

WORLD METEOROLOGICAL ORGANIZATION

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ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS) INCLUDING NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2015

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Introduction

Met Éireann / Ireland

1. Summary of highlights

Met Éireann – the Irish Meteorological Service – runs the HIRLAM and HARMONIE numerical weather prediction (NWP) systems, operationally, four times per day. Forecasts are produced out to 54 hours by both models. The international research programme HIRLAM is a research cooperation of European meteorological institutes. Details may be obtained from the HIRLAM web site:

<http://joomla.hirlam.org/index.php/hirlam-programme-53/general-model-description>

Met Éireann and ICHEC, the Irish Centre for High-End Computing, have signed a collaboration agreement in relation to operational NWP and NWP research. As part of this collaboration, ICHEC provides computational facilities and support to Met Éireann to enable it to run its operational high-resolution forecast models on ICHEC's flagship supercomputer, fionn. See <http://www.ichec.ie> for further information.

2. Equipment in use at the Centre

The operational NWP systems use the fionn Linux cluster at ICHEC (<http://www.ichec.ie/infrastructure/fionn>). The fionn Linux cluster is a heterogeneous SGI installation. Met Éireann use resources on the "thin" component of fionn. The "thin" component is an SGI Altix ICE X system with 320 nodes. Each compute node consists of 2 Intel (Ivy Bridge) cores with 12 core processors on each core. Met Éireann use an allocation of 16 compute nodes for its operational NWP.

3. Data and Products from GTS in use

SYNOP, SHIP, BUOY, AIREP, AMDAR, ACARS, TEMP, TEMPSHIP and PILOT observations are used. The data are packed into BUFR format both for storage and for input to HIRLAM and HARMONIE.

4. Forecasting system

4.1 System run schedule and forecast ranges

Met Éireann runs the HIRLAM and HARMONIE systems 4 times per day [starting from the analyses of 00UTC, 06UTC, 12UTC and 18UTC]. The forecast length for both models is 54-hours.

4.2 Medium range forecasting system (4-10 days)

Met Éireann does not run a medium range forecasting system.

4.3 Short-range forecasting system (0-72 hrs)

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

HIRLAM Data Assimilation

Analysis: HIRLAM 4D-Var [4-dimensional variational assimilation]. The analysis runs on 60 hybrid [eta] levels. Upper-air observational data is accepted on all standard and significant levels (10 hPa to 1000 hPa) and interpolated to eta levels.

Assimilation Cycle: HIRLAM has a six-hour cycle using the forecast from the previous cycle as a first-guess. [It is also possible to use an ECMWF forecast as a first-guess].

Initialization: HIRLAM uses an Incremental Digital Filter.

HARMONIE Data Assimilation

Analysis: HARMONIE carries out a surface analysis without any upper-air analysis.

Assimilation Cycle: HARMONIE has a six-hour cycle using the forecast from the previous cycle as a first-guess.

Initialisation: HARMONIE does not use a digital filter.

4.3.1.2 Research performed in this field

The next model upgrade of HARMONIE will use 3DVAR.

The assimilation of volume radar data and high resolution radiosonde data by HARMONIE is being researched as part of the HIRLAM-B project.

4.3.2 Model

4.3.2.1 In operation

HIRLAM Forecast Model:

HIRLAM 7.2 is a hydrostatic grid-point model and is run on a rotated latitude-longitude grid with the South-Pole at (-30° longitude, -30° latitude). Fields are based on a 654x424 grid corresponding to a 0.1° x 0.1° horizontal Arakara C-grid. There are 60 levels in the vertical.

Integration Scheme: Two time-level three-dimensional semi-Lagrangian semi-implicit scheme with a time-step of 240 seconds.

Filtering: Fourth order implicit horizontal diffusion.

Physics: CBR vertical diffusion scheme; Sundqvist condensation scheme with the **Kain Fritsch & Rasch Kristjansson convection and condensation** scheme; Savijarvi radiation scheme.

Lateral Boundary Treatment: Davies-Kallberg relaxation scheme using a cosine dependent relaxation function over a boundary zone of 8-lines. The latest available ECMWF 'frame' files are used [based on 4 ECMWF runs per day at 00Z, 06Z, 12Z and 18Z].

HARMONIE Forecast Model:

HARMONIE 37h1.1 is a non-hydrostatic convection-permitting limited area spectral model. Output fields are based on a 529x489 grid with a Lambert conic conformal projection with a grid-spacing of 2.5km at the domain centre. There are 65 levels in the vertical.

