

**SECFT**

SPANISH SOCIETY  
FOR CARTOGRAPHY,  
PHOTOGRAMMETRY  
AND REMOTE SENSING

National Report to the International Cartographic Association's  
16<sup>th</sup> General Assembly 2015 Rio de Janeiro, Brazil



**2011**  
**National Report of Spain**  
**2015**

XXVII International Cartographic Conference  
International Cartographic Association. ICA

23rd-28th August 2015, Rio de Janeiro, BRAZIL

# Board of the Spanish Society for Cartography, Photogrammetry and Remote Sensing (Sociedad Española de Cartografía, Fotogrametría y Teledetección, SECFT)

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This Board was renewed at the Ordinary General Assembly of the Spanish Society for Cartography, Photogrammetry and Remote Sensing, held in Madrid, on November 25, 2014

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MR. ADOLFO DALDA MOURÓN and MR. MILAN KONECNY, all of them for their dedication and services  
to the Spanish Society for Cartography, Photogrammetry and Remote Sensing.



**National Report to the International Cartographic Association's  
16<sup>th</sup> General Assembly 2015 Rio de Janeiro, Brazil**



**XXVII International Cartographic Conference  
International Cartographic Association. ICA**

**23rd-28th August 2015, Rio de Janeiro, BRAZIL**

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# Presentation

**DR. FRANCISCO JAVIER GONZÁLEZ MATESANZ**

*Presidente of SECFT*

**T**he 27th International Cartographic Conference, 16th General Assembly to be held in August in Brazil will be not only a great opportunity of knowledge exchange between different mapping organizations around the world but a real challenge to redesign the world as cartographers have been done since the beginning of time. This time the title of the event is "Maps Connecting the World", something that have been done from the cartographers for a long time and now, absolutely mandatory since all world is connected because all the events that happens on it are also connected.

Nowadays it is not common at all to have a map without a spatial database, not only to provide more efficient way to produce up to date maps but to give specialized user a Geographical tool where ask the database as many queries from every point of view and, obviously to retrieve the desired information. From the general user's point of view, the database has to be accessible, up to date and easy to use.

The challenge without any doubt is to have the most sensitive objects in the database updated, then the classic production workflows turns unaffordable as far as they are maintained as a whole. A strategy change arises, keeping updated the core information, so called Reference Geographical Information. Such information needs to be fast as possible, reliable, and consistent with the rest of the geographical objects and with the maximum resolution allowed. This strategy not only allows a competitive geographical information compared with other commercial services but to keep the cartographic products and any other GIS services updated continuously with fresh information.

The Spanish Society for Cartography, Photogrammetry and Remote Sensing (SECFT) provides a great interest on this strategic approach because some members of the executive board are involved on this transformation. On this occasion in Rio do Janeiro we want to present this Spanish National Report as a good example of that interest. With it we want to present the most important achievements of the Spanish activity both in geographical information and in cartography.



Board of the Spanish Society for Cartography,  
Photogrammetry and Remote Sensing  
(Sociedad Española de Cartografía, Fotogrametría  
y Teledetección, SECFT)



## Introduction

The SECFT represents both the International Cartographic Association (ICA) and the International Society for Photogrammetry and Remote Sensing (ISPRS) in Spain. (According to this) In that capacity, SECFT has been present in the last few years, in biannual international conferences organized by the ICA, and in 9 –generally quadrennial– conferences organized by the ISPRS. Moreover, it has represented our cartographic sector in the general assemblies of the ICA, as well as the photogrammetry and remote sensing sector at the general meetings of the ISPRS.

It is worth noting the work done by our Society in organizing the contribution of the Spanish cartography at the international exhibitions of maps of the Cartographic Conferences of the ICA during the past 20 years. We should also note that, in recent years, the Spanish cartography has been one of the most awarded in various exhibitions held in conjunction with international cartographic conferences. This has happened in Barcelona in 1995, in Ottawa (Canada) in 1999, in Durban (South Africa) in 2003, in A Coruña in 2005, in Moscow in 2007, in Santiago de Chile in 2009, in Paris in 2011, and finally, in Dresden in 2013. Our Society contributes, promotes and organizes, with great pride and satisfaction, the Spanish participation in these exhibitions, something that has been recognized since the various respective juries have awarded several prizes to our maps.

One of the main objectives of these meetings is to facilitate the exchange of knowledge and experiences among professionals who either develop their work in the academic world, in the official cartographic agencies, or in companies specialized in these sectors. In this respect, the (diverse) several reports of activities presented at the respective International Cartographic Conferences play an important role, for they constitute an essential tool for knowing and becoming acquainted with the current cartographic knowledge, trends, and working methods of the different countries of the world. The SECFT Board has been paying special attention to the preparation of reports on the different activities, for they are very useful in promoting and showing the goals achieved between meetings, as well as a great source of historical information on the achievements of the cartographic development along time.

Nowadays, on both the SECFT webpage [www.secft.es](http://www.secft.es), in its “PUBLICATIONS-National Reports” section, as well as on the ICA webpage [www.icaci.org](http://www.icaci.org), in the “MEMBERS-National Reports” section and in the Archive, the latest reports submitted from 1999 to 2011 can be consulted online, for the last three year periods 1999-2003, 2003-2007, 2007-2009, 2007-2011 and 2011-2013.

The role of the Spanish participation in international conferences has been growing steadily, as can be concluded just observing the last one, held in 2013 in Dresden, Germany; and we hope that this contribution will remain so important in the next one, to be held this year 2015 in Rio de Janeiro (Brazil). Without any doubt, we are now a country closely linked with the ICA, and one of the countries that contributes clearly to

the international cartographic community. Spain is the only country in the world that has hosted three international cartographic conferences, in Madrid in 1975, in Barcelona 1995, and finally, in A Coruña in 2005. We have been collaborating actively with the ICA for more than 50 years, since its creation in 1959.

The Society continues to participate actively in various projects of the ICA; this year we participated in the two ICANEWS Bulletins published by the ICA, <http://icaci.org/ica-news/> in the ICANEWS 62 June Bulletin (see Figure 1), we presented an article by the then SECFT president Ramon Lorenzo on the Society, and its national and international activities, that will probably help to increase the knowledge and awareness about the SECFT between the diverse members and collaborators of the ICA.

## profiles sociedad española de cartografía, fotogrametría y teledetección

[www.secft.es](http://www.secft.es)



SPANISH SOCIETY FOR CARTOGRAPHY, PHOTOGRAMMETRY AND REMOTE SENSING

The Sociedad Española de Cartografía, Fotogrametría y Teledetección (SECFT) / Spanish Society for Cartography, Photogrammetry and Remote Sensing was founded in 1977 with the purpose of integrating a wide range of activities in the field of cartography and photogrammetry into a single society. The SECFT is a non-profit organisation with full legal status and capacity to operate. One of its aims is to provide continuity of the work carried out since 1927 by the then major Spanish cartographic institutions.

Since its beginnings, SECFT is closely linked with the ICA; its members participate in many activities, from representation on the ICA Executive Committee to the work in many ICA Commissions and Working Groups. The Society was involved in the organisation of three International Cartographic Conferences: 7th ICC in Madrid in 1974, 17th ICC in Barcelona in 1995 and 22nd ICC in A Coruña in 2005. Thus Spain is the only country in the world to have hosted three ICA Conferences.

Since its foundation, SECFT is preparing and presenting reports on the activities carried out by Spanish cartographers. These are presented at the ICA Conferences and General Assemblies, as well as other ICA events. The Society also coordinates contributions to the International Cartographic Exhibitions and the Barbara Petchenik Children's World Map Competitions, which – over the years – received many awards. These successes are a testimony to the quality of entries from Spanish cartographers, and cartographic organisations and institutions.

Members of the SECFT promote projects, developments and activities in the field of cartography and geographic information for the benefit of the Spanish cartographic sector at both local and international level. They currently participate in the work of the ICA Commissions such as Atlases, Cartography and Children, and others. As a result of this work, the SECFT informs its members about topics of interest in world cartography and

regularly offers updates related to cartography. In addition, the Society publishes a biannual newsletter *Boletín Informativo de la SECFT*, which is available from the SECFT website.

Ramón Lorenzo | President | Spanish Society of Cartography, Photogrammetry and Remote Sensing | Spain ●

Members of the SECFT Executive Committee and Associates: (from left) Juanma Rodríguez (Treasurer), Pilar Sánchez-Ortiz (Secretary General), Francisco Dávila (Associate), Águeda Sauco (Member), Fernando Aranz (Member of Honor), Dolores Abad (Vice Secretary for Cartography), Carmen Carmona and Alfredo del Campo (Associate) and F Javier G Matesanz (Vice Secretary for Photogrammetry) | Photograph courtesy of Pilar Sánchez-Ortiz



Figure 1

On the sad occasion of the passing away of our beloved president Ramón M. Lorenzo, on September 12, 2014, an obituary reporting this sad loss was published in the ICANEWS 63 December 2014 Bulletin (see Figure 2); this information was previously posted on the website of the ICA [www.icaci.org](http://www.icaci.org) in September 2014, and the remembrance, written and signed by General Secretary Pilar Sanchez-Ortiz on behalf of the SECFT, was published on the website and sent on a printed note to ICA members in December 2014.

## obituary

### Ramón M Lorenzo

06.07.1945 – 12.09.2014



Ramón M Lorenzo was born on 6 July 1945 in Foz, Lugo Province, Spain.

His education was influenced by the world of cartography and geographic information since his studies at the Naval School where he

became an officer in the general Navy corps. His first specialisation was nautical charting, which he studied between 1973-1974 at the Hydrographic Institute in San Fernando, Cadiz. At that time he was also a lecturer aboard the *Juan Sebastian Elcano* training ship and until 1976 participated in drawing nautical charts for the island of Mallorca.

He joined the corps of geographical engineers and between 1976-1977 attended the specialisation course at the National Geograph-

ic Institute (IGN). Upon completing the course he started his professional career at IGN, first being in charge of the National Topographic Map 1:25,000. Two years later, he took up the position of Director at the new IGN office in Galicia, located in A Coruña, where he carried out extensive cartographic activities until 1989.

From 1989, he was Director of the National Geographic Information Centre, where he promoted a wide-ranging project for the development, implementation and use of new geographic information technologies in both the public and private sectors.

During 1998-1999, he was a Spanish delegate to the European Commission for the development of the Galileo project, a European Satellite Navigation System, and participated in numerous meetings of its Steering Committee. In 1999, he was a Spanish delegate to the United Nations Conference on the exploitation and peaceful use of outer space (UNISPACE III).

From 2000-2012, he was Director of the Publications Office at the Spanish Ministry of Public Works. He was responsible for the Official Road Map of Spain, published in both CD-Rom and printed book formats.

He spoke at numerous conferences about cartographic developments and their application in his career. He also published widely,

primarily in journals specialising in geographic information. In 2001, he produced a book *Cartography: Urban Planning and Property Development*, published by CIE-Dossat.

His teaching experience was extended as a lecturer in cartography on the Advanced Course on Property Management and Analysis, at the Comillas Pontifical University in Madrid. In 2002 he started teaching the cartography module in the "Advanced Course for Specialisation in Planning and Territorial Development" at the University of Santiago de Compostela as well.

Ramón M Lorenzo was decorated the Knight Commander of the Spanish Order of Civil Merit in 1982 and of Spanish Order of Isabel la Católica in 2003.

Between 2003-2007, he served as Vice President of the International Cartographic Association (ICA) and in 2005 received a Diploma for outstanding services to the ICA. He was President of the 22nd International Cartographic Conference organized in A Coruña in July 2005.

Ramón M Lorenzo was President of the Spanish Society of Cartography, Photogrammetry and Remote Sensing from 1996 to 2014.

Pilar Sanchez-Ortiz | Spanish Society of Cartography, Photogrammetry and Remote Sensing | Spain

Figure 2

It's also worth noting that one of the most important works of collaboration between ICA and SECFT took place last year (2014). This task consisted in accepting and completing the translation into Spanish, from its original English, of the book "The World of Maps", ("El Mundo de los Mapas" in Spanish), a project carried out in order to facilitate the access to this document of geographical interest to the international Spanish speaking cartographic community, along with its original English version, and a French translation.

The proposal was made by the ICA to the SECFT, by the representatives Bengt Rystedt and Ferjan Ormeling, managers and coordinators of the ICA International Project known as **IMY 2015-2016, International Year of the Map 2015-2016**, for the years 2015 - 2016. Due to this event, ICA is carrying out a series of activities, and among them, is the edition, publication and free distribution of this aforementioned book ("The World of Maps"). This book initially written in English by experts in cartography and geographic information, that are related in one way or another to the world of cartography and especially to the ICA, will be available for free downloading via the ICA webpage [www.icaci.org](http://www.icaci.org), and in order for this document to receive the maximum exposure, its officials and organizers proposed to the SECFT this collaboration, considering it the appropriate institution to carry out the translation into Spanish of the book.

After carefully studying the advantages and disadvantages of the proposal, the SECFT Board, accepted the challenge.

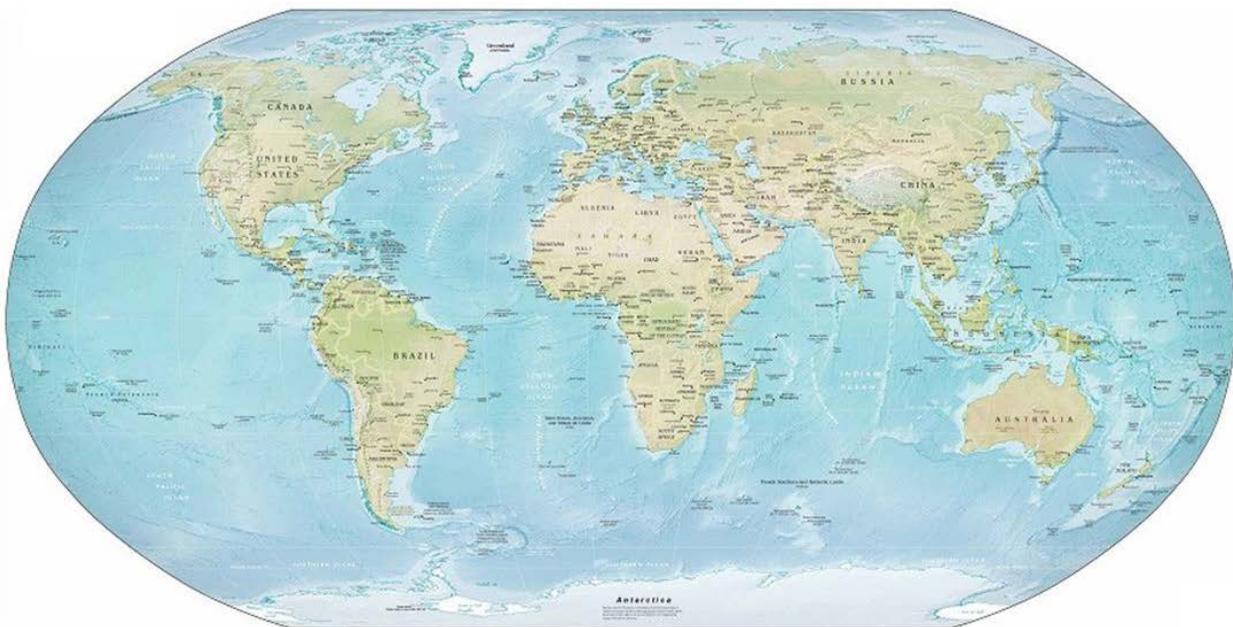
After many a great effort, the translation was finished on December 10th, 2014 and all the bureaucratic and economic efforts were successfully carried out for all employees and collaborators involved in the project, including the translator, the IGN and the SECFT, as

well as Bengt Rystedt, Ferjan Ormeling (coordinators of the International Project of the ICA IMY 2015-2016) and all the authors of the book.

