

June 1997  
Number 3

# Newsletter

## OF THE INSTITUT CARTOGRÀFIC DE CATALUNYA

 Generalitat de Catalunya  
Departament de Política Territorial  
i Obres Públiques  
Institut Cartogràfic de Catalunya

Information about the production, development and research projects  
of the Institut Cartogràfic de Catalunya

## Special issue for the 18th International Cartographic Conference Introduction

The Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) was created in 1982 after the Law 11 (October 8th) of the Parlament de Catalunya (Catalonia Parliament), in order to achieve a consistent action over all the catalan territory, incorporating new technologies and work techniques. We can consider the consolidation of the ICC as a Generalitat de Catalunya (Catalan Autonomous Government) organism that, taking on the work started by the geographical services of the Mancomunitat and the Generalitat at the time of the Republic, intends to place the cartographic studies and production that can be done at present in Catalonia in a level of innovation and modernity. In 1995, the ICC assumed management of the Servei Geològic de Catalunya (Geological Survey of Catalonia), which was formerly assigned to the General Secretary of the Departament de Política Territorial i Obres Públiques (Regional Planning and Public Works Department).

The purpose of the Institut Cartogràfic de Catalunya is to achieve the technical

tasks for the development of the cartographic information, as might be the following:

- Producing, reproducing and spreading basic cartographic works which are carried out through programs that work all over Catalonia.
- Densifying and surveying the lower order geodetic network.
- Achieving the road cartography projects necessary for the roads and public work projects that are to be carried out in Catalonia.
- Executing programs for the development of thematic cartography as well as for the cartography intended for the evaluation of resources by means of remote sensing techniques used to estimate areas affected by fires, land use, geology, etc.
- Creating, structuring and organizing the Cartoteca de Catalunya (Catalonia Map Library) which coordinates the compilation and study of the available cartographic and geographical documentation.
- Creating a cartographic database in order to use automatic systems in the carto-

graphic design which enables, not only obtaining basic cartography but also its immediate exploitation for different services such as public works, official land registry, etc.

- Doing the technical coordination of the cartographic works done by public or private institutions and, if might be the case, the cooperation with public organizations, either of the autonomic communities or the State itself, as well as with private organizations with similar purposes.
- Publishing and circulating the works done by the Institute that might be of public or scientific interest.

In this context, the ICC does a cartographic service of official nature or general interest for the Generalitat, as well as undertaking studies and works assigned or requested by any other public or private institutions. Since its origin, the ICC intends on the obtention of a quality cartography able to allow the planning and support of the many different works that are being carried out.



# Flights

The Flight department started the functions related to the development of the photogrammetric flights in 1984, with a first plane (Partenavia P-68 Observer -EC-DTS-) and a Wild RC-10 camera. From then onwards the Flight department has been developed with a human and technical team to undertake the work related to the execution of aerial photogrammetric flights; projects, flight planning, flights, quality control and photographic laboratory.

The most important accomplishments during the last years are:

- 1987.** Increase of the fleet with the plane Cessna Citation I (EC-EDN). Beginning of the high height flights (1:70 000).
- 1989.** Placement of the Flight department in a hangar built at the airport of Barcelona.
- 1991.** Beginning of the photographic laboratory tasks. First camera of new generation (Zeiss RMK Top 15). First flights with the electro-optical sensor CASI. Beginning of the systematic flights in colour. License of Aeronautical Workshop.
- 1993.** Systematic development of all types of flights with the GPS technology on board (to perform the aerotriangulation).
- 1994.** First campaign of flights performed out of Spain: Cartocentro project 1:60 000 (Republic of Venezuela). Installation and work with CCNS-4 assisted navigation systems (IGI, Germany).
- 1996.** Calification of *Trabajos Aéreos* (aerial works) by the Flight department (Dirección General de Aviación Civil -Civil Aviation Head Office).

The basic equipment we have to undertake the flights are:

**Planes.** One Cessna Citation I (EC-EDN) and one Partenavia P-68 Observer (EC-DTS). With both planes we carry out an annual production of 500-600 flying hours.

**Cameras.** Two Wild RC-30 cameras, one Zeiss RMK Top 15 camera, three Wild RC-10 (upgrade GPS) cameras, one electro-optical sensor CASI 501 and one camera for oblique photography 6 cm x 6 cm format (Rolleiflex 6008).

