Application and verification of ECMWF products 2010

AEMET-Spain

1. Summary of major highlights

- Maintenance and improvement of the AEMET Intranet website including some products from ECMWF EPS used as the main operational tool for medium range forecasts.
- Use of ECMWF products for generation of the Digital Forecasting Data Base, from H+72 up to 192, and post-processing output: precipitation and temperature predictions.
- Use of ECMWF deterministic model as boundary conditions of our HIRLAM deterministic NWP operational model.
- Use of ECMWF deterministic model as boundary conditions of our multimodel Short Range Ensemble Prediction System. We run HIRLAM, COSMO, HRM, MM5 and UM using boundaries from ECMWF.
- Dynamical downscaling of Sistem3 seasonal forecasts with the Rossby Centre Atmospheric model (RCA).

2. Use and application of products

In operational duties, a large amount of ECMWF products from medium to monthly range is used. We use both the deterministic model and EPS system for medium range weather forecast. EFI products and probability maps are used to produce a map for warnings in our early warnings for high impact weather system, called “Meteoalerta“. Moreover, and extraordinary report (not available on our public web server) based on EPS monthly probabilistic system, is made once a week. Other activities and products are related to:

- Comparison of high resolution deterministic model with the EPS control model in Spanish area.
- Specific Spanish clustering of EPS.
- EPS probabilities for various meteorological parameters in two specific Spanish areas.
- EPSgrams.
- PCP and T2m anomalies and probabilities in the upper a lower tercils from monthly forecast.

2.1 Post-processing of model output

2.1.1 Statistical adaptation

- Statistical method based in analogues (ANALO) for adapting ECMWF seasonal forecast of precipitation to local scale in Spain.
- Application of Analogue Method, to estimate the probability of precipitation from deterministic ECMWF model (12 UTC run), D+1 to D+3 in 24h periods (07-07 UTC).
- Use of Analogue Method from EPS, EPS-AM, to estimate the probability of precipitation from D+1 to D+7 (12 UTC run) in 24h periods (07-07 UTC).
- Maximum and Minimum temperatures predictions (D+7) using the EPS mean corrected by surface observations of 40 previous days.
- Estimation of the potential snow-rain limit considering from ECMWF deterministic model output, up to D+7.
- Estimation of probability of snowfall considering the EPS-AM precipitation probability and the probability of snow-rain limit (D+3).

2.1.2 Physical adaptation

- Boundary conditions for LAM short range NWP model (operational HIRLAM and experimental HARMONIE).
- Boundary conditions for dynamical downscaling of the ECMWF seasonal forecasting system with the Rossby Centre Atmospheric model.
- Boundary conditions to drive the Limited area models (HRM (DWD), UM (UKMO), HIRLAM, LOCAL Model (Cosmo Consortium) and MM5 (USA) in the AEMET Short Range Ensemble Prediction System, SREPS, project.
- Total Ozone Column from ECMWF is routinely used in AEMET to provide daily maximum UV radiation forecasts to the public in a number of villages and cities over Spain. The present system is based on the usage of a radiative transfer model to produce estimates of UV index in clear sky conditions. ECMWF Total Ozone Column is used as input to the radiative transfer model.
- ECMWF atmospheric fields are being used by the Chemistry Transport Model MOCAGE in a global domain running experimentally in AEMET for nuclear or chemical accidental point source release. In the configuration adopted in AEMET the global MOCAGE model contains two consecutively nested domains (up to 10km resolution) using the HIRLAM operational NWP products as dynamical forcings.

2.1.3 Derived fields

- Specific Spanish clustering of ECMWF EPS.
- EPS Probabilities for various meteorological parameters in two specific Spanish areas: The Iberian Peninsula /Balearic Islands and Canary Islands.

2.2 Use of products

Use of ECMWF products for deriving:

- Frontal diagnosis parameters: TFP, THW, etc.
- Aeronautical and maritime products.
- Seudosounding graphics from deterministic model using pressure levels.
- Wind gust estimation maps.
- Specific parameters for diagnosing thunderstorms potential: CAPE, LI, CIN, convergence zones, SRH, etc.,

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

Post-processing of EPS 2m-temperature in Spain.

EPS 51 members forecasted 2m-temperature at 00, 06 12 and 18 UTC is interpolated at each of the synoptic observatories of Spain. Its mean is calculated and corrected with the errors (forecasted – observed) from previous days. This procedure is also applied to the daily extreme temperatures.The next figure shows the time evolution of percentage of extreme temperature values which error is smaller or equal than 2ºC ..

