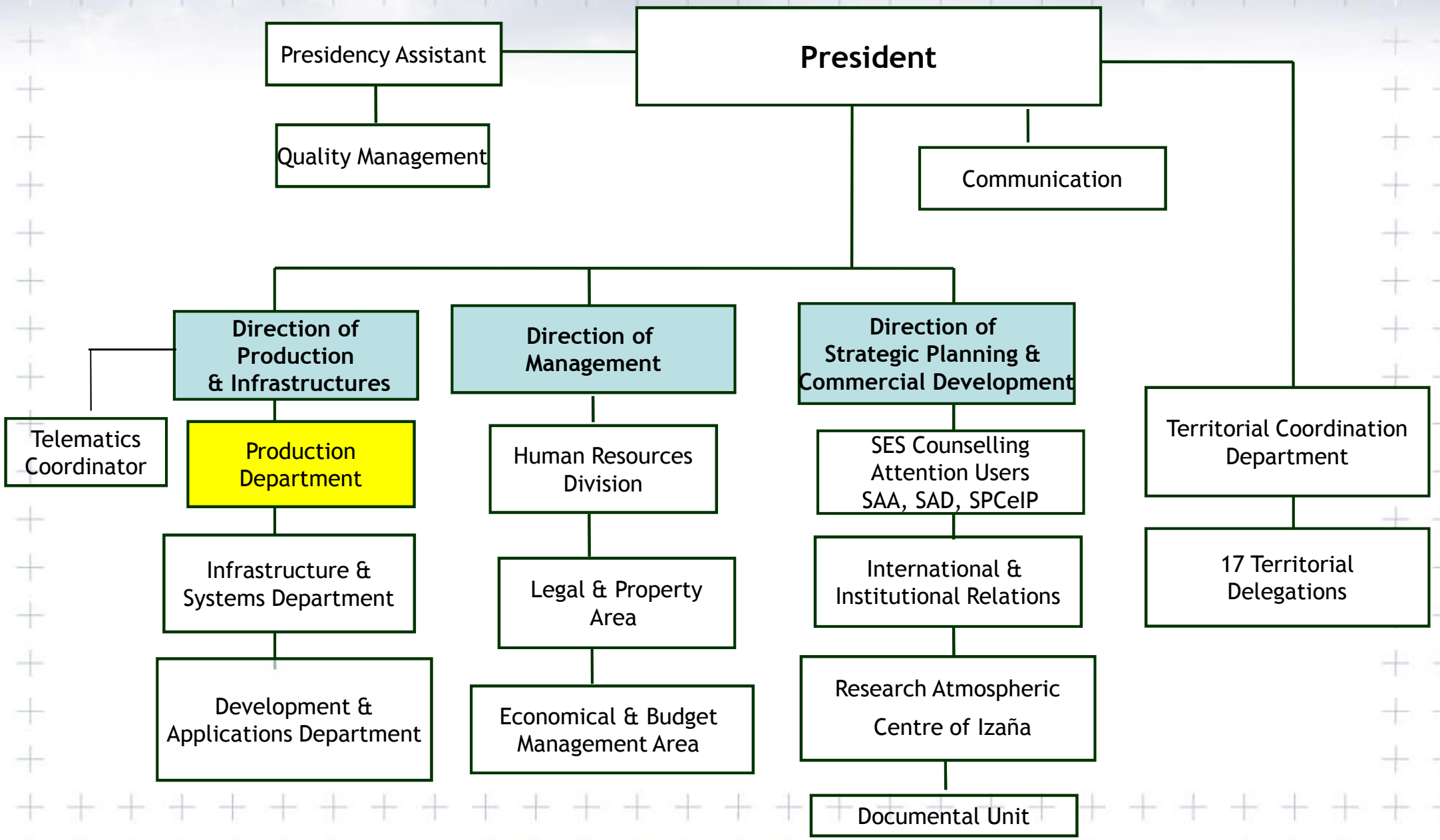
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE
AEMet
Agencia Estatal de Meteorología

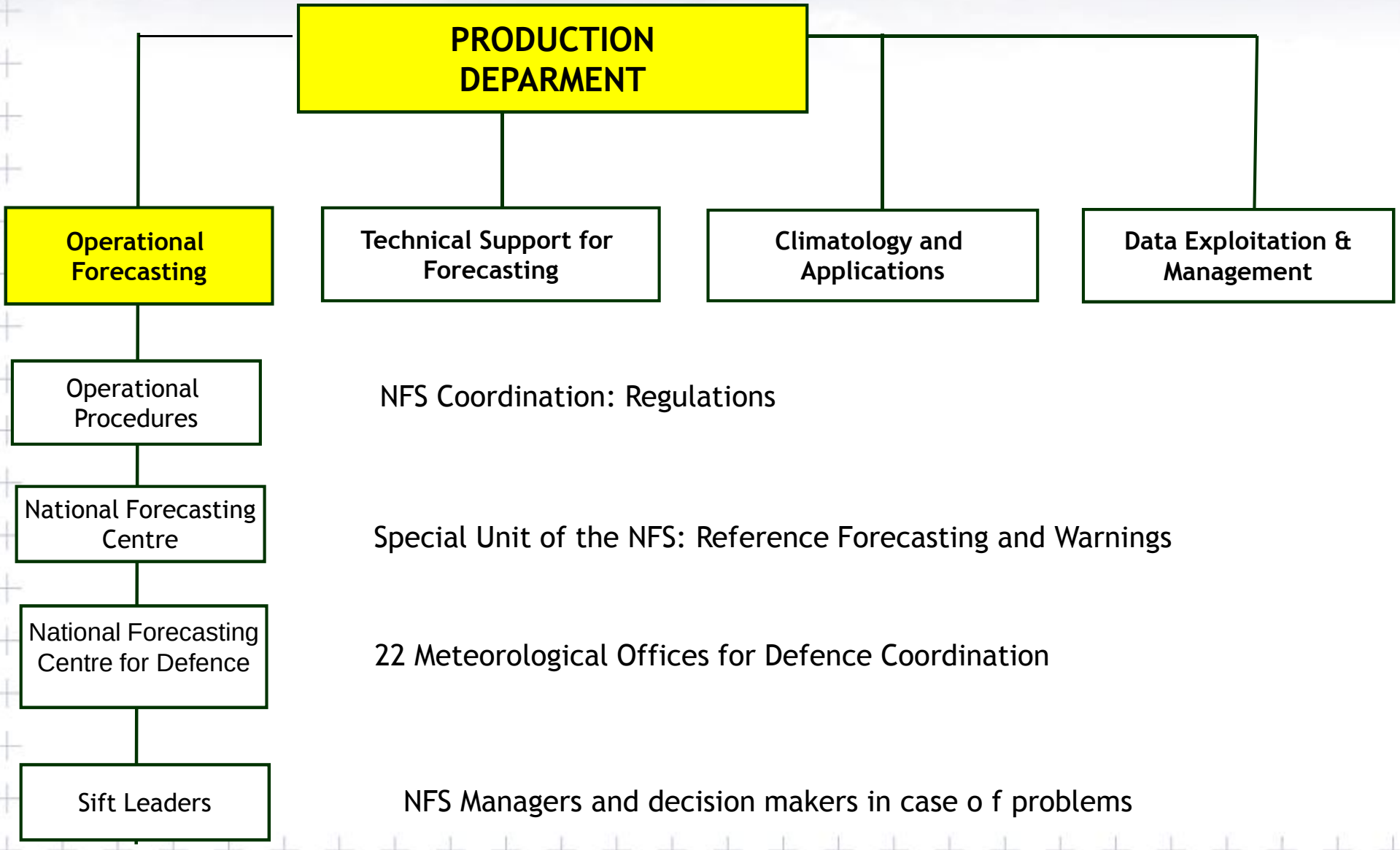
Modernisation of Forecasting Process Program

National Forecasting System

Ángel Alcázar

- 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


President
Presidency Assistant
Quality Management
Communication
Direction of Production & Infrastructures
Direction of Management
Direction of Strategic Planning & Commercial Development
Territorial Coordination Department
Telematics Coordinator
Production Department
Infrastructure & Systems Department
Development & Applications Department
Human Resources Division
Legal & Property Area
Economical & Budget Management Area
SES Counselling Attention Users SAA, SAD, SPCeIP
International & Institutional Relations
Research Atmospheric Centre of Izaña
Documental Unit
17 Territorial Delegations


PRODUCTION DEPARMENT
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 o f problems

Organic Units of SNP/NFS

2 National Forecasting Centres:

CNP y CNPD.