**Focal.** 150 mm (basic), 210 i 300 mm (accessories).

**Additional on board equipment.** Two GPS (Global Positioning System) sets (two GPS Ashtech Z-12 receptors, two laptop computers and two GPS antennas), two standard CCNS-4 assis-



ted navigational sets, one GPS land Station.

**Laboratory.** Kodak Versamat 11C developer (developing in b/w), sensitometre, densitometre and photogrammes reproduction equipment (contacts and slides in b/w). Ordering the developing and copying of colour films to other laboratories (USA, France, etc.). The annual production is 8 000-10 000 meters of film (30-40% in colour).

**Flight control.** Two Zeiss L3 exploration tables, densitometre Screen DM-500, computer sets to do the flight graphics. The annual production is about 17 000-25 000 useful photogrammes.

With these means the following aerial photography flights can be done:

- All types of photogrammetric or non photogrammetric flights (mosaics) with vertical photography of 23 cm x 23 cm format, between 1:1 500 and 1:80 000 scales and utilising b/w panchromatic, colour negatives, colour slide and also b/w or colour infrared film.
- Flights of oblique photography with a 6 cm x 6 cm format.
- Flights with a non photographic sensor; CASI 501 sensor, for environmental purposes.

These flights can be grouped in the following categories which form the basic structure of each flight campaign:

- Territorial flights over Catalonia, in small and medium scale (1:60 000, 1:32 000, 1:15 000).
- Planning flights (town planning and territorial planning), 1:5 000-1:10 000 scales.
- Flights for road network projects, 1:5 000 scale.
- Flights for urban cartography, municipal and metropolitan, 1:3 500, 1:5 000, 1:8 000 scales.
- Specific flights in Catalonia (external projects), at different scales.
- Territorial flights in Spain (external projects), generally at 1:15 000, 1:40 000, 1:60 000 scales.
- Territorial flights in other countries (external projects), generally at small scales (1:40 000-1:60 000).
- Flights of oblique photography.
- Flights with non photographic sensors.
- Test flights with other sets of equipment / sensors.

# Geodesy

The Institut Cartogràfic de Catalunya, is as well, the geodetic agency of the Catalan government. Its activities in the field range from the conventional geodetic surveying tasks to the recently established differential GPS (Global Positioning System) services for real-time and post-process positioning. ICC is also involved in research, development and technology transfer activities to support the latter.

Because of the global nature of geodetic problems and technology, many of ICC's geodetic projects are based on cooperative work with other groups, be it at the local or international level.

## *Geodetic production: products and services*

The ICC co-operates with the Instituto Geográfico Nacional of Spain (National Geographical Institute, IGN) in the establishment and maintenance of the fundamental geodetic network. Though in the advent of GPS this has become less important, some geodetic and topographic surveying practices still rely on the existence of a precise geodetic network. The network is currently being improved: it is becoming high-precision and 3D.

The ICC does also selective network densification in urban areas where the availability of a highly dense network ( $\approx 800$  m inter-point distance) is still necessary.

Coordinates for these points and some other auxiliary information and software are available on-line via BBS and WEB utilities, free of charge.

Geoid undulations are also available through the UB91 local geoid model. UB91 was computed already in 1991 in the frame of a cooperation with the University of Barcelona and the Geophysical Institute in Copenhagen.

GPS permanent stations are becoming the basis of the positioning and navigation services provided by ICC. There are four

of them already established, two additional ones planned for this year and more will come in the future. Data collected at the GPS sites are also available via BBS and WEB. The EBRE station belongs to the IGS (International Geodynamics Service) network.

Differential GPS pseudorange corrections are broadcasted in the RTCM SC-104 format as a public-free service with the RASANT (Radio Aided Satellite Navigation Technique) system. ICC is cooperating with other organisations in the extension of RASANT to the rest of Spain.

## *Geodetic research and development*

ICC does also a limited amount of geodetic research and development to better support its mapping activities. To mention an example, ICC was one of the pioneers in the application at kinematic GPS techniques in photogrammetry.

The Geodesy department cooperates with the Geology department –now an ICC department, formerly a separate organisation– in the collection and analysis of high precision data of tailored GPS networks for seismic hazard evaluation. These two groups were pioneering the introduction of this type of work in Spain.

