Title: HIRLAM/HARMONIE Forecasts: Experience in Met Éireann.

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NOTICE: A definitive version was subsequently published in *ALADIN-HIRLAM Newsletter*.

Citation: McGrath, R., E. Gleeson, and E. Whelan. “HIRLAM/HARMONIE Forecasts: Experience in Met Éireann.” *ALADIN-HIRLAM Newsletter* 4 (2015): 33–35.

HIRLAM/HARMONIE forecasts: experience in Met Éireann

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1 Introduction

One of us is old enough to have worked with HIRLAM back in the 1990s and remembers the difficulties in getting the operational forecasters to use the products. It was an uphill struggle; the forecast quality was quite poor by today's standards and HIRLAM had very stiff competition from ECMWF. The advantages of higher resolution (HIgh Resolution was an aspiration!), and the flexibility of quick updates four times per day, did not win the argument; most forecasters would politely tell you that they invariably used ECMWF products as they felt they were more accurate. It was difficult to change this sentiment as ECMWF kept raising the bar in terms of quality and resolution, maintaining its poll position among forecasters.

But the tide has turned in the last few years, particularly since the HIRLAM-B phase and the introduction of the HARMONIE model for operational use (*Ireland was one the first countries to use HARMONIE operationally*). HARMONIE forecasts are now well regarded by the forecasters. True, some will still express a preference for ECMWF forecasts for a particular weather element but the verification scores show that HARMONIE generally has the advantage, especially when resolution matters (e.g. for local precipitation). Forecasters tend to be conservative and a single bad forecast may colour their overall judgement of a model; it is essential that the objective performance scores are regularly advertised and forecasters briefed so that negative views do not become entrenched.

2 Case Study: Storm Tini February 12th 2014

An excellent example of the performance of HARMONIE occurred on 12 February 2014 when storm Tini (also known as storm Darwin marking the 205th anniversary of Darwin's birth) crossed the western and northern regions of Ireland. Valentia Observatory in the south west of the country recorded violent storm force 11 sustained winds, only the fourth occurrence at the station since 1940. The extreme west to northwest gusty winds behind the storm centre caused major damage. Remarkably, there was no reported loss of life even though many houses lost their roofs and building structures collapsed. The forestry industry estimated that up to 7.5 million trees were felled.

HARMONIE did an excellent job in providing advance warning of the severity of the storm.

A striking feature of the weather system was the presence of a relatively narrow band of extreme wind speeds near the tip of the wrapped-around occluded front. A detailed examination of the structure of the storm shows that it shared many features associated with so called 'sting-jet' cyclones (Smart & Brown, 2014): a low level jet in advance of the cloud head, descending to the surface.

The 12 UTC sounding from Valentia Observatory – it was in fact delayed by 45 minutes due to a burst balloon and therefore missed the core of the jet - and the analysed vertical winds from the HARMONIE and ECMWF models, are shown in Figure 1. Based on a subjective analysis of the event, of the two models the HARMONIE profile is probably the more accurate.