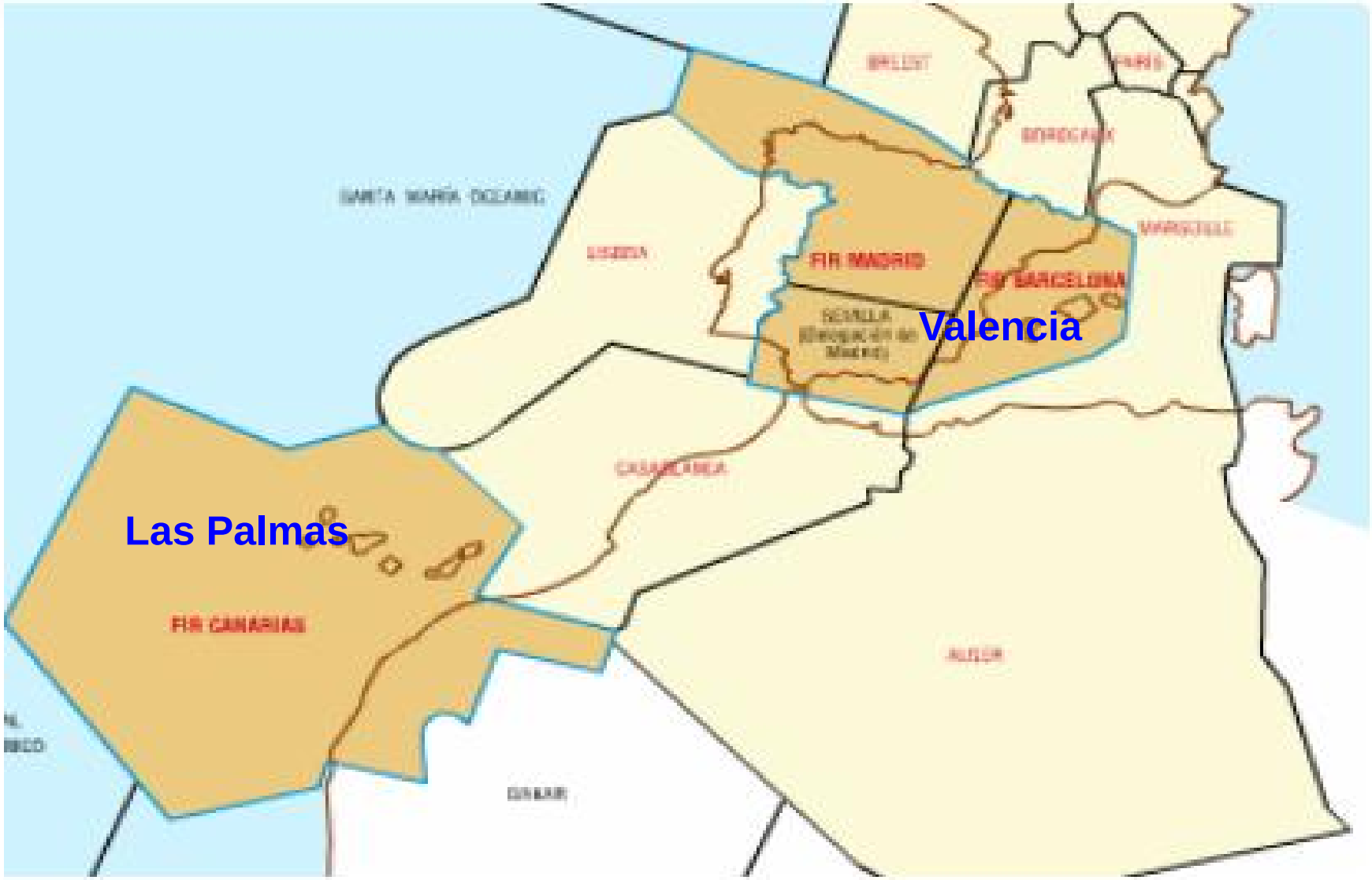
11 Forecasting and Watching Groups

38 OMA, 22 OMD

Functional Structure of SNP/NFS

Unit	Functional Competence
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

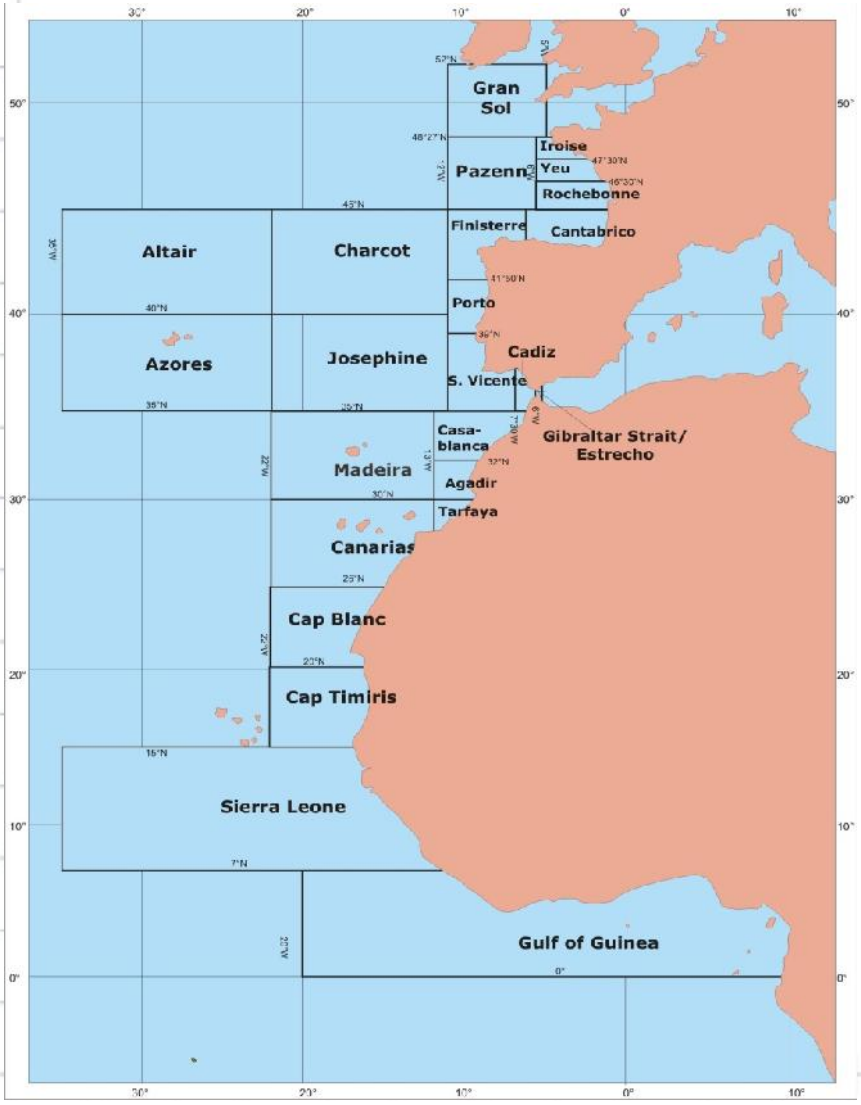
Warning & Aeronautical Units



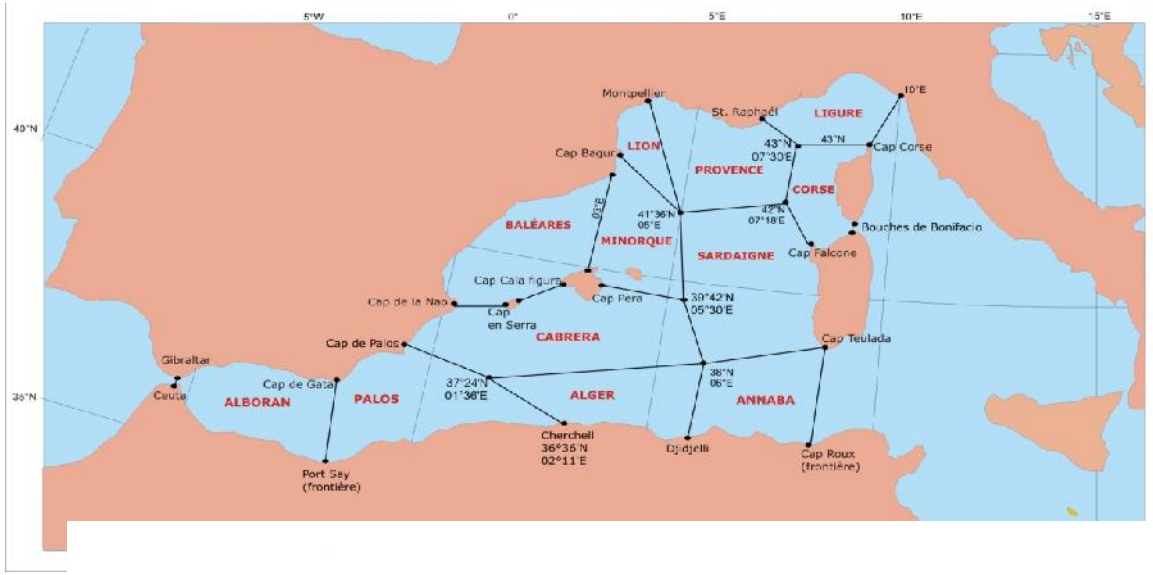
Meteorological Watching Offices

Maritime Units

Atlantic Sea: **A Coruña**



Mediterranean Sea: **Palma de Mallorca**



Mountain forecasting & Nivology Unit

Back up Units

Unit	Timing
CNP	H24
A Coruña	H18
Barcelona	H18
Las Palmas	H24
Madrid	H24
Málaga	H18
Palma	H18
Santander	H24
Sevilla	H24
Valencia	H24
Valladolid	H18
Zaragoza	H18

- 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.

- Working Group for the Modernisation of the Forecasting Process (2005).

- 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 obtain 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.

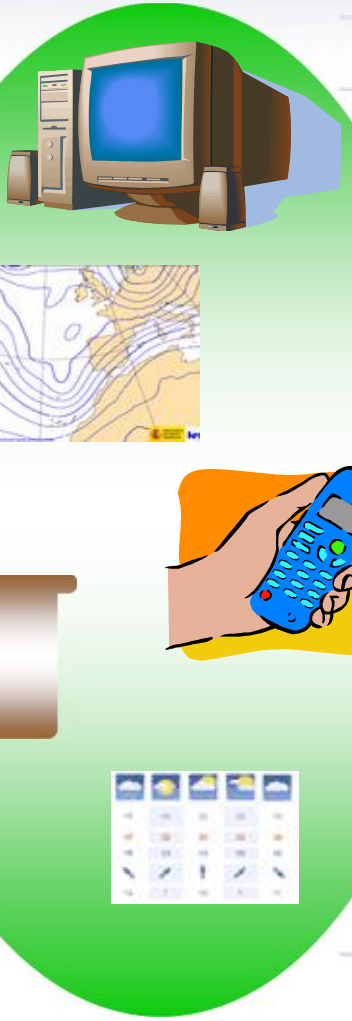
Fundamental elements

