P10R.7

THE SPANISH WEATHER RADAR NETWORK

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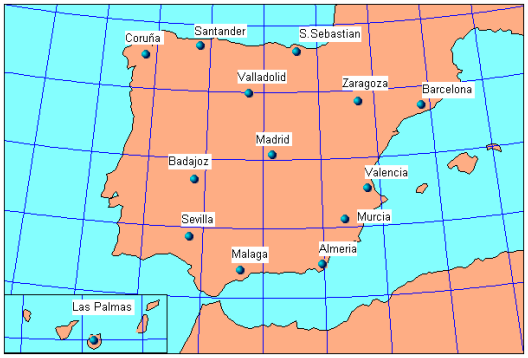
1. NETWORK DESCRIPTION

The Spanish Radar Network is based in fourteen Ericsson, type UBS 103, C band Doppler radars. The scope of the radars (240 km.) and their geographical positions provide a basic observational coverage of most of the Spanish territory; some lack of it affects however, the Balearic Islands, the west part of the Canary Islands and, to a lesser extent, the south of the Spanish Central Plateau



The operations of the network are managed on three levels, the radar sites (RS), the regional centres (RRC) and the national centre (RNC).

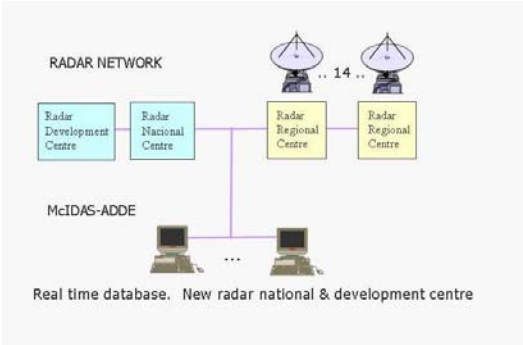
Each RS has the main radar equipment (all that needs to perform its unmanned operation) and a link with a RRC, which provide control, data processing and distribution facilities. The main flow of radar data between RS and RRC consist on intensity and Doppler mode radar observations arranged as polar volumes; from them, a wide range of radar products are generated.

Radar data from RRC are collected and combined with other meteorological information in the RNC for generating composites and other products of national coverage. Several procedures monitor and control the main radar facilities and generate monthly reports to improve operations and drive maintenance.

	Unit	Intensity	Doppler
Frequency	ghz	5,62	
Peak power	kw	250	
M.D.S.	dbm	-109	-114
Antenna gain	db	43	
Antenna RR.	rpm	6	2
PR frequency	hz	250	900, 1200
Pulse width	µsg	2	0,5
Beamwidth	deg	0.9	

Main radar technical data

The Radar Development Centre (RRC) makes considerable development work to improve the operational procedures, to widen the distribution channels and to increase the number and quality of radar products.



2. RADAR DATA PRODUCTS

The radars work in a ten minutes production cycle; first, a twenty elevations intensity mode volume scan collects reflectivity data up to a range of 240 km.; next, a eight elevations doppler mode scan gets, reflectivity and radial velocities and spectrum width wind data up to a range of 120 km.

	Unit	Intensity	Doppler
Elevations.		20	8
Range cover	km	240	120
Range resol.	km	2	1
Angle resol.	deg	0,86	
Data type		Z	Z,V,W
Z precision	dbZ	< 0,6	
V precision	mps		< 0,6
V unambig	mps		+/- 48

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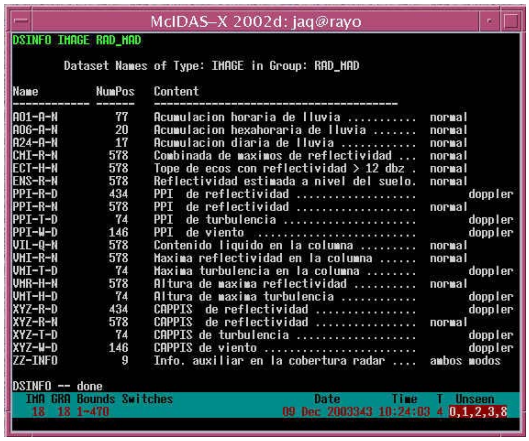
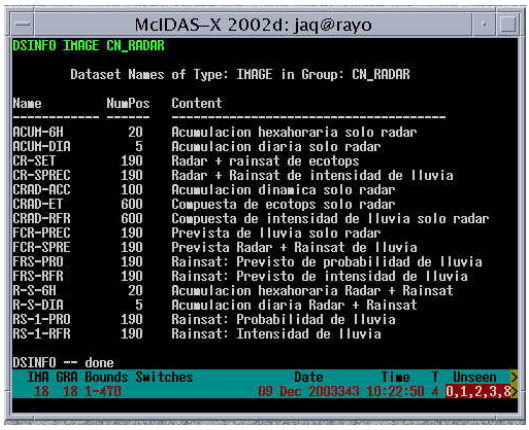
The RRC generates, from these scans a wide variety of radar images and tables. PPI, CAPPI, maximum vertical data, height of the maximum, VIL, VAD profiles, etc; additional radar regional products include accumulations of precipitation in different periods of time and radar nowcasting up to three hours lead-time.