Currently ongoing projects are the use of inertial techniques for sensor orientation and airborne gravimetry acquisition and the deployment at GPS data broadcasting systems for real-time centimetre level positioning on selected areas.

Last, but not least, ICC is always available to the surveying and academic community for them to take advantage of the existing geodetic infrastructure. Harmonious development and use of geodetic products and services can only be achieved through effective communication between public administration, industry and University.



# Aerotriangulation

The aerotriangulation method is used to solve the problem of the complete orientation of the stereoscopic models. The objective of the method is to determine the terrain co-ordinates of the points of the images, to make the check points lighter (in most cases they are impossible to perform) hence saving time and money.

Going through the development of the method, it is important to bear in mind the big step that was to jump from the analog procedure to the analytic one (with instruments of the Wild A-7 type and adjustment programmes like Schut). From the formation of the ICC in 1982, the analytic method has been utilised with a Wild AC-1 stereocomparator and the ATM programme (adjustment programme for independent models). The following year the aerotriangulation capacity was increased with the acquisition of a Wild BC-1. In 1984 started the production of an adjustment programme by AF0 control strips developed by the Geodesy department at the ICC. In 1988 the geodesic effort was concentrated on the GeoTeX project, a general system on the calculation of networks for geodesy, photogrammetry and remote sensing. It incorporates, as the nucleus of the system, the ACX (Combined Network Adjustment) programme, which allows the integration of different types of observations (photogrammetric, Global Positioning System –GPS–, Spatial, CASI, etc.). In 1990 there was the first test with GPS technology to backup the photogrammetric flights (aerial kinematic control). In 1994 the ICC became one of the pioneering companies in Europe to incorporate this system to all its photogrammetric projects, with the reduction of the check points and the increase in precision, almost doubling the performance of the method. The last jump, after a small period of tests, has been the progressive tendency of the analytical procedure towards the digital aerotriangulation. At present, the problem of the aerial triangulation is focused in the completely automatic digital methods, not only on the measurement methods but also in the compensation and adjustment ones.

# Photogrammetry

From the creation of the Institut Cartogràfic de Catalunya in 1982, the photogrammetry has suffered, inside the ICC, a continuous technological improvement. These technological improvements can be divided into four categories:

- Analogical machines (Wild B-8, A-8, A-7).
- Analogical machines connected to codifiers and PCs (Wild B-8, A-8, A-7 and AMH).
- Analytic machines (Wild BC-1, BC-3 i Zeiss P-3).
- Photogrammetric digital stations (Intergraph-IM6887).

The photogrammetry inside the ICC is divided into five big areas:

Architectural	stereoplotting at 1:50, 1:100, 1:200 scales
Specific projects	stereoplotting at 1:200, 1:500, 1:1 000, 1:2 000 scales
Urban	stereoplotting at 1:500, 1:1 000, 1:2 000 scales
Road network	stereoplotting at 1:500, 1:1 000, 1:2 000 scales
Territorial	stereoplotting at 1:2 000, 1:5 000, 1:10 000, 1:25 000 scales

An example of the stereoplotting process used in each of the areas can be:

Architectural	Seu Vella of Lleida, monastery of Poblet
Specific projects	Segarra-Garrigues irrigation channel
Urban	l'Hospitalet de Llobregat, Granollers, Mancomunitat de municipis de l'Àrea metropolitana de Barcelona (Mancommunity of municipalities of metropolitan area of Barcelona)
Road network	Eix transversal (transverse road)
Territorial	Topographic maps of Catalonia, Balearic Islands, Aigüestortes (natural park)



The most emblematic ground photogrammetry project the ICC has produced is the series *Mapa topogràfic de Catalunya 1:5 000* (Topographic map of Catalonia), which contains 4 269 sheets covering the 3 189 530 hs of Catalonia. This project started in 1988 and the first set of this series ended in 1994, using for its stereoplotting a flight at 1:22 000 scale. This project had 694 fly-overs and 18 000 photogrammes (80% of the longitudinal covering); 8 190 pairs were aerotriangulated using 2 172 check points and obtaining 43 859 aerotriangulated points. The photogrammetric stereoplotting can be divided into 3 phases:

Analogical phase      2 379 900 stereoplotted hectares

Analytic phase            618 900 stereoplotted hectares  
Digital phase            201 197 stereoplotted hectares

A numerical information of 8 538 Mbytes can be obtained and a terrain elevation base of 45 m x 45 m with a precision superior to 2 m of RMS (Root Mean Square).