- 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.

Numerical models

Sensible weather elements

Interactive BDDP modification



BDDP – Digital Forecast Data Base

Automatic product generation

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)

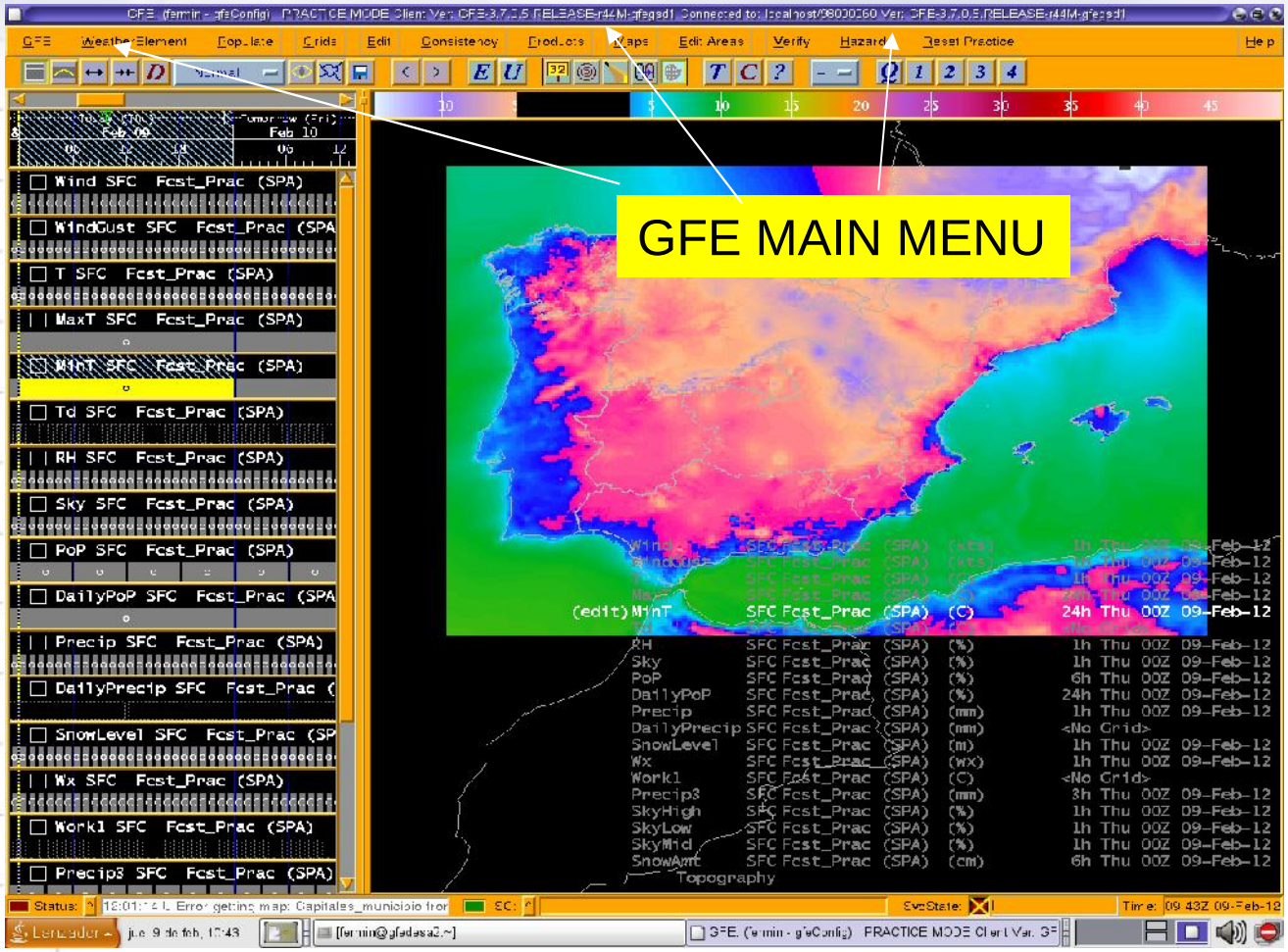
- Operative version 2.3
  - Exploitation for different users: Internal and external
- Ready to start: Version 3 (Generate from GFE)
- In process: definition migration of work schedule for product generation
  - Now: specific and independent applications
  - Future: Integration of the product generation(possible 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: continuos 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
- 2011. Visit to GSD (Boulder, US): Beginning of the work
- 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 trough the use an specific interface
- 2015: Spanish Version1. Specific developments for maritime and defence
- 2016: Full operational



