

JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM AND NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR 2007

Estonian Meteorological Hydrological Institute

1. Summary of highlights

EMHI obtained membership in HIRLAM consortium 01.01.2007 which makes possible of using HIRLAM NWP model in operational work.. HIRLAM is an international limited area NWP consortium and is formed by the national meteorological agencies of Denmark, Finland, Iceland, Ireland, The Netherlands, Norway, Spain, Sweden and includes now also Estonia. EMHI also joined EUMETNET which gives possibility to participate in EUMETNET SRNWP programme. Major upgrade of computing platform took place in the end of 2007 which will be used operationally together with upgrade of NWP system during 2008.

2. Equipment in use

EMHI has a 12 node GNU/Linux PC cluster with Gigabit Ethernet interconnects. Each node has 1.6 GHz Pentium IV processor and 1GB of RAM.

New computing platform was acquired and installed in EMHI at the end of 2007. The new system is 32 node GNU/Linux PC diskless cluster computer with Myrinet 2000 interconnects. Each node has 2.8 Ghz dual-core AMD Opteron processor and 8 GB of RAM. The new computing platform will be used operationally in 2008.

3. Data and Products from GTS in use

EMHI has a GTS link and receives observation data through this. However, these data are not used for NWP purposes right now. An observation file in BUFR format is put together in Finnish Meteorological Institute and provided to EMHI through internet connection. The file contains TEMP, PILOT, SYNOP, SHIP, BUOY, AMDAR, AIREP observations from GTS. The file is used for HIRLAM NWP modelling.

4. Forecasting system

4.1 System run schedule and forecast ranges

EMHI-s activities in medium range forecasting are based on ECMWF operational model. This means 10 days forecasts twice a day with 00 and 12 GMT starting time are available to EMHI. Short range NWP modelling is based on HIRLAM system. For ranges and schedules please follow the Model section 4.3.2. However, the work to upgrade the HIRLAM NWP environment at EMHI started at the end of 2007 and will be finished in January – February 2008.

4.2 Medium range forecasting system (4-10 days)

Products from ECMWF are used for medium range forecasting. Operations concentrate mainly on deterministic products. Ensemble prediction system products are additionally examined in the case of possible hazardous weather event or in the case of special demand from the client.

4.2.1 Data assimilation, objective analysis and initialization

-

4.2.2 Model

-

4.2.3 Operationally available Numerical Weather Prediction Products

10-day deterministic forecasts are available at EMHI. Some of the products are downloaded from ECMWF as images and displayed on internal website.

- mean sea level pressure analysis and forecast
- 6h accumulated precipitation (amount and phase) forecast
- 2 m temperature analysis and forecast
- 10 m wind analysis and forecast

- temperature analysis and forecast on 1000/925/850/700/500/400/300/250/200/150 mb pressure levels
- geopotential height analysis and forecast on 1000/925/850/700/500/400/300/250/200/150 mb pressure levels
- specific humidity analysis and forecast on 1000/925/850/700/500/400/300/250/200/150 mb pressure levels
- wind components analysis and forecast on 1000/925/850/700/500/400/300/250/200/150 mb pressure levels
- multi-layer cloudmap in false colours forecast
- sea surface temperature
- sea ice cover

4.2.4 Operational techniques for application of NWP products (*MOS, PPM, KF, Expert Systems, etc.*)

NWP products are used to pre-fill site forecast information in selected points in Europe and over the World. The information is later over-viewed by duty forecaster.

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

-

4.2.5.2 Research performed in this field

-

4.2.5.3 Operationally available EPS Products

- Probability of the wind gusts exceeding certain threshold (15 m/s and 25 m/s) from ECMWF web-site
- Probability of temperature below 0°C from ECMWF web-site
- Probability of wave height exceeding certain threshold (2 m, 4 m, 6 m, 8 m) in Baltic Sea downloaded as maps and displayed in internal website.
- EPSgrams of selected points in Estonia from ECMWF web-site

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

Short-range forecasting is based on HIRLAM consortium NWP model which produces 54 hour forecasts. Experimentally 3,3 km horizontal resolution model is run in continuous mode.

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

HIRLAM 3DVAR (Unden et al 2002) analysis is employed together with normal mode initialization as the initial dataset. Boundary conditions are provided by Finnish meteorological Institute from their operational system.

4.3.1.2 Research performed in this field

-

4.3.2 Model

4.3.2.1 In operation

The NWP model, which is employed in the NWP environment, is HIRLAM (Unden et al 2002) version 6.4.0 with minor modifications. HIRLAM provides a wide range of options for modelling applications, but the following set has been chosen for current environment:

- 3DVAR data analysis
- Implicit normal mode initialization as initialization scheme
- Semi-implicit semi-Lagrangian scheme
- ISBA scheme for surface parameterization
- The STRACO scheme for large scale and convective condensation
- Savijärvi radiation scheme
- CBR-turbulence scheme

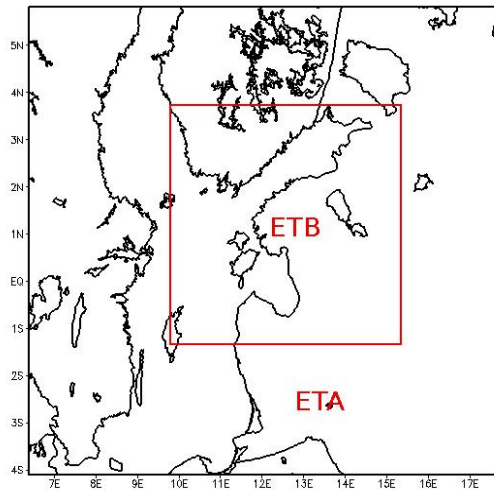


Figure 1. Modelling areas.

