Title: Met Éireann NWP Highlights 2015

Author(s): E. Whelan, E. Gleeson, S. Gallagher, and R. McGrath

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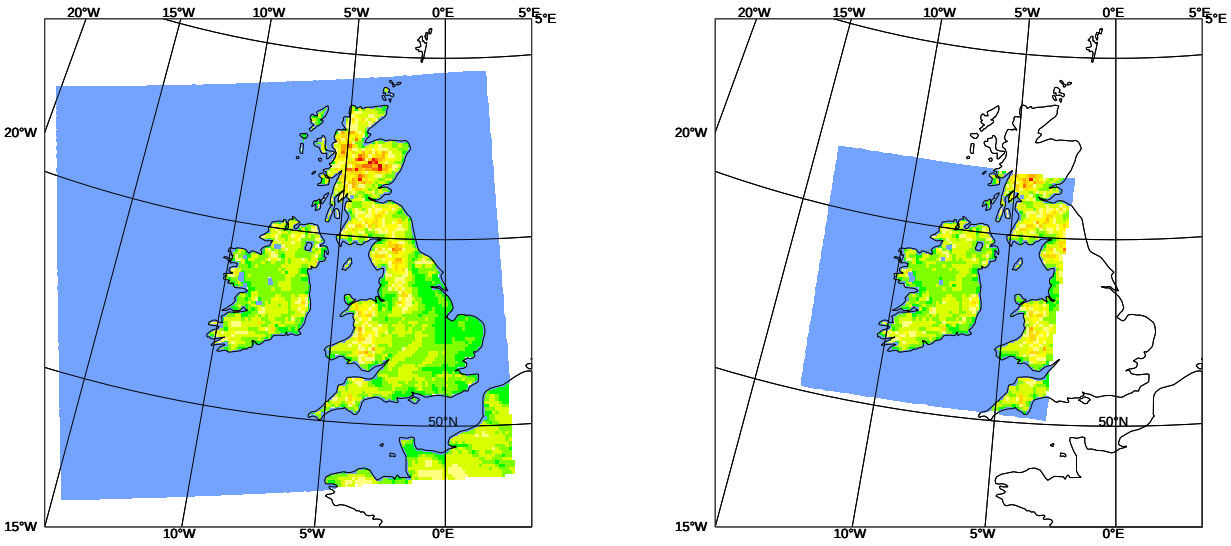
Met Éireann NWP Highlights 2015

Eoin Whelan, Emily Gleeson, Sarah Gallagher, Ray McGrath

1 Introduction

HARMONIE is used operationally by Met Éireann as its short-range forecast model as well as a research tool by Met Éireann scientists. HARMONIE 36h1.4 was made operational by Met Éireann in July 2011 with cycle 37h1.1 being introduced in January 2013. This article provides a summary of the current operational HARMONIE configuration as well as summaries of some of the NWP research carried out at Met Éireann during 2015.

2 Operational NWP



(a) Met Éireann operational HARMONIE domain

(b) Renewable energy project HARMONIE domain

Figure 1: Met Éireann HARMONIE domains

Met Éireann runs a single operational HARMONIE configuration on a domain covering Ireland, the United Kingdom and part of Northwest France. 54 hour forecasts are produced four times each day using cycle 37h1.1 on a 2.5km horizontal grid with 65 levels in the vertical and a model top at 10hPa (the operational domain is shown in figure 1(a)). No upper air analysis is carried out and optimum interpolation is used for the surface analysis. The observation cut-off is set at 45 minutes; this is enough time to collect and process the surface observations used by the surface analysis.

HARMONIE 38h1.2 is currently[1] being evaluated. The proposed operational configuration will use the same domain but 3DVAR upper air analysis using conventional observations will be enabled. The forecast cycle frequency will also be doubled so that forecasts will run eight times per day.

3 Renewable Energy

Met Éireann staff and researchers at University College Dublin (UCD) started a project at the end of 2014 which used the HARMONIE model and the WAVEWATCH III wave model (NOAA/NCEP [2016]) to produce a high resolution wind and wave atlas for Ireland based on the years 2000 to 2013 inclusive. During 2015 results from the simulations were analysed; further details are available in Gallagher et al. [2016].

Met Éireann ran HARMONIE cycle 37h1.2 on a small domain covering Ireland and its coastal waters (see figure 1(b)) for the 14 years to produce 10m winds that were used to drive the WAVEWATCH model for the period. The HARMONIE configuration for this project used ERA-Interim data (79km grid-spacing) for its boundary conditions without any intermediate model following the approach taken by Burgers et al. [2013]. This represents a downscaling ratio of approximately 32:1 which is significantly larger than the accepted maximum ratio of 5-10:1. An "intermediate" model using a grid-spacing of about 10km could have been used. However, the results presented by Burgers et al. [2013] and early tests in preparation for this project did not suggest any significant problems with this approach. HARMONIE 10m winds were found to be generally superior to ERA-Interim in predicting both wind speed and direction when compared with land observations and marine observations close to the coastline. Figure 2 shows an example of the output from the project, the winter average wind power at 90m for the south-west coast of Ireland.

