Modernisation of Forecasting Process Program

National Forecasting System

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• Topics
  • National Forecasting System
  • Background
  • Objectives
  • Elements: BDDP, GFE, Product Generation
  • Benefits
  • Other elements
    • Change of forecasting workstation
    • Other Changes: Mesoscale model (HARMONIE) & HPC
    • Specific applications: SIGA, SIGTAF
Modernisation Forecasting Process Program

PRODUCTION DEPARTMENT

Operational Forecasting

Technical Support for Forecasting

Climatology and Applications

Data Exploitation & Management

Operational Procedures

National Forecasting Centre

National Forecasting Centre for Defence

Sift Leaders

NFS Coordination: Regulations

Special Unit of the NFS: Reference Forecasting and Warnings

22 Meteorological Offices for Defence Coordination

NFS Managers and decision makers in case of problems
Organic Units of SNP/NFS

2 National Forecasting Centres: CNP y CNPD.
11 Forecasting and Watching Groups
38 OMA, 22 OMD
### Functional Structure of SNP/NFS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Functional Competence</th>
</tr>
</thead>
</table>
| CNP            | Reference Forecasting Group  
Warning Groups: North, Southern Interior  
Back-up Communications Group |
| A Coruña       | Maritime forecasting Group: Atlantic Sea                                                |
| Barcelona      | Warning Group: East                                                                    |
| Las Palmas     | Warning Group: Canary Islands  
Aerodrome Forecasting Office: Canary Islands  
Meteorological Watching Office: Las Palmas FIR |
| Madrid         | Aerodrome Forecasting Office: Interior                                                 |
| Málaga         | Warning Group: South                                                                  |
| Palma          | Maritime forecasting Group: Mediterranean Sea                                          |
| Santander      | Aerodrome Forecasting Office Norte                                                     |
| Sevilla        | Aerodrome Forecasting Office Sur                                                       |
| Valencia       | Aerodrome Forecasting Office Este  
Meteorological Watching Office: Madrid & Barcelona FIR |
| Valladolid     | Warning Group: Northern Interior                                                       |
| Zaragoza       | Mountain Forecasting & Nivology                                                        |
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Santander
Madrid
CNP
Barcelona
Valladolid
Valencia
Sevilla
Málaga
Las Palmas
Las Palmas

Warning & Aeronautical Units
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Maritime Units

Atlantic Sea: A Coruña

Mediterranean Sea: Palma de Mallorca

Madrid, 1 de enero de 2015

Presentacion Institucional
### Back up Units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNP</td>
<td>H24</td>
</tr>
<tr>
<td>A Coruña</td>
<td>H18</td>
</tr>
<tr>
<td>Barcelona</td>
<td>H18</td>
</tr>
<tr>
<td>Las Palmas</td>
<td>H24</td>
</tr>
<tr>
<td>Madrid</td>
<td>H24</td>
</tr>
<tr>
<td>Málaga</td>
<td>H18</td>
</tr>
<tr>
<td>Palma</td>
<td>H18</td>
</tr>
<tr>
<td>Santander</td>
<td>H24</td>
</tr>
<tr>
<td>Sevilla</td>
<td>H24</td>
</tr>
<tr>
<td>Valencia</td>
<td>H24</td>
</tr>
<tr>
<td>Valladolid</td>
<td>H18</td>
</tr>
<tr>
<td>Zaragoza</td>
<td>H18</td>
</tr>
</tbody>
</table>

- Warning Units without 24 hours service are backed-up by National Forecasting Centre

- Aeronautical and Maritime Units are baked-up each other

- Only communication back-up for Mountain and Nivology Unit
Background

• We are aware that the accumulated delay in automation at the AEMET, during the last decade, has created a difficult situation for the production activities. Our present system may eventually block if the demands of the society steadily increase, as we foresee.

• It was clear, in 2005, that a high priority of the AEMET should be to initiate, as soon as possible, the activities leading to a modernisation of the forecasting process and to an increase of the automation in the product generation, to give the adequate answer to the increasing user needs.


• The WG analyzed and reviewed other forecasting systems around the world, particularly the NWS approximation which has been the leading guide.
Objectives

- To develop an integrated forecasting/production environment allowing:
  - A rational elaboration of products with a prescribed quality. Final products will be obtained in different formats and for different temporal and spatial scales without the intervention of the forecasters.
  - A significant increase in the number of graphic products. A primary means of providing weather forecasts is still textual in form, but graphic products are the most adequate way to communicate to the users all the details available in the forecasts.
  - Provide interoperable products or services. Increasingly, our users demand products that would fit into their systems. Our production system should evolve to the use of standards.
Fundamental elements

- The new approach will rely on three basic elements:
  - Digital Forecast Data Base (BDDP in Spanish)
  - Generation of the basic digital forecast by interactive modification of the BDDP
  - Automatic elaboration and dissemination of products

