

SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year 2025

Project Title: Improving AMOC Representation in EC-Earth through Enhanced Vertical Coordinate and High-Resolution Nested Domains

Computer Project Account: spieodea

Principal Investigator(s): Enda O'Dea

Affiliation: Met Éireann

Name of ECMWF scientist(s) collaborating to the project (if applicable) NA

Start date of the project: 1 January 2025

Expected end date: 31 December 2026

Computer resources allocated/used for the current year and the previous one (if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	N/A	N/A	50,000,000	0
Data storage capacity	(Gbytes)	N/A	N/A	1,500	0

Summary of project objectives (10 lines max)

The core objective is to significantly improve the representation of the Atlantic Meridional Overturning Circulation (AMOC) within the EC-Earth model. This will be achieved by implementing a local Multi-Envelope (ME) vertical coordinate system and high-resolution, two-way nested domains in the North Atlantic. These enhancements aim to more accurately simulate key processes like Nordic Sea overflows, which are fundamental to the stability of the AMOC and its influence on the climate of north-western Europe.

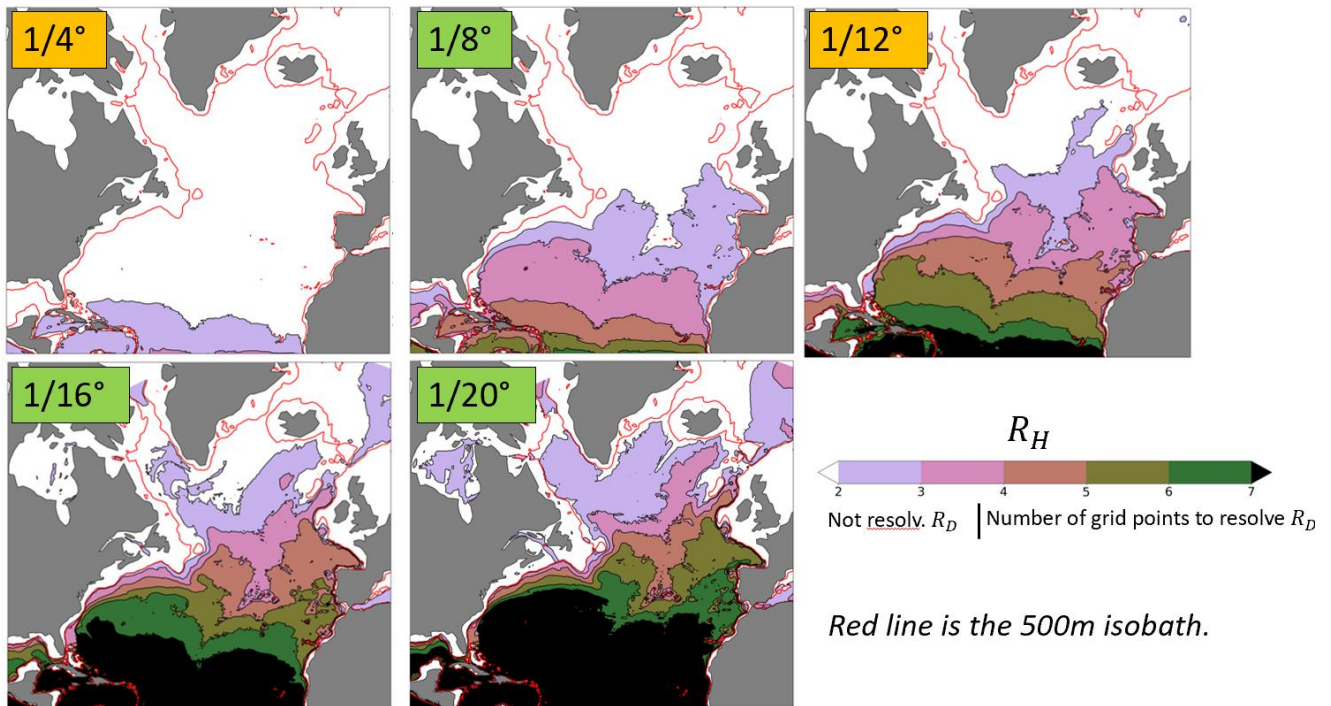


Figure 1: The number of points per Rossby Radius for successive uniform global resolutions $1/4$ - $1/16$ degree. In the reference $1/4$ degree resolution the Rossby Radius in the North Atlantic is not resolved at all.