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

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

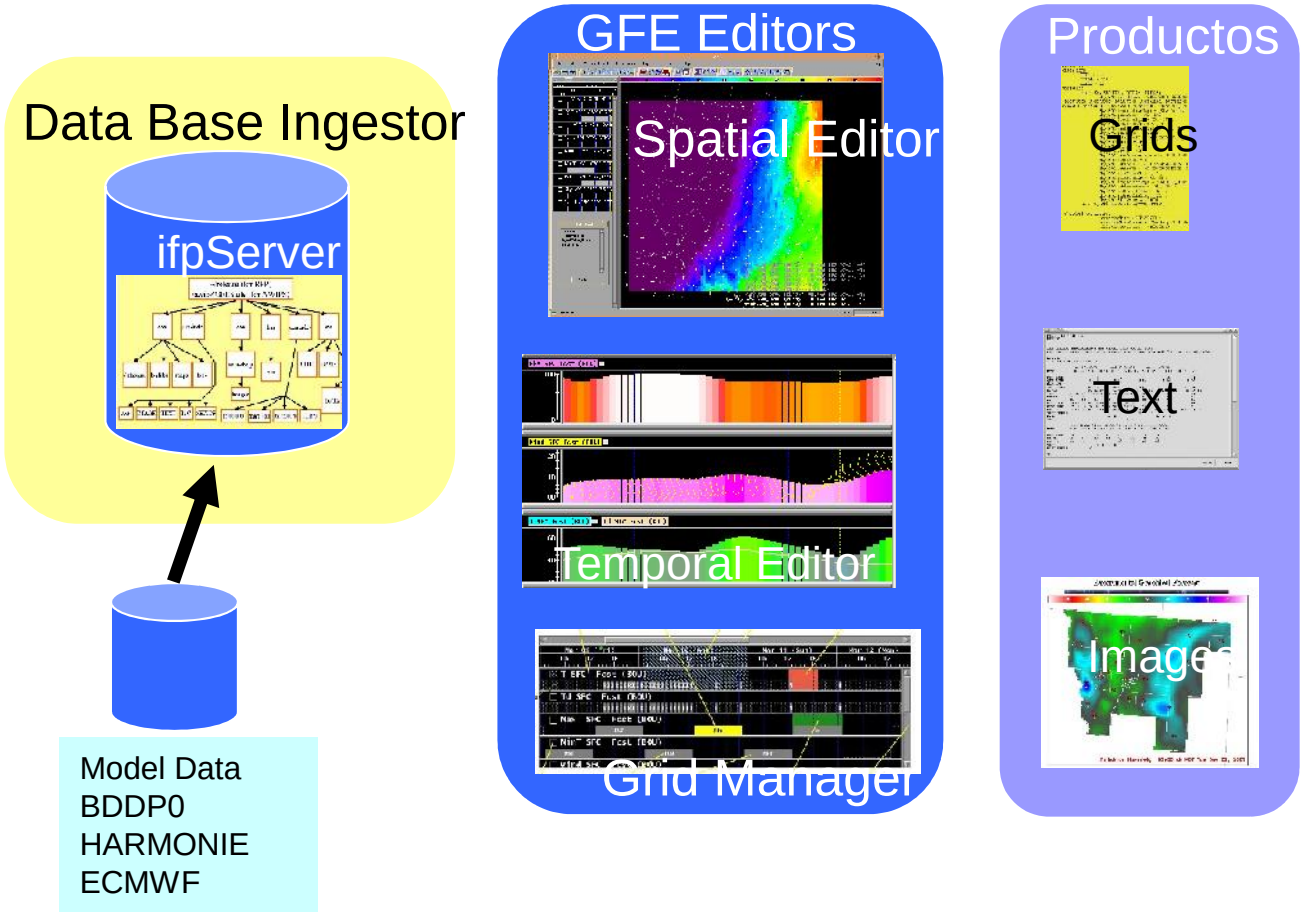
Populate
- Procedures
- Copy Selected Grids From
- Copy All Grids From

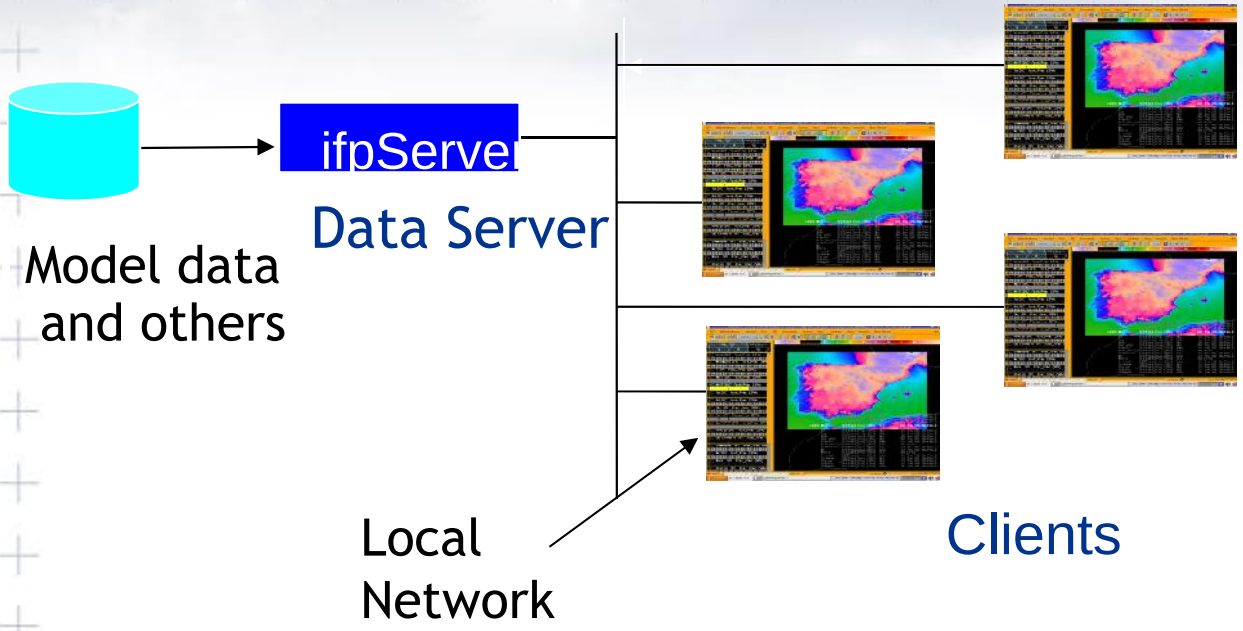
Grids
- Interpolate
- Split Grids
- Fragment Grids
- Create Grids From Scratch
- Assign Default Value
- Assign PickUp Value
- Delete Grids
- Select Grids By Time
- Select All Weather Elements
- Deselect All
- Time Shift
- Find Weather Element