In 1995 the actualisation of the series was started with IM-6887 digital photogrammetric stations which have a C400-I (Intergraph) processor and a 64 Mb RAM memory. This will create the numerical cartographic base of Catalonia, as well as the 3D base and the road and water network.

## Cartographic Action Programmes

This Cartographic Action Programmes department is in charge of the following tasks:

- **Cartographic design.** Design and definition of all the elements that are part of the new map: symbology, lettering (toponymy, titles, etc.), additional information, etc. This task is carried on considering the general cartographic rules already fixed, and the digital mapmaking processes.
- **Topographic cartography.** Making of topographic bases by photointerpretation of orthoimages, directly from screen, or by generalization of existing cartographic bases. Those bases are used for publishing topographic maps and as bases for thematic maps. Main scales are 1:25 000, 1:50 000, 1:100 000, 1:250 000, and lower ones.
- **Thematic cartography.** Making and publishing maps that deal with specific subjects. According to the information provided by different sources, some classes and the symbology that represents them (shown in the legend) are defined and designed. Main scales are 1:25 000 (soils, geology, avalanches), 1:50 000 (vegetation, tourism and mountaineering) and 1:250 000 (several subjects).
- **Atlases.** Making and publishing atlases about different geographical areas on different scales. General atlases, that provide global information about all the geographical elements of a specific area; and thematic atlases, that provide information about a specific subject regarding also a specific area. Some examples are *Atles topogràfic de Catalunya 1:50 000* (topographic atlas), *Atles comarcal de Catalunya* (regional atlases), *Atles universal català* (world atlas), *Atles climàtic de Catalunya* (climatic atlas), etc.
- **Toponymy.** Building a toponymy database of Catalonia, inserting toponymy in different cartographic materials, validating the toponymy that comes out in the cartographic and bibliographic documents that the ICC publishes. First steps consisted in collecting and locating toponymy obtained through fieldwork with cartography at 1:5 000 scale.
- **Territorial boundary marking.** Technical support regarding the fixing, midification and revision of the territorial boundaries of the local institucions (mainly municipalities). The juridical side is handled by the Direcció General d'Administració Local (Local Administration Head Office). The ICC also keeps up-to-date the map of Catalonia administrative divisions.
- **Publications related to cartography.** Editing and publishing the works done by the ICC as well as the ones done by other organizations or particulars that might be of public or scientific interest. Some examples: books accompanying thematic maps at 1:25 000, 1:50 000 and 1:250 000 scales; monographs on toponymy studies, on history of cartography, catalogues,

etc. Periodicals and serial publications are also included: magazine *TERRA. Revista Catalana de Geografia, Cartografia i Ciències de la Terra*, calendars and bulletins.

- **Prepress and printing.** From the graphic design until the printing process of all the cartographic and bibliographic publications. Text processing and composition, graphic preparation (drawings, pictures), maquette, formatting, photomechanical process, filming and printing.

The tasks of this department are carried on by three units, which have the following names and functions:

### Cartography and territorial boundaries unit

- Cartographic design
- Production of topographic cartography
- Development of thematic cartography
- Territorial boundary marking

### Graphic edition and realization unit

- Manual and digital photomechanical process
- Electronic prepress
- Printing process management

### Editorial and toponymy unit

- Toponymy
- Bibliographic and periodical publications
- Editing texts



# Automatic Cartography

Automatic Cartography department is dedicated to the development of software which allows to automate cartographic processes in order to optimize the use of technical and human resources. The software development includes the study of commercial products, the customization to adapt them to the ICC project specifications and, in some cases, the introduction of improvements or a new functionality.

It is important to note that all the developed tools are integrated in continuous lines of production. Some series include quite a number of intermediate steps, manual computer assisted steps as well as automatic ones; the software assures the continuous workflow of information, safe and ergonomic, between the different production environments.

## Data capture

The data are digitized in three and two dimensions, depending on the project specifications.

