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:	Enhanced Climate Simulations of the North Atlantic
Computer Project Account:	spienola
Principal Investigator(s):	Paul Nolan, paul.nolan@ichec.ie
Affiliation:	Irish Centre for High-End Computing, National University of Galway
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Dr Tido Semmler, Met Éireann, tido.semmler@met.ie Dr John Hanley, Met Éireann, johnp.hanley@met.ie
Start date of the project:	2025
Expected end date:	2027

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	80m	2m
Data storage capacity	(Gbytes)	N/A	N/A	50,000	50,000

Summary of project objectives (10 lines max)

The climate of Ireland and northwest Europe is dominated by the Atlantic Ocean and its interaction with the atmosphere It is therefore vital for the assessment of national climate change that climate models demonstrate high skill in the representation of the North Atlantic Ocean, and associated atmosphere-ocean interactions.
The objectives of the proposed research are two-fold;

- investigate and improve the EC-Earth4 Earth System Model in the representation of the North Atlantic Ocean-Atmosphere System, and
- contribute to the CMIP7 "Fast Track" project with high-resolution EC-Earth4 simulations

Summary of problems encountered (10 lines max)

The problems encountered were minimal. The implementation and running of EC-Earth3&4 on the Atos system presented no issues. The only minor issues were the transferring of the large climate datasets from atos to local servers which resulted in some delays.

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

The PI will work with Met Eireann and the EC-Earth community over the coming year to develop EC-Earth4 and contribute to CMIP7 "Fast Track" experiments.

List of publications/reports from the project with complete references

N/A – Project Commenced in 2025

Summary of results

The project commenced in 2025 so results to date are minimal. The EC-Earth4 model was installed and scale-tested on atos using the intel compilers and intel-openmpi. The EC-Earth4 AOGCM configuration comprised the following components: OpenIFS 43r3v2, NEMO 4.2.0, XIOS 2.5+ and OASIS3-MCT 5.2. The system was tested using standard MPI and hybrid MPI-OpenMP (implemented within OpenIFS). Figure 1 presents timings for a one-month simulation. In all runs, the number of cores for XIOS was set to 1. For each node, numerous different allocations of cores between OpenIFS and NEMO were tested to quantify the optimal balancing of cores between model components. The figure presents the optimal timing for each node. The higher resolution versions of EC-Earth v4 were not available for testing at the time of the scaling experiments, but it is expected that the high-resolution model will better avail of the hybrid MPI-OpenMP configuration.

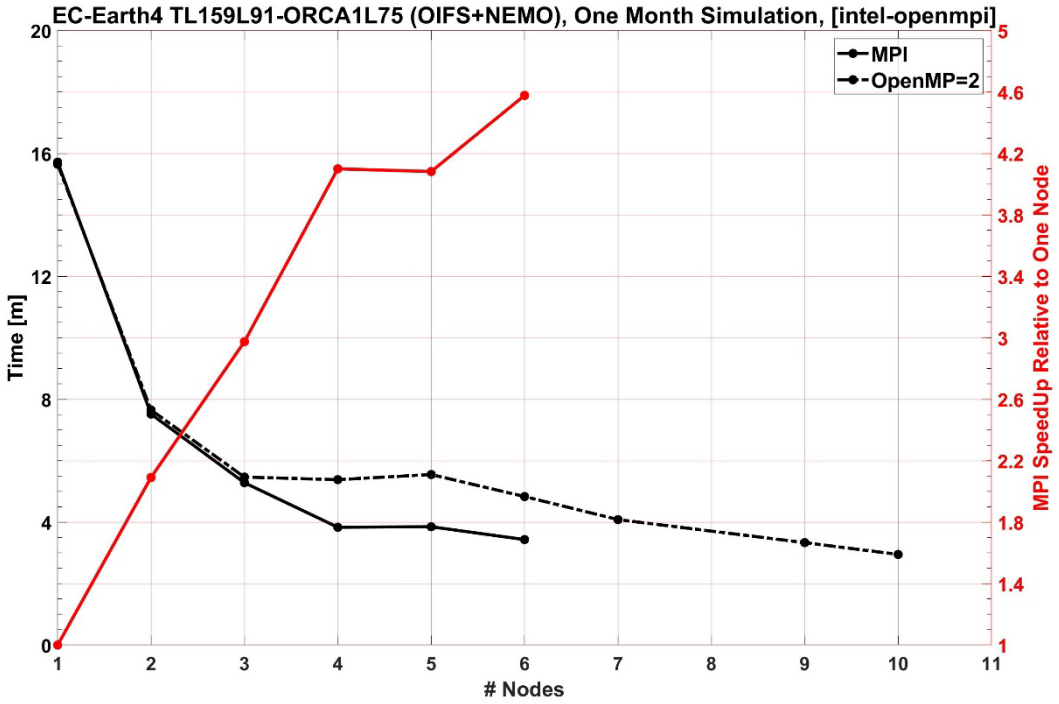

Figure 1. EC-Earth4 TL159L91-ORACA1L75 timings for a one-month simulation.