WWW TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS), AND THE ANNUAL NUMERICAL WEATHER PREDICTION (NWP) PROGRESS REPORT FOR THE YEAR 2005

Portugal

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1. Summary of highlights

The main progress of the Portuguese Data-Processing and Forecasting System during 2005 was the migration of observations pre-processing to a new platform, the DecAlpha/True 64 UNIX server in cluster as it is described bellow. It is now pre-operational the pre-processing of data in BUFR format on the new machine. An on-line data-base for GRIB and BUFR data is under test on a Live Linux distribution where several NWP tools have also been installed and some working this direction will continue in order to find proper computer solutions for our NWP development work needs. Besides new geographical configurations for our local version of the ALADIN model have been tried. The open sea-wave model (MAR3G), among with post derived diagnostic products from ECMWF and ALADIN/Portugal models are two components of our system that are now running on the new platform providing faster delivery of forecasting products. Besides, Metview under UNIX batch environment was introduced into operations for the creation of NWP derived products.

2. Equipment in use at the Centre

To handle GTS links:

1 cluster of 4 Micro VAX's (2x3400,2x400) – dual system, with 5 Gbytes of mirrored disk space.

To handle GDPS functions (ECMWF dissemination data) and the numerical sea-wave prediction activities:

1 cluster of 2 DecAlpha Servers 2000 4/275, with 128 Mbytes of memory (each) and 36 Gbytes of mirrored disk space.

To handle graphical applications:

1 DecAlpha X1000 server, with 500 Mbytes of memory.

To handle the numerical weather prediction activities:

1 DecAlpha XP1000 server, with 1 Gbytes of memory.

3. Data and products from GTS in use

Typical number of reports received daily:

SYNOP(including automatic)	20 076 reports
SHIP	3 269 reports
TEMP and TEMPSHIP	3 reports

NWP model products available:
GRIB (ECMWF – ATL_1_area)
GRIB (LPMG – Local area)

4. Data input system

Fully automated.

5. Quality control system

Before being put on the GTS, checks are applied against traditional WMO international code forms for national SYNOP and TEMP data; if an error is detected, messages are routed for manual inspection and correction, when possible.

6. Monitoring of the observing system

Monitoring of the observing system is not implemented.

7. Forecasting system

Several components are included on the national forecasting system. Main components are: the atmospheric trajectory model based on ECMWF forecasts; the atmospheric mesoscale limited area model, hereafter called **ALADIN/Portugal**; some derived products from ECMWF and ALADIN/Portugal model forecasts; and an open sea-wave model, hereafter called **MAR3G**.

7.1. System run schedule and forecast ranges

Pre-processing GTS data system runs in quasi-real-time basis.

Atmospheric trajectory model:

0300	12UTC ECMWF forecasts (up to H+48)

Mesoscale limited area atmospheric model, ALADIN/Portugal, forecast run schedule:

0255	00UTC ALADIN/Portugal (up to H+48 step)
1455	12UTC ALADIN/Portugal (up to H+48 step)

Open sea-wave model, MAR3G, forecast run schedule:

2300	12UTC MAR3G (up to H+120 step)

7.2. Medium range forecasting system (4-10 days)

Derived products are operationally elaborated from ECMWF dissemination field forecasts.

7.2.1. Data assimilation, objective analysis and initialisation

None.

7.2.2. Model

None.

7.2.3. Numerical weather prediction products

None.

7.2.4. Operational techniques for application of NWP products

Several derived products are produced from ECMWF dissemination forecasts: pseudo-TEMP's up to H+24h, Q vector divergence (using real wind), thermal front parameter, stability indexes (convective instability index, Jefferson index, total totals index), moisture convergence in the layer 1000-850hPa, temperature advection at 850hPa, vorticity advection at 500hPa, differential temperature advection in the layers 850-500hPa and 700-300hPa and differential vorticity advection in the layers 850-500hPa and 700-300hPa.

7.2.5. Ensemble prediction system (Number of runs, initial state perturbation method, clustering)

None.

7.3. Short-range forecasting system (0-72 hrs)

The kernel of the national short-range weather forecasting system is the atmospheric mesoscale limited area model, ALADIN/Portugal. Besides, derived products are created in operational mode for forecasting purposes.

7.3.1. Data assimilation, objective analysis and initialisation

ALADIN/Portugal does not have its own assimilation system; it runs on a dynamical adaptation mode in which initial and boundary conditions are provided by the global model ARPEGE (via Météo-France).

7.3.2. Model

ALADIN/Portugal is a spectral limited area model and the operational version runs in hydrostatic mode with the digital filter initialisation option; the temporal discretization is the two-time level semi-Lagrangian scheme with 600s of time step. The integration domain covers the Iberian Peninsula and part of the neighbouring Atlantic Ocean and has 100 x 90 point size with 31vertical levels and 12.7 km horizontal resolution; the coupling frequency is 6h.