The three-dimensional data capture collects planimetric and altimetric data using analytical stereoplotters and digital photogrammetric workstations; for some orthophoto projects the digital terrain model is collected

using automatic correlation and adding some digitalized points on the terrain.

The two-dimensional data are obtained digitizing on the screen using a digital orthophoto, in color or in b/w or digitizing on the paper using a digitizer table.

The software developed for data capture helps the classification, the visualization and the manipulation of the information. It is completed by the data cleaning processes, that includes detection of errors and tools to facilitate its correction.

Some Geographic Information Systems (GIS) projects include, during the data capture, the creation of the database with attributes.

## Cartographic edition

Cartographic edition is the process of preparing the data to be transformed in digital cartographic products or in paper maps.

The software developed includes the tools to facilitate the interactive incorporation of fieldwork data, to warranty the connection between elements and facilitate the creation of polygons, to incorporate the toponymy databases, to generate contour lines from the digital terrain models and to symbolize. The symbolization software includes manual assisted tools to correct the overlapping of elements or to introduce some aesthetic refinements, and automatic tools to substitute symbols, texts or to generate linear and area patterns.

In photogrammetric data capture the information is collected only inside the stereoscopic model, during the editing phase the sheet is extracted automatically from various models. Also the

frames, legends, identifiers, index maps, sheet coordinates, survey points and any other information according to the design of the cartographic serie, is generated by an automatic process.

## Rasterization, lithography and film recording

The software developed to obtain printed maps, allows to substitute the manual photomechanical processes by a digital process. The digital processes manage raster files, therefore the initial phase is the conversion from vectorial data to raster data or rasterization; the lithographic processes allow to obtain the final color separations with reserves and masks, which are film recorded using laser plotters.

## Generalization

During the last years, resources have been dedicated to the field of cartographic generalization. The tasks performed are the evaluation of the commercial software and the development of some generalization algorithms.

The first software evaluated was CHANGE from the German company Zeiss. The results were satisfactory specially in the ge-

neralization of buildings for scales bigger than 1:50 000. At this moment this software is used in the generalization of data from 1:500 and 1:1 000 to 1:5 000.

The second software evaluated was MAP GENERALIZER from Intergraph. The results are also satisfactory. It has been used to obtain the topographic map 1:100 000 from the topographic map 1:50 000, and also in other projects.

Among the generalization algorithms internally developed it is worth mentioning the automatic generation of axes from the two margins of a road or a river, the collapse of areas to points maintaining the orientation of the original area, and others.

## Plotting

At present we are using ten Hewlett-Packard DesignJet (650C, 750C and 750C Plus) inkjet plotters, five for the internal production and five for the distribution of plots in the ICC shops; a Scitex IRIS 3047 inkjet plotter used for color proofing, previous to the publishing process; a 3M sublimation printer of medium size (A3); an Optronics MapSetter 5000 film recorder of big format (100 cm x 127 cm); and a Lynotype 5000 film recorder of medium format (45 cm x 60 cm).

The software developed to support automatic plotting consists of basically the creation of tables with the parameters (line thickness, colours, etc.) and the processes which optimize the creation of plotting files.

An important collection of translators in raster formats is also included in this phase.



# Remote Sensing and Image Processing

The main tasks of the Institut Cartogràfic de Catalunya are performed on an increasing way using digital images. From the beginning a department working on satellite imagery has been established to promote the use of digital images in the cartographic tasks. The strong involvement of ICC in digital data has spread these techniques to many different departments.

Now the Remote Sensing and Image Processing department main operations are distributed in three principal sections:

- The development section is in charge of the maintenance of the computer application and the development of new algorithms oriented to the extraction of information from remote sensing data, the study of new sensors and the analysis of new technologies.
- The image cartography section produces image cartography using remote sensing images and digitized aerial photographs; the main product is the orthophotoimage resulting from the geocorrection of those images.
- The thematic cartography section works with the interpretation and classification of remote sensing images oriented to land use and land cover cartography.

