

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 2021

Project Title: Investigation of the impact of the different parametrizations on the fog development in HARMONIE-AROME for NWP forecasting for Ireland

Computer Project Account: SPIEMCAU

Principal Investigator(s): Ewa McAufield

Affiliation: Met Éireann

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

Start date of the project: 01-01-2021

Expected end date: 31-12-2021

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)			9M	
Data storage capacity	(Gbytes)			8.7M	

Summary of project objectives (10 lines max)

Fog is an on-going issue in the HARMONIE-AROME NWP model. The goal of this special project was to test a range of physics options in order to improve fog prediction over Ireland. The main options tested (for 2-week periods for each season and a selection of 6 other fog case studies) include: cloud droplet number concentration, the maximum Richardson Number, minimal stomatal resistance, precipitation release from the Kogan scheme, new LW cloud optical properties and saturation of lowest levels.

Summary of problems encountered (10 lines max)

There were not really any problems encountered as such but the extent of the testing and tuning was found to require more resources than this year's allocation. We are thus applying for a project extension to continue this useful investigatory work.

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

As we have almost used our allocation, further testing will be done using our national allocation. One thing that needs urgent testing is the use of a CDCN profile rather than constant CDCNs everywhere. The latter induced a positive temperature bias in summer due to the clouds being too transparent.

List of publications/reports from the project with complete references

We have not published results in any journals to date but the following section provides a link to technical reports and presentations.

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.

The main findings to date are that using lower values of cloud droplet number concentration greatly improve the overestimation of fog in HARMONIE-AROME. Even with such a model change, persistent fog over the sea, particularly in Spring, remained an issue – see <https://drive.google.com/file/d/1y1CG87BytQIU8fIHBEHcy0PB4mzjGhNT/view?usp=sharing> for details. Further analysis revealed the benefit of using a positive maximum Richardson Number. A value of zero was used initially as otherwise, we got biases in nighttime winds and temperatures, something that would impact on road-ice forecasting during the winter season. A new LW cloud optical property scheme coupled with the use of lower CDCNs in the radiation scheme, also vastly improves fog prediction but a more general review of this option showed that it impacts on summer temperatures – positive bias due to clouds being too transparent (the CDCNs are used in the calculation of cloud droplet effective radii).

The results from experiments carried out using this special project are mainly included in the following reports and presentations:

<https://drive.google.com/drive/folders/1BXwb9kgzzT8fxxShBqKZtAGC9YOCaHzp?usp=sharing>