The SECFT, is very satisfied with the results, because it has managed to meet a new challenge, that already has and will further have a future appreciation from the national and international cartographic communities, and is also an important contribution to the International Year of the Map 2015-2016, this important event that will be officially launched in August 2015, and will continue until 2016. On December 22th, 2014 the SECFT received a letter from the President of the ICA and the heads of the IMY 2015-2016, congratulating us for the work accomplished.

In connection with the ICA we should also note that the SECFT has accepted the proposal made by some members of the Board of Directors of ICA to the SECFT in order to present its General Secretary Pilar Sanchez Ortiz's candidacy to Vice-President of the ICA in 2015. The aforementioned G. S., has studied and considered this proposal with both the Board of Directors of the SECFT, and with the National Geographic Institute (Instituto Geográfico Nacional, IGN) managers, institution where she is currently working at and that has supported her in institutional and financial matters, real important aspects in order for her to achieve successfully future tasks at the ICA.

## *El mundo de los mapas*



International Cartographic Association  
Association Cartographique Internationale



Grupo de Trabajo del Año Internacional del Mapa

Editores: F. Ormeling y B. Rystedt  
© ICA y los autores

WE MAPS  
INTERNATIONAL MAP YEAR 2015-2016

SECFT

SOCIEDAD ESPAÑOLA DE CARTOGRAFÍA, FOTOGRAFÍA AEREA Y TELEMETRÍA

Traducido por J. M. García-Courel



Figure 3

The General Secretary reported that, in order to carry out the work of translating the Book of the ICA, and similar future projects, the SECFT have made several administrative formalities to ensure the best result as possible, that were made in conjunction by General Secretary Pilar Sánchez-Ortiz and Treasurer Juan Manuel Rodriguez, always having the support of President Ramon Lorenzo, after months of administrative efforts, which started on August 12th, 2014, in the Translation and Conference and Exhibition activities. With this first objective already achieved, we can say that we have successfully passed the first cartographic challenge that the ICA had proposed us: the translation of the book "The World of Maps", and as can be seen in Figure 3, where all the logos of the participants institutions appear, this great achievement can open up the possibility of carrying out other future collaborations projects of interest to the SECFT.

On the occasion of the 27th International Cartographic Conference in Rio de Janeiro, ICC2015 to invite participants in the International Cartographic Exhibition ICC2015 National Report Summary 2011-2015, and the 2015 International Competition Barbara Petchenik, and to encourage to participation in these important events of the congress, the links that allowed access to participating in these activities, have been enabled on the web page [www.secft.es](http://www.secft.es) (see Figures 4 and 5).

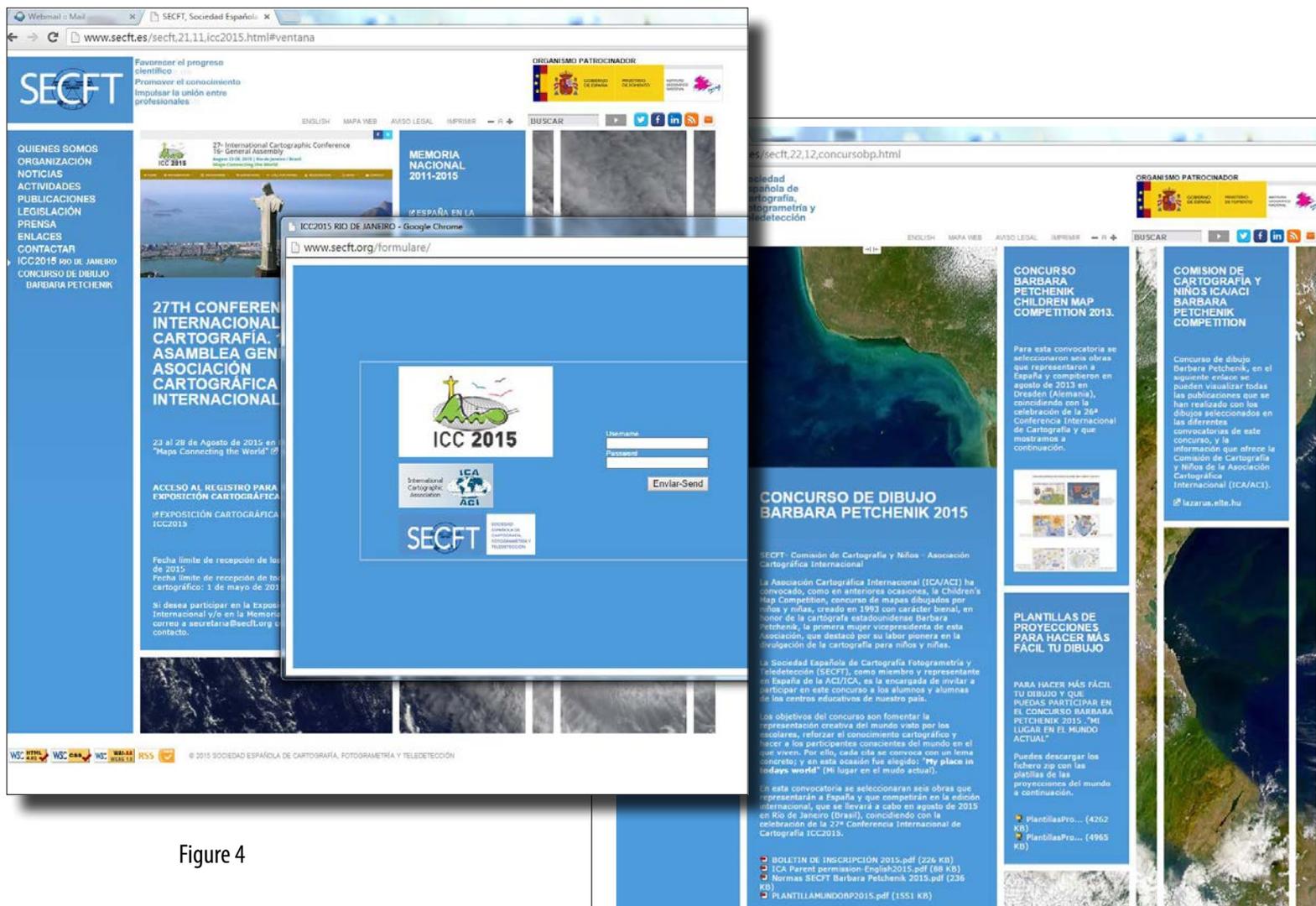


Figure 4

**BARBARA PETCHENIK CHILDREN MAP COMPETITION 2015**

The six drawings selected in Spain to participate in the International Competition Barbara Petchenik in 2015, to be held at the XXVII International Cartographic Conference ICC 2015 in Rio de Janeiro (Brazil), are:



My places in the universe  
Martin Monreal (age: 7)  
C.P Jimenez de Jamuz (León)



Take care of the world like you take care of your-self  
Joselin Romero (age: 12)  
IES Complutense -Alcalá de Henares (Madrid)



Big world, small people  
Carlos Montalvo (age: 12)  
Colegio Arturo Soria (Madrid)



We make our world  
Marina Buitrago (age: 12)  
IES Atenea-Alcalá de Henares (Madrid)



We are the World  
Nuria Rojas (age: 12)  
IES Atenea-Alcalá de Henares (Madrid)



All together for a solidarity world  
Nicole Abreu (age: 12)  
IES Atenea-Alcalá de Henares (Madrid)

Figure 5

## SECFT newsletter

The Spanish Society for Cartography, Photogrammetry and Remote Sensing (SECFT) was created in 1977, and already has more than 30 years of existence. Throughout this long period of time, the SECFT has devoted its efforts to the dissemination of national and international initiatives related to cartography, photogrammetry and remote sensing; for this reason, we have established the SECFT Newsletter, which will be edited every six months, and in which we will continue to maintain the promotion of knowledge of what is emerging in these fields of activity. The Newsletter complements the information which we already provide through our website [www.secft.es](http://www.secft.es), enabling it to be directly accessible to the professionals of these sectors who work either in government, at universities and / or in the business world. In 2013 we successfully completed Newsletters Nos. 10 and 11, with a total of 28 articles (and there are already 14 published newsletters: 0-1-2-3-4-5-6-7-8-9-10-11-12-13), and we continue to work, requesting support and collaboration from our partners.

Following are the front pages of Newsletters 12 and 13 (see Figures 6 and 7).

# BOLETÍN INFORMATIVO DE LA SECFT

SOCIEDAD  
ESPAÑOLA DE  
CARTOGRAFÍA,  
FOTOGRAMETRÍA  
Y TELEDETECCIÓN

N.º 12 • JULIO 2014

Favorecer el  
progreso científico  
Promover el  
conocimiento  
Impulsar la unión  
entre profesionales

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## Tesoro del Atlas Nacional de España

### El primer buscador de un atlas temático

**E**l Tesoro del Atlas Nacional de España (ANE) supone la catalogación de todo el contenido temático del ANE, mediante la organización de las palabras clave o descriptores que describen los recursos en sus distintas ediciones: «ANE 1955-1985», «ANE 1986-2008, Grupos temáticos» y el Sistema de Información del Atlas Nacional de España en internet (SIANE), SIANEWEB 2010-2014. La utilización de un tesoro como motor de búsqueda en un atlas es un proyecto innovador. Además, en los próximos meses se dispondrá de una aplicación informática, basada en el tesoro, que se convertirá en la herramienta de consulta, recuperación y visualización de los recursos del ANE.

Las palabras clave, incluidas como metadato obligatorio en la Norma ISO-19115 (Información Geográfica. Metadatos), pueden ser listas sin relaciones ni jerarquización, pero lo más deseable es crear un tesoro. El Tesoro del ANE se ha creado según la Norma ISO UNE 50-106:1990: *Directrices para el establecimiento y desarrollo de tesoros monolingües* (versión en español de la Norma ISO 2788-1986: *Guidelines for the establishment and development of monolingual thesauri*), norma básica de creación de tesoros que recoge la normalización de la terminología, las pautas y las posibles metodologías que deben seguirse. Se trata de un vocabulario creado con un lenguaje de indicación controlado, tanto en la forma como en la función de los descriptores.

El método de construcción del tesoro ha sido inductivo, se ha partido de unas categorías genéricas, correspondientes a la estructura temática del ANEXI y, mediante un análisis conceptual, se han seleccionado y priorizado los términos descriptores que conceptualizan los recursos de los grupos temáticos. Esta etapa de selección y priorización es la más compleja y minuciosa en la elaboración de un tesoro. Este proceso está ligado a la recuperación de la información, de tal forma que el éxito en las búsquedas depende de la facilidad de ajustar un término específico con la descripción y caracterización de un recurso. Por otro lado, la estructuración temática conlleva dificultades en cuanto a la adscripción de los términos a uno u otro tema, ya que hay descriptores de un determinado grupo temático que, desde un punto de vista científico, podrían figurar entre los términos preferentes de otro grupo, siendo necesario establecer un equilibrio entre el punto de vista científico y la estructura temática del ANE. Tanto en la fase de recopilación de términos descriptores como en la posterior selección y clasificación se han consultado tesoros generales y especializados, obras científicas, organismos oficiales y profesionales.

Los términos preferentes o descriptores son las entradas principales a cada uno de los conceptos incluidos en el Tesoro ANE. Las funciones otorgadas a los descriptores permiten establecer las **relaciones de equivalencia, jerárquica y asociativa** entre los términos. El correcto establecimiento de las relaciones facilita al usuario las búsquedas y el acceso a conceptos tratados desde diferentes puntos de vista en el ANE.

**La relación de equivalencia** se establece entre los términos preferentes y los no preferentes (Usado por/Used for) que son sinónimos, o casi sinónimos, o también puede tratarse de términos que representan conceptos opuestos analizados en un mismo recurso (feminidad/masculinidad).

**La relación jerárquica** estructura los temas en varios niveles de subordinación, desde la clase más amplia al concepto más concreto, mediante los términos cabecera (Término Cabecera/Top Term) que son las clases más amplias dentro de cada tema del ANE.

**Para contactar**

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**NUEVOS SOCIOS:** Si quieres ser miembro de la SECFT, puedes descargar la solicitud en [www.secft.es](http://www.secft.es), cumplimentarla y enviarla a: [secretaria@secft.es](mailto:secretaria@secft.es)

**Boletines anteriores:**  
[www.secft.es/asecft46publicaciones.html](http://www.secft.es/asecft46publicaciones.html)

# BOLETÍN INFORMATIVO DE LA SECFT

SOCIEDAD  
ESPAÑOLA DE  
CARTOGRAFÍA,  
FOTOGRAMETRÍA  
Y TELEDETECCIÓN

N.º 13 • DICIEMBRE 2014

Favorecer el  
progreso científico  
Promover el  
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Impulsar la unión  
entre profesionales

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## En memoria de Ramón M. Lorenzo, impulsor de la Cartografía Española en el Mundo

La Sociedad Española de Cartografía, Fotogrametría y Teledetección (SECFT) ha vivido con tristeza la pérdida de quien fue su presidente durante casi veinte años; uno de los grandes impulsores de la cartografía española en el ámbito nacional e internacional.

Ramón Lorenzo nació en Foz (Lugo) el 6 de julio de 1945 y falleció en A Coruña el 12 de septiembre de 2014.

Realizó su formación como Oficial del Cuerpo General de la Armada en la Escuela Naval Militar de Marín (1968). Muy pronto orientó su actividad hacia el mundo de la cartografía, al ser destinado como profesor en el Buque Escuela Juan Sebastián de Elcano (1972-73).

Esta experiencia le permitió especializarse en Hidrografía en el Instituto Hidrográfico de la Armada (1974), donde realizó el levantamiento de cartas náuticas en la costa de Mallorca; este primer encuentro con la cartografía le animó a continuar estos estudios geográficos con el ingreso en el Cuerpo Nacional de Ingenieros Geógrafos del Instituto Geográfico Nacional (1976).

A partir de ese momento desempeñó trabajos de responsabilidad dentro de la cartografía oficial española.

Fue el primer Director del Servicio Regional del Instituto Geográfico Nacional (IGN) en Galicia (A Coruña, 1979-1990). Assumiendo la responsabilidad de iniciar, promover y desarrollar las áreas de cartografía, geodesia, nivelación deslindes y Catastro Topográfico Parcelario y la representación del IGN en esa Comunidad Autónoma.