Integration Scheme: Two time-level three-dimensional semi-Lagrangian semi-implicit scheme with a time-step of 60 seconds.

Physics: 1D prognostic Cuxart-Bougeault TKE scheme; EDMF-M shallow convection, ICE micro-physics; Morcrette radiation scheme.

Lateral Boundary Treatment: The latest available ECMWF boundary files are used [based on 4 ECMWF runs per day at 00Z, 06Z, 12Z and 18Z].

4.3.2.2 Research performed in this field

Research on the radiation parametrization is carried out as part of the HIRLAM-B project

4.3.3 Operationally available NWP products

Upper-air products [such as temperature and wind] are available in GRIB code on standard levels. A variety of surface products [such as rainfall] are also produced.

4.3.4 Operational techniques for application of NWP products

4.3.4.1 In operation

Kalman filter techniques are used to produce input to a road ice prediction model

4.3.4.2 Research performed in this field

No current research in this area.

4.3.5 Ensemble Prediction System

Met Éireann does not run a medium range forecasting system.

4.4 Nowcasting and Very Short-range Forecasting Systems (0-6 hrs)

Short range HIRLAM forecasts are run operationally on a one-hour cycle [out to 9 hours] with a short cut-off time of 20 minutes.

4.5 Specialized numerical predictions

Met Éireann does not run any specialized numerical predictions

4.6 Extended range forecasts (ERF) (10 days up to 30 days)

Met Éireann does not run an extended range forecasting system.

4.7 Long range forecasts (LRF) (30 days up to two years)

Met Éireann does not run a long range forecasting system.

5 Verification of prognostic products

Met Éireann does not carry out verification for inclusion in the WMO Progress Report on the GDPFS

6 Plans for the future (next 4 years)

6.1 Development of GDPFS

6.2 Planned Research activities in NWP, Nowcasting, Long-range Forecasting and Specialized Numerical Predictions

6.2.1 Planned Research Activities in NWP

Continue NWP research and development as part of the HIRLAM Consortium

6.2.2 Planned Research Activities in Nowcasting

No plans

6.2.3 Planned Research Activities in Long-range Forecasting

No plans

6.2.4 Planned Research Activities in Specialized Numerical Predictions

No plans

7 Consortium

Met Éireann is a member of the HIRLAM Consortium.

7.1 System and/or Model

In the past the HIRLAM Consortium has developed the HIRLAM model. Development of this model ceased in 2012. HIRLAM now develops HARMONIE as its primary NWP system. Many HIRLAM NMSs still run HIRLAM operationally.

7.1.1 In operation

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Lateral Boundary Treatment: The latest available ECMWF boundary files are used [based on 4 ECMWF runs per day at 00Z, 06Z, 12Z and 18Z

7.1.2 Research performed in this field

Research on the radiation parametrization is carried out as part of the HIRLAM-B project.

7.2 System run schedule and forecast ranges

HARMONIE: 54 hour forecast at 00z, 06z, 12z & 18z with a 45 minute observation cut-off

HIRLAM: 54 hour forecast at 00z, 06z, 12z & 18z with a two hour observation cut-off

7.3 List of countries participating in the Consortium

HIRLAM members		
Danish Meteorological Institute	DMI	Denmark
Estonian Environmental Agency	EEA	Estonia
Finnish Meteorological Institute	FMI	Finland
Icelandic Meteorological Office	VI	Iceland
Irish Meteorological Service	Met Éireann	Ireland
Royal Netherlands Meteorological Institute	KNMI	Netherlands
Norwegian Meteorological Institute	MET Norway	Norway
Spanish State Meteorological Agency	AEMET	Spain
Swedish meteorological and Hydrological Institute	SMHI	Sweden
Lithuanian Hydrometeorological Service	LHMS	Lituania
Météo-France (associate member)	Météo-France	France

7.4 Data assimilation, objective analysis and initialization

7.4.1 In operation

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7.4.2 Research performed in this field

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The assimilation of volume radar data and high resolution radiosonde data by HARMONIE is being researched as part of the HIRLAM-B project.

7.5 Operationally available Numerical Weather Prediction (NWP) Products

Upper-air products [such as temperature and wind] are available in GRIB code on standard levels. A variety of surface products [such as rainfall] are also produced.

7.6 Verification of prognostic products

Met Éireann does not carry out operational verification of prognostic products

7.7 Plans for the future (next 4 years)

7.7.1 Major changes in operation

Upgrade HARMONIE model version as they made available by HIRLAM Consortium

7.7.2 Planned Research Activities

Continue NWP research and development as part of the HIRLAM Consortium

8 References