INSTITUT CARTOGRÀFIC DE CATALUNYA

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INSTITUT CARTOGRÀFIC DE CATALUNYA

NEWSLETTER

HYDROGEOLOGICAL MAP OF THE LOWER SECTION OF THE RIVER LLOBREGAT AND ITS DELTA 1:30 000

Underground water management requires suitable instruments, which must also serve for outreaching information. With this in mind, the Comunitat d'Usuaris d'Aigües del Delta del Llobregat (Llobregat Delta Water Users Community), the ICC and the Institut Geològic de Catalunya (IGC) signed a cooperative agreement to produce the *Mapa hidrogeològic del tram baix del Llobregat i el seu delta 1:30 000* (in collaboration with the Comunitat d'Usuaris d'Aigües de la Cubeta de Sant Andreu de la Barca-Water Users Community of the Sant Andreu de la Barca Basin).

"THIS MAP DRAWS TOGETHER ALL THE INFORMATION ABOUT THE WATER CYCLE IN ONE AREA"

The information has been duly captured, compiled, georeferenced, digitized, analyzed and processed.

As it is published, the document includes a main map at 1:30 000 scale, a map of the deep aquifer at 1:50 000, a map showing the location of aquifers at 1:200 000, a map of the distribution of developed areas at 1:200 000, nine geological sections of Quaternary deposits, and nine columns representing these materials. The hydrogeological description of the different units appears in the legend.

The information of the main map is presented on a generalization at 1:30 000 scale of the Topographic database of Catalonia 1:25 000 of the ICC. On the hydrogeological maps it is important that the anthropogenic elements which may in some way modify or affect the water cycle are shown. In this respect, in addition to urban and industrial areas, the map marks petrol stations, agricultural areas, former gravel pits that have been filled in, and the principal embankments associated with road and rail infrastructure. As for elements of hydrological control, the map shows the main piezometers, indicating the average piezometric level in the period 2000-2004, meteorological stations, gaging stations, and the consumption units of the aquifers structured by volume of extraction and use of the extracted water.

The geological sections have been constructed from geological cartography and lithological descriptions of 650 boreholes of various origin.

Therefore, this map is a basic planning instrument which provides reliable and comprehensive environmental information required by technicians, researchers and users of the aquifers. This information facilitates the management of a natural resource, water, the conservation of vulnerable areas, the establishment of protection perimeters, and the location of sources which might pose a risk to the aquifer.

SUMMARY

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GENERATION OF DIGITAL TERRAIN MODELS BY MEANS OF ADVANCED DIFFERENTIAL RADAR INTERFEROMETRY TECHNIQUES

In the last years the ICC has developed the DISICC (Differential Interferometry Software of ICC) software.

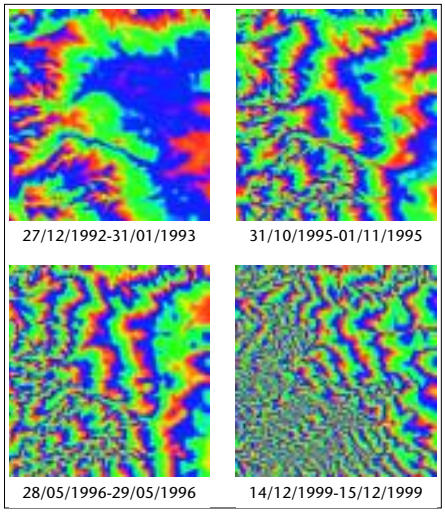
On the one hand, this software allows the monitoring of centimetric movements of the terrain at a large scale through radar images acquired by satellite. With a temporal sequence of interferograms (combinations of two images of Synthetic Aperture Radar) is possible to determine the terrain deformation pattern with an extraordinary accuracy and a great coverage, especially in urban environments where the quality of the signal is very high.

"THE TECHNIQUE USED FOR THE GENERATION OF DEMs IS CALLED: TopoDInSar"

On the other hand, with a selection of data aimed to reduce the levels of noise, the software is able to generate terrain deformation maps and also DEMs of large surfaces (each satellite image covers an area of 100 x 100 km). For the generation of the DEM the combination of very close SAR images in time is necessary to avoid the loss of signal quality and to cover the maximum surface of the terrain.

Figure 1 shows how, due to the different acquisition orbits, each color cycle corresponds to different height increments for each interferogram, in a similar manner to the contour lines. When all this information is combined by means of the DISICC software, the DEM shown in Figure 2 is obtained. The accuracy analysis of this DTM, free of atmospheric effects and other uncertainties, provides an altimetric precision of less than 9 meters with a pixel size of 30 meters.