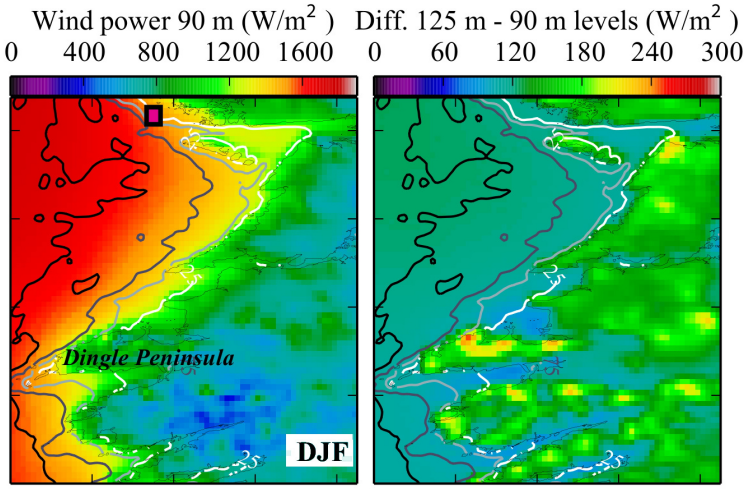


Figure 2: Winter average of the wind power at 90 m (left panel) and the difference between the 125 m and 90 m levels (right panel) for the southwest coast of Ireland. The square marker shows the proposed position of a wind energy project.

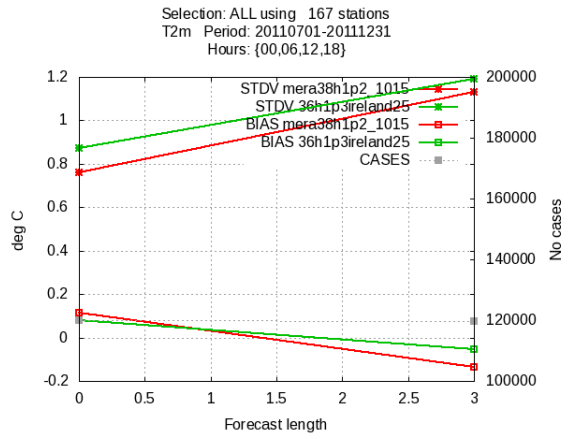
By considering the wind and wave conditions jointly, the research was able to build a unified description of the wave and wind nearshore energy potential of Ireland. This made it possible to select regions that have both a high energy density and are reasonably accessible for marine operations and maintenance. The study provides detailed information on wind and waves that reflects the current climate, an important consideration in view of climate change over past decades. This information also makes it possible to inform commercial interests

[1] January 2016

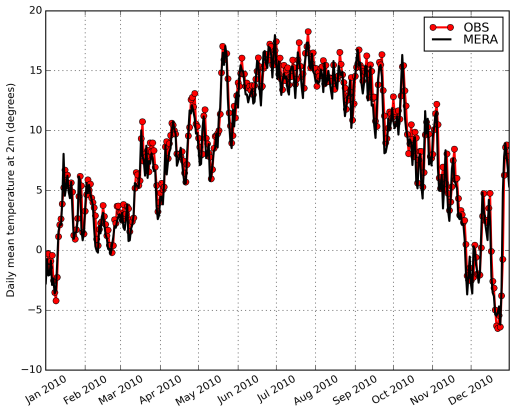
involved in marine operations in general, and in exploiting ocean renewable energy.

4 Regional re-analysis

In 2015 Met Éireann staff commenced a 35-year regional re-analysis of the Irish climate using the HARMONIE model, Met Éireann Re-Analysis (MÉRA). HARMONIE 38h1.2 was set up on the current operational domain, see figure 1(a), with 3DVAR upper air analysis of conventional observations enabled. Observations prepared from Met Éireann's climate database were used to supplement conventional observations used by ERA-Interim. The 35-year simulation period was split in to seven streams each consisting of a 1 year "spin-up" followed by 5 "production" years. Production started in February 2015 and the streams are now at the half way mark.



(a) Verification of 2m temperature (0-hour and 3-hour) forecasts comparing Met Éireann operational HARMONIE forecasts (36h1p3ireland25, green) and MÉRA forecasts (mera38h1p2_1015, red)



(b) A comparison between gridded observed daily mean 2m temperatures and output from the MÉRA simulations

Figure 3: MÉRA results

Initial analysis of MÉRA output suggests that the simulations are performing well. Point verification of the output has shown that MÉRA (38h1.2) performs better than the original (Met Éireann) operational configuration (36h1.3 with no upper air analysis), see figure 3(a). MÉRA output also compares well with Irish gridded observations, see figure 3(b).

References

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