Primer Mapa Autonómico de Galicia a escala 1:250.000 realizado por la Delegación del Instituto Geográfico Nacional en A Coruña en colaboración con la Junta de Galicia (1981)

**Para contactar**

SOCIEDAD ESPAÑOLA DE CARTOGRAFÍA, FOTOGRAMETRÍA Y TELEDETECCIÓN (SECFT)

C/ General Ibáñez Ibero, 3  
28003 Madrid  
T.F. +34 91 2502289  
e-mail: [secretaria@secft.es](mailto:secretaria@secft.es)

**NUEVOS SOCIOS:** Si quieres ser miembro de la SECFT, puedes descargar la solicitud en [www.secft.es](http://www.secft.es), cumplimentarla y enviarla a: [secretaria@secft.es](mailto:secretaria@secft.es)

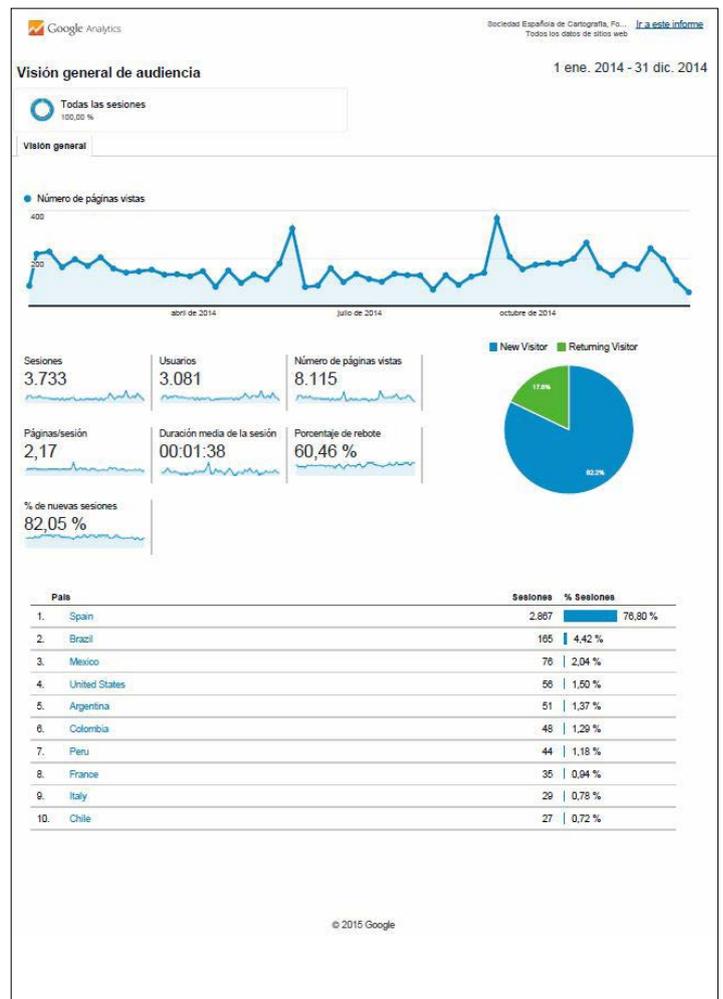
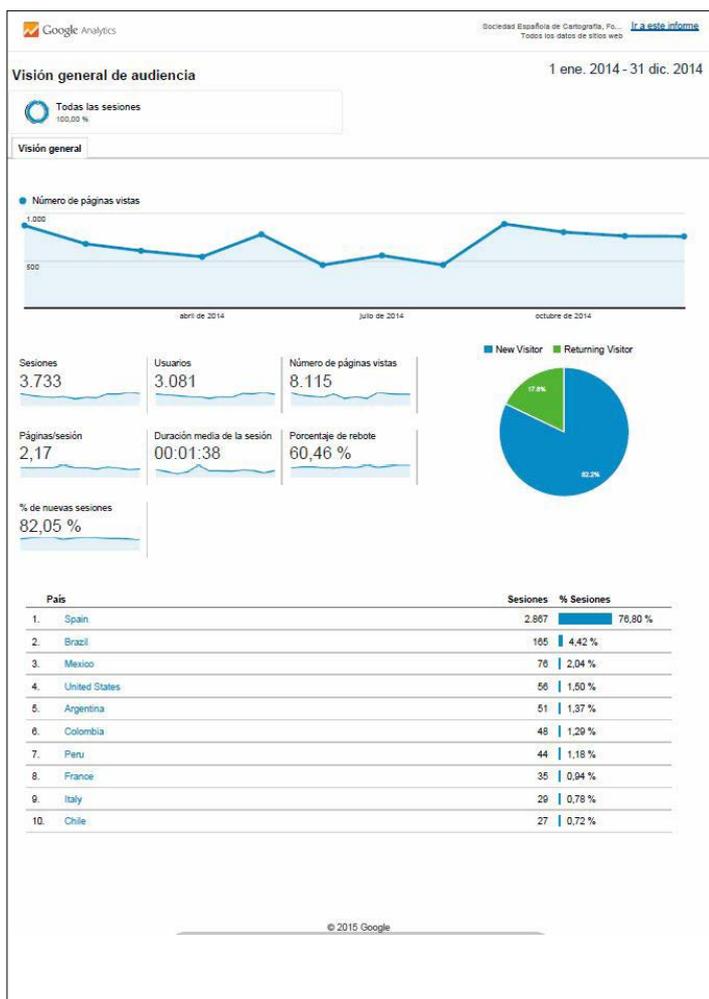
**Boletines anteriores:**  
[www.secft.es/asecft46publicaciones.html](http://www.secft.es/asecft46publicaciones.html)

Figures 6 and 7

**www.SECFT.es: SECFT webpage, information highlights and updating.**

Throughout 2014 we have continued to promote and divulge information related to cartography and geographic information systems activities in Spain and abroad, keeping up and updating our webpage [www.secft.es](http://www.secft.es) contents.

The SECFT is continuously updating its website in all those issues that our partners offer and demand us, and we also try to present all the new information related to the different activities as quickly as it is possible.



Figures 8 and 9

Last year we conducted a study on Google Analytics and the access data vary greatly in comparison to previous reports; in the case of this report on Google Analytics, the data that can be extracted are only referred to visits, and each visit accounts only regarding the page display, not the items that it includes (images, etc), explaining thus the much lower numbers.

According to the report, the number of visits to the website in 2014 was of 8,115, which is the amount of times that SECFT website was accessed.

The days with most visits to the web, as obtained from the weekly reports are:

- Week of September 14th: 369 views
- Week of May 25th: 325 views
- Week of November 2nd: 266 views
- Week of December 7th: 242 views

And the months with the most number and the least number of visits, are:

- January: 869 visits (the highest number of visits)
- September: 885 visits (second highest number of visits)
- June: 452 visits (the lowest number of visits)

See graphics and analysis in Figures 8 and 9

### Collaboration agreements between SECFT and other Societies and Institutions

In the year 2014, the collaboration agreement between the National Geographic Institute (Instituto Geográfico Nacional, IGN) and SECFT, was materialized in a very important collaboration: the Spanish translation of the book “The World of Maps”, which was previously mentioned when discussing the activities carried out by the SECFT, and that collaboration can be seen on the cover of the book, Figure 3, where the logos of both participant institutions appear, something which is reflected in the collaboration agreement IGN-SECFT.

As is the dissemination of all kinds of own documents and research through its website, [www.secft.es](http://www.secft.es), in all national and international initiatives related to the SECFT activities.



And in particular the development of projects and programs of diffusion and dissemination of cartography and geographic information, promoting study meetings and forums on matters of common interest.

The IGN still keeps in its web homepage ([www.ign.es](http://www.ign.es)) the link to the SECFT website; see Figure 10.

Figure 10

Within the SECFT relationships with various institutions in this year 2014, two events were held with representatives of the Royal Geographical Society (Real Sociedad Geográfica, RSG), the National Geographic Institute (IGN) and the Association of Spanish Geographers (Asociación de Geógrafos Españoles, AGE), RSG-SECFT-IGN-AGE. Attached is an image of the events held with the logos of the collaborating institutions, among which is the SECFT.

On the occasion of the exhibition called "La Real Sociedad Geográfica en la Biblioteca Nacional de España. Geografía, Colonialismo y Enseñanza en la España de la Restauración" ("The Royal Geographical Society in the National Library of Spain. Geography, colonialism and education in the Spain of the Restoration") that the Royal Geographical Society (RSG) presented from February 4th to May 18th 2014 in the "Sala de las Musas" (Hall of the Muses), at the National Library of Spain (Biblioteca Nacional de España, BNE), some of the most important pieces of the cartographic and bibliographic collection of the Royal Geographical Society, deposited in the National Library of Spain since 1971, were brought together.

Among the activities carried out at the BNE, during this exhibition, were a series of conferences and workshops. The General Secretary of the SECFT, along with Cristina Rodríguez, another member of the SECFT, teaching lessons for free at the workshop "Didactic applications of the National Atlas of Spain" (see Figure 11).

**COMISARIOS**  
Carmen Lliber Mayo y Fernando Arroyo Ilera

**CONFERENCIAS**  
Jueves 6 de febrero, a las 19:00 h.  
*La Real Sociedad Geográfica en la BNE, razones y sentido de una exposición*  
Carmen Lliber Mayo y Fernando Arroyo Ilera, comisarios de la exposición y miembros de la RSG.  
Salón de actos, planta 0

Miércoles 12 de febrero, a las 19:00 h.  
*Mapas y cartógrafos en la Real Sociedad Geográfica*  
Rodolfo Núñez de las Cuevas y José Cruz Almada, ingenieros geógrafos, miembros de la RSG.  
Salón de actos, planta 0

**TALLERES**  
LAS NUEVAS TECNOLOGÍAS EN EL ESTUDIO DEL TERRITORIO

- Los SIG y la cartografía:  
– Itinerario por las murallas de Madrid.  
M<sup>a</sup> Luisa Lázaro y Torres (RSG y UCM).  
– Georreferenciación y cartografía.  
ESRI España.
- Aplicaciones didácticas del Atlas Nacional de España.  
Pilar Sánchez Ortiz y Cristina Rodríguez Díaz (RSG, IGN y SECFT).
- Iniciación a la Teledetección.  
Emilio Chuvieso (RSG, UAN-I).

Información de fechas y horarios en [www.bne.es](http://www.bne.es)  
Para talleres escolares y familiares consulte información en [www.boe.es](http://www.boe.es)  
Impartidos por Miriam Serrano

Colaboran

Paseo de Recoletos 20  
28071 MADRID

TELÉFONOS  
91 580 78 00 (Centralita)  
91 580 78 03 / 48 (Información)  
91 580 77 59 (Museo)

Info@bne.es  
museo@bne.es  
[www.bne.es](http://www.bne.es)

TRANSPORTES  
Metro: línea 4, estaciones de Colón y Serrano  
Autobuses: 1, 5, 9, 14, 19, 21, 27, 37, 45, 51, 53, 74, 150  
RENFE: estación de Recoletos

HORARIO EXPOSICIÓN  
Martes a sábados de 10:00 a 20:00 h.  
Domingos y festivos de 10:00 a 14:00 h.  
Último pase 30 minutos antes del cierre  
Entrada gratuita

*La Real Sociedad Geográfica*  
en  
*La Biblioteca Nacional de España*  
Geografía, colonialismo y enseñanza en la España de la Restauración

MUSEO DE LA BIBLIOTECA NACIONAL DE ESPAÑA  
Sala de las Musas

4 de febrero - 18 de mayo de 2014

Geografía de Martín Ferrero (detalle). 1894-96.

Organiza:

Colabora:

NºPO: 002/14/003/1  
Deposito Legal: M-1403-2014

Figure 11

Another activity related to the collaboration RSG-SECFT-IGN-AGE partnership, was the training seminar **“The geodata in the Cloud and its reuse in research”**, which was conducted in November 2014. In this seminar, the General Secretary of the SECFT, along with Cristina Rodríguez, another member of the SECFT, organized and directed a free workshop at the headquarters of the Royal Geographical Society, in order to give publicity to the SECFT cooperation with the RSG, IGN and AGE, in a bundle of events held whenever we can, in order to give the maximum publicity to our Society.

Similar events are also planned for 2015:

The Directorate General of the National Geographic Institute (Dirección General del Instituto Geográfico Nacional), The National Center for Geographic Information (Centro Nacional de Información Geográfica), La Universidad Complutense de Madrid, La Universidad Politécnica de Madrid, and **The Spanish Society for Cartography, Photogrammetry and Remote Sensing SECFT** and ESRI Spain (see Figure 12)



Te proponemos un seminario muy práctico, dirigido a la sociedad en general, al profesorado y a **alumnos universitarios**. Especialmente aquellos que vayan a presentar algún trabajo de investigación referente a un espacio geográfico en sus asignaturas cursadas o en los trabajos Fin de Máster, Grado, Licenciatura...

Todos ellos verán en seis sesiones las nuevas posibilidades de las herramientas WebGIS, familiarizándose con el trabajo en la nube y aprendiendo a:

- Buscar y reutilizar **datos públicos**
- Derechos de autor y licencias **Creative Commons**
- Trabajar con **GPS**
- Exponer su propio proyecto empleando **ArcGIS Online**

Organiza:



Colabora:



Más información e inscripciones:

<http://bit.ly/WebSIG-RSG>  
[www.realsociedadgeografica.com](http://www.realsociedadgeografica.com)  
[mllazaro@ucm.es](mailto:mllazaro@ucm.es)

## Seminario

Los geodatos en la nube  
y su reutilización en los  
trabajos de investigación  
y en la docencia

Curso 2014-2015

Real Sociedad Geográfica  
Madrid, 15 de octubre a 3 de diciembre



Figure 12



## **National Mapping Organizations**

- 2.1 National Geographic Institute
- 2.2 National Center of Geographic information
- 2.3 Spanish Army Geographic Center
- 2.4 The Spanish Hydrographic Office
- 2.5 Cartographic and Photographic Center.  
Spanish Air Force
- 2.6 Geological and Mining Institute of Spain
- 2.7 Spanish Institute of Oceanography

# National Geographic Institute

**General Ibáñez de Ibero, 3**  
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**Phone: +34 91 5977000**  
**Fax: +34 91 5979765**

Since its foundation in 1870, the National Geographic Institute of Spain (IGN) has been engaged in scientific investigations and production activities in the field of mapping. IGN is also engaged in activities related to astronomy, geodesy, geophysics, photogrammetry, remote sensing, mapping, geographic information systems, spatial data infrastructures and administrative boundary lines.

## Territory Observation

Territory Observation constitutes a fundamental activity in the proper management of policies that are based on a detailed and precise knowledge of the spatial environment. Continuous changes to the territory must be update by periods.

They must allow the observed territory information updated in order to facilitate efficient and sustainable economic development

Technological development has advanced territory observation methods by providing the necessary mechanisms for acquiring precise and quality information in less time and at less cost.

The National Geographic considers to Territory Observation like a key activity in conducting the cartographic activities it is assigned with.