Figure 1. Set of 4 topographic interferograms (combinations of two Synthetic Aperture Radar images obtained by satellite) of a sector of the comarca (administrative division of Catalonia) of Bages.



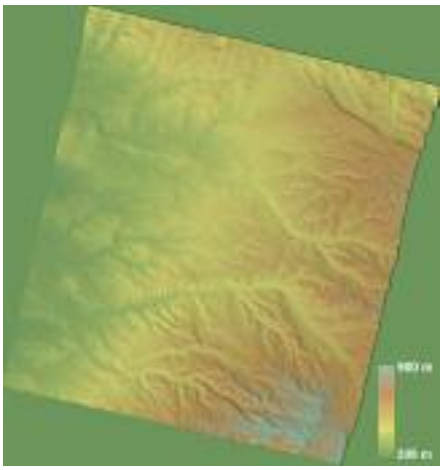
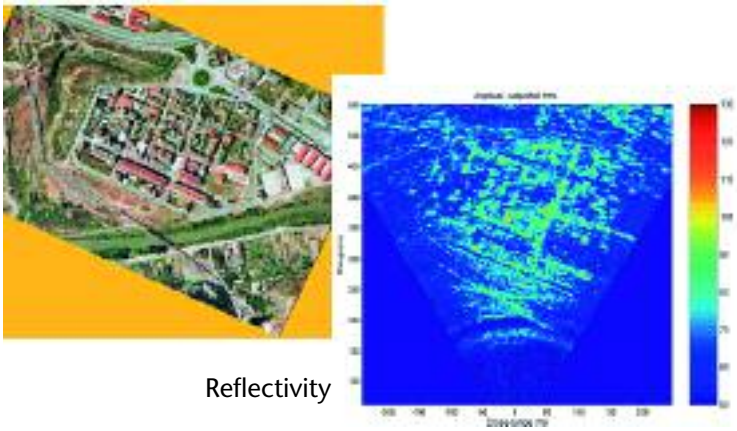


Figure 2. DEM resulting from the TopoDInSAR process.

GROUND BASED RADAR (GB-SAR) FOR HIGH-RESOLUTION MONITORING OF LAND SUBSIDENCE

Together with the Universitat Politècnica de Catalunya (UPC), the ICC is undertaking a pilot test to detect small land movements by means of a new ground based radar system designed by the UPC. This radar, known as GB-SAR (Ground Based Synthetic Aperture Radar), can operate at various band frequencies, at X-band (9.65 GHz), which is fully operative, and at C-band (5.3 GHz) and K-band (17.5 GHz) by means of assembly. The sensor moves on a rail of 2 or 6 meters, according to requirements, and it is equipped with six pyramidal antennas, two for continuous transmission and four for reception in polarimetric-interferometric configuration.



Reflectivity

The image shows a preliminary result obtained during the test and sensor calibration days in July 2006 in the Barri de l'Estació in Sallent. The GB-SAR was installed on a hill at the East part of the district where the castle of Sallent is located, at an elevation of 391 m. This example shows the reflectivity image of the terrain jointly with the optical image. In the image of reflectivity, where the buildings show a level of signal higher, the structure of the Barri de l'Estació can be identified. In future measurement campaigns this reflectivity image will be transformed into land deformation evolution maps through differential interferometry techniques.

CONNECTING OUR WORLD

Together with the publishing house Marcombo SA, the ICC has just published the translation into Catalan of the book "Connecting Our World", by Winnie Tang and Jan Selwood, published in English by ESRI Press. This initiative reflects the interest of the ICC in publicizing information about geomatic sciences.

"THE BOOK EXPLORES THE TECHNOLOGY OF GIS WEB SERVICES"

This book focuses on GIS web services, which are of great importance in the design of information management systems. Through this technology robust applications can be created, and data and functions can be shared and integrated on the World Wide Web. These applications are practically independent of any platform, they are easily updated and maintained, without the need for a great outlay, and furthermore, they can reach a potentially global public.

Thus GIS web services offer the opportunity to break down some of the barriers that obstruct integration and communication between the various information systems, regardless of whether these barriers have been created by data storage limitations or the incompatibility of data formats, hardware or software. GIS web services also overcome the barrier of distance, making it possible for users anywhere in the world to gain access to the wide range of data and services available.