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

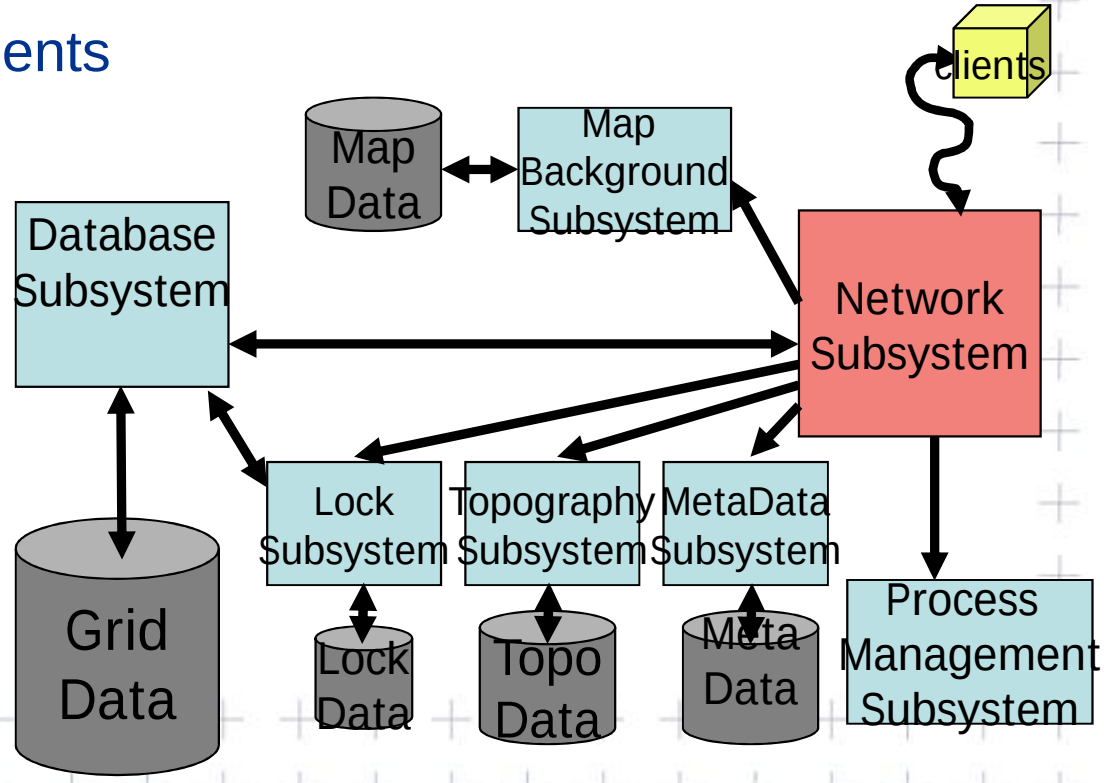
Consistency
-

GFE: Components

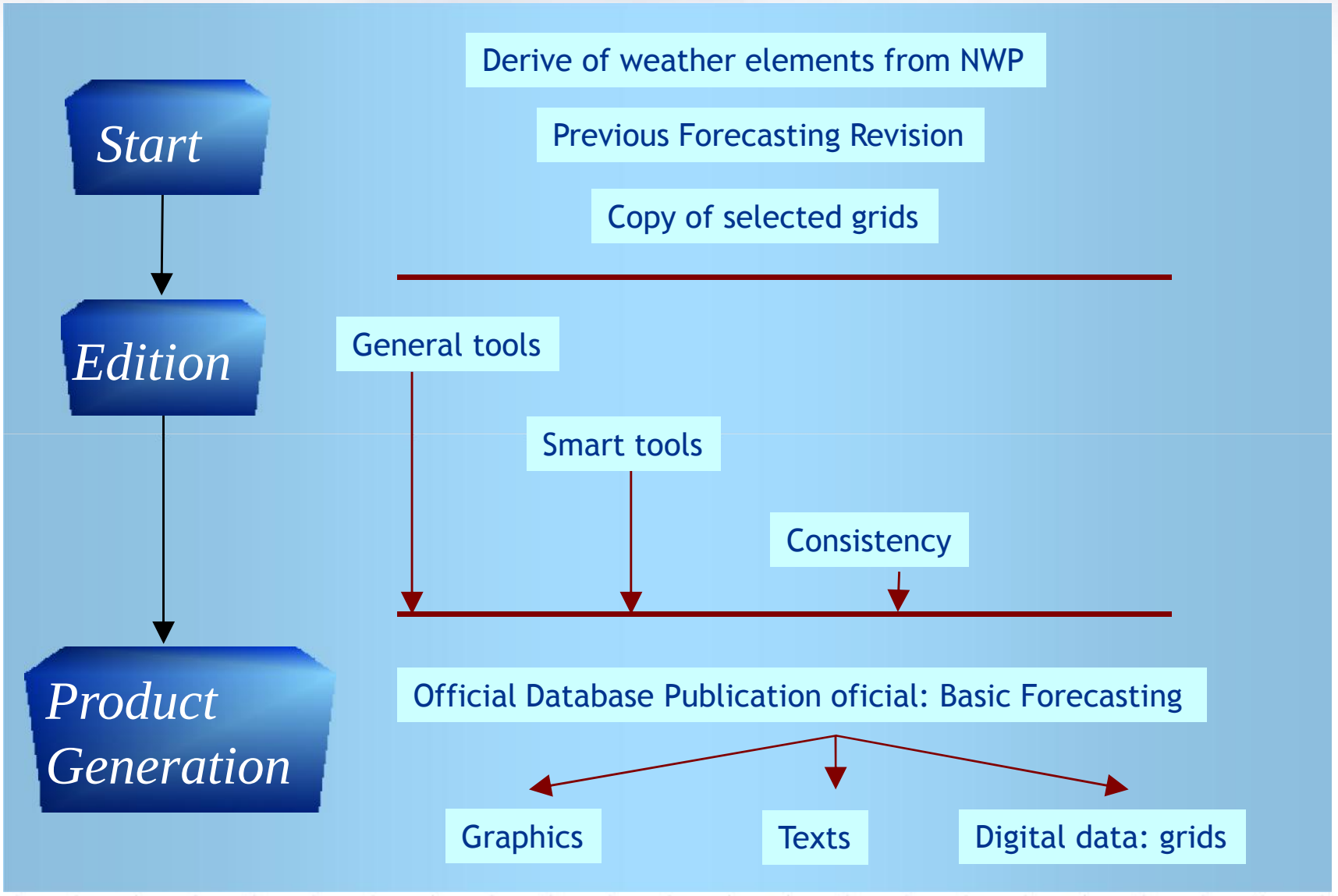


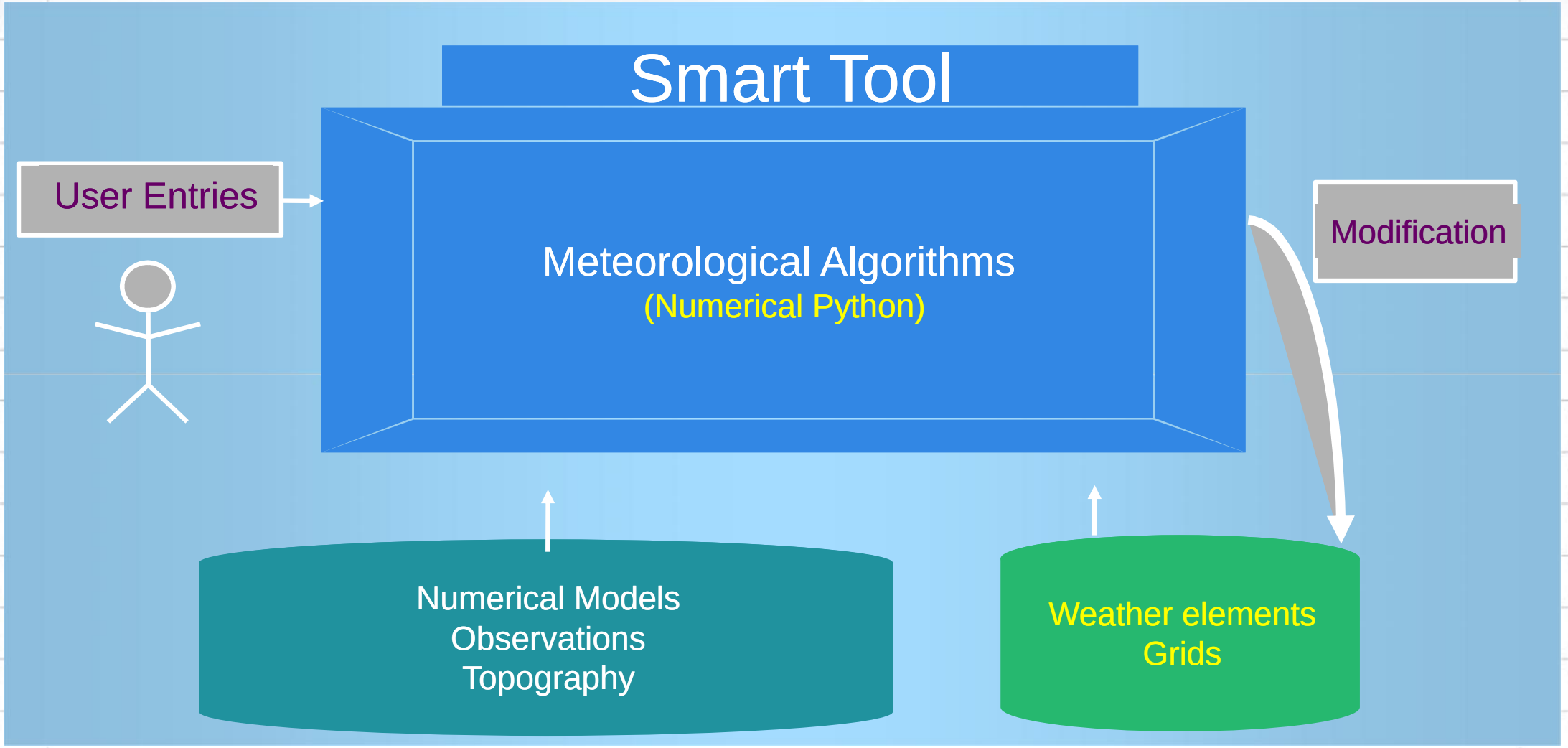


GFE Architecture



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


Smart Tool
User Entries
Meteorological Algorithms
(Numerical Python)
Modification
Numerical Models
Observations
Topography
Weather elements
Grids

Text Formatters

Basic Forecasting
BDDP

Formatters Infraestructure

Sampler

Sample
Analysis

Statistics

Text rules

Text products
Clear language
(or tables)

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.
- 2009: we contract NinJo licenses 10/2010, 20/2011, 30/2012
- 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.