The integration areas are presented in Figure 1. Lower resolution area named ETA has horizontal resolution 11 km and hydrostatic SISL scheme with 400 s time-step is applied in the forecast model. The grid is 114x100 points in horizontal directions and 40 levels. ETA area is the main operation model for EMHI. High resolution ETB is used as an experimental model. The ETB area has 3.3 km horizontal resolution and applies nonhydrostatic extension of HIRLAM developed at University of Tartu (Rõõm et al 2007a,b) with 120 s time-step. The grid is 186x170 points in horizontal and 40 levels.

Boundary fields to ETA are provided by Finnish Meteorological Institute (FMI). They are cut out from forecasts of FMI operational model which has horizontal resolution 22 km. The fields are provided four times a day with forecasting start-point at 00, 06, 12 and 18 GMT. As FMI requires the time to prepare the analysis and calculate the forecast, the fields arrive 4.5 h hours later. The time frequency of boundary fields for ETA is 3h. The time frequency of boundary fields for ETB area is 3h as well.

Four times a day 54h forecasts and analyses are produced in ETA area.

The ETB area uses forecasts of ETA area as lateral boundaries. 36h forecasts are produced twice per day with start at 00 and 12 GMT and analysis cycles at 06 and 18 GMT. ETB has its own analysis cycle similar to ETA.

4.3.2.2 Research performed in this field

EMHI has actually no official scientific research activities as part of annual workplan. However EMHI works closely together with University of Tartu to develop further the high resolution (3,3 km ETB) NWP system currently based on nonhydrostatic extension of HIRLAM.

4.3.3 Operationally available NWP products

The products are publicly available on the website. In addition to weather maps, meteograms and upper atmosphere diagrams of selected locations were provided.

- mean sea level pressure forecast
- 3h accumulated precipitation (amount and phase) forecast
- 2 m temperature forecast
- 10 m wind forecast
- 850 mb temperature forecast
- multi-layer cloudmap in false colours forecast
- isallobars forecast

4.3.4 Operational techniques for application of NWP products

Not used in the context of short range forecasting in EMHI currently.

4.3.5 Ensemble Prediction System

Not used in the context of short range forecasting in EMHI currently.

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

Such a system is not available in EMHI

4.5 Specialized numerical predictions

Only products from ECMWF are available at EMHI. No specialized modelling takes place.

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

Products from ECMWF are available at EMHI which are used to produce forecast once per month.

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

Products from ECMWF are available at EMHI, but they are not used.

5. Verification of prognostic products

Verification scores on global domain can not be provided as EMHI has only limited area model HIRLAM available. EMHI collects regular verification statistics on its limited area domains for quality assessment.

6. Plans for the future (next 4 years)

6.1 Development of the GDPFS

-

6.2 Planned research Activities in NWP, Nowcasting and Long-range Forecasting

As already mentioned has actually no official scientific research activities. However, EMHI participates in HIRLAM development together with University of Tartu concentrating on high resolution dynamics and verification issues. Introduction of a nowcasting system to EMHI is under consideration.

7. References

Undén, P., L. Rontu, H. Järvinen, P. Lynch, J. Calvo, G. Cats, J. Cuxart, K. Eerola, C. Fortelius, J. A. Garcia-Moya, C. Jones, G. Lenderlink, A. McDonald, R. McGrath, B. Navascues, N. Woetman Nielsen, V. Odegaard, E. Rodriguez, M. Rummukainen, R. Room, K. Sattler, B. Hansen Sass, H. Savijärvi, B. Wichers Schreur, R. Sigg, H. The, A. Tijn (2002):. HIRLAM-5 scientific Documentation, HIRLAM-5, c/o Per Undén SMHI, S601 76 Norrköping, Sweden. Available electronically at <http://www.hirlam.org/>.

Rõõm, R.; Männik, A.; Luhamaa, A. (2007). Nonhydrostatic semi-elastic hybrid-coordinate SISL extension of HIRLAM. Part II: Numerical testing. Tellus Series A-Dynamic Meteorology and Oceanography, 59(5), 661 – 673.

Rõõm, R.; Männik, A.; Luhamaa, A. (2007). Nonhydrostatic semi-elastic hybrid-coordinate SISL extension of HIRLAM. Part I: Numerical scheme. Tellus Series A-Dynamic Meteorology and Oceanography, 59(5), 650 - 660.

<http://www.emhi.ee>
<http://www.hirlam.org/>
<http://www.ecmwf.int>