The book illustrates this technology with twelve of the most innovative examples drawn from organizations all over the world. These range from the presentation of the national mapping service in New Zealand and the digital map creation for on-the-run journalists in the USA, to location-based services in Scandinavia.

DATABASE AND MAP OF LAND AREAS OF A SLOPE SUPERIOR TO 20%

At the request of the General Direction of Urban Planning assigned to Regional Planning and Public Works Department, the ICC has completed the database of land areas of a slope superior to 20% at 1:5 000 scale, and is currently producing the series at 1:50 000 scale. By September 2006, all database sheets at 1:5 000 scale (4 274 sheets) and 21 of 41 sheets at 1:50 000 scale have been delivered.

The digital elevation model used to calculate the land areas of slope superior to 20% is a regular grid model that contains orthometric altitudes distributed according to a 5 m grid. This model is obtained from photogrammetric stereoplotting of the Topographic database of Catalonia 1:5 000. The stereoplotted altimetric information gathers regular profiles, spot heights, break lines and, exceptionally, contour lines in areas with little information. Profiles are alignments of points on the terrain, with separation of 45 m and in a same direction, that reflect the slope changes. In each profile, distance between points ranges from 20 to 60 m according to terrain features. The set of spot heights is a cloud of points of variable density, distributed in passes, peaks, cliffs, depression bottoms, plains and communication routes. Break lines complete the terrain morphology with crest lines, troughs, taluses, the road network and the river system.

To develop a digital elevation model, a triangulation process is applied to altimetric data in order to obtain a triangular terrain model; afterwards, the spot height is calculated for each point of the regular grid with equidistance of 5 x 5 m. The altitude of each point of the regular grid is determined by linear interpolation of triangle vertices spot heights to which its orthogonal projection corresponds.

3D SCENARIOS OF THE REGIONS OF GIRONA

In December 2005, the ICC and the Diputació de Girona (Regional Council) signed an agreement to produce 3D maps of the *comarques* (administrative divisions) of Girona.

These maps have been created using the GeoShow application, made by GeoVirtual. This program constructs and displays dynamic 3D scenarios starting from a terrain elevation model and a raster layer that serves as a base for the representation of the territory.

In September 2006, a DVD was published with the global scenario of the *comarques* of Girona, together with five DVDs with specific scenarios devoted to the following large landscape units: Pyrenees-Pre-Pyrenees, Alt Empordà-Costa Brava north, Gavarres-Ardenya-Costa Brava south, Montseny-Guilleries-Gironès plain and la Selva, and Garrotxa-Vall de Llémena-Pla de l'Estany. Furthermore, these scenarios will be uploaded to the website of Diputació de Girona and can be viewed on the Internet. The *Ortofotomapa de Catalunya 1:5 000* series has been used as the base for representation of the territory. The administrative boundaries and the principal road network have been added as complementary layers, which can be visible or not, as required.

In order to make the scenarios easier to view, a selection has been made of the toponyms from the Toponymic database of Catalonia 1:5 000 and its edition. The toponymy can also be visible on the territory or not, as required, and the selection of a toponym through interaction with the program automatically starts off a 3D navigation process that leads to it.

To complement the scenarios, a variety of multimedia information has been incorporated (photographs of landmarks, details of nature reserves, links to the website of Diputació de Girona, the councils of the comarques and the municipal councils in the province of Girona, and addresses of the tourist offices) which can be viewed when the corresponding symbols are activated.

Roses. Alt Empordà-Costa Brava North.

BRIEF NOTES

WORKING SYMPOSIUM ON APPLICATIONS OF GOOGLE TECHNOLOGY TO CORPORATE ENVIRONMENTS

This Symposium, organized by Google, Sitesa and the ICC, was held on September 28th, 2006 at the ICC headquarters.

The aim of the Symposium was to outline the new alphanumeric and graphic technological features of Google, and to consider their application to corporate environments. A review of actual cases was also made: the practical experiences of introducing Google technology into both the Generalitat de Catalunya and ExpoZaragoza 2008 were presented. Finally, successful cases in other European countries were reviewed.

CLOSING SESSION OF THE PROJECT FOR THE COMPUTERIZATION OF THE ASSOCIATION DE SAUVEGARDE DE LA MÉDINA (ASM). TUNIS

On April 3rd, 2006 the closing session was held in the project for the computerization of the Association de Sauveguarde de la Médina de Tunis (Association for Protection of the Tunis Medina, ASM). We would remind readers that this project consisted in technical training and information computeration of the ASM, with the goal to improving the management, use and updating of information in the working sphere of the ASM (Medina and adjacent districts). For more information, see ICC Newsletters numbers 22 and 25.