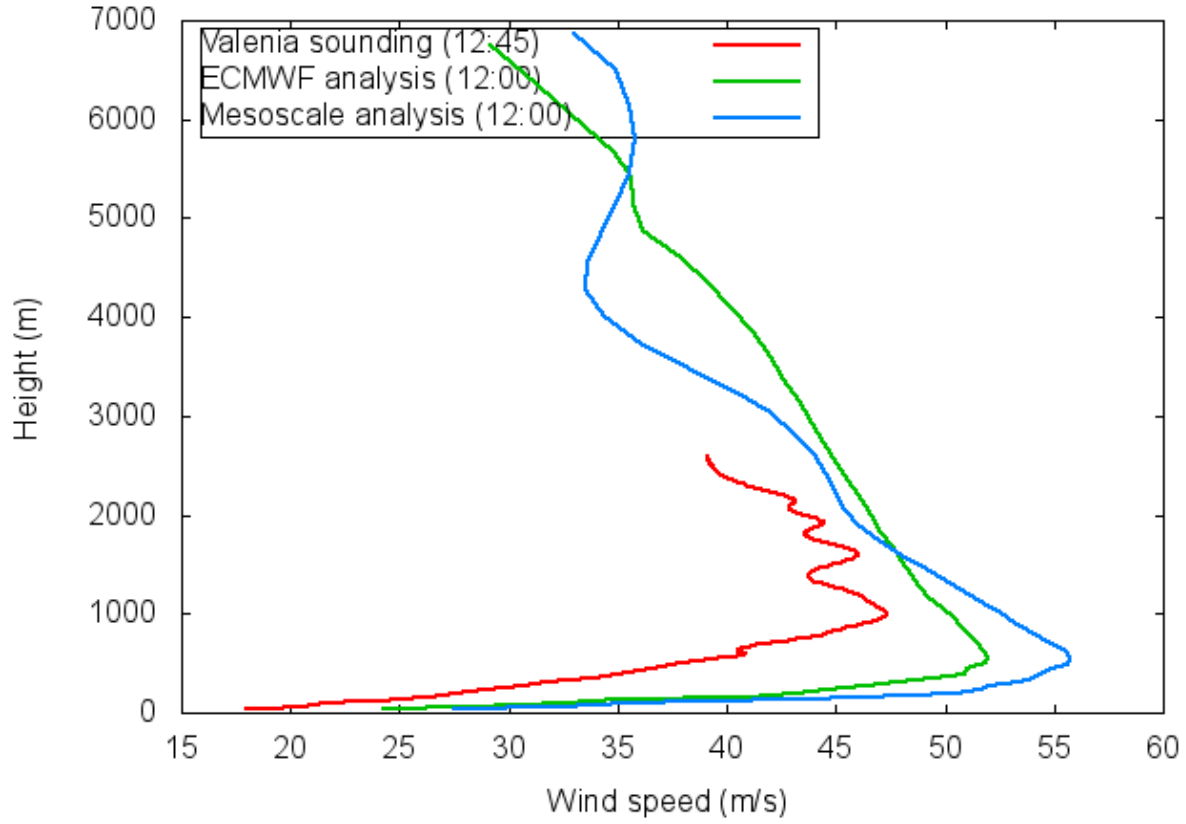

Figure 1: Vertical wind profiles at Valentia Observatory for 12 February 2014. Red (observed; 12.45 UTC); green (ECMWF analysis; 12 UTC) and blue (HARMONIE analysis; 12 UTC) model level wind data.

Figure 2 shows the HARMONIE 24-hour forecast and verifying analysis for 12 UTC. The agreement is remarkable, including the details regarding the storm force surface winds (not shown here).

On the previous day when this forecast became available some of the forecasters felt that the surface winds were 'far too strong'; in reality, the HARMONIE forecast was quite accurate and this was reinforced by later forecasts which led to severe weather warnings being issued.

Wind storms are not uncommon in Ireland and it a challenge to forecast those that are classified climatologically as exceptional; in such cases the dividend from an accurate forecast is far higher. The Darwin storm falls into this category and the climate records suggest that it was a roughly 1 in 20 year occurrence. The last comparable storm occurred in 1998 and a check on the global and regional forecasts for the time shows that it was not well forecast.

Recent performance reflects the impressive progress made in weather forecasting by the NWP community, including HIRLAM/ALADIN.

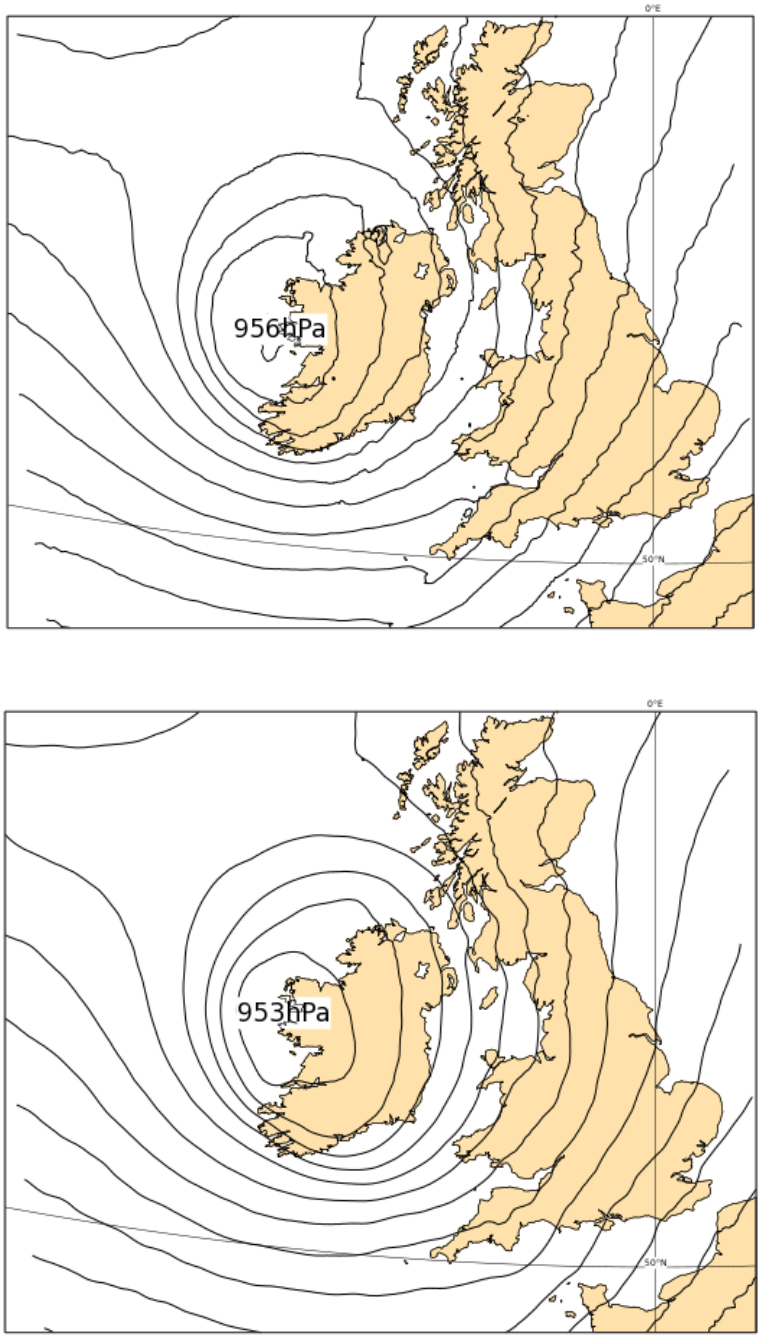

Figure 2: (top) HARMONIE 24-hour MSLP forecast for 12 UTC 12 February 2014; (bottom) the verifying NWP analysis.

3 References

Smart, D. J. and Browning, K. A. (2014), Attribution of strong winds to a cold conveyor belt and sting jet. Q.J.R. Meteorol. Soc., 140: 595–610. doi: 10.1002/qj.2162