These are a few examples of their activities:

- Production of a satellite map over Argentina at 1:50 000, 1:100 000 and 1:250 000 scale using SPOT and LANDSAT TM images, covering almost 2 200 000 km<sup>2</sup>.
- Production of the orthophotomap covering the full territory of Catalonia at different scales: 1:5 000 b/w, 1:25 000 colour and 1:25 000 IRC.
- Analysis of different data sets including Synthetic Aperture Radar (SAR) images to extract Digital Elevation Models (DEM) using both interferometry and radargrammetry techniques.
- Production of a land use map covering Catalonia at 1:250 000 scale produced combining automatic multispectral classification, expert rules running on an expert system and human image interpretation.
- Management of the Catalonia air photo library including the development of a digital catalog and the on-line access to scanned aerial photography.



# Geographical Information Systems

Institut Cartogràfic de Catalunya activities in Geographical Information Systems (GIS) context focus on two areas, first one related to cartographic and thematic databases generation and integration, and the second one related to application development.

## *Cartographic and thematic databases generation and integration*

The objective is to produce cartographic and thematic databases suitable for its use in GIS applications. In this area, we can point out:

- The cartographic database 1:50 000, which in the current version has been compiled by means of interpretation of digital orthoimages (colour, pixel 2.5 m).
- The administrative boundaries database.
- The 1:5 000 digital topographic cartography, compiled by means of photogrammetric methods. This cartography is now in an updating process.
- The digital terrain model database, a regular grid with a 15 m spacing.
- The colour digital orthoimage (2.5 m pixel) and b/w digital orthoimage (0.5 m pixel).

- The geologic database 1:25 000.
- The snow avalanche zones database.

## *GIS application development*

ICC is at the same time a developer and a user of GIS technology. Some applications are developed in order to cover our own needs and some others to give technical support to other departments in the Catalan Autonomous Government. Some of the projects we can mention are:

- The implementation of a system for the management of regular services for public transportation of passengers by road.
- The development of a control system for the agricultural policy of subsidies for the European Union to the herbaceous and fodder crops surfaces and land abandonment.
- The study of favourable areas for the sitting-up of quarries, taking into account lithological, stone quality and urban planning viewpoints.
- The use of GIS technology as a tool in Intranet and Internet.





# Geology and Geophysics

The Geology department has recently been joined the ICC. Its main activity fields are: geological cartography, engineering geology, geophysics, seismology and natural hazards.

## Projects, products and services

- Geological cartography:
  - Geological map at 1:250 000 scale
  - Geological map at 1:25 000 scale
  - Map of hidrogeological areas at 1:250 000 scale
  - Specific geological studies and cartographies
- Engineering geology:
  - Geological and geotechnical studies for construction industry, urban planning
  - Environmental geology
  - Geological resources
- Geophysics:
  - Gravity map at 1:500 000 scale
  - Aeromagnetic map at 1:250 000 scale
  - Gravimetric network of Catalonia
  - Geophysical prospecting: electrical and seismic
  - Borehole loggin
- Seismology:
  - Instrumental seismic network of Catalonia. Determining earth-

quake parameters, production of seismological bulletins, public information activities

Macroseismic studies of felt events

Instrumental, macroseismic and historical earthquake catalogue and database

Engineering seismology. Local effects, microzoning

- Natural hazards:

Landslides and rock falls

Ground subsidences

Floods

Daily forecasting of snow avalanches in the Pyrenees

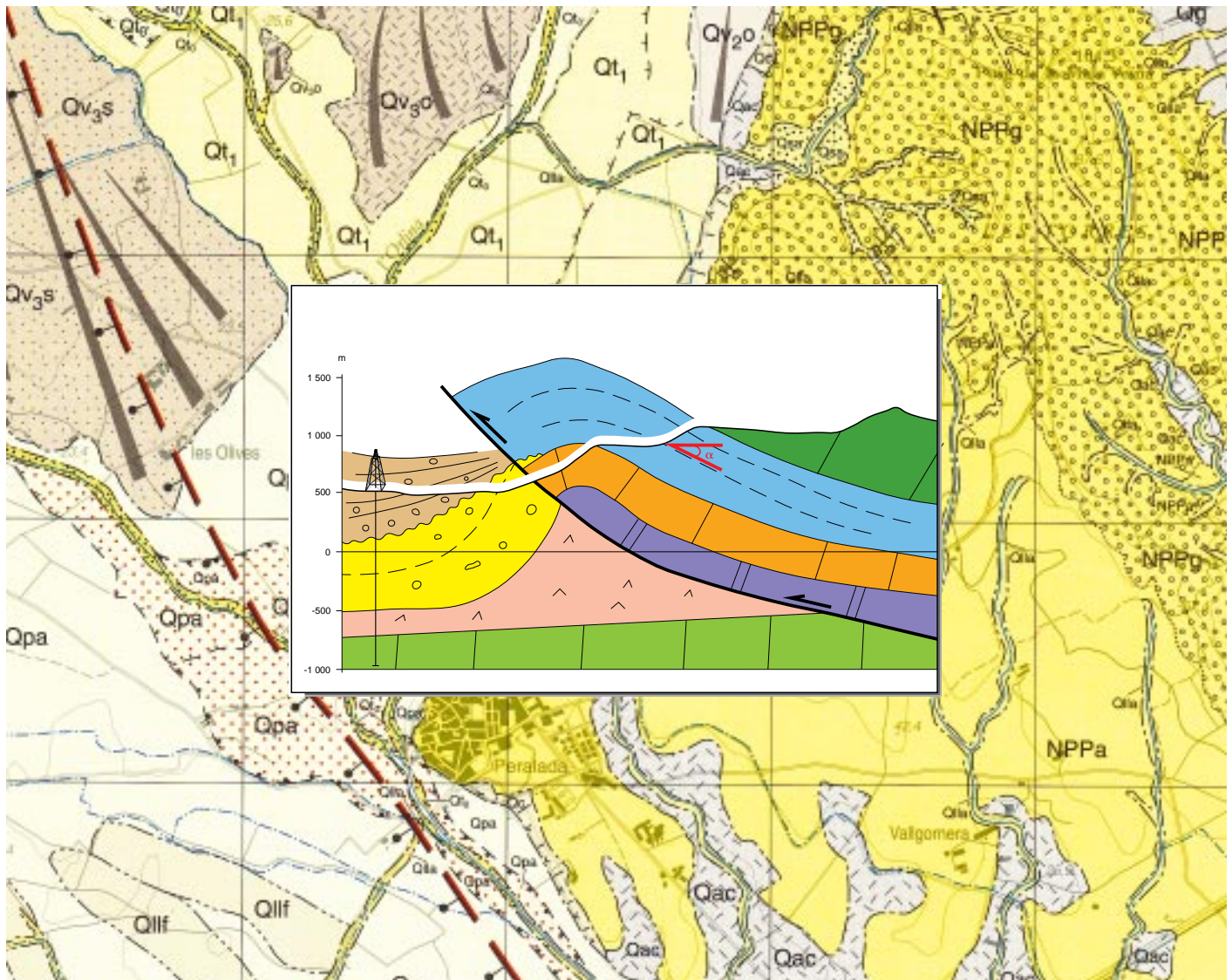
Maps of avalanche zones in the Pyrenees at 1:25 000 scale

Earthquake hazard assessment

Seismic risk. Vulnerability and damage scenarios

## Research and development

The ICC makes important efforts in research and development to support all the above outlined activities. Collaboration with various international organisations is currently carried out. It should be mentioned the participation of the ICC to a number of European Union funded projects, together with different research groups from universities, administration and industry.



# Cartographic Commercial Distribution and Sales

The basic activity of the Cartographic Commercial Distribution and Sales department is to provide the public with the cartography that has been carried out by the ICC. To fulfil this purpose, we have approached the cartography to the customer by means of five centres of customer service and sales distributed among the four Catalan capitals.

The ICC production is based on three major categories: printed items, aerial photography and digital cartography.

**1. Printed items.** This kind of production, either cartographic or bibliographic, has been thought to facilitate the

picking up of the product from the shelf. The most important series are the following:

- Basic cartography of different scales: 1:500 000, 1:250 000, 1:50 000, 1:25 000 and 1:5 000.
- Thematic cartography: Documents with concrete thematic information.
- Other: Bibliographic and periodical printed materials, atlases, etc.

**2. Aerial photography.** The centres of customer service and sales are provided with collections of photogrammetric aerial photographs in b/w and colour that cover the whole territorial exten-

sion of Catalonia in different scales: 1:18 000, 1:22 000, 1:70 000 and partially in 1:40 000 and 1:5 000.