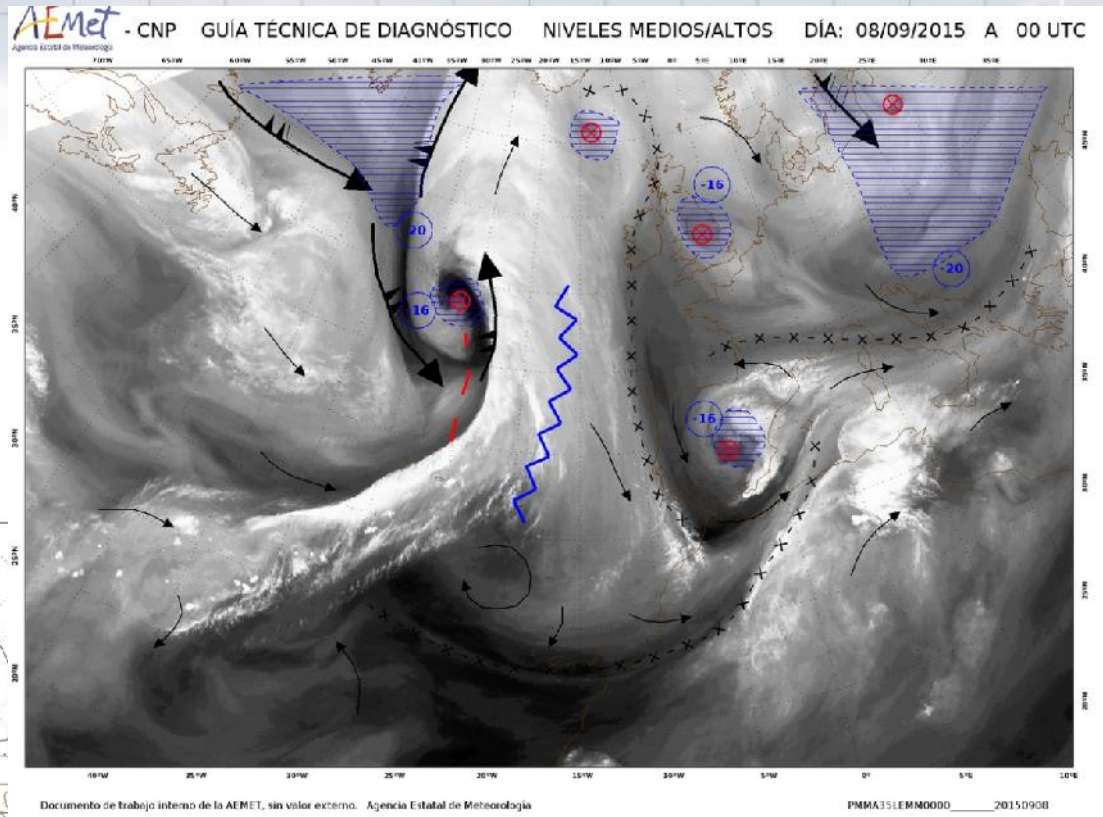
- Main recent results, PWB (2013-2015):
  - Completion of PWB templates&configuration (huge EBP dependence but close interaction).

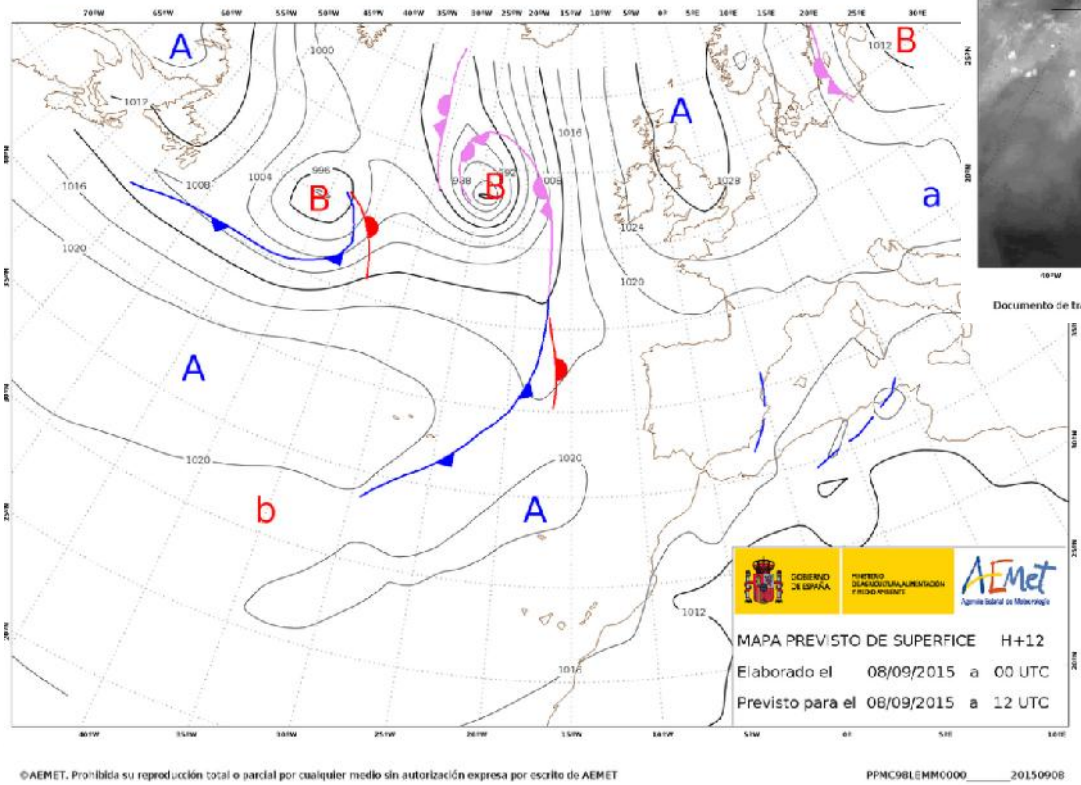
  - Specific forecasters' training, posts with involvement in Synoptic&General Guidance PWB production in CNP.

  - 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.

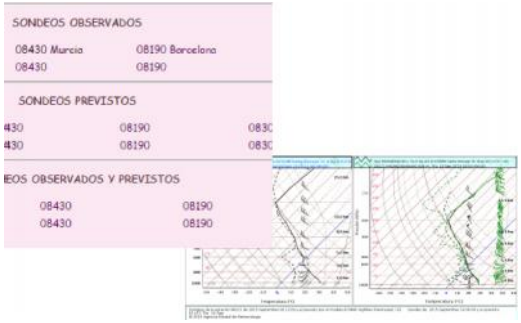
  - Start of PWB production for Aviation LL SWC (at Valencia and Las Palmas forecasting posts): decisions to be taken (if additional-to-user specific forecasters' training is needed; to assume –or not!- template limitations e.g. final product differs from created, with limitations to include map side comments).

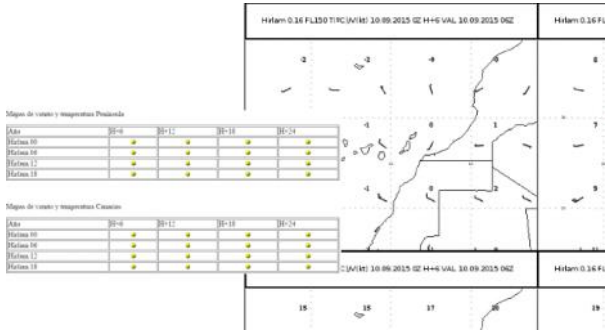
- AEMET Synoptic PWB production, 2 examples (other formats are created).
- 2/day, diagnosis + 5 forecast times.
- Until operational, internally distributed (AEMET Telecoms. System) and shown (General NWP intranet page).