- More than this, we will also need to cover additional requirements for nowcasting, warnings and aviation products.
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Numerical models

Interactive BDDP modification

Sensible weather elements

BDDP – Digital Forecast Data Base

Automatic product generation

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BDDP

- It will be the crucial element of the modernisation process.
- The BDDP stores the basic forecast using sensible weather elements and parameters.
- It contains a picture, as detailed as possible, of the state of the atmosphere and its evolution.
- The basic forecast is established only one time for every forecast cycle. (Previously we need to re-elaborate the forecast every time we have to prepare a new product)
- BDDP is not designed for a specific product or purpose, so it could be easily adapted to meet future requirements.
BDDP (state of the art)

- Operative version 2.3
  - Exploitation for different users: Internal and external

- Ready to start: Version 3 (Generate from GFE)

- In process: definition migration of work schedule for product generation
  - Now: specific and independent applications
  - Future: Integration of the product generation (possible problems on the side users)
BDDP Edition- Graphical Forecast Editor (GFE)

- Interactive forecast preparation system allowing the forecaster to modify the BDDP in order to create the digital basic forecast.
- The system include tools for spatial and temporal edition.
- The system should incorporate automatic controls for quality and consistency, both spatial and temporal.
- Text Formatters
- Verification Tool: continuous improvement
GFE Implementation

- 2008: First contact with GSD (NOAA). Karl Bullock (development team responsible) visited Madrid
- 2009. Start of the negotiating process for an agreement with NOAA
- 2011. Signature of agreement
- 2012. Two weeks stay of Mark Mathewson y Tom LeFebre at AEMET (January). New visit to Boulder (work on understanding on text formatters, March). Two weeks stay of Tracy Hansen at AEMET (work on Smart Tools, September)
- 2013: Preoperative version: Evaluation Group
- 2014: Generation of provincial forecasting text (without forecaster intervention) and final intervention through the use an specific interface
- 2015: Spanish Version1. Specific developments for maritime and defence
- 2016: Full operational
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GFE MAIN MENU

GFE:
- Editing Preferences
- Viewing Preferences
- Show Warnings, etc

Weather Element
- Weather Element Groups
- Weather Element Browser
- Manage Hidden W. E

Populate
- Procedures
- Copy Selected Grids From
- Copy All Grids From

Grids
- Interpolate
- Split Grids
- Fragment Grids
- Create Grids From Scratch
- Assign Default Value
- Assign PickUp Value
- Delete Grids
- Select Grids By Time
- Select All Weather Elements
- Deselect All
- Time Shift
- Find Weather Element

Edit
- Undo Grid Edit, Undo Edit Area, Procedures, Save Forecast... , Revert Forecast... .

Consistency
GFE: Components

Data Base Ingestor

ifpServer

Model Data
BDDP0
HARMONIE
ECMWF

GFE Editors

Spatial Editor

Temporal Editor

Grid Manager

GFE Editors

Productos

Text

Images

Grids
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Model data and others

Data Server

Local Network

Clients

GFE Architecture

Database Subsystem

Network Subsystem

Grid Data

Map Data

Map Background Subsystem

Lock Subsystem

Topography Subsystem

MetaData Subsystem

Process Management Subsystem

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GFE Process

Start

Edition

Product Generation

Derive of weather elements from NWP
Previous Forecasting Revision
Copy of selected grids

General tools

Smart tools

Consistency

Official Database Publication oficial: Basic Forecasting

Graphics
Texts
Digital data: grids

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Smart Tool

Meteorological Algorithms
(Numerical Python)

User Entries

Numerical Models
Observations
Topography

Weather elements
Grids

Modification

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Text Formatters

Basic Forecasting BDDP

Formatters Infrastructure

Sampler

Sample Analysis

Statistics

Text rules

Text products
Clear language
(or tables)

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Product generation

- Starting from the digital basic forecast, most of the products will be obtained in automatic (or semiautomatic) way in different formats: text, tables, graphics, etc.

- The possibility for the forecasters to interact with the final product will be limited.

- There will be more possibilities to adapt the products to the user needs.
Benefits of the new model

- The forecasting and production processes will be independent.
- The forecasters will not longer redundantly type several text products containing largely the same information.
- Product generation will not be time consuming.
- Changes in the digital forecast will be transferred to all the products at the same time.
- It is adaptable to new needs and requirements.
- Information is provided with spatial and temporal consistency.
- It is possible to issue forecasts with much more detail than now.
- It is possible to automatically compare the BDDP with new observations, alerting the forecasters about differences.
- More possibilities to develop objective verification activities.
- It makes more easier the backup activities between different units, as all of them use the same Data Base (BDDP).
New meteorological workstation