From the Subdirectorate General for Geodesy and Cartography, the IGN carries out the following functions:

- The management and development of national plans for territory observation with geographic and cartographic application.
- The use of photogrammetry and remote sensing systems.
- The production, updating and use of digital terrain models obtained from aerospace images.

Since 2004 this activity revolves around the National Plan for Territory Observation (PNOT), in which the general state administration, via various ministerial departments, and all of the autonomous communities participate. It is thus a cooperative plan that pools technical, logistical and economic efforts through complex mechanisms of inter-administrative coordination led by the IGN/CNIG.

This Plan is divided in three different phases. In the first phase, the objective of the PNOT is to obtain aerial image coverage from satellite and digital elevation models for multidisciplinary applications, with economically optimized resolution and updating periods, as well as to develop applications in which these images are going to be used.

This coverage is organized into various levels of spatial resolution and time frequencies, which are materialized into specific plans:

- National Plan for Aerial Orthophotography (PNOA), which provides, among other photogrammetric products, periodic coverage (from two to four years) of the entire national territory via very high resolution aerial orthophotography, PNOA25/50 (25/50 cm) and PNOA10 (10 cm).
- National Remote Sensing Plan (PNT), which provides periodic coverage (annual, monthly and weekly) of the entire national territory via medium- and low-resolution satellite images (2.5 to 100 m).

The second phase of the Spanish National Plan for Land Observation takes in the coverage of the PNOA and PNT in cartographic, environmental and land-cover operations by the various participating organizations.

It produces basic and thematic geographic information for carrying out service and development activities.

It is noteworthy that in 2009 the first coverage of the Spanish Land Cover/Use Information System (SIOSE) was completed. This project includes information from the land-cover data bases (urban, agricultural, forested, natural, and wetland areas), generated by the autonomous communities and the general state administration, with a precision equivalent to a scale of 1:25,000 and updated each two years.

The third phase (also included in the service and development activities) of the PNOT takes in the dissemination of all information at an institutional as well as user level. It uses the Iberpix image server for this, which enables the display, consultation and downloading of geographic information generated and managed in the PNOT environment.



Figure 13. LIDAR generated DTM

## Cartography

Cartography provides people with knowledge of a territory by interpreting and representing it with maps or their many and modern versions, such as digital maps, cartographic databases and geographic information systems.

From data acquired by territory observation, cartography thereby constitutes a practical platform that is indispensable in its managing from a multidisciplinary (through topographic cartography or as a geometric description of the territory) and specific standpoint (through thematic mapping that emphasizes, develops, or incorporates specific aspects linked to industrial, cultural, social and environmental activity).

A basic necessity is therefore involved that is fulfilled by configuring a knowledge and management infrastructure for the territory. Its availability is guaranteed by the public services, which promote its production and updating in order to boost economically efficient development that is environmentally sustainable and useful to society.

The National Geographic Institute thus considers cartographic production, among its various duties, as a high priority activity that is performed through the Subdirectorate General for Geodesy and Cartography via:

- The production and updating of topographical map of Spain at 1:25,000 and 1:50,000 scales, derived map (provincial maps, autonomic maps, etc.)
- The production, updating and use of nationwide topographic and cartographic bases in order to integrate them into geographic information systems, as well as for shaping the national topographic map and other basic and derived mapping.
- The management of mapping laboratories and workshops.
- The creation and updating of the National Atlas of Spain and of thematic mapping in support of the general state administration's specific action programs.
- The provision of technical assistance to public bodies on mapping issues.

All mapping series and spatial databases are produced in one global project what ensures consistency between all the products and takes advantage of synergies between departments and other agencies.

This unique production project has been developed in two phases:

- First phase, it has built a workflow for production of small scale products.
  - A key fact in this regard is the definition and implementation of The National Topographic Database 1:100,000 (BTN100) in partnership with Spanish Army Geographical Center (CEGET)

- The collaborative framework IGN-CEGET desires to define, capture and maintenance of two national geographical databases. The National Topographic Base 1:100,000 (BTN100), mainly used in GIS applications, and the National Cartographic Base 1:200,000 (BCN200) also introduces cartographic parameters that facilitate the publication on paper of different series of both institutions.
- Furthermore, BCN200 aims cartographic tasks since it is the basis for the production of the Thematic and Derived Mapping Plan series produced by the IGN or NATO series produced by the CEGET: The Provincial Map at 200k (MP200), NATO Series 250C, the Spanish Map at 500k (ME500) as shown in the following figure.

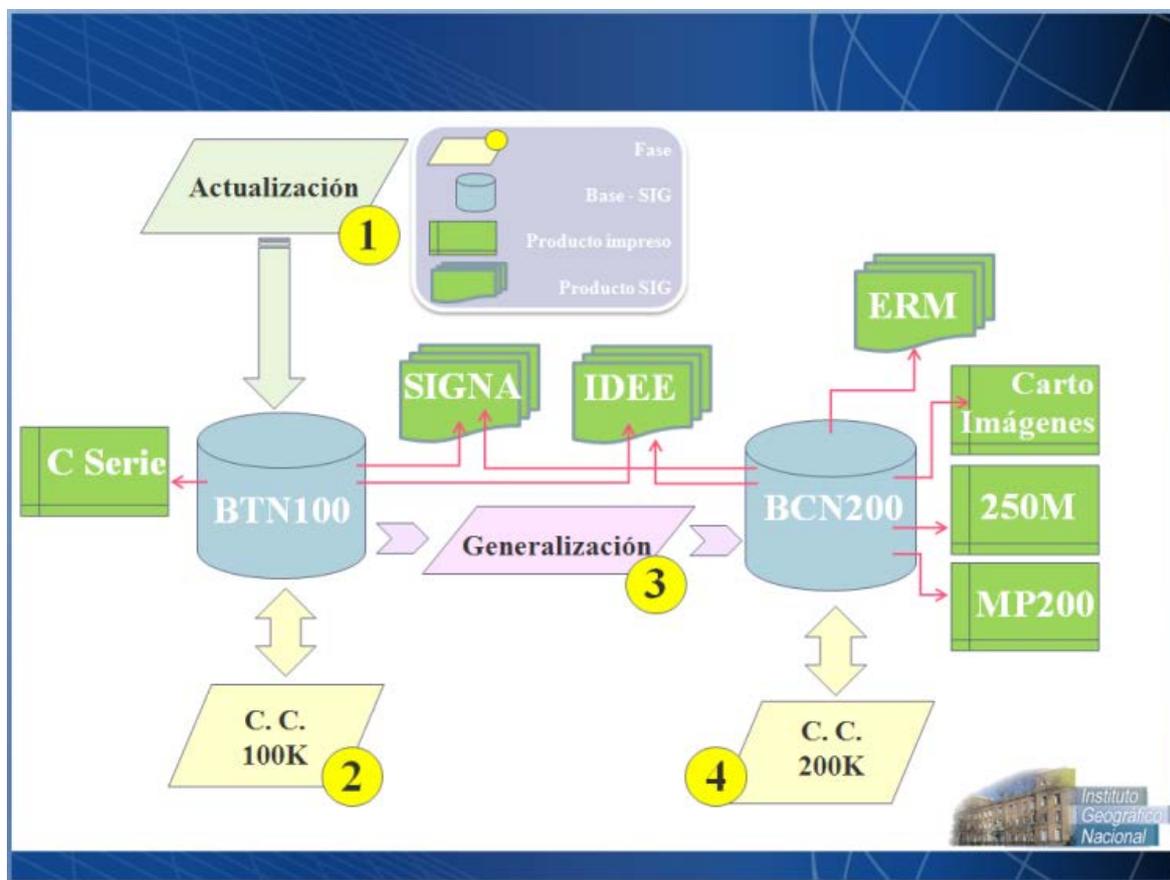


Figure 14. Collaborative Frame Workflow

- Second phase, IGN has designed a large and medium scale production workflow, taking into account the growing importance of the distribution of digital mapping and geographic information viewer services that require very quick actions for supplying changes from the real-world to the users. This workflow is based on a full automated production of The National Topographic Map 1:25,000 (MTN25) from National Topographic Database 1:25,000 (BTN25) by an automated application of cartographic generalization developed in our department.

Finally, IGN has changed its production processes in 2014. Nowadays, our workflows are based on specialized bases of Geographic Reference Information (GRI) that will be the main data sources for all his cartographic products, as shown in the next figure.

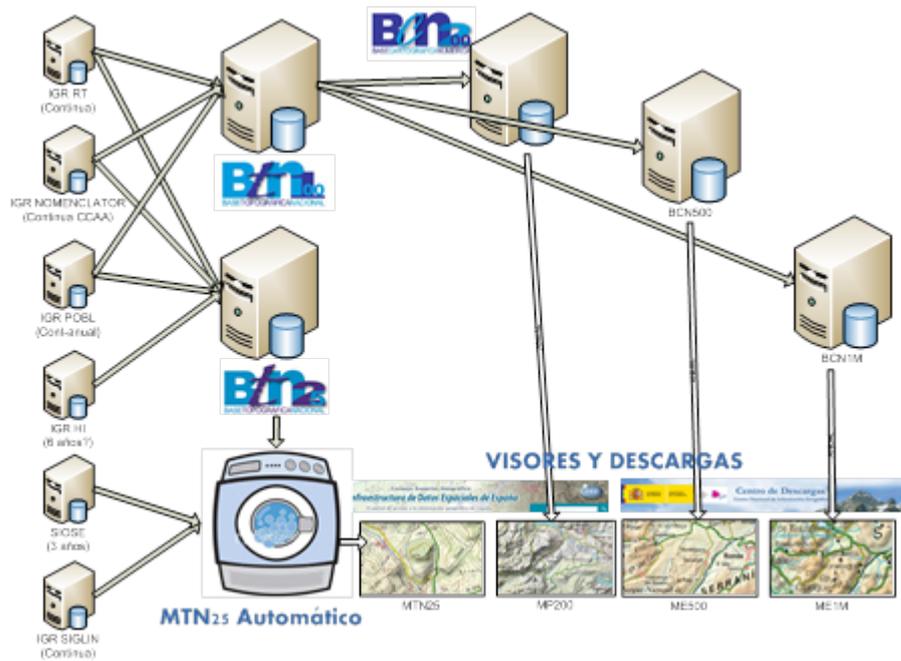


Figure 15. Full integrated cartographic production process

### National Cartographic Plan (PCN)

The National Cartographic Plan (PCN) is the planning tool for the official cartographic production carried out by the National Government of Spain and a tool to facilitate connection among National Government mapping production organizations and regional official cartographic production plans. The National Cartographic System, passed by Royal Decree 1545/2007, established this essential approach to coordinate cartographic activity carried out by the three levels of Governments in Spain (National, Regional and Local Governments) and Public Sector organizations, Regional and Local Government Levels are voluntarily included in the System. The Plan will enable the coordination of the National Government’s geospatial information production and its matching and coordination with Regional Governments plans.



Figure 16. National Cartographic Plan. Yearly Operative Programs. 2015

The plan aims at two great targets:

Firstly, to produce all the Geospatial Reference Information at once and to share it, and from this one all the subject matter information, needed to exercise the general and specific Governmental tasks (cadaster, land register, army, environmental, facilities, transport networks and infrastructures, hydrography, territory organization, emergencies, etc... )

Secondly, to use in a shared way the Geospatial Reference Information and the Geospatial Information in general produce by agencies of the National Government of Spain. Every National Government Ministry have taken part in the making of the 2013-2016 National Cartographic Plan working during nearly two years.

Regarding coordination, a very important aspect is jointly processing of statistical and geospatial information. Such essential information at economic, political and social decision making is taken into account by the Statistical National Plan (PEN), a four-sided planning tool managing statistical operations of the National Government. The coordinating tool between PEN and PCN is under construction.

The National Cartographic Plan is controlled and revised by Yearly Operative Programs. These Programs enable the PCN periodical evaluation of its results and therefore its convenient revisions.

All about the Plan and, specifically, the products and services that will be generated as its outcome are available on the High Geographic Council website, which it can be visited through the Infrastructures and Transports Ministry and the National Geographic Institute websites.

### **Production of the geographic information of reference**

According to the data specifications of the National Geographic Institute (IGN) and in compliance with the principles set out in Directive 2007/2/EC for the establishment of the Infrastructure for Spatial Information in Europe (INSPIRE) as well as corresponding law 14/2010, July 5 from the Infrastructure and Services of Geographic Information in Spain (LISIGE), all of which encourage the re-use of data and the avoidance of duplication of the same capture, the methodology for the production and maintenance of IGN products that contain common themes is being fully restructured so that the regulations will be coordinated and efficient.

Therefore, the National Geographic Institute (IGN) has launched a coordinated high-resolution plan, in cooperation with INSPIRE, for the production of geographic information of reference (IGR). This plan aligns with United Nations' geospatial reference information management decisions according to the requirements of IGR at national, European and global levels.

IGR is the geographic information required by any user or computer application that references data; it provides a precise location, allows the comparison of data from different sources and serves to interpret data by placing them in a geographic area. IGR must have

automated maintenance and is characterised as being public, reliable and accurate; it must also conform to the major requirements of common users.

The IGN, through working groups on each of the topics, collaborates with the technical working groups (TWGs) created within the Steering Council of the Geographic Information Infrastructure in Spain (CODIIGE). The new production strategy is based on the generation of databases (BB. DD.) of geographic reference information from data sets currently existing in the different projects carried out by the IGN, after debugging and accuracy improvement.

These databases (BB. DD.) will become the reference sources for all projects managed both by the IGN and the National Center for Geographic Information (CNIG) requiring the incorporation of the themes stored therein. Thus, the products of the CNIG—for example, CartoCiudad, which incorporates the transport network, or SIGNA, which enables the analysis and visualisation of hydrography and transportation networks—and the IGN—for example, national topographic databases containing data from facility, network and transport infrastructures, hydrographic elements, toponymy and so on— will all utilise the same BB. DD. reference for each product, adapting the data depending on the particular requirements that must be met.

These database are:

- Database for Hydrography
- Database for Transport
- Database for entities of population

### **Thematic Cartography**

The National Geographical Institute of Spain is working on the thematic Cartography under the idea of the collaborative hypermedia cartography. For that, it has been developed computer tools in order to allow experts in each interesting issue can publish their information in a common visualizer. The experts can also embed this visualizer in their own web pages. This project achieves several goals:

First, give a support to the partners of each subject that, often, they don't have the right tools to publish their information in a georeferenced way and above maps or terrain images.

On the other hand, publishing all the subjects in the same visualizer, allow users to put on or off the issues in which they are interested and create a "map on demand".

Finally, the expert partners mentioned collaborate in an active way because, as they can embed the visualizer in their own web pages, they are the main interested ones in have the information completely and updated.



Figure 17. Thematic Cartography Visualizer

Also, the National Geographical Institute can, based on that thematic information, make other cartographic products in a very efficient way as, for example the map titled “Camino de Santiago en la Península Ibérica” on a scale of 1:1,250,000.

### National Atlas Of Spain (NAS or ANE in Spanish)

ANE is a statistical operation in the National Statistical Plan and a cartographical operation in the National Cartographical Plan.