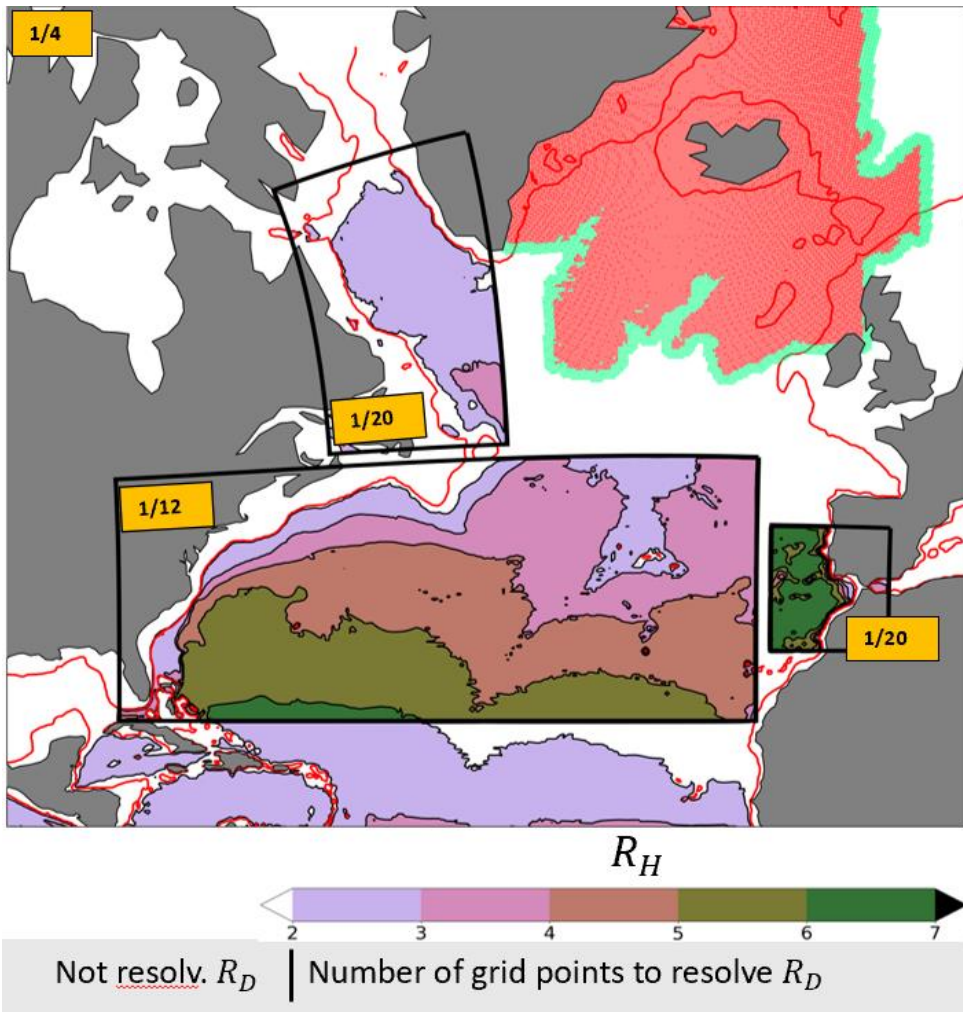


Figure 2 Proposed GOSI10na+ configuration showing areas where refined horizontal resolution using AGRIF 2-ways nests at 1/20th and 1/12th degree resolution and the region of overflows between the Arctic and Atlantic basins where Multi Envelope Coordinates will be targeted between Greenland and Scotland.