The event was attended by the Spanish Ambassador in Tunis, the Director of the Spanish Agency for International Cooperation in Tunis, the Director of the ASM, and representatives of the ICC, among others.

All the parties agreed that the project had been a success and that it should serve as an example of international institutional cooperation.

THE PHOTOGRAMMETRIC RECORD

Mr. Josep Lluís Colomer Alberich, the ICC's Technical Deputy Director, is a member of the Editorial Board of the English journal "The Photogrammetric Record".

VIRTUAL REFERENCE STATIONS

With respect to the Catalan Integrated Geodetic Positioning Systems (SPGIC) project, these being based on the positioning infrastructure of the CatNet permanent GNSS stations network, the services to improve positioning based on the network solution have been put into operation.

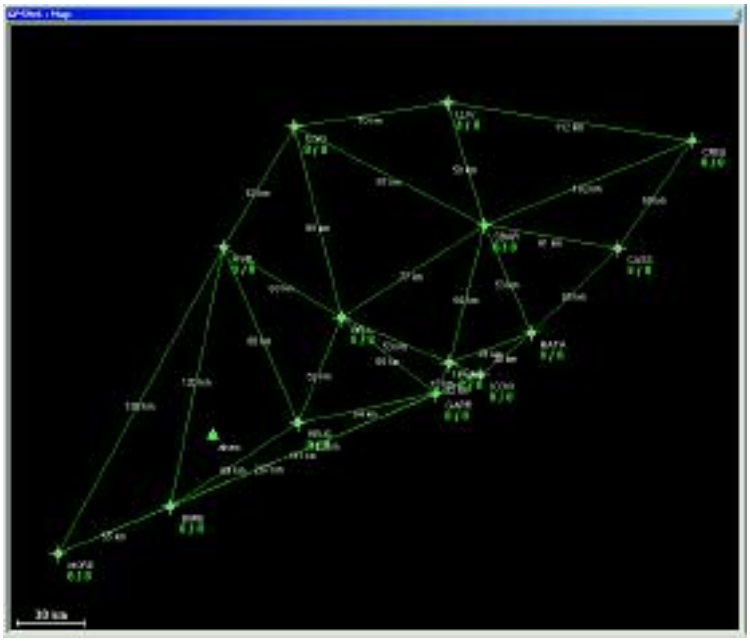
"THESE SERVICES COMMENCED IN FEBRUARY 2006"

The services have been well received by the topographic community. This is demonstrated by the more than 170 users registered, by the growing use of the access to the services, which has increased by 18% a month, and by the two million periods (seconds) of corrections issued in July 2006.

In the field of phase correction services in real time or RTK, various solutions exist to provide this service, from simple RTK, which consists in transmitting phase corrections from a single station to clients in the vicinity of that station, to extended RTK, through which it is possible to increase the operating limit situated at some 20 km from the reference station for simple RTK to more than 35 km. The extended RTK services, also known as RTK network solutions or Virtual Reference Stations (VRS), use data from the stations enclosing a working area which are within a service node accessed by users. Using the data compiled, an ionospheric and tropospheric model of the service area is computed, so that the correction data can be extrapolated from a station to the vicinity of the user. In this way, as far as precision and operating capacity are concerned, the user obtains results equivalent to those that would be obtained working a few meters from the actual reference station.

Unlike classic correction services, the extended RTK services require bidirectional channels in order that they may be provided. Given the easy access to Internet servers from mobile devices, whether with GPRS or with 3G, the services available can be accessed from any fixed or mobile device with a network connection using the NTRIP protocol.

For more information and access to the services, visit: **catnet-ip.icc.es**



Example of CatNet network coverage formed by several service areas.

Contact addresses of the ICC

Parc de Montjuïc – E-08038 Barcelona – Telephone 34-93 5671500 – Telefax 93 5671567 – E-mail: esther.muns@icc.cat
Balmes, 209-211 – E-08006 Barcelona – Telephone 34-93 2188758 – Telefax 93 2188959
Emili Grahit, 10 A – E-17002 Girona – Telephone 34-972 200493 – Telefax 972 200493
Doctor Fleming, 19 – E-25006 Lleida – Telephone 34-973 281930 – Telefax 973 261055 – EADOP
Major, 37 – E-43003 Tarragona – Telephone 34-977 21 17 97 – Telefax 977 22 01 27 – EADOP

http://www.icc.cat

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