IGN has been working to develop a strategy for ANE agree with the vision that a national atlas is a collection of maps with explanations to describe (“storytelling) in a reasoned manner the physical and human geography of a nation.

- We have defined a variety of products for different users, grouped into logical sets. Between the main identified users, the first goal is being to achieve a publication for general public for “describing in a reasoned manner” that geography of Spain.
- For that description in a reasoned manner, scientific and academic collaboration is needed. ANExxi Network has been established as a network of scientific and academic organizations for the scientific direction and collaboration in ANExxi (ANE in the XXI century): 34 universities, 1 research center, Royal Academy of History (for Map Library Section), National Library of Spain (for Map Library Section), 1 professional association for research (Association of Spanish Geographers). Nearly 160 researchers working. It began with a definition of 9 thematic sections, which integrates 23 topics and these, in turn, about 76 subtopics. For each topic, it was asked to define 100-120 fundamental

resources/contents, distributed evenly between the subtopics that comprise it. These resources are the core (ANE\_Core\_2500) from which the content of the atlas will increase in concentric layers. The number of currently defined resources is much higher than 2500, but not always homogeneous. The Scientific Advisory Committee is working to debug it. We developed the defineANE collaborative web application to define the contents of the ANE.

- We present the “Proposal to establish of a Working Group of the Permanent Committee of the Interministerial Statistics Commission to set up an Infrastructure of Statistical Data and Cartography of the State General Administration (AGE)” to the Interministerial Statistics Commission. Finally, it was approved a pilot group of three organizations (included the National Statistical Institute) for a “Pilot project to develop a system for supplying, exchanging and disseminating statistical data and their integration into the information system of the National Atlas of Spain for the production of statistical cartography as a pilot for its extension to the statistical units of the State General Administration (AGE) and as an initiative of an infrastructure of statistical data and cartography of the AGE”.
- As we have not enough staff or budget, we have integrated “spin-off” of the Network member universities and seeking private funding (sponsoring) through the Network.
- We must continue improving and maintaining the Web national atlas information system. Between 2011 and 2015 SIANE (ANE information system) has continued to evolve:
  - new improvements in functionality and usability;
  - development of the ANE thesaurus and an application “Buscón del ANE” (ANE seeker) that exploits the thesaurus to improve the search, even over the entire historical production of ANE;

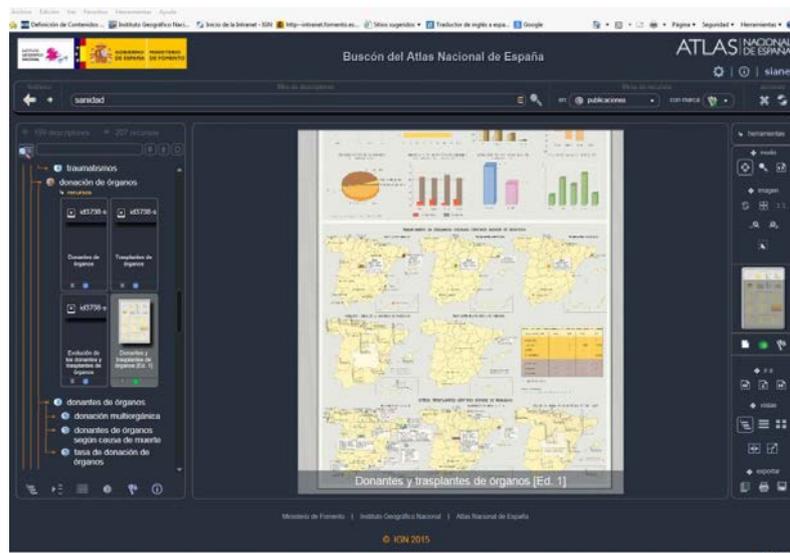


Figure 18. Web application “Buscón del ANE” (ANE Seeker) which lets searching in almost all ANE publications (new and historical) based in the ANE thesaurus

- Development of the web application sumANE and integration with SIANE. It aims to achieve a supply of meaningful, official data, with quality assured, maintained by their own initiative by the organizations / units which update or own such data. It has a module to produce statistical maps using templates and a simple wizard to the most common cartographic techniques. It allows them to easily update a map of the ANE made with their data in the last edition and also draw other statistical maps for other data using simple mapping techniques. These maps are created in a file with a specific format (SIANE integration format) that includes interactive maps and a light display application and it can be seen even on mobile devices (smartphones and tablets). The application has an input module for data and metadata that allows to obtain, validate and import data and metadata to external statistical units. And in a standardized way (format and code lists).

### **Summary of IGN cartographic products and geographic information databases:**

- National Basic Cartography
  - Topographic Cartographic Database at 1:25,000 (BTN25). It is a geographic information system that contains detailed geographic vectorial reference data of the entire state. It is the main source of National Topographic Maps.
  - National Topographic Map at 1:25,000 (MTN25). In paper and digital format (vector and raster) in continuous updating.
  - National Topographic Map at 1:50,000 (MTN50) In paper and digital format (vector and raster) in continuous updating.
- Derived and Thematic Maps
  - National Topographic Database at 1:100,000 (BTN100). It is a multipurpose geographic information system with 20 m resolution, and it is the main data source of derived cartography products.
  - National Cartographic Database at 1:200,000 (BCN200). It is other multipurpose geographic information system, aimed to provide an easy way to develop cartographic products. BCN200 has a numerical link with BTN100.
  - Provincial Maps Series. It a set of 48 independent maps of Spanish provinces at 1:200,000 scale.
  - Autonomous Regions Map Series, It is a series of ten Multiprovincial Autonomous regions map from 1:200.000 to 1:400.000 scales.
  - National Cartographic Database at 1:500,000 (BCN500). It is a multipurpose geographic information, linked with the Map of Spain at 1:500,000 scale.
  - Map of Spain at 1:500,000 scale. In paper and digital format (vector and raster)
  - Map of Spain at 1:1,250,000 and 1:2,000,000 scale. In paper and digital format (vector and raster)
  - Raised Relief maps. They are a set of printed over the raised relief plastic maps.

- CartoCiudad the Spanish official Transport Network Database to be used in location-based services.
- SIOSE the Spanish Land Cover/Use Information System with a precision equivalent to a scale of 1:25.000.
- Aerial Photos and Remote Sensing Image Collections
  - Aerial Photos, available at 0.22 m or 0.45 m resolution of the entire national territory.
  - Ortophotos available at 25/50 cm resolution for the whole of Spain in a periodic coverage from two to four years, and 10 cm resolution for specials areas.
- Digital Terrain Model:
  - MDT5 of 5 x 5 m grid
  - MDT25 of 25 x 25 m grid
  - MDT200 of 200 x 200 m grid.
  - MDT LiDAR. Obtained by Lidar

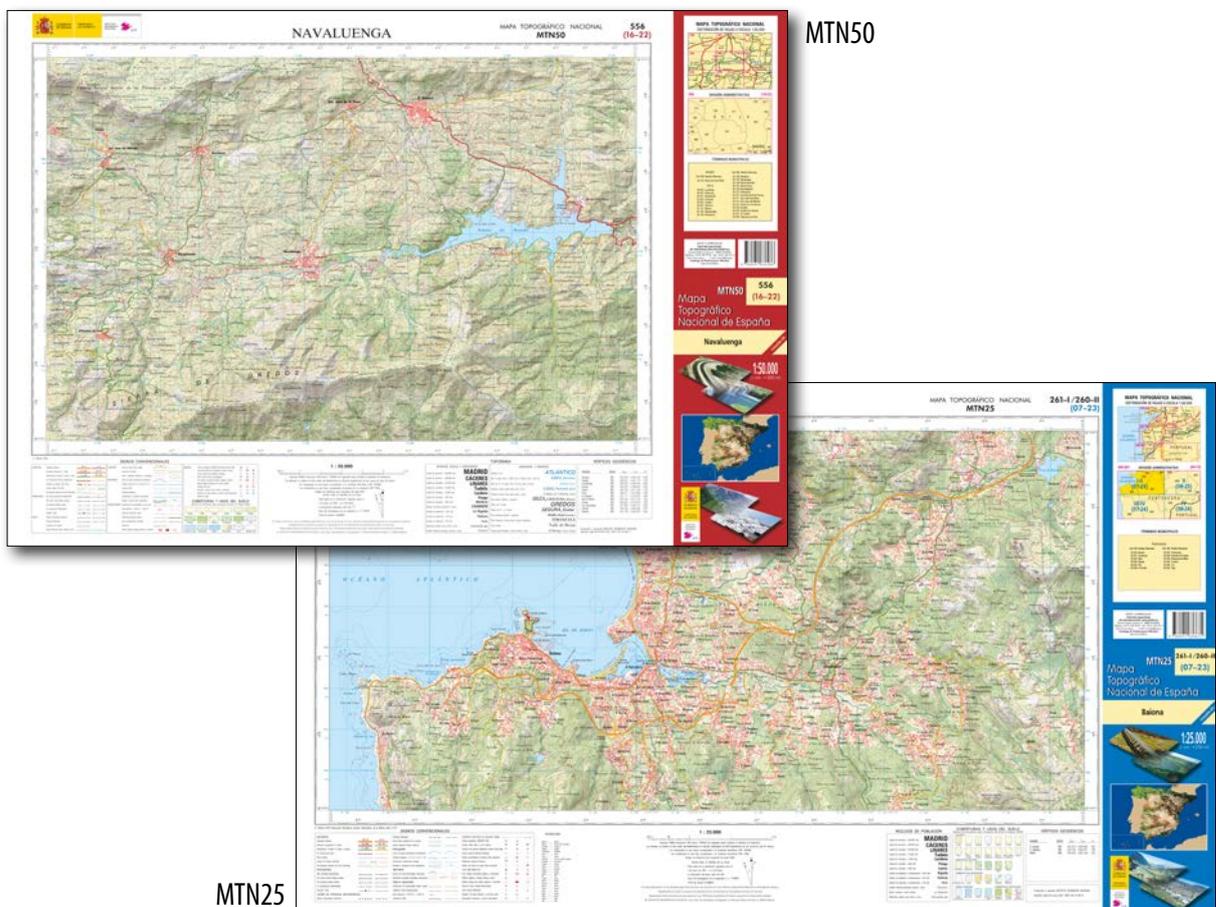


Figure 19 and 20

# National Center of Geographic information

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**Fax: +34 91 5351713**

**T**he National Center for Geographic information (CNIG), an independent agency attached to the Ministry of Infrastructures and Transport, through the Directorate General of the IGN, is responsible for producing, developing and distributing the geographic work and publications demanded by society. In particular and according to the CNIG statute, approved by Royal Decree 663/2007, dated May 25, it is tasked with the following functions:

- To market and disseminate the products and services of the Directorate General of the IGN.
- To guarantee the quality and distribution of official geographic information.
- To support the development and use of national mapping.
- To develop products and services on demand.
- To maintain a territorialized system of public information and manage the operations of the regional services of the Directorate General of the IGN and, if needed, of its territorial dependencies, as well as the organizational and functional management of the network of "Casas del Mapa" (sites that provide geographic information).
- To provide specialized technical assistance in the field of geographic techniques and sciences, and for the operations established in the Statute and those committed by the High Geographic Council for government departments integrated into the National Cartographic System.

In accordance with article 17.1.j) of Royal Decree 30/2011 and within the strategic framework defined by the Directorate General of the National Geographic Institute, the CNIG is likewise tasked with the planning and management of the National Spatial Data Infrastructure of Spain, as well as the harmonization and standardization within the framework of the National Cartographic System of official geographic information.

It is also in charge of planning and developing value-added services and new geographic information systems and applications.

The National Centre for Geographic information has published the following between 2011-2015:

- National Parks:
  - Cabañeros (map + guide + DVD)
  - Garajonay (map + guide + DVD)
  - Timanfaya (map + guide + DVD)
  - Teide (map + guide + DVD)
  - Islas Atlánticas de Galicia PACK (map + guide + DVD)
  - Aigüestortes i Estany de S. M. PACK (map + guide + DVD)
  - Taburiente (map + guide + DVD)
  - Doñana (map + guide + DVD)
  - Sierra de Guadarrama (map + guide + DVD)
  - Monfragüe (map + guide + DVD)
  - Ordesa y Monte Perdido (map + guide + DVD)
  - Picos de Europa (map + guide + DVD)
  - Sierra Nevada (map + guide + DVD)
- National Topographic map 1:25,000
- National Topographic map 1:50,000
- Provincial map 1:200,000
- Autonomic map
- Map of Spain of 1:500,000 scale
- Relief map:
  - Aragón 1:300,000
  - Asturias 1:200,000
  - Extremadura 1:300,000
  - Galicia 1:250,000
  - La Rioja 1:200,000
  - Madrid 1:200,000
  - Parque Natural del Lago de Sanabria y Alrededores
  - Península Ibérica, Baleares y Canarias 1:1.250,000
  - Principado de Asturias 1:200,000
  - Región de Murcia 1:200,000
  - Rías de Ferrol, Ares, Betanzos y A Coruña
  - Rías de Pontevedra y Vigo
- General map of Spain: Physical and political maps from Spain. From the General Map of Spain 1:1:1,250,000 to 1:2,000,000 to the map of Spain printed in plastic or the mural physic and politic two-sided printing
- Gondar City Tourist Map (Mapmaker Award 2013)

