REQUEST FOR A SPECIAL PROJECT 2025–2027

MEMBER STATE: IRELAND

Principal Investigator[1]: Emily Gleeson

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Other researchers: ……

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Project Title: Improving cloud forecasting in HARMONIE-AROME

To make changes to an existing project please submit an amended version of the original form.)

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** ……..	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2025	
Would you accept support for 1 year only, if necessary?	YES ☐ X	NO ☐

Computer resources required for project year:		**2025**	**2026**	**2027**
High Performance Computing Facility	[SBU]	35M		
Accumulated data storage (total archive volume)[2]	[GB]	National allocation		

EWC resources required for project year:		**2025**	**2026**	**2027**
Number of vCPUs	[#]			
Total memory	[GB]			
Storage	[GB]			
Number of vGPUs[3]	[#]			

Continue overleaf.

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide annual progress reports of the project's activities, etc.

[2] These figures refer to data archived in ECFS and MARS. If e.g. you archive x GB in year one and y GB in year two and don't delete anything you need to request x + y GB for the second project year etc.

[3] The number of vGPU is referred to the equivalent number of virtualized vGPUs with 8GB memory.

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Extended abstract

The shared ALADIN-HIRLAM numerical weather prediction system is used for operational weather forecasting by 26 national meteorological services in Europe and North Africa which form the ACCORD (A Consortium for COnvection-scale modelling Research and Development) consortium. The Irish Meteorological Service, Met Éireann, is one of the 26 members and has been using the HARMONIE-AROME canonical configuration of this system since 2011. Met Éireann is part of United Weather Centres-West along with Iceland, Denmark and the Netherlands, which currently runs cycle 43h2.2 of HARMONIE-AROME operationally on a Lambert Conformal projection using a 1920x1620 horizontal grid with 2 km grid spacing at the centre and 90 vertical levels.

Cycle 46 has since been released, but cycle 49 contains more advanced physics and newer schemes and will be the focus of this special project. In HARMONIE-AROME cycle 49 the 2-moment LIMA microphysics scheme and the ECRAD radiation scheme are available for the first time. In addition to these schemes, further tests with Copernicus Atmospheric Monitoring Service (CAMS) near real-time aerosols and the CAMS climatology, as opposed to the old default Tegen climatology will be carried out, as well as tests with the ICE-T scheme, which is similar to ICE3 but contains elements of the Thompson scheme relevant for supercooled liquid water, and scale-aware shallow convection options.

The focus of the experiments for this special project will be on clouds and improving the forecasting of clouds in terms of cloud condensate type (water, ice, supercooled liquid), vertical distribution, diagnostic cloud cover and cloud overlap as used in the radiation scheme. A large focus will be on evaluating the outputs of the experiments using data from the CloudNet and ICOS networks, supersite data, satellite retrieval archives and measurements from campaigns such as RALI-THINICE.

2. SBU Justification for Various Experiments

An old operational domain for Ireland covered an area of 1000 x 900 points (figure 1, orange domain) with a horizontal grid spacing of 2.5 km and 65 vertical levels. Running this domain for one 24-hour forecast cycle costs approximately 13000 SBUs. An even older operational domain (Figure 1, red domain) covered an area of 500 x 540 grid points. To optimise the use of SBUs I will use the smaller domain for testing. This domain enabled us to run a comprehensive suite of tests with previous special

projects, which has proven greatly beneficial for operations and enhancing our knowledge of the model capabilities.

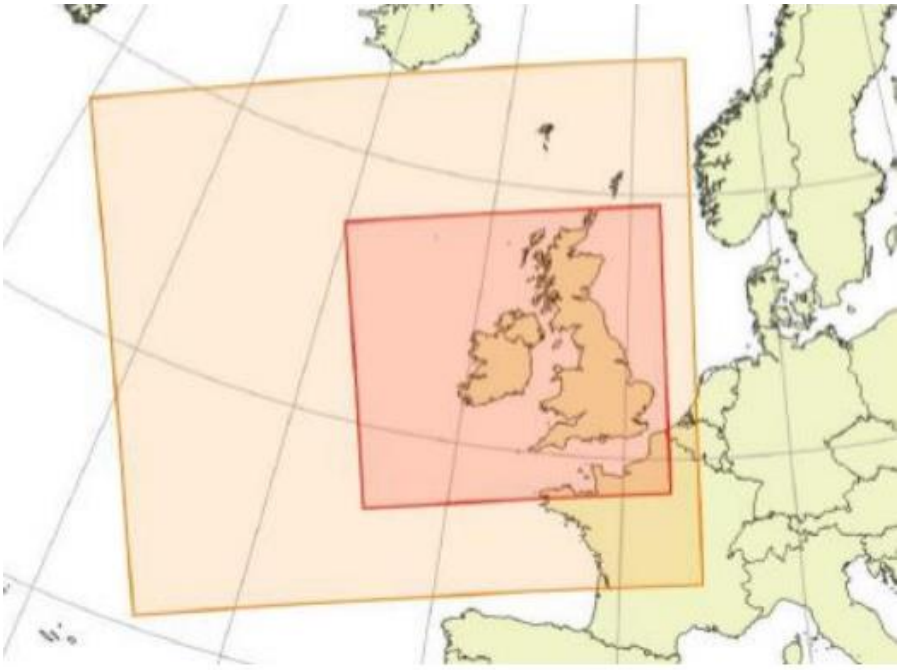

Fig 1. 2 old Irish operational domains in orange and red.

The requested resource of 35 M SBUs will be spent as follows:

- Testing of aerosol options (default, CAMS climatology, CAMS NRT and perhaps a hybrid option where only desert dust aerosols are a NRT field), with a focus on cloud regimes (frontal, convective – open and closed cell).

- Testing and tuning the ICE-T scheme.

- Testing scale-aware shallow convection (various options within).

- Tests with the LIMA – 2 moment scheme and having select hydrometeors in 2 moments.

- Cloud overlap options with ecRad, testing the decorrelation length for exponential random overlap.

3. Benefits of the Project

Within HIRLAM and ACCORD we are putting a greater emphasis on thoroughly evaluating the model using as many datasets as possible with particular emphasis on comparing like with like, as opposed to looking at headline scores. This project will focus on longer runs and special case studies focussing on clouds. The SBUs will be

run to test many configurations, enabling us to compare with specialised observations in order to decide on optimal operational set-ups for the future. While some of the new physics options have undergone some testing, a focus on clouds with detailed comparisons to observations has not yet been done and is vital in order to efficiently improve the model.

4. References

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