**3. Digital cartography.** This kind of cartography is becoming more known and accepted as time passes by. From the items that the ICC has in digital format and that cover Catalonia we can emphasise the following:

- Topographic map at 1:5 000 scale.
- Cartographic base at 1:50 000 scale.
- Orthophotographic cartography at 1:5 000, 1:25 000 scale b/w and colour.



# Catalonia Map Library

The Catalonia Map Library department was open on March 12th, 1986. Its purpose is to collect, keep and circulate cartographic material. The office timing for the public is from Monday to Friday, from 09.00 am to 17.30 pm.

Its collections are composed by four big files: cartographic file, bibliographic file, photographic file and documentary file. The first one is constituted by maps that cover from the 14th century to our days –the most ancient corresponds to facsimile editions. Concerning contemporary cartography the Catalonia Map Library offer the possibility to consult all the production of the

ICC referred specially to Catalonia and a big collection of series produced by almost the whole world in medium and big scales. Also it is possible to look up an important part of the cartographic collections of the Instituto Geográfico Nacional of Spain (National Geographical Institute, IGN).

The other three files are composed by a specialised library with about 25 000 volumes, a photographic archive with about 100 000 items and the documentary file with some 25 archives.

This is to provide information to the ICC technical staff and to anybody interested in cartography.



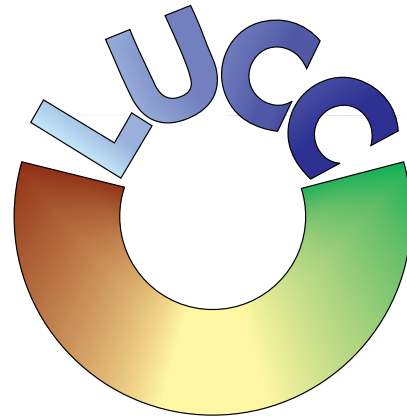
# Land Use and Land Cover Change

The Institut Cartogràfic de Catalunya hosts the LUCC International Project Office, which carries out the organizational, communication, data/information and networking efforts of the Project.

The Land Use and Land Cover Change (LUCC) Project is a Programme Element of both the International Geosphere and Biosphere Programme (IGBP) and the International Human Dimensions Programme for the Global Environmental Change (IHDP). Land use and land cover changes are, at the same time a cause (driving force) and a consequence (impact) of the global environmental change. These changes constitute a known and undisputed aspect of the global change, impacting among others, on climate warming, land degradation and desertification, biodiversity loss, food production and human health. So, we need to know their scale and pace, from which may depend adaptive responses of the environment.

The general objectives of LUCC are *a)* to obtain a better understanding of global land use and land cover driving forces; *b)* to investigate and document temporal and geographical dynamics of land use and land cover; *c)* to define the links between sustainability, and *d)* to understand the inter-relationship between LUCC processes, biogeochemistry and climate. The project is divided in 3 focus areas, namely Focus 1: Land use dynamics, comparative case study approach; Focus 2: Land cover dynamics, empirical observations and diagnostic models, and Focus 3: Regional and global integrated models.

Among the communication activities assumed by the International Project Office (IPO), we can point out the centralization and distribution of mailing and information fluxes; the edition of a newsletter and a series of reports; the building up and production of CD-ROMs containing datasets for regional research projects; the maintenance of a database of LUCC-related scientific community, and the design and maintenance of a Web site at <http://www.icc.es/lucc>. This Web site includes a wide variety of information, such as the LUCC Science-Research Plan, a win-



LAND USE AND  
COVER CHANGE

dow for the LUCC regional research projects, a library of key-papers, a calendar of events, and the application form for LUCC-Status proposals.

Among the scientific functions of the IPO, there can be highlighted *a)* the leadership in data and classification efforts, accomplished through DAPLARCH, a data plan for LUCC constituted by four workshops; *b)* the identification, endorsement and following up of core and contributing LUCC research projects; *c)* support to the network so created, and *d)* the promotion of linkages of LUCC in an institutional approach. In this sense, the IPO is currently involved in co-operation activities with the Directorate General XII within the European Commission, and with the GCTE (Global Change and Terrestrial Ecosystems) and DIS (Data and Information Systems) within the IGBP.

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This information sheet is a free quarterly publication available in Catalan, Spanish and English.  
 Year 2 – Number 3 – June 1997 – ISSN: 1137-2370 – D. L.: B. 40 970-1996