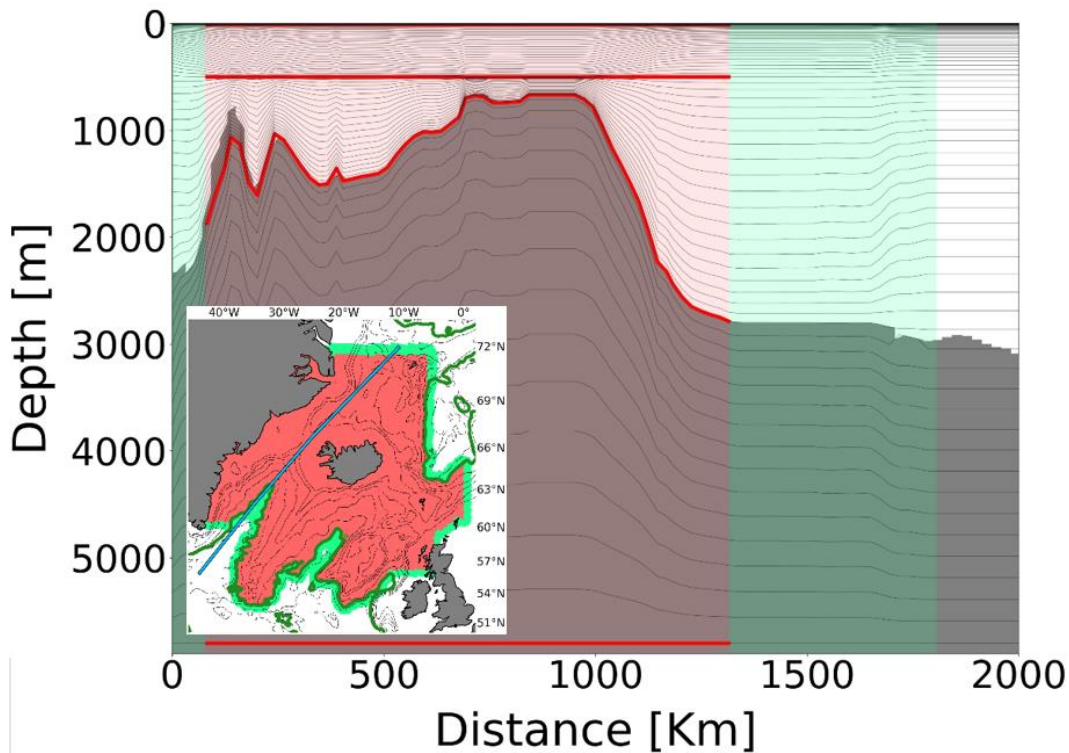


Figure 3: **Localisation area**: the model uses Multi-Envelope (ME) s-coordinates (Bruciaferri et al. 2018); computational levels are terrain-following up to 2800m. **Transition area**: model levels smoothly blend. **Global area**: the model uses zps levels

Summary of problems encountered (10 lines max)

The project's computational work has been delayed. The execution of the technical goals relies on a dedicated postdoctoral researcher, whose recruitment has been postponed. This is not due to funding, which is fully secured by Met Éireann, but due to complexities in finalizing a legal agreement with the UK Met Office concerning model configuration sharing. These legal discussions have progressed well, and we expect the agreement to be formalized by the respective legal departments soon, allowing us to proceed with recruitment and have the postdoc in place by early to mid-2026.

Summary of plans for the continuation of the project (10 lines max)

Once the legal issues are resolved, and during the subsequent recruitment process, the PI will undertake preparatory technical work. This involves setting up UKMO and EC-Earth configurations on Atos so that many initial technical hurdles are already overcome when the postdoc is in place. This work is estimated to utilize approximately 5-10 million SBU. We propose that the remaining balance of the 2025 allocation be made available to support other projects. The project will proceed at full capacity in 2026 once the postdoc is in position.

List of publications/reports from the project with complete references

N/A

Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

As this report is submitted during the first project year, the following is a summary of activities from the project start to June of the current year.

No computational experiments have been conducted, and therefore no scientific results have been generated. The project's activities to date have been administrative and preparatory.

As detailed in the "Summary of problems encountered" section, the primary cause for the lack of results is the delay in recruiting a postdoctoral researcher. This delay is due to the ongoing finalization of a legal agreement between the international partners regarding the sharing of model configurations. We are hopeful for a resolution soon, which will allow the recruitment process to commence. We are confident that the project will proceed as planned in the next reporting period once this is resolved.