep Water onto the Antarctic continental shelf.
- Interactions among ocean circulation, sea ice and ice-shelf dynamics.



- Impacts on carbon transfer from the surface ocean to the seafloor.
- Assessment of organic carbon dynamics in the marine sediment relative to changing environmental conditions.
- Consequences for carbon sequestration, ecosystem resilience and climate feedbacks.
- Potential links between Antarctic change and broader Earth-system processes.

The project will combine oceanographic observations, satellite data, climate reanalyses data and ecological datasets to improve our understanding of how physical climate change propagates through Antarctic ecosystems and how these changes may influence global climate regulation.

#### References:

Gille, S.T. (2002). Warming of the Southern Ocean since the 1950s. *Science*, 295(5558), 1275-1277. DOI: 10.1126/science.1065863.

Isla, E., & Gerdes, D. (2019). Ongoing ocean warming threatens the rich and diverse macrobenthic communities of the Antarctic continental shelf. *Progress in Oceanography*, 178, 102180. DOI: 10.1016/j.pocean.2019.102180.

Isla, E. (2023). Animal-Energy Relationships in a Changing Ocean: The Case of Continental Shelf Macrobenthic Communities on the Weddell Sea and the Vicinity of the Antarctic Peninsula. *Biology*, 12(5), 659. DOI: 10.3390/biology12050659.

Turner J et al. (2020) Recent decrease of summer sea ice in the Weddell Sea, Antarctica. *Geophysical Research Letters*, 47, e2020GL087127. <https://doi.org/10.1029/2020GL087127>.

## Hosting research team

The PhD candidate will join the Antarctic marine research activities of the Institut de Ciències del Mar (ICM-CSIC), working in an interdisciplinary environment combining oceanography, climate science, marine ecology and Earth-system research. The candidate must meet the eligibility requirements to apply for the FPU fellowship.



Pg. Marítim de la Barceloneta, 37-49  
08032 Barcelona  
+34 932 309 500  
[www.icm.csic.es](http://www.icm.csic.es)

The project builds upon long-term research on Antarctic continental shelf ecosystems, ocean-climate interactions and environmental change, with a particular focus on the Weddell Sea and Antarctic Peninsula regions.

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*Interested candidates, please contact the Principal Investigators:*

[isla@icm.csic.es](mailto:isla@icm.csic.es), [jsole@icm.csic.es](mailto:jsole@icm.csic.es)

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