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:	Evaluation, Tuning and Optimisation of Surface Physics Parametrizations in HARMONIE-AROME for NWP forecasting for Ireland
Computer Project Account:	SPIEGLEE
Principal Investigator(s):	Emily Gleeson
Affiliation:	Met Éireann
Name of ECMWF scientist(s) collaborating to the project (if applicable)	
Start date of the project:	01-01-2019
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)			3M	
Data storage capacity	(Gbytes)			3M	

Summary of project objectives (10 lines max)

The overarching goal of this special project was to optimise the surface physics options in HARMONIE-AROME for Ireland.

Summary of problems encountered (10 lines max)

Some of the problems encountered were:

- The ECOLCIMAP-SG physiography used in cycle 43 of HARMONIE-AROME was not optimal for Ireland with most of our area represented by grassland. This resulted in lots of tests being carried out to try to improve the roughness lengths.
- Another issue encountered and not yet solved is excessive evaporation during Spring and Summer which exasperates our issues with fog prediction.
- A third issue involves too cold night time temperatures and too strong night time winds – a stable boundary layer issue. We partly alleviated this through poor physics – setting the maximum Richardson Number to 0.0, a decision we will soon reverse.

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

We have used all our SBUs but further testing will continue using our national allocation of units.

List of publications/reports from the project with complete references

Walsh, E., Bessardon, G., Gleeson, E., and Ulmas, P.: Using machine learning to produce a very high resolution land-cover map for Ireland, Adv. Sci. Res., 18, 65–87, https://doi.org/10.5194/asr-18-65-2021, 2021.

Keany, E., Bessardon, G., Gleeson, E., Leveraging machine learning to produce a cost effective national building height map of Ireland to create local climate zones. In preparation.

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 project SBUs were used to carry out a range of tests to improve on our operational cycle 43 set-up. We were mainly unhappy with our unphysical XRIMAX=0 setting and the use of surface DA to restrict T2m. We carried out a suite of tests for all seasons and came up with new settings that did not rely on the above and yielded similar operational performance. The main surface-related tests conducted included: XRIMAX, ECUME6 – a new sea flux scheme, LICERAD – which improves surface temperatures by making cloud ice more consistent in radiation and microphysics.

The key results are summarised in https://drive.google.com/file/d/1ZRuPTD2ERVWquqCjeTdB_ZzoC8HAgDKF/view?usp=sharing

Earlier results are available in https://drive.google.com/file/d/1ZRuPTD2ERVWquqCjeTdB_ZzoC8HAgDKF/view?usp=sharing

And
https://drive.google.com/file/d/1ZRuPTD2ERVWquqCjeTdB_ZzoC8HAgDKF/view?usp=sharing
contains other relevant talks and papers.