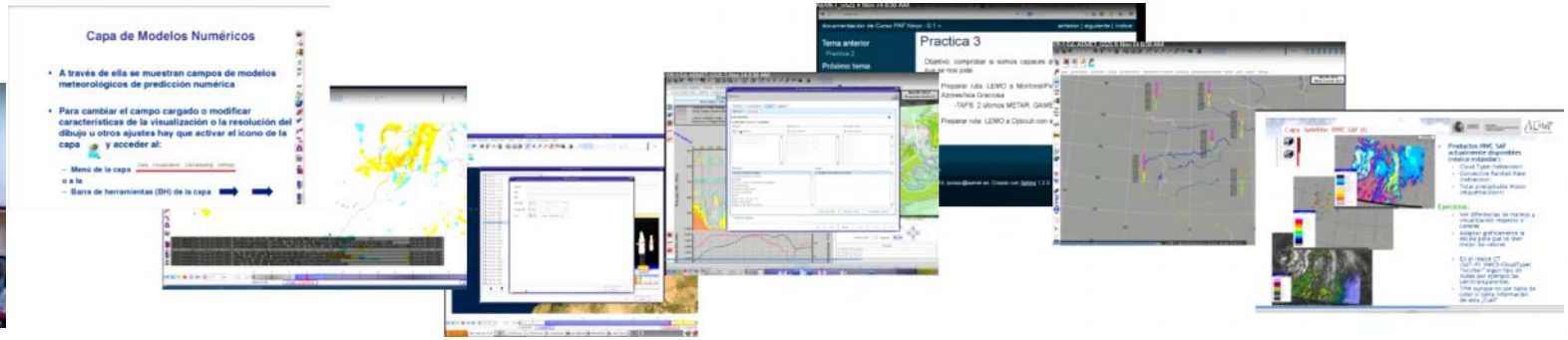


- Main recent results, Batch, Training and use:
  - A Batch product demonstrator is running and proposing online some close to operational prototype products. A general scheme of Batch production has to be refined, including enhancement/improvement of demonstrator products, Usual McIDAS (old system) 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.

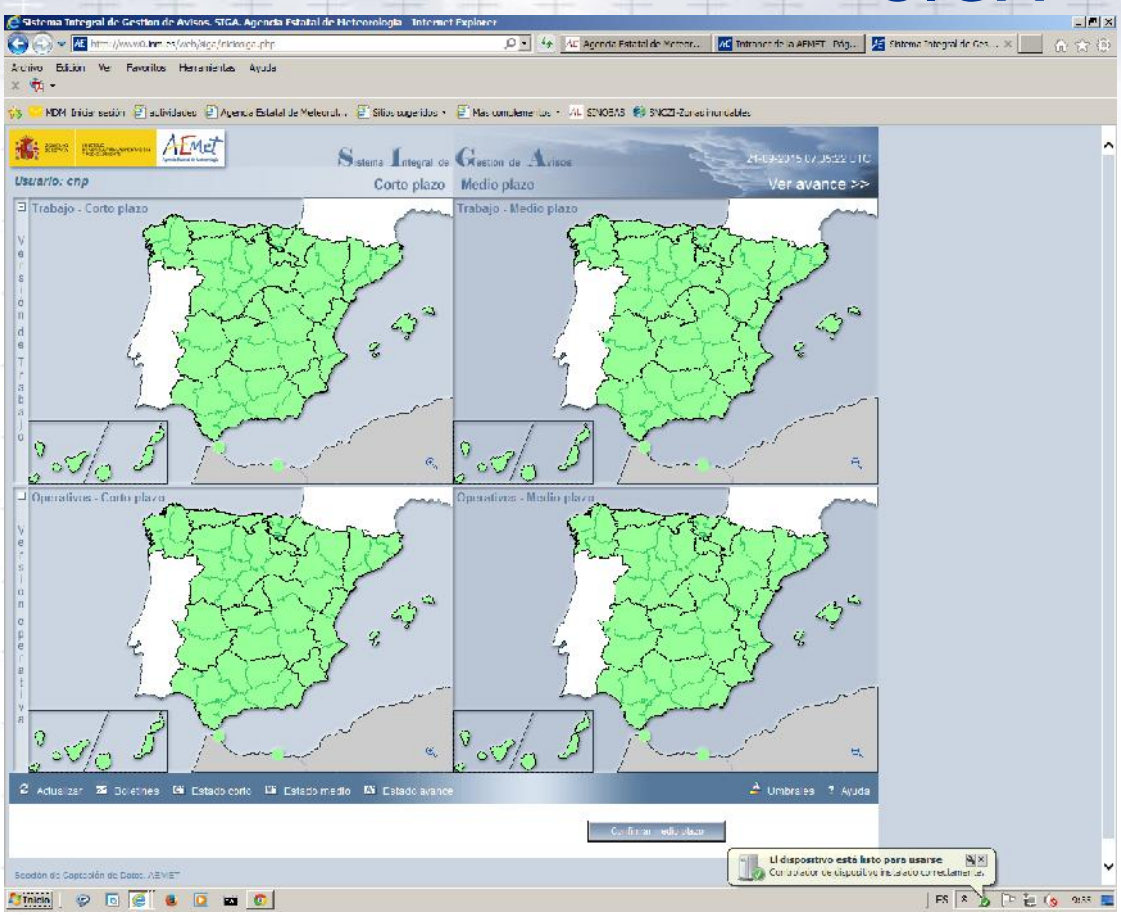
- Data content is quite complete now (and maintenance/server configuration somewhat "easied" with practice…),and to be completed next installation (including radar radial wind, Automats –new format, minor errors in others and Warning areas managed in AutoMON). For independence (and to get rid of CineSat), 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).

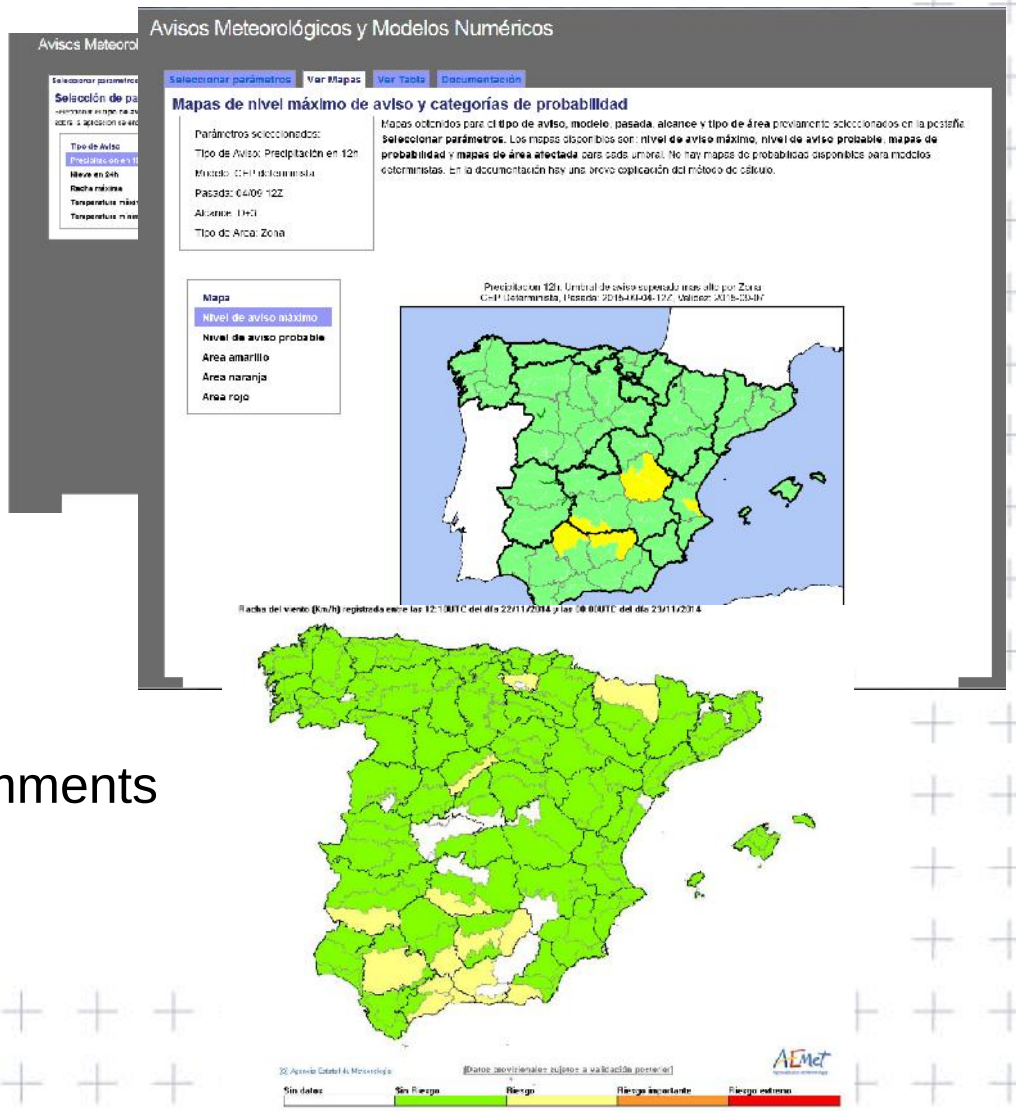
New applications for warning and aviation

- 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.