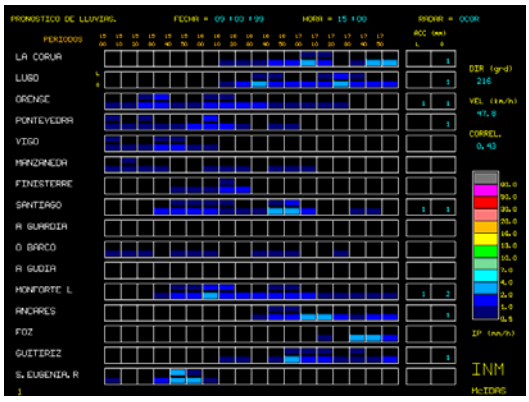


List of Spanish RRC products

RNC generates composites of regional data with the same spatial and temporal resolution; composite capabilities extend to all regional images and include more choices that "only radar" data, but uses satellite and NWP model information to generate RAINSAT and combined (radar + RAINSAT) composites.



List of Spanish RNC products



Radar forecast from La Coruña RRC

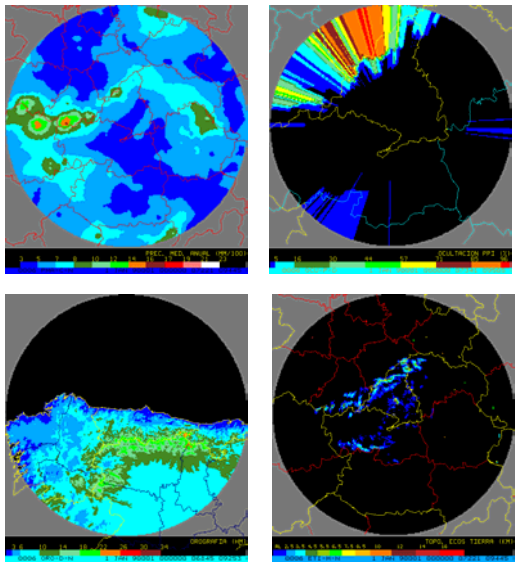
Both RRC and RNC provide ADDE server facilities to the McIDAS system; using them, McIDAS gets the radar data and generate new regional and national radar products; besides, McIDAS serves as a bridge to the main radar archive, coding and dissemination facilities.

3. DEVELOPMENTS

A key Spanish RDC result has been the development and integration of McIDAS-ADDE servers into the RRC and RNC radar software. That has meant the integration of the real time radar databases into the main INM development and operational framework; the extension of that capability to the historical databases followed with the installation of additional RRC´s and RNC software for off line applications in the main INM radar offices

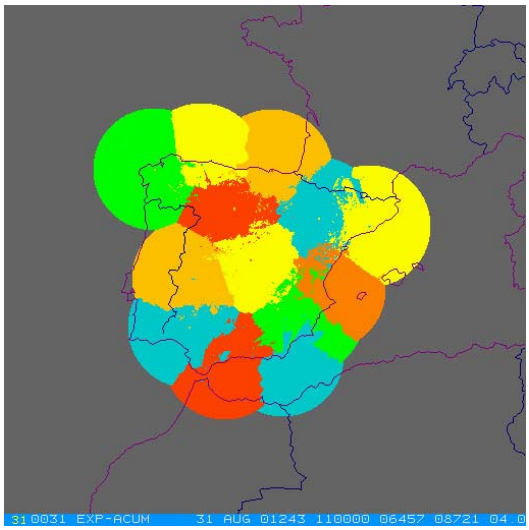
RDC has developed also some operational procedures, like the ones that force RRC and RNC to sign their actions in order to have a full control of the radar production and distribution chain or other that check radar calibration consistency in order to guarantee radar stability.