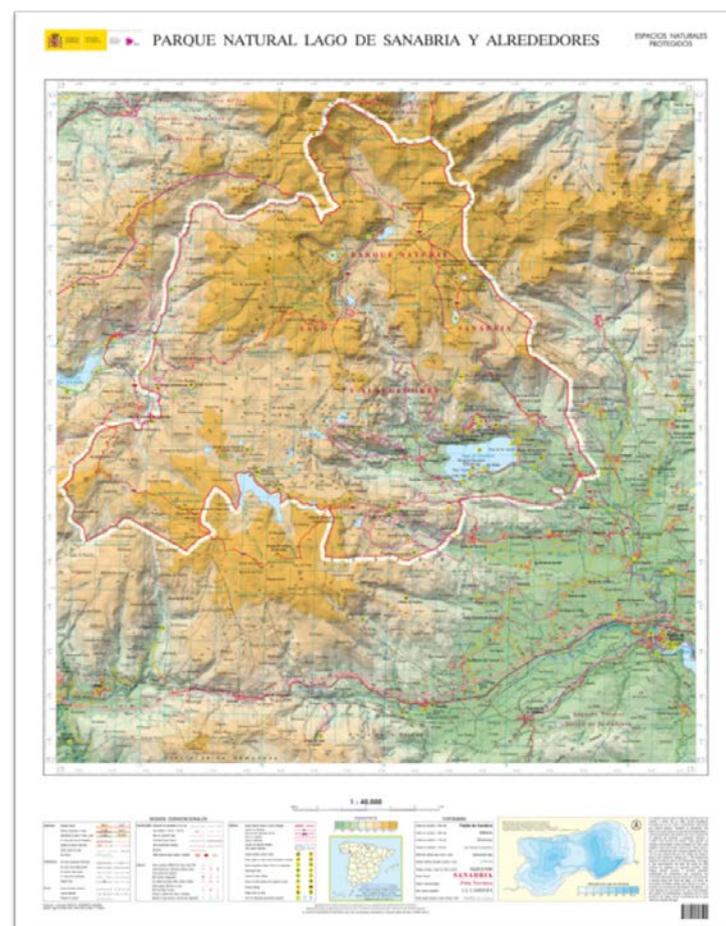


Figure 21. Relief map. Parque de Sanabria y Alrededores

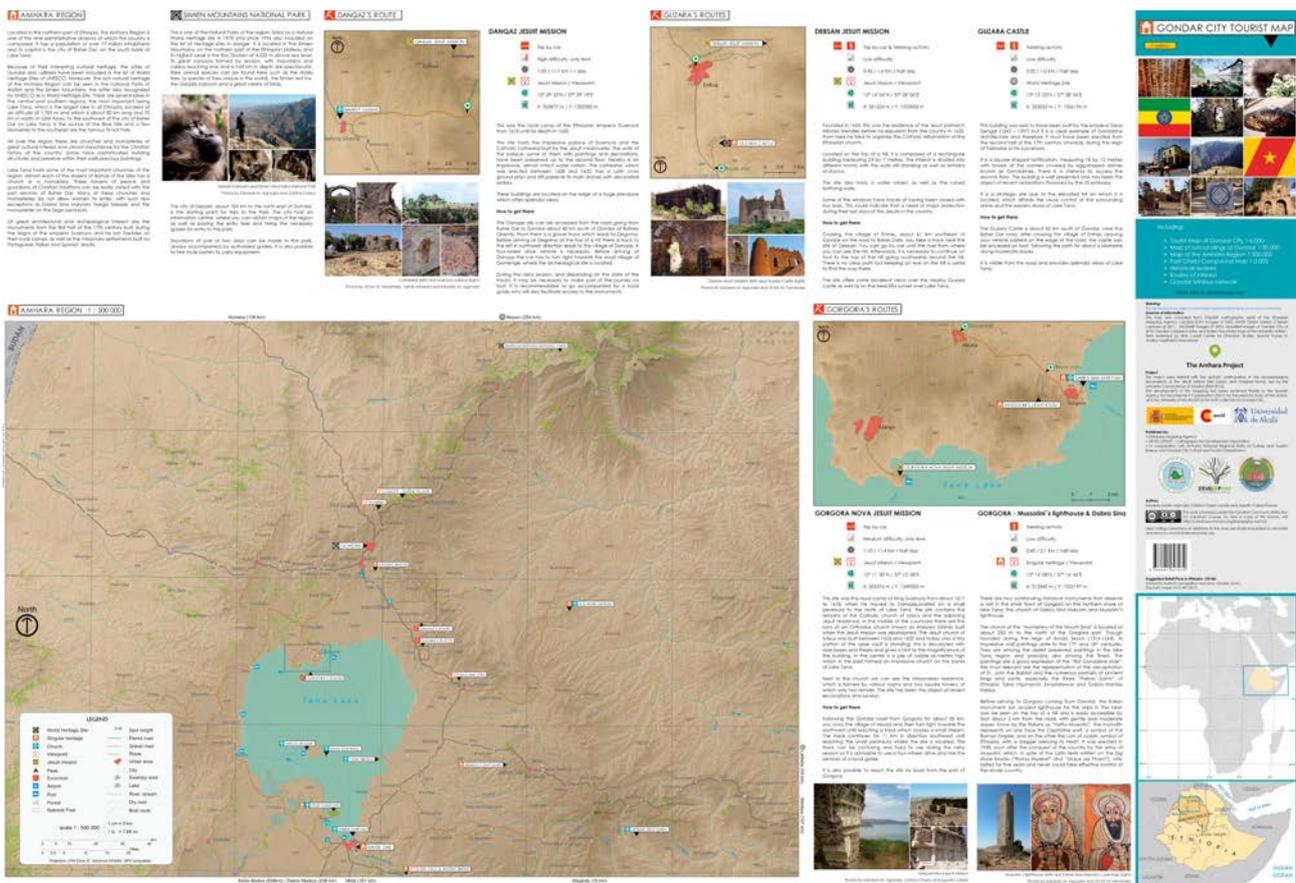


Figure 22. Gondar City Tourist Map

- Map of Camino de Santiago (Way of St. James)
- Map of Cathedral of Toledo
- Smartphone & Tablet apps:
  - National parks
  - Way of St. James

## SIGNA

The National Geographic Information System of Spain (Sistema de Información Geográfica Nacional - SIGNA) is a GIS that integrates data and standard services from IGN in a common environment, accessible by users through internet using a geoportal <http://signa.ign.es/signa/>

SIGNA Project has two different areas of work:

1. Data processing, with the aim of creating geographical features from the elements of the reference databases.

2. Geoportal development, for designing a geoportal capable of displaying, analyzing and downloading the feature information.

The characteristics of the geoportal are:

- Multiscale and seamless information
- Feature oriented
- Based on a thin-client
- Gate to the SDI node
- Easy to use for non-experts and also powerful for experts
- SDI and GIS functionalities

## SIGNA Geoportal

Opened in December 2010, the project has gone through different versions, the current version is 3.0. Signa geoportal is a gate to access to the geographic data and services of the National Geographic Institute of Spain (IGN). Nowadays, it receives about 15,000 visits per month.

The geoportal integrates the best of GIS and SDI worlds in a common environment accessible in a free and open manner for experts and non-experts without installing any plug-in.

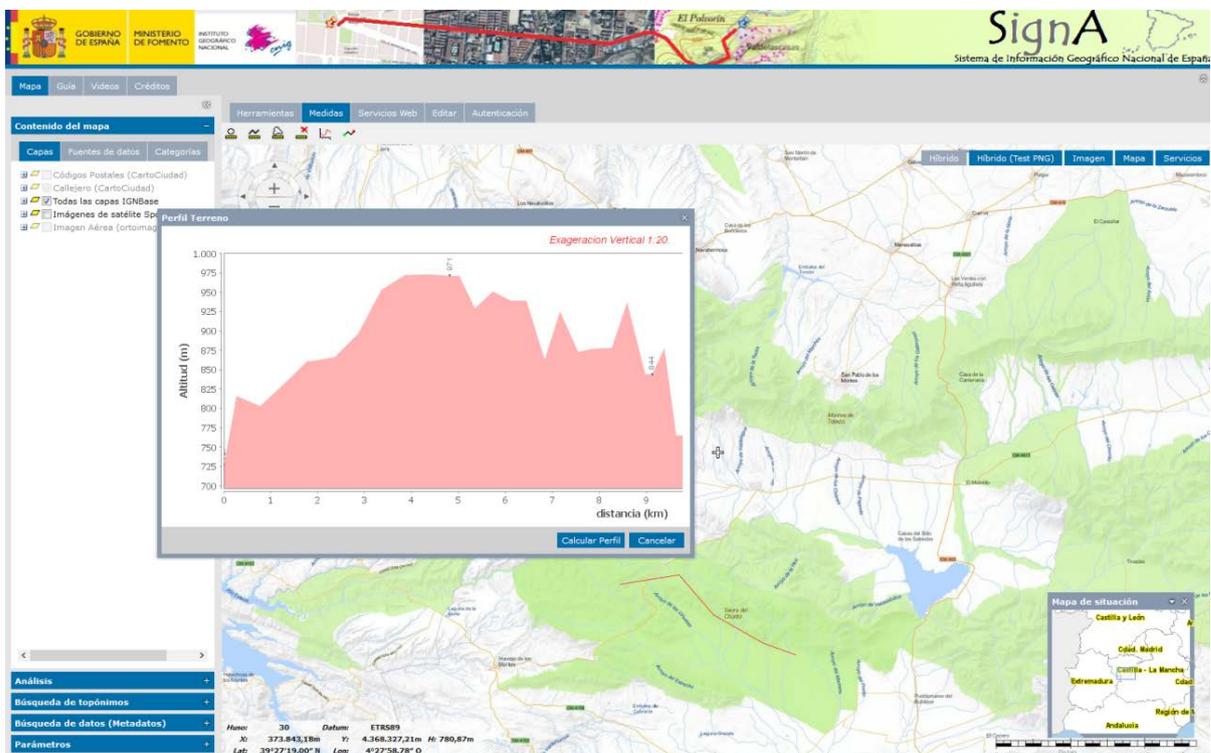


Figure 23. SIGNA Geoportal

*Basic tools:*

Within the basic capabilities of the geoportal it is emphasized that the user is able to navigate at different scales, it is possible to display the data from several points of view: hybrid, images, maps and services, showing feature attributes, searching geographical names and addresses, showing XY coordinates, making measurement: distances and areas, print, share a map with others users, making suggestions and report mistakes for improving our data and displaying common queries like higher mountains, bigger municipalities, longer rivers, etc.

*GIS tools:*

GIS functionalities are intended for users with knowledge in geographic information data, through them users are able to change the Coordinate Reference System among the following: ETRS89, WGS84 y ED50, geographic coordinates and UTM projected (28, 29, 30 and 31 zones), make semantic (by attributes) and spatial queries, define buffers and download GML and shape data.

*SDI tools:*

Another possibility for web users is to work with SDI technologies such as GetFeatureInfo operation, load of different OGC standard web services: WMS, WMTS, WFS, WFS-G, OpenLS, Web Map Context, data and services searching using a CSW (metadata), searching of geographical names using a WFS-G service, performing semantic and spatial queries using data from WFS services, connection to the SDI directory.

*New developments:*

In the latest version (3.0) of the geoportal, users can also make routes through Cartociudad WPS, DTM analysis (IDEE WPS), feature download (shape and GML), users maps creation (txt, point, line, pol) and preconfigured queries.

SIGNA is the more powerful GIS project available on the web to be freely used and exploited by all kind of users.

## **National Spatial Data Infrastructure (NSDI) of Spain**

The National Spatial Data Infrastructure of Spain (*Infraestructura de Datos Espaciales de España*, IDEE), is a collective project based on the cooperation of a large number of actors in Spain: governmental bodies at national, regional and local levels, private companies, universities, citizens, etc. designed to freely offer a wide range of geographic resources on the Net.

The Geoportal of the Spanish Spatial Data Infrastructure, IDEE, provide a basis for spatial data discovery, evaluation, and analysis oriented to all kind of applications, users and providers, taking into account the three levels of Spanish government (national, regional and local), the private sector, academia and citizens in general. Nowadays, a set of ten different services following OGC specifications, ISO standards and Directive 2007/2/EC of the European Parliament and of the Council as regards



Figure 24. Geoportal of IDEE

the Network Services has been implemented: Catalogue Service Web (CSW), Web Map Service (WMS), Web Map Tile Service (WMTS), Web Feature Service (WFS) 260, Web Coverage Service (WCS), Processing Service (WPS) and Web Coordinates Transformation Service (WCTS).

The IDEE viewer allows access to more than 2,000 web services. Through the National Geoportal it is possible to access other Spanish SDI geoportals, to consult documentation about the project, and a new approach is being implemented to offer client applications to access to the whole set of available services in all the nodes integrated in Spanish NSDI. This project run under coordination of the National Geographic High Council, a governmental body, whose Technical Secretariat is the National Geographic Institute.

From the organizational point of view the Working Group for the IDEE open to all actors involved from public private sector and academia, coordinates the project and defines technical recommendations based on consensus. This group meets with a frequency of two per year:

<http://www.idee.es/web/guest/reuniones>

Since 2005, an annual Iberian Workshop on SDIs (JIIDE for *Jornadas Ibéricas de Infraestructuras de Datos Espaciales*) is held each year to cover Spanish, Portuguese and Andorran SDI community.

<http://www.idee.es/web/guest/jornadas>

## CartoCiudad

CartoCiudad is a seamless cartographic database all over Spain with the road network topologically structured; it also contains building numbers, blocks, kilometre points, toponyms, and postal and census boundaries. This database is the result of harmonization and integration of official digital cartography produced by the main stakeholders of Geographical Information in Spain: Cadastre, Statistical Office, Post Office, National Geographic Institute and regional governments.

The policy of updating is by means of collaboration between administrations at different level: national, regional and local administrations.

CartoCiudad publishes its data through:

- Viewer of CartoCiudad Geoportal: API made of open-source software components, available to the citizen. [www.cartociudad.es](http://www.cartociudad.es)
- Standard web services complying with the Open Geospatial Consortium (OGC) specifications: WMS for visualising, WFS for locating and downloading features (addresses, postcodes, census information) and WPS for data geoprocessing (routing, reverse geocoding, influence areas definition, etc.).
- INSPIRE compliant services: View Service and Web Download Services on Addresses and Transport Network themes.
- Other utilities like massive calculations of direct and reverse geocoding, and distances among points along the road network.
- Download Centre of National Centre of Geographic Information: for downloading vector files of every region of Spain.
- <http://centrodedescargas.cnig.es/CentroDescargas/buscadorCatalogo.do?codFamilia=02122>

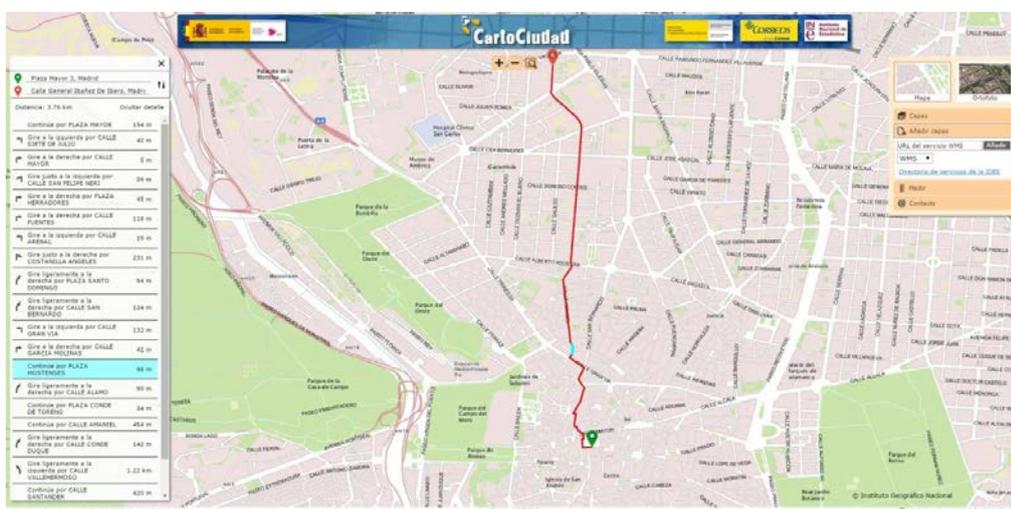


Figure 25.  
Geoportal of IDEE

# Spanish Army Geographic Center

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**Fax: +34 91 512 69 43.**

**S**panish Army Geographic Center mission is to provide military users with geospatial information and support for planning and conducting operations. Consequently we not only produce homeland geospatial information but wherever area of interest that could be designated, as the National Cartographic Plan reflects.