This model is integrated twice a day – 00UTC and 12UTC – up to H+48h, and post-processing is applied every 1 hour with conversion of all required fields done into GRIB (projection used Lat/Lon) for further handling, visualisation and archiving.

7.3.3. Numerical weather prediction products

Surface parameters: surface pressure, mean sea level pressure, two metre temperature, soil temperature, soil wetness, deep soil temperature, deep soil wetness, snow depth, height geopotential, land sea mask, ten metre u wind component, ten metre v wind component, two metre relative humidity, two metre maximum temperature, two metre minimum temperature, total cloud cover, convective cloud cover, convective precipitation, convective snow-fall, large scale precipitation, large scale snow-fall.

Standard pressure level parameters: geopotential, temperature, u wind component, v wind component, relative humidity, absolute vorticity, potential temperate, pseudo-wet-bulb potential temperature.

7.3.4. Operational techniques for application of NWP products

Isentropic Potential Vorticity is a derived product locally produced. Besides, pseudo-TEMP's up to H+24h, Q vector divergence (using real wind), thermal front parameter, stability indexes (convective instability index, Jefferson index, total totals index), moisture convergence in the layer 1000-850hPa, temperature advection at 850hPa, vorticity advection at 500hPa, differential temperature advection in the layers 850-500hPa and 700-300hPa and differential vorticity advection in the layer 700-300hPa.

7.4. Specialized forecasts (on sea waves, sea ice, tropical cyclones, pollution transport and dispersion, solar ultraviolet (UV) radiation)

As specialized forecasts products we can mention: the 2D air trajectory model and the sea-wave model described bellow.

7.4.1. Data assimilation, objective analysis and initialisation (where applicable)

None.

7.4.2. Models (as appropriate, related to 7.4)

2D trajectory model, used operationally and in nuclear emergencies to follow the trajectory of radioactive plumes (in cooperation with the Environment Institute).

Sea-wave model, named MAR3G, used to forecast the sea conditions. MAR3G is a third generation wind-wave model that, solves the transport using a Mercator projection (propagation in lat-long grid) with a grid mesh 1º latitude per 1º longitude, and source and sink terms based on a physical approach to wave growth induced by wind, non-linear wave-wave interaction and dissipation by white capping. MAR3G also includes a parameterisation for the effect of the wind variability on the Miles mechanism for wave generation that improves the model performance. For each point of the model, a spectral grid of 24 directions and 25 frequencies is calculated; and consequently, are calculated wave parameters, such as significant wave height, mean wave direction and mean period. The model is integrated once a day up to H+120h, with a 6h time step. To transform waves from the open seas to near-shore is used a Ray model, that reproduces the effects of shelter by the shore, refraction, shoaling and dissipation by bottom friction. This model, constrained by the bathymetry, computes 25 ray fans (one for each of the frequencies of MAR3G) using 360 rays spaced by 1º at the origin. The parameters obtained by Ray model are: significant wave height, wind sea height, swell height, maximum height most probably in 6 hours, power density, mean period, peak period, peak period unidirectional, power equivalent period, spectral width, peak direction, mean direction, wind sea direction, swell direction and power direction.

7.4.3. Numerical weather prediction products

None.

7.4.4. Operational techniques for application of NWP products

Fire Weather Index (FWI), used to support the forecast fires prevention and fighting activities.

7.5. Extended range forecasts (10 days to 30 days) (Models, Methodology and Products)

None.

7.6. Long-range forecasts (30 days up to two years) (Models, Methodology and Products)

None.

8. Verification of prognostic products

ALADIN/Portugal forecasts are objectively verified on a regular basis. When possible, a comparative analysis is done using ECMWF forecasts. In general the verification scores for surface and upper-level parameters are computed following standard recommendations. Upper level parameters, namely, geopotential, temperature, specific humidity and wind speed are compared against sound observations and analysis. Moreover, wind speed, wind direction and accumulated precipitation in 6h and 24h are treated as categorical parameters and several statistics (Hit Rate, POD, FAR, for instance) are computed based on categorical tables.

MAR3G is also objectively verified. In particular, a validation of model's parameters is made, in order to evaluate the model's performance. Several statistical parameters, such as mean error (ME), mean absolute error (MAE) and root mean square error (RMSE), are calculated for significant wave height, peak period and mean wave direction.

9. Plans for the future

- Keep on going the migration of products processing systems from VAX/OpenVMS to the Dec Alpha/UNIX platform
- To receive HIRLAM/Spain forecast products
- Establishment of the migration plan to start pre-processing of WMO table driven code forms messages (BUFR and CREX)
- To continue the upgrade of ALADIN/Portugal forecasting system (New computer platform, frequency run and run schedule, new geographical configuration)
- To better represent waves in shallow waters near South Coast of Portugal Mainland and to use an input wind provided by ALADIN/Portugal, it will be adapted and implemented the SWAN model (Simulating Waves Near-shore) to Cadiz Golf, to represent waves in Levant conditions. As boundary conditions it will be used directional spectra from MAR3G and ECMWF models.

10. References

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