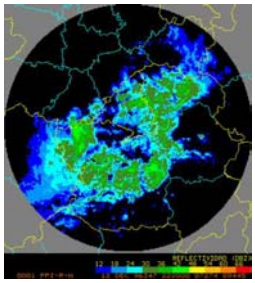
Other RDC developments have driven to ancillary radar products for a variety of purposes: RRC radar images of theoretical blocking, ground echo topography, orography, mean annual precipitation amount or mean annual precipitation frequency,

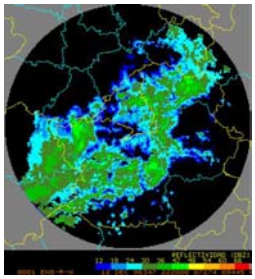


Pseudoimages: Mean annual precipitation, theoretical blocking, orography and ground echo topography.

Finally, RDC has developed, from radar climatology, the optimum composite masks that RNC use operationally and a new radar product, the ground reflectivity estimate, obtained by the modification of PPI data according to the mean vertical reflectivity profile. Now, works are in progress to qualify the quality of national composite products at pixel level in order to facilitate their quantitative use.



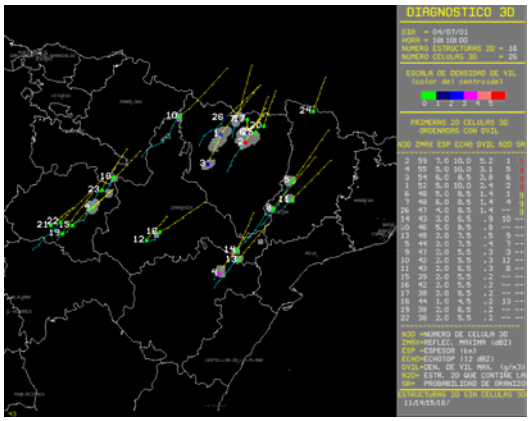




Above: Optimum RNC composite mask
Down: Madrid RRC-PPI and its VPR corrected version.

Besides RDC staff, others INM groups include radar data in their development goals, being their main results gotten in nowcasting and NWP.

Referring to nowcasting, INM-STAP has developed software modules to analyses in two and three dimensions the convective cells; through their identification, diagnosis, tracking and nowcasting, the modules gets better short-range forecasts.



A display of the 3D convective analysis showing several hail events

The INM-STAP convective analysis uses RRC, RNC reflectivity and other meteorological data and bases in the Steiner-Yuter-Houze procedure (2D) and the NSSL-SCIT algorithm (3D) that estimate hail probability.

Besides, INM-STAP has developed some Doppler data based utilities and products and now, is working in the development of a mesocylone analysis module.

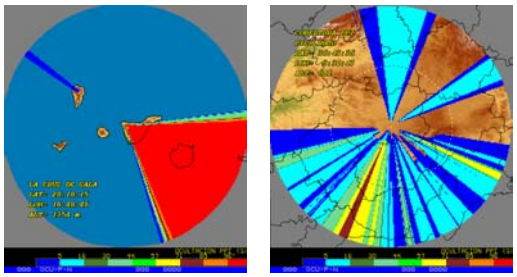
As for the INM-NWP, the radar activities have mainly focussed on model VAD winds validation. However, some works are now in progress to assimilate in the models, radar wind and reflectivity data. A results in that line are, for example, a HIRLAM 0,05º, reflectivity simulation product which serves to the first radar reflectivity comparisons.

Finally, I have to mention that now; one of the most important RDC goals refers to the improvement of the hydrological utility of the radar data

CEDEX tool for river flood and dams management that uses INM radar national precipitation data

4. FUTURE PROJECTS

The Spanish INM is involved now in some projects. The most important ones are an integral modernisation plan of all the radar subsystems and the installation of three new radar sites to improve and complete the network national coverage. One of these new radars, which has the same technology of the rest, will site in Mallorca Island and start operations before finish this year.



PPI theoretical blocking of two new radar sites for the Spanish network: Tenerife and Valdepeñas