Homeland mapping production is based on standard cartographic series. In 2009, once 50k scale M7814 Series was finished, we started the M7815 Series. It is referenced to the new European Reference System EUREF89. The workflow is designed to update M7814 Series with photogrammetric flights and field revision.

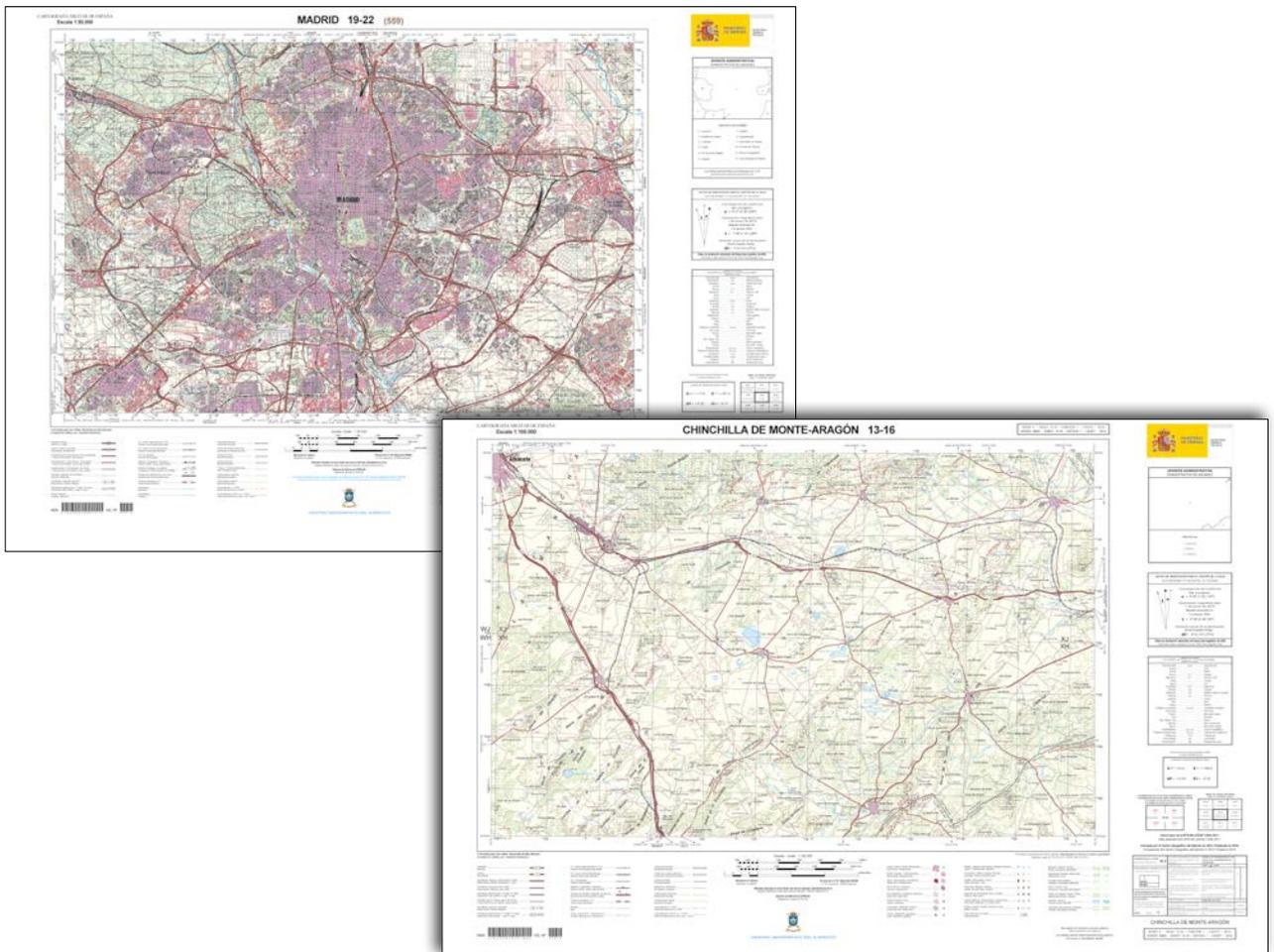


Figure 26. 19-22 Madrid - M7815 Series and 13-16 Chinchilla de Montearagón M682 Series

The new M682 Series, 100k scale and reference system ETRS89, is produced using as primary source the BTN100 Series. BTN100 Series is a INSPIRE standard database. It is produced into partnership with the National Geographic Institute of Spain. This project makes a mark on the collaboration between the most important Spanish geographic information producers

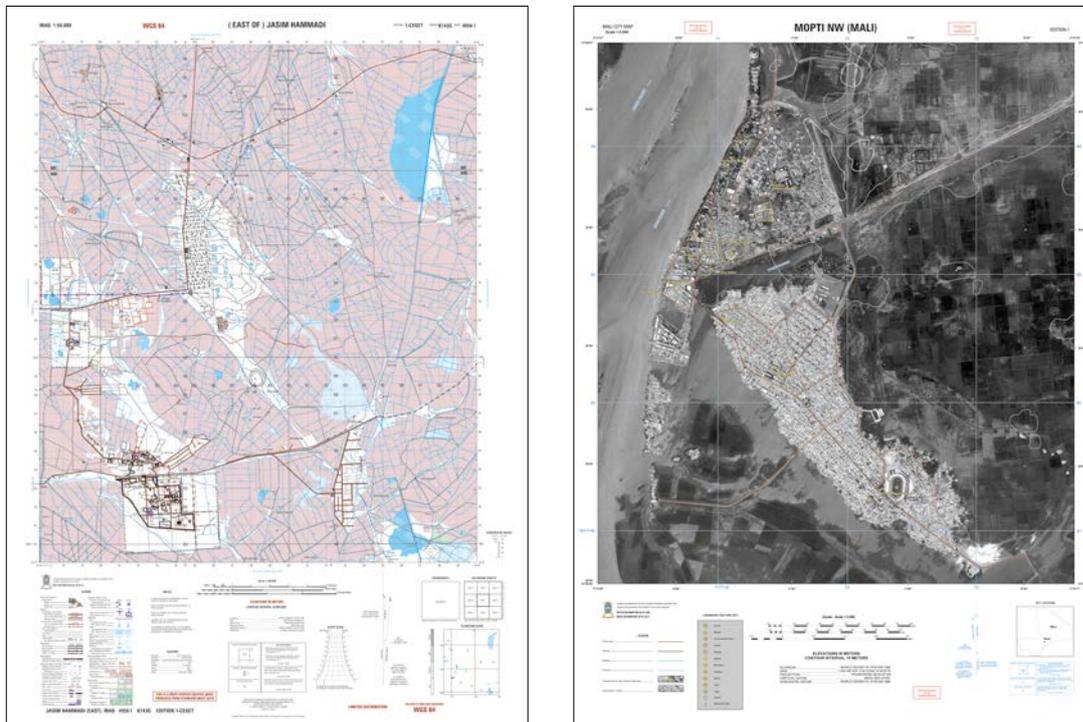


Figure 27. Irak sheet. 4956-I (East of Jasim Hammadi) K743G Series and Image City Map of Mali (Mopti NW), both derive from MGCP data.

Spanish geographic information requirements are completed with small homeland series: Ground Joint Operations Graphic 1501 at 250k scale, 1404 at 500k scale, Spain 1M scale chart, Spain 1.5M scale map and the Road Map at 400k scale(which includes access to military facilities information). All these series are updated every 4 years.

Finally the CMT Series is the Series for national training military areas. This Series is a heterogeneous one. It is a set of maps/orthophoto maps at different scales of military training areas, fire ranges and military facilities. These Series include a military information layer symbolized according to NATO STANAG 3833 Ed3.

The geospatial Information production of areas of interest beyond the national borders is based on spatial imagery and information of the Multinational Geospatial Co-Production Program (MGCP). Spain joined the MGCP project as a "Leader Nation". Our tasks are orthorectification of high resolution satellite imagery, vector data collection, national quality control and international quality assurance checks (no national production). Based on MGCP data we produce Map Derived Graphics over those areas where Spanish Armed Forces are deployed.

The Spanish Geographic Unit, designed for deploying in operations theatres, has all the needed elements to provide, timely and directly on the ground, accurate geographic information to national and international Units. This support includes map production, topographical works, ground cartography review, IPB (Intelligence preparation of the battlefield), thematic maps production, natural disasters simulation, virtual 3D scenario models, printing and geographic information dissemination. This Unit has taken part in



Figure. 28. Army Geographic Unit personnel in a topographical work at Qala I Naw (Afghanistan).

many national and multinational exercises and operations, mainly are under the umbrella of Eurocorps (as part of the Eurocorps Combined Geo-Support Unit), NATO (geographic support to NATO Response Force), European Union (EU Battlegroup) or the Spanish Emergency Military Unit (UME).

In addition the CEGET represents Spain in many national or international meetings as Multinational Geospatial Co-Production Program (MGCP) Technical Group , TanDEM-X High Resolution Elevation Data Exchange Program (TREx) Technical Group, Defence Geospatial Interchange Working Group (DGIWG), NATO Interservice Geospatial Working Group (IGeoWG), Spanish Infrastructure for Spatial Information (GT-IDEE), Spanish Geodetic Reference System working Group, Spanish Metadata Working Group, Spanish Geographic Names Committee, etc.

The Army Geographic Center is the technical manager of the Military Geographic Information Program (SIGMIL).

SIGMIL is a geospatial tool for developing the Spanish command and control systems and it is a programming libraries as a whole. The Army Geographic Centre is the

technical manager of this program. It provides the visualization and geographic analyst modules to command and control and weapons systems. A derived product of SIMIL is the Digital Chart, a Geospatial Information System designed for heavy users. It has the capacity of visualization and exploitation, analysis of many raster and vector sources. You can generate 3D visualization models, use advanced symbology or military standard symbology as APP-6A.

Depending on the Foreign Affairs Ministry the Army Geographic Center is responsible for demarcation and maintenance of the Spanish borders. Every year there are meetings and campaigns for the maintenance of the borders with Portugal and France.

Finally, the Army Geographic Center holds the Cartographic Archive and Geographic Studies. It has a historical collection of 290 Atlas in 354 volumes, 14,874 plans and

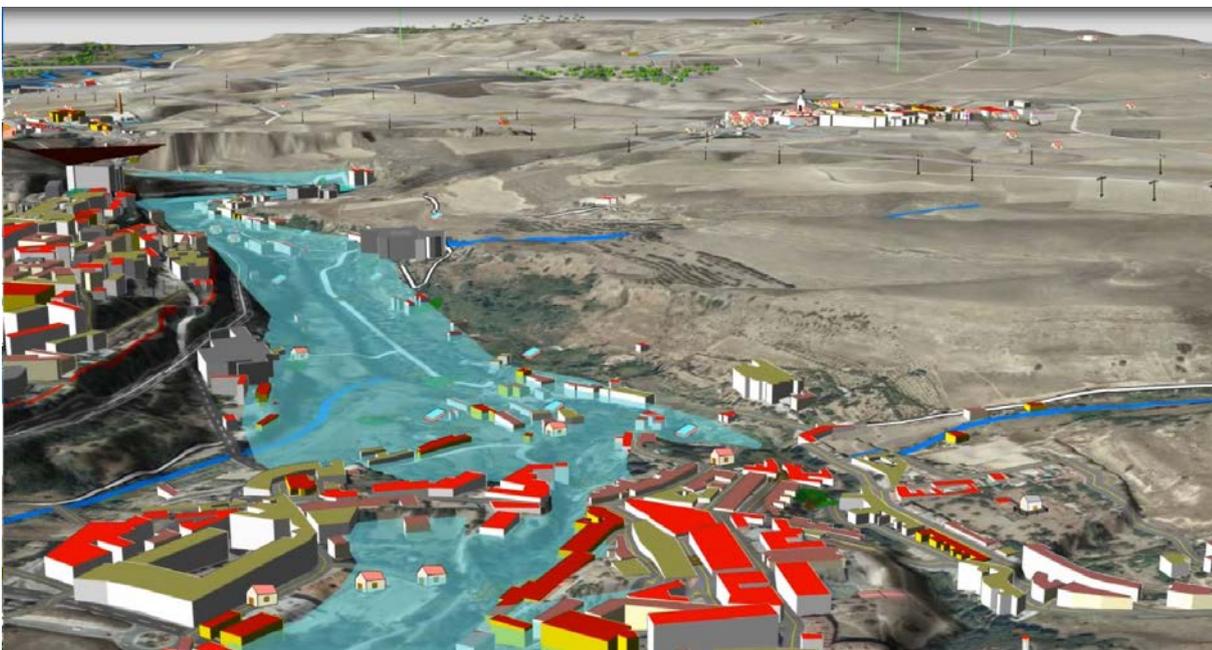


Figure 29. Digital Chart 3D flood scene

maps, 946 Geographic Reports and 3,519 description routes. All collections are dated between XVI and XIX Century. It also includes a modern collection of 96 Atlas in 166 volumes and more than 40,000 plans and maps. The main collection areas are Spain, America, North Africa and Philippines. The Cartographic Archive has a permanent exhibition in the Alfonso X Facilities but besides it organizes exhibitions all over Spain.

Recently, the 75<sup>th</sup> Anniversary of the foundation of Geographic Military Service, currently named Army Geographic Center, was celebrated. CEGET Members go on carrying out the mission as the same excitement as the first day, focusing in training in order to keep on a high skill and human level.

# The Spanish Hydrographic Office

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The Spanish Hydrographic Office (*Instituto Hidrográfico de la Marina* (IHM)) is a Spanish Navy organization of public and international interest, tasked with the safety of navigation and the capture and dissemination of maritime and coastal information to further nautical sciences. One of its main missions is the production, publication and updating of nautical charts considered of interest for mariners, as well as military cartography. Also, production of military cartography developed in different Additional Military Layers (AML) to be used in WECDIS consoles is carried out.

