

## SPECIAL PROJECT FINAL REPORT

All the following mandatory information needs to be provided.

<b>Project Title:</b>	Investigation of the impact of the different parametrizations on the fog development in HARMONIE-AROME for NWP forecasting for Ireland.
<b>Computer Project Account:</b>	spiemcau
<b>Start Year - End Year :</b>	2021 - 2023
<b>Principal Investigator(s)</b>	Ewa McAufield
<b>Affiliation/Address:</b>	Met Éireann 65/67 Glasnevin Hill Dublin 9 D09 Y921
<b>Other Researchers (Name/Affiliation):</b>	Emily Gleeson, Colm Clancy

The following should cover the entire project duration.

## Summary of project objectives

The aim of this project was to test various parametrizations in the HARMONIE-AROME model in order to help to improve fog forecasts in the Irish domain. The tests include changes to: XRIMAX (tested values from 0 to 0.3), ZTINER (switched on/off), RSMIN (1.5, 2.0), RFRMIN 10 (set to 20), VSIGQSAT (0.02, 0.03), LMIXUV (switched on/off), LICERAD (switched on/off), HGT\_QS (switched on/off), ECUME6 vs ECUME, RFRMIN(24) set to 1.

## Summary of problems encountered

Testing using Cycle 43h2.2 was delayed due to the switch from ECGATE to ATOS.

## Experience with the Special Project framework

My experience with the SP framework was very good. The application procedure and reporting was clear.

## Summary of results

The main conclusions of the project are as follows:

- Increasing XRIMAX from 0 to 0.1, 0.2 or 0.3 reduces the amount of shallow fog over land and sea.
- XRIMAX>0 and RFRMIN(10) set to 20 are the most effective in reducing the amount of fog over land and over sea, with RFRMIN(10) setting being generally more effective over sea.
- In few fog cases, ECUME6 in EXP2 reduced fog compared to EXP1, however for the same fog cases, ECUME6 along with LICERAD set to TRUE and LMIXUV set to FALSE increased the amount of fog in the model.
- LMIXUV set to FALSE and LMIXUV set to TRUE (with no ECUME6, i.e. EXP5) reduce fog most of the time.
- Settings chosen from the experiments EXP1 to EXP7 that help to reduce fog over land and sea, vary between fog case studies. However, the most likely settings that help to reduce the lowest visibilities are included in EXP5 (XRIMAX=0.2, ZTINER removed, LICERAD=TRUE and LMIXUV=FALSE), second best settings are in EXP4.
- All experiments (EXPF0-EXPF6 and EXP0-EXP9) show significant improvement in the lowest visibilities with XRIMAX>0. In most cases, XRIMAX=0.2 shows to reduce fog more than XRIMAX=0.1.
- From the monitor scores, the recommendation for the Met Éireann operational suite would be to: change XRIMAX from 0 to 0.2, switch off ZTINER to improve the near surface temperature, set LICERAD to TRUE and set LMIXUV to FALSE.
- LHGT\_QS – when switched off, in some cases, it results in too much fog over the Irish domain, especially over the sea. However the monitor averaged scores are improved when LHGT\_QS is switched off.
- ECUME vs ECUME6 – no significant impact on the cloud cover when switched from ECUME to ECUME6.

## **List of publications/reports from the project with complete references**

A more detailed analysis of the results can be found here:

<https://www.overleaf.com/project/609e96dd1d734e79e60096c8>

## **Future plans**

Fog is a very complex phenomenon. Therefore, more testing of the parametrizations in the models as well as tuning would be needed with each new release of the Harmonie-Arome model cycle, such as Cycle 46. Special Projects that involve such testing might be submitted in the future.