

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 2023

Project Title: Forecasting at sub-kilometre resolution with the HARMONIE-AROME model

Computer Project Account: spiecla2

Principal Investigator(s): Colm Clancy

Affiliation: Met Éireann

Name of ECMWF scientist(s) collaborating to the project (if applicable) N/A

Start date of the project: 1 January 2023

Expected end date: 31 December 2023

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)	-	-	20 M	16.7 M
Data storage capacity	(Gbytes)	-	-	0	0

Summary of project objectives (10 lines max)

The objective of this project is to explore options for running hectometric-scale forecasts over Ireland, specifically in terms of the lateral boundary conditions (LBC) and coupling options.

Summary of problems encountered (10 lines max)

Some technical issues at one stage with my eflow server, resolved by Support Desk.

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

The small remaining amount of SBUs will be used to continue with case studies of heavy rainfall events, as mentioned below.

There are many potential extensions to this project, including increasing the resolution further and/or testing the benefits and feasibility of a hectometric-scale ensemble. Therefore, it is likely that a new Special Project will be applied for in continuation of this work.

List of publications/reports from the project with complete references

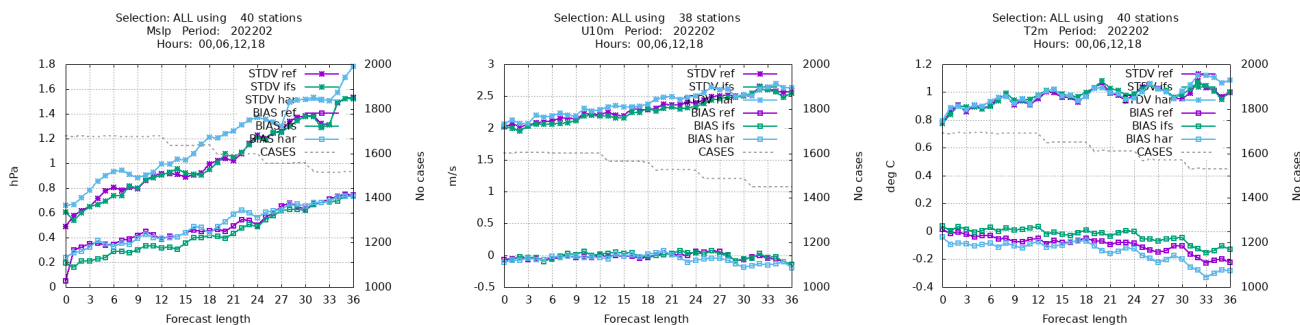
None

Summary of results

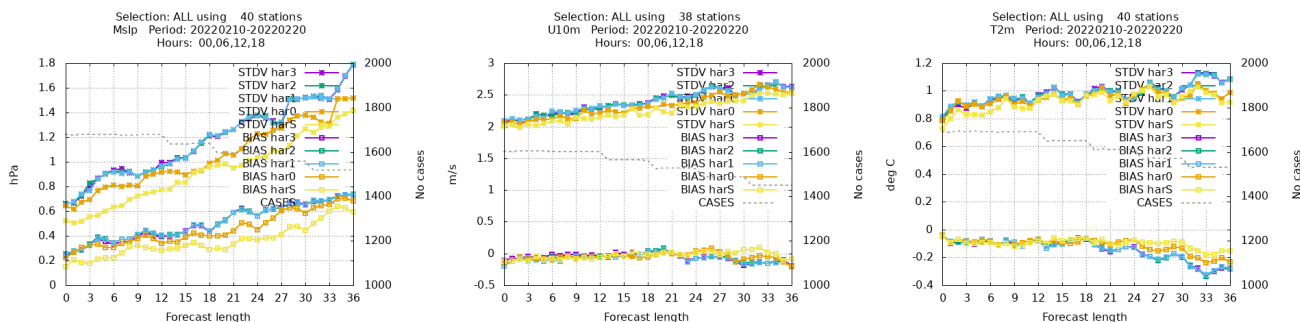
If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period 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.

Cycle 43h2.2 of the HARMONIE-AROME NWP model has been run for various experiments, at a horizontal resolution of 750m with 90 vertical levels. The resolution of reference runs has been 2 km with 90 levels, as this is the target resolution for the coming UWC-W operations. The main testing period has been the 10-20 of February 2022, when three named storms impacted Ireland.

The plots below show sample verification scores for MSLP, 10m wind and 2m temperature, comparing the reference (ref, purple) with 750m HARMONIE-AROME driven by LBC from IFSHRES (ifs, green), and nested within the reference (har, blue). We see from these that the use of the intermediate nesting strategy actually leads to slightly inferior scores.



In these tests 3-hour cycling is used so that, for example, the nested 750m 12z forecast uses the reference 09z forecast as LBC; i.e. 3-hour-old boundaries. We have also tested with HARMONIE LBC of a different “age”. In the verification below, har3, har2, har1 refer to 3-, 2-, and 1-hour old boundaries, and we see little difference among the three. Another option is to use the same forecast time, e.g. nest a 12z 750m within a 12z reference; this option may be impractical operationally, but can be seen to give better results (har0, orange). A final test was harS (yellow), which nests a 12z 750 within the 12z reference driven by LBC from the 12z IFSHRES. While this is completely impractical, it nevertheless shows the ultimate importance of the “age” of the global model, rather than that of the intermediate.



This kind of point verification gives only one side of the story. We are currently examining rainfall maps from the forecasts, both for this test period and for separate case studies of heavy rainfall events. These are showing more differences among the experiments when the various LBC options are used. This work will constitute the remainder of the project.