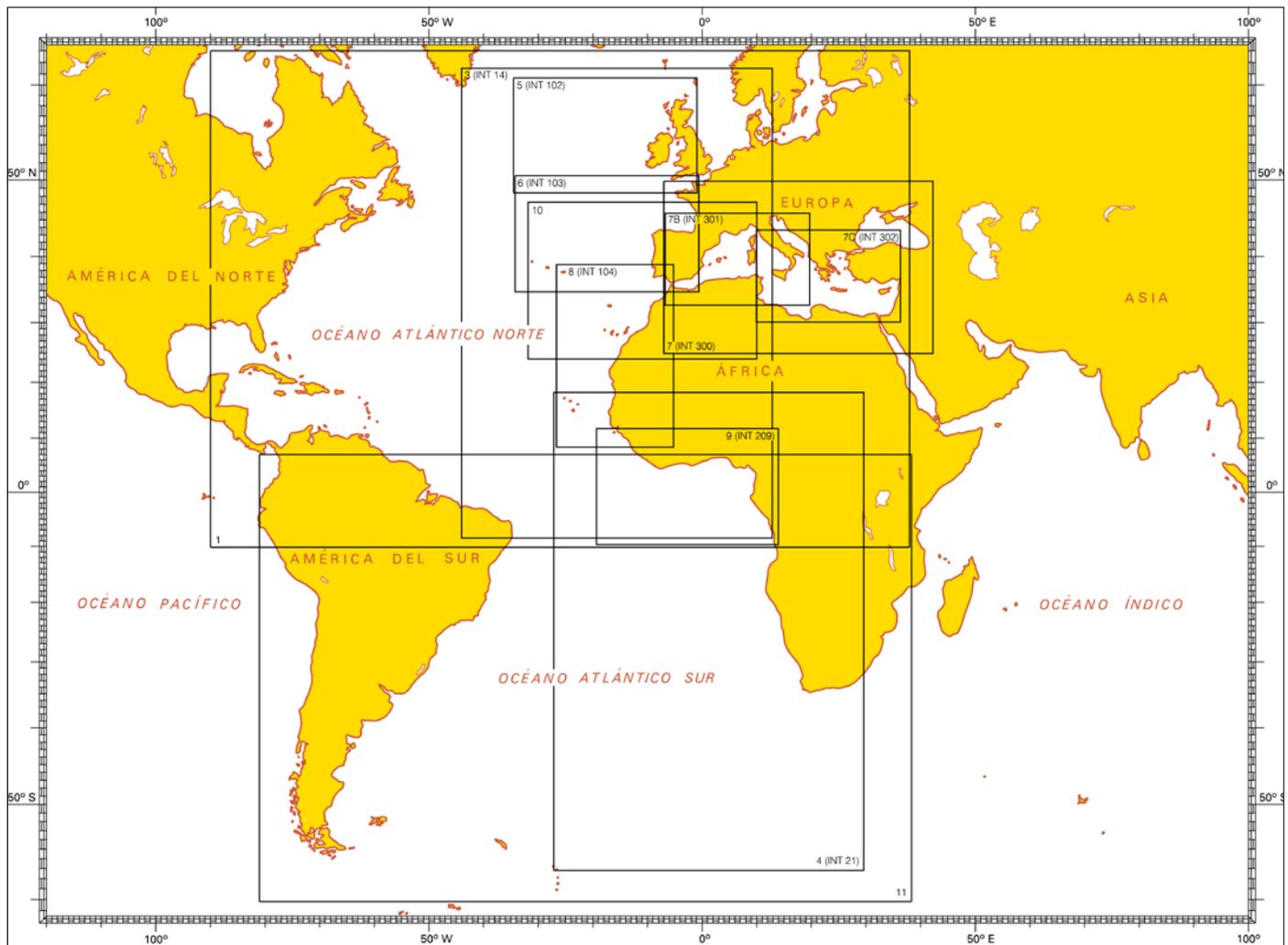


Figure 30. Coverage area of Spanish nautical charts.

Furthermore, requests for geographic information from areas unrelated to navigation and involving concepts of Spatial Data Infrastructure (SDI), both at the national level and inside the International Hydrographic Organization (IHO), have caused the consideration of requirements necessary to satisfy this new demand.

During the last two years the production of New Charts and Editions on paper is considered as adequate, as the average age of published cartography is 10,15 years, which compares favorably with neighbouring Hydrographic Offices.

Also, as a part of the Cartographic Project, production of ENC Electronic Cartography is continued, having achieved full coverage for Purpose 2 "General 1:1,000,000", Purpose 3 "Coastal 1:100,000" and Purpose 4 "Approaches 1:50,000". Purpose 5 "Harbour 1:8,000" is at 65% coverage, and it is expected to achieve complete coverage at the end of 2016, covering all main ports and harbors.

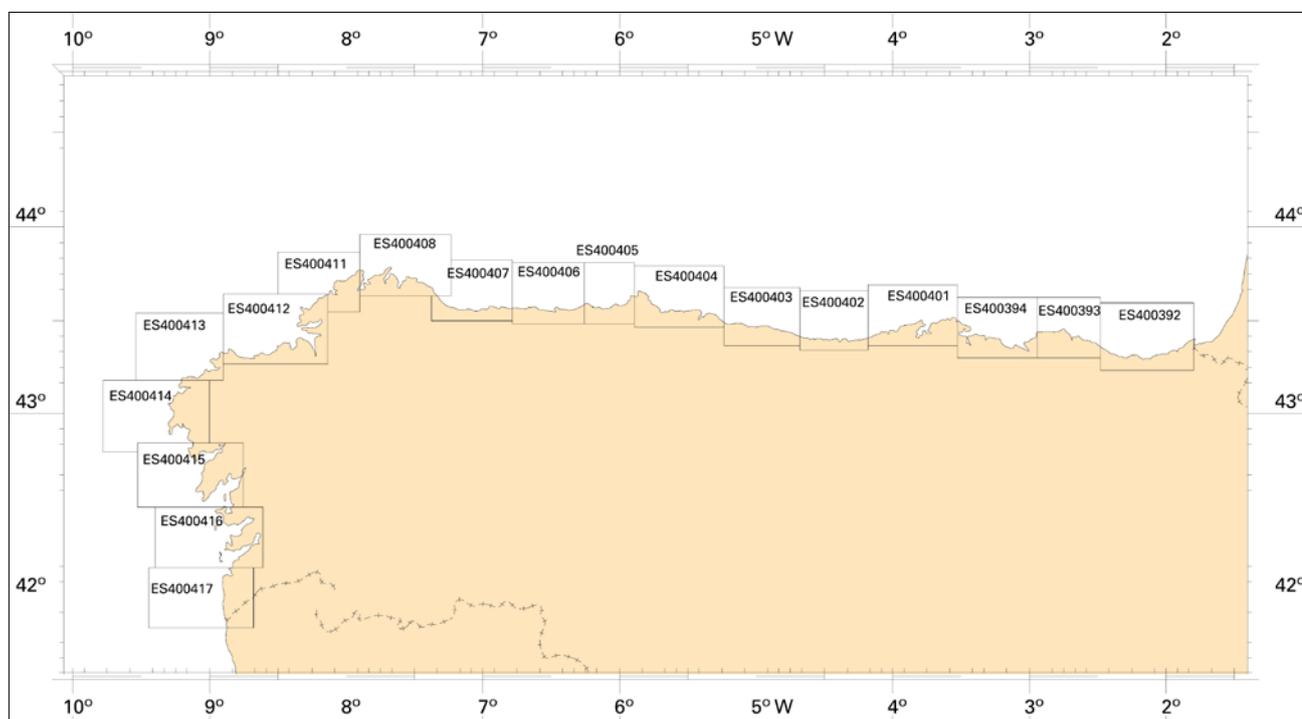


Figure 31. Spanish NW ENC purpose 4 (medium scale range 1:50.000)

During 2011 and 2015 this IHM provided the Central Registry for Cartography under the National Geographic Institution with the updated coastline for Spain, derived from the base chart series at scale 1:50000.

### Cartographic Production

Cartographic production during the relevant time period is as follows, both for paper charts and ENC.

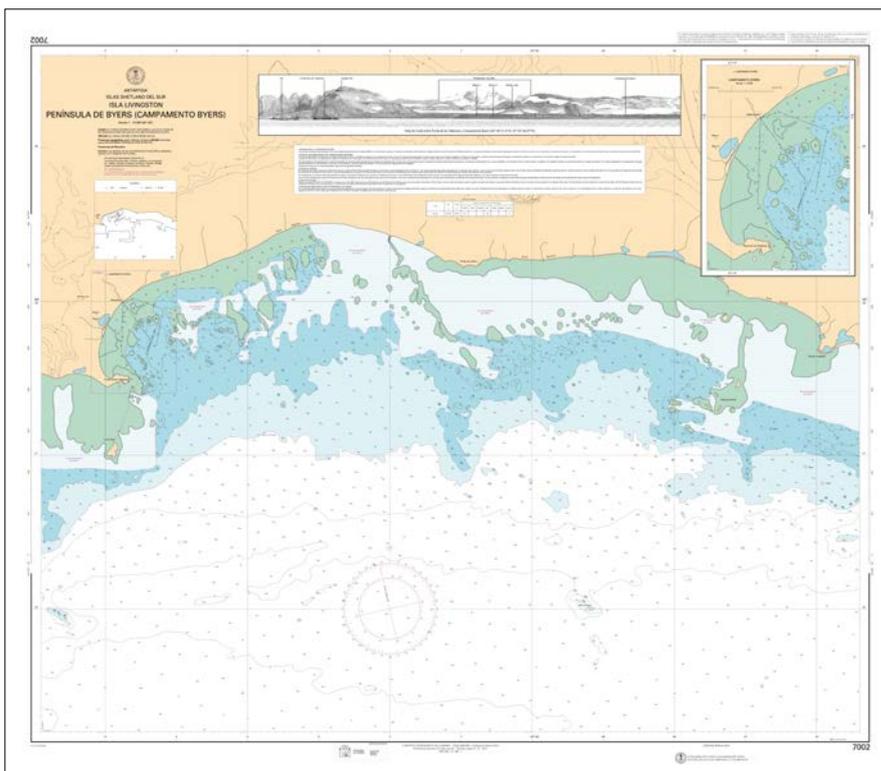


Figure 32. Nautical Chart 7002 «Campamento Byers. Isla Livingston, peninsula Byer»

### Paper Charts

48 nautical charts were published, as follows:

- 48 New Charts and New Editions. Highlighting the new chart of Antarctica "Campamento Byers. Isla Livingston, peninsula Byers".
- 46 Reprinted charts.

### Electronic Nautical Charts (ENC) (since 2011)

189 ENCs have been produced, as follows:

- 111 New Charts.
- 78 New Editions.

Currently (April 30, 2015) the overall amount of available ENCs is 230, which can be classified by their navigational purposes as follows:

- General 4
- Coastal 21
- Approaches 82
- Harbor 123

## Updates

Our chart portfolio is updated using information received mainly from Port Authorities, Hydrographic Commissions, Harbour Masters and Naval Offices. They are distributed as follows:

- 1352 Notices updating paper charts, 292 of them including block corrections, published in the Weekly Edition of our Notices to Mariners Bulletin.
- Also, the corresponding corrections were applied to the stocks of paper charts at this IHM.
- 1727 updates for ENC's.

## Other publications

- A new edition of "*Catálogo de Cartas Náuticas y Otras Publicaciones*" (Nautical Chart and Publication Catalogue) was published in June 2015.
- A new edition of "*Símbolos, abreviaturas y términos usados en las cartas náuticas*" (Symbols and Abbreviations Used on Nautical Charts) will be published in October 2015.
- 4 Leisure charts, D416, D440, D45 and D45A were published in a new A3 booklet format.
- New printings of the Training Chart and Plotting Sheet (0B).

## Military Cartography

### AML Project

This project involves a number of digital geospatial data products designed to cover all requirements of NATO maritime defense not related to navigation.

One AML layer production project has been developed at the national level including co-production with NATO (Permanent AML) as well as production-on-demand of Dynamic AML Layers requested by different branches of the Navy in support of tactical or strategic planning of operations or exercises.

## Developments

### IDE Infrastructure

Within the framework of Spatial Data Infrastructure, and building on developments during the previous four years, we have established nautical chart display services (Web Map Service, WMS) based on the display of electronic nautical charts complying with the S52 display standard, as well as a download service (Web Feature Service, WFS) of the Spanish coastline at scale 1:50000, and a catalog service for nautical cartography metadata (Catalog Service for Web, CSW). All these services have been developed using open source tools and

based on OGC (Open Geospatial Consortium) standards, following the guidelines in the INSPIRE European Directive and the Spanish Law LISIGE.

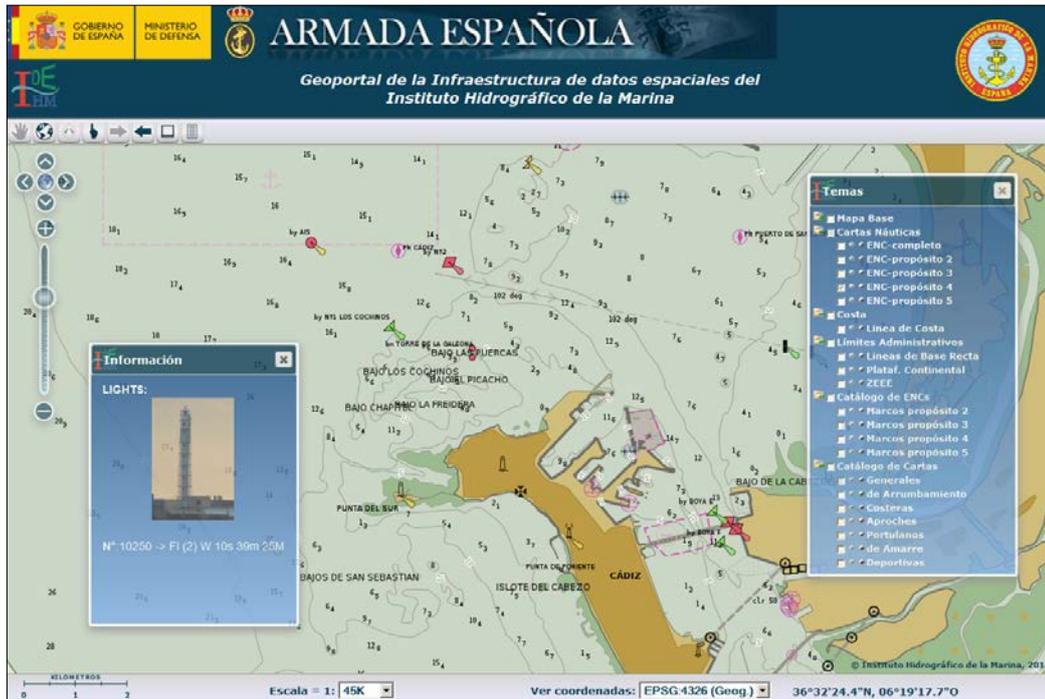


Figure 33. IHM WMS Service Browser

There is also a IHM Web catalogue services including information on available IHM data and services, with a simple browser to display different WMS services.



Figure 34. Main page of the IHM Web catalogue services on Spatial Data Infrastructure

# Cartographic and Photographic Center. Spanish Air Force (CECAF)

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**F**rom 1920, when the aerial photographic and reconnaissance activities firstly began to nowadays, the Spanish Air Force has been producing many cartographic and photographic series, mainly for the aircrews to fly and for the aeronautical cartographic production.

A little of history. In 1930 the Cartographic and Photographic School was created to train the aircrews in the photographic technics. Later, in 1950, the Cartographic and Photographic Service produced the first aeronautical charts for fighters meanwhile the School continued to train personnel in photogrammetric and cartographic sciences. In 1979 the CECAF adopted the current denomination.

CECAF's main activities spans from aeronautical cartography production, photointerpretation, aerial photography, offset printing, nav aids calibration, aircraft navigation procedures design and aerial validation, topography, photogrammetry, historical photography archive and photo-video production.

CECAF's main productions are instrumental and visual aeronautical charts, both in paper and in digital formats.

## **Instrumental Chart 1:2,000,000 (upper and lower air space)**

### *General information*

Mercator projection

Aeronautical information