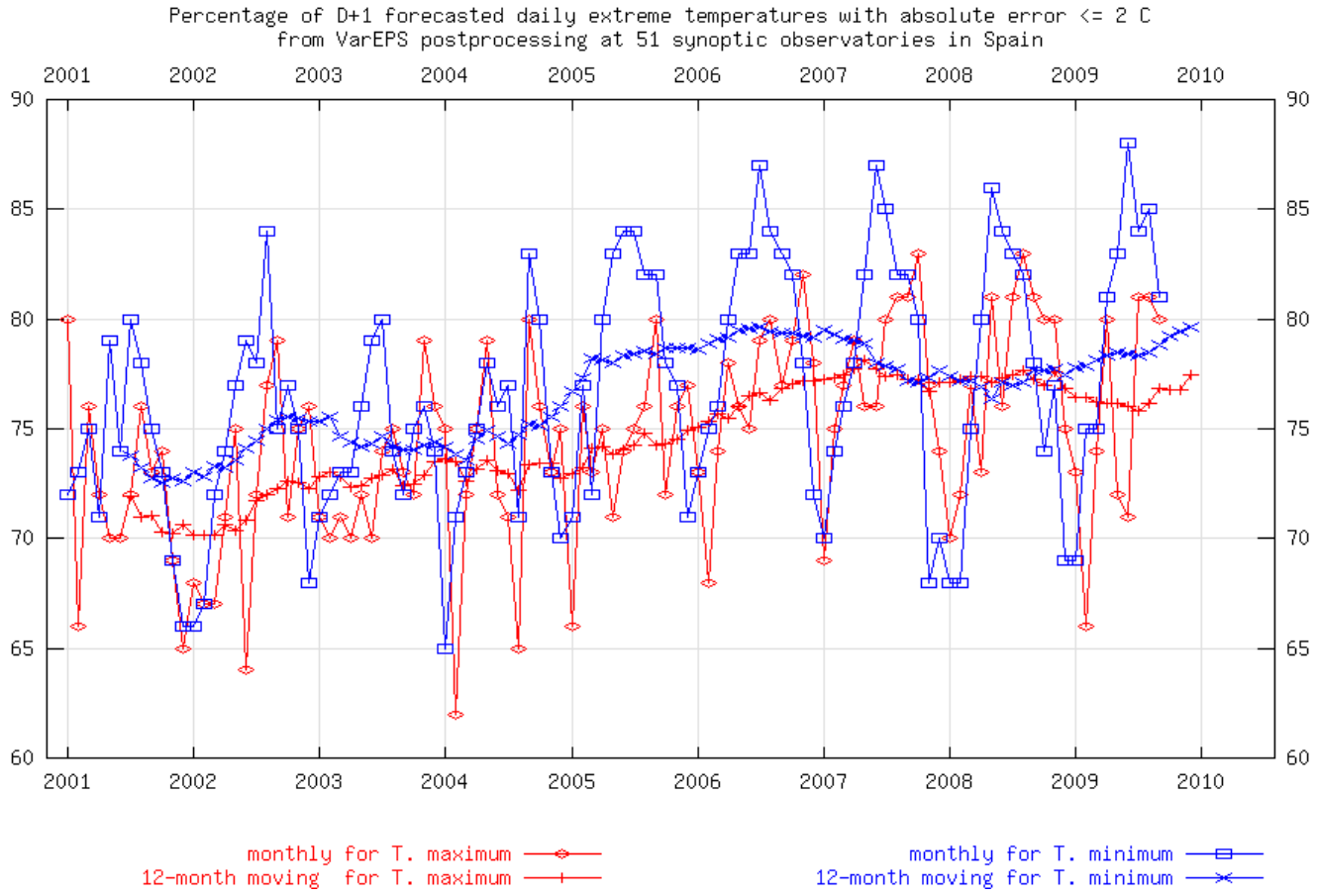

Figure 1. Percentage of EPS postprocessed daily extreme temperature (D+1 forecast) which absolute error ≤ 2ºC (over a total number of 51 synoptic observatories in Spain).

3.1.1.1 Seasonal forecast

3.1.2 ECMWF model output compared to other NWP models

3.1.3 Post-processed products

Surface temperature and precipitation from the dynamical and statistical downscaling of ECMWF seasonal forecasting system are routinely verified over the Iberian Peninsula and Balearic Islands using the AEMET high resolution climate observation network.

3.1.4 End products delivered to users

3.2 Subjective verification

3.2.1 Subjective scores (including evaluation of confidence indices when available)

3.2.2 Synoptic studies

Evaluation of the behaviour of the EPS in severe weather situations:

- 31 Jan. - 2 Feb. 2010 heavy precipitation event in Canary Islands: a case study (figure 2)
- 17-18 February 2010 gale force winds in Canary Islands: a case study

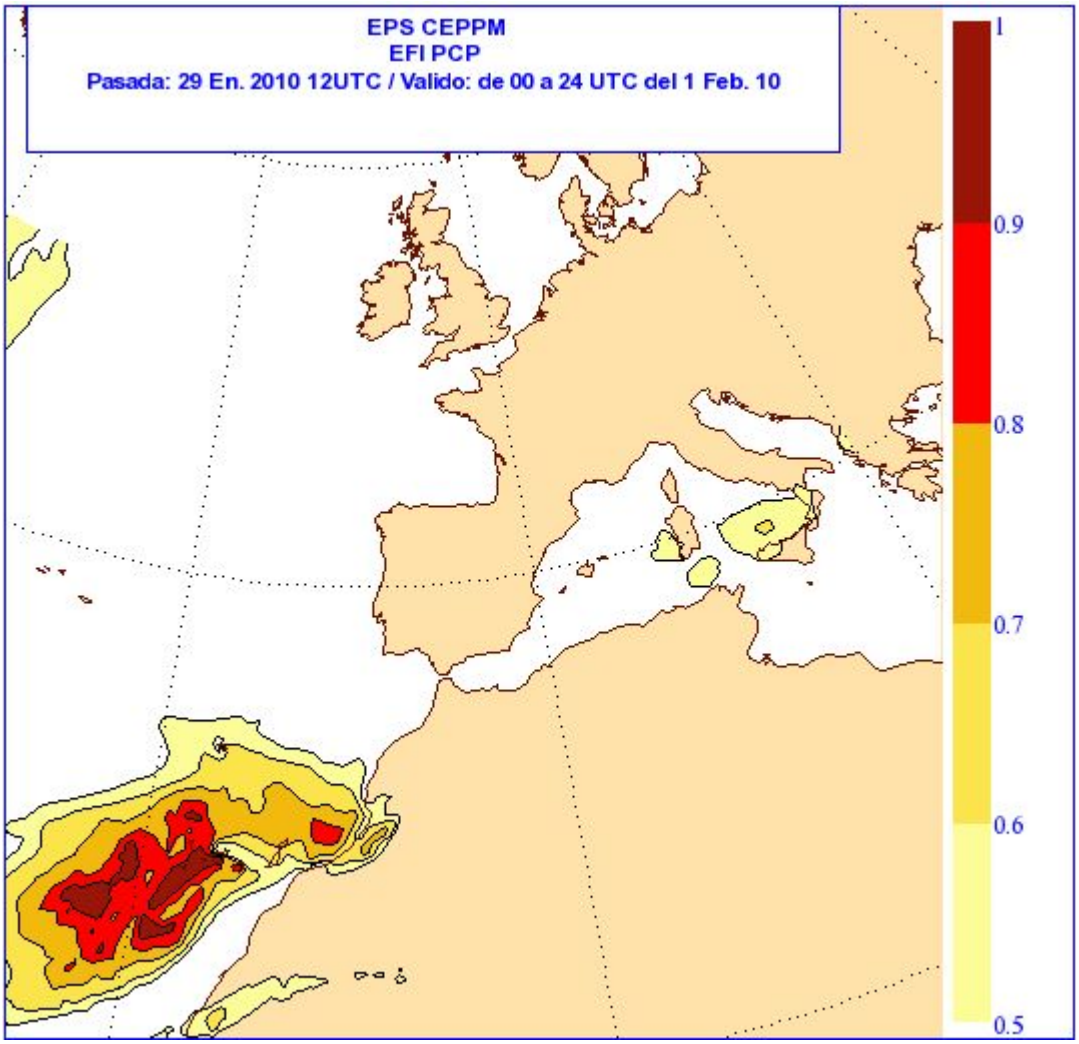

Figure 2. EFI map of total precipitation, from 29th January 2010 EPS 12 UTC run: D+2.

From 30 th January to 2 nd of February 2010, heavy precipitation events affected Canary Islands. On 1st of February the hazardous precipitation caused great social and media impacts in Tenerife Island. The complex orography of the Canary Islands plays an important role in these extremes events. Later on, 17-18 February, gale force winds and gusts were reported in many places of Canary Islands when a low pressure system swept the area. Once again, the topographical effects should be taken into account to understand the wind gusts measurements..