- Replacement of McIDAS WS: important element of the Program
- 2007: we initiated the activities to introduce NinJo system.
- NinJo is a meteorological WS developed in java by an consortium of the German, Canadian, Swiss and Danish NMS.
- 2008: we evaluated 4 NinJo clients.
- Problems with the integration of data because of specific characteristics of AEMET
- The progress of the NinJo project is based of the requirements of NinJo consortium members and not from AEMET requirements
- Too many changes in other systems: Numerical model, virtualization of computer network, etc.
- As a result: delay in implementing NinJo system
- New contract: only 20 licences, at this moment only five units use NinJo in a operational way
• **Current contract 2014(June)-2017: Initial operational phase.**

• **Main recent results, PWB (2013-2015):**
  - Completion of PWB templates&configuration (huge EBP dependence but close interaction).
  - Specific forecasters’ training, posts with involvement in Synoptic&General Guidance PWB production in CNP.
  - Synoptic production (at Head shift post) was started afterwards and went increasing, but not yet fully operational (eventually to go to external Web) due to recently informed ocasional problem (background NWP field in final product is not the good but an old one), still not completely understood and managed. General Guidance PWB (at Short&mean range shift post) will then follow.
  - Start of PWB production for Aviation LL SWC (at Valencia and Las Palmas forecasting posts): decisions to be taken (if additional-to-user specific forecasters’ training is needed; to assume ‑or not!‑ template limitations e.g. final product differs from created, with limitations to include map side comments).
• AEMET Synoptic PWB production, 2 examples (other formats are created).
• 2/day, diagnosis + 5 forecast times.
• Until operational, internally distributed (AEMET Telecoms. System) and shown (General NWP intranet page).
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- **Main recent results, Batch, Training and use:**
  - A Batch product demonstrator is running and proposing online some close to operational prototype products. A general scheme of Batch production has to be refined, including enhancement/improvement of demonstrator products, Usual McIDAS (old system) display-like, equivalent pages (to start thinking on removing MCiDAS in forecasting posts while allowing further users), and of course new products, as well as ways of distribution or access for each.

- **General user Training in AEMET:** 6 editions (8/2014 to 5/2015), 4 days, 9 teachers (AEMET NinJo team), all forecasters and other support staff were trained. Mostly presential&practical, and introducing created favorites. PPTs&recordings are also kept available online.

- **Use of clients in regional posts increasing since gradually (but irregularly).** Limitation: in most, only one client is currently allowed. Parallel creation of working post favorites (some already created for the training under request, by Madrid team also adapting to standard configuration and gathering a complete set of interest favorites for a high level, for a simplification of configurantion maintenance).
• Version 1.7.4 (delivered end 2013, installed early 2014). New installation (v1.8) first foreseen before summer 2015, delayed (asked first by EBP, so we decided to wait and include further content, mainly HARMONIE H.R NWP model), new discussion: end 2015?

• New central server (unique Blade unit) is running, installation of definitive servers in regional forecasting centres (11 + Defence) is on-going. Basic routines for operations are also implemented.

• Only 20 clients now, only one in most regional centres, once all posts covered hardly more than one or 2 for activity out of operations. Clients are with 2 screens (wide/24” is the assumption for as many as possible operational posts).

• Still remaining problems: blocking (rare now, however) of Batch server and AutoMON.

• Data content is quite complete now (and maintenance/server configuration somewhat “easied” with practice...), and to be completed next installation (including radar radial wind, Automats -new format, minor errors in others and Warning areas managed in AutoMON). For independence (and to get rid of CineSat), we develop Satellite enhanced import on graphical formats (then: Pytroll); and want but still asking for information, to configure other imports, specially for small unavoidable changes in NWP GRIBs.

• We also maintain an Intranet NinJo page, where all that stuff useful for any aspect of the NinJo in AEMET, is available (e.g. includes up-to-date entry to those NUG -many!- presentations found most potentially useful).
New applications for warning and aviation

- Also during the last years we have developed specific applications to help the forecasters in the preparation of warnings and aviation forecasts (TAF).
- For warnings there is a system, SIGA. Forecasters introduce all the needed information, and all the warning messages (text bulletins, XML files, etc.) are automatically generated.
- For aviation purposes we have put in operation a system called SIGTAF, with the aim to facilitate the preparation of TAF messages by the forecasters.
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- SIGA

- Effective tools for locate the exceeds of warning thresholds (numerical model and observations)

- Select area, warning level, valid time, values, comments
- XML and CAP generation
- Automated submission
• TAF proposal
• Verify TAF vs. METAR
• Specific outputs from the model
Other changes

- **Mesoscale numerical model**
  - From HIRLAM (5 km) to HARMONIE (2.5 km)

- **HPC**
  - From CRAY to BULL: 168 Teraflops (338 nodos)
Immediate future

- Put into operation the use of GFE for the graphic edition of the BDDP
- Replace completely the McIDAS WS by NinJo-based WS in the operational environment
- Adaptation for specific users: maritime, mountain

Next steps

- Integrate all the system. Standards definition

Thanks for your attention