• 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

• SIGTAF

Editar TAF	Metar vs. TAF	TAF vs. Metar
FCSP LEBG	METAR LEBG 100700Z AUTO 10001KT 9999 // FEW046/// 11/11 Q1013= METAR COR LEBG 100600Z 00000KT 9999 FEW015 10/10 Q1015=	TAF LEBG 100500Z 1006/1015 VRB05KT 9999 SCT035 PROB40 TEMPO 1006/1008 3000 BR PROB30 TEMPO 1008/1015 SHRA SCT025TCU=
FCSP LELN	METAR LELN 100700Z VRB01KT 9999 SCT040 07/06 Q1014= METAR LELN 100600Z 00000KT 9999 SCT048 07/06 Q1013=	TAF LELN 100500Z 1006/1015 VRB05KT 9999 SCT040=
FTSP LESA	METAR LESA 100700Z VRB01KT 9999 MIFG FEW018 11/11 Q1013= METAR LESA 100630Z VRB01KT 9999 MIFG FEW018 11/11 Q1013= METAR LESA 100600Z 00000KT 9999 SCT018 12/12 Q1013= METAR LESA 100530Z 22004KT 190V260 9999 BKN018 12/12 Q1013=	TAF LESA 100500Z 1006/1106 VRB05KT 9999 SCT035 TX19/1015Z TN12/1105Z PROB40 TEMPO 1006/1008 RA BKN014 PROB30 TEMPO 1008/1016 SHRA SCT025TCU=
FTSP LEVD	METAR LEVD 100700Z 15002KT 4000 BR BKN018 12/11 Q1013= METAR LEVD 100630Z 11003KT 3000 BR SCT000 11/11 Q1013= METAR LEVD 100600Z 13003KT 4000 BR SCT015 11/11 Q1013= METAR LEVD 100530Z 11003KT 4000 BR FEW002 12/11 Q1013=	TAF LEVD 100500Z 1006/1106 VRB05KT 9999 SCT035 TX17/1014Z TN09/1105Z PROB30 TEMPO 1006/1008 3000 BR PROB30 TEMPO 1008/1016 SHRA SCT025TCU=

Editar Aviso	Metar vs. Aviso			Avisos activos y futuros
	METAR	TIPO	STATUS	
WWSP LEBG	METAR LEBG 100700Z AUTO 10001KT 9999 // FEW046/// 11/11 Q1013= METAR COR LEBG 100600Z 00000KT 9999 FEW015 10/10 Q1013=	NO WRNG OBS NO WRNG OBS	NO WRNG OBS NO WRNG OBS	NO HAY AVISOS ACTIVOS NI FUTUROS
	METAR	TIPO	STATUS	
WWSP LELN	METAR LELN 100700Z VRB01KT 9999 SCT048 07/06 Q1014=	NO WRNG OBS	NO WRNG OBS	NO HAY AVISOS ACTIVOS NI FUTUROS
	METAR LELN 100600Z 00000KT 9999 SCT048 07/06 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR	TIPO	STATUS	
WWSP LESA	METAR LESA 100700Z VRB01KT 9999 MIFG FEW018 11/11 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR LECA 100630Z VRB01KT 9999 MIFG FEW010 11/11 Q1013=	NO WRNG OBS	NO WRNG OBS	NO HAY AVISOS ACTIVOS NI FUTUROS
	METAR LESA 100600Z 00000KT 9999 SCT018 12/12 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR LECA 100530Z 22004KT 150V260 9999 BKN010 12/12 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR	TIPO	STATUS	
WWSP LEVD	METAR LEVD 100700Z 15002KT 4000 BR BKN018 12/11 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR LEVD 100630Z 11003KT 3000 BR SCT000 11/11 Q1013=	NO WRNG OBS	NO WRNG OBS	NO HAY AVISOS ACTIVOS NI FUTUROS
	METAR LEVD 100600Z 13003KT 4000 BR SCT015 11/11 Q1013=	NO WRNG OBS	NO WRNG OBS	
	METAR LEVD 100530Z 11003KT 4000 BR FEW002 12/11 Q1013=	NO WRNG OBS	NO WRNG OBS	

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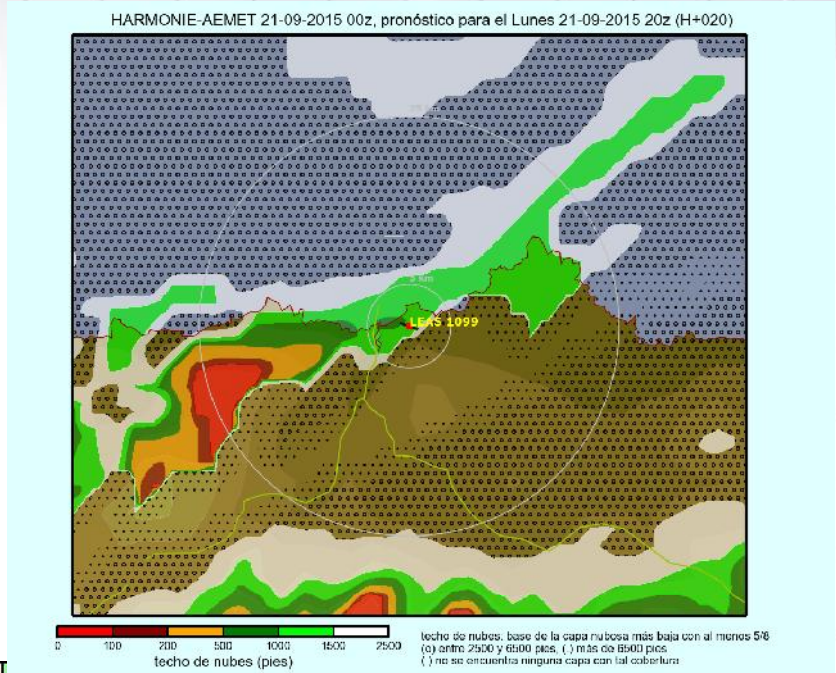

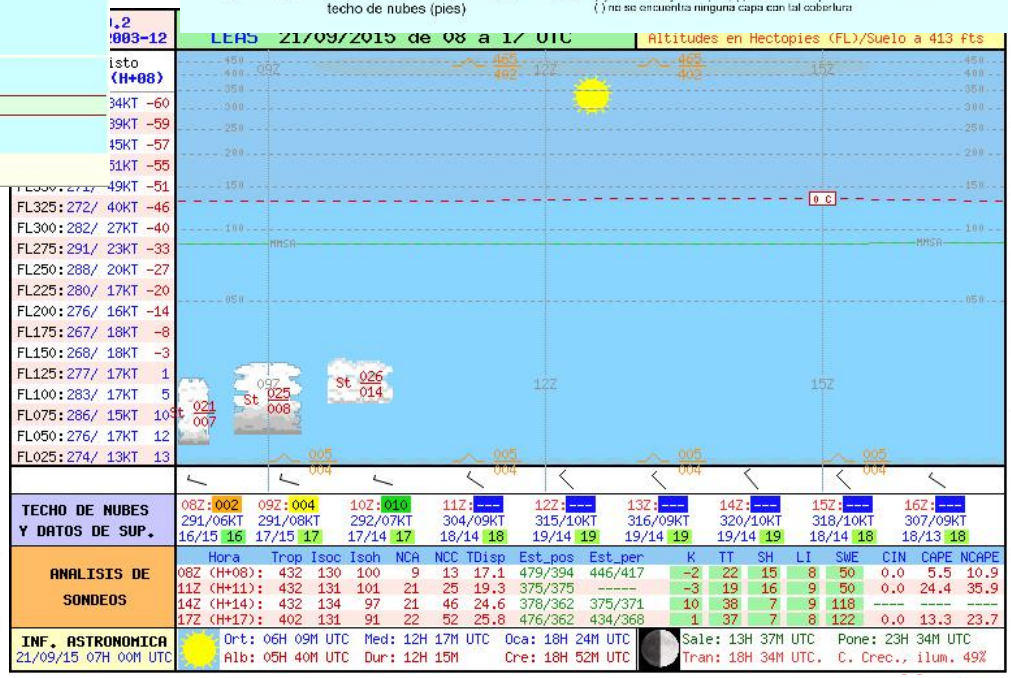

- TAF proposal
- Verify TAF vs. METAR
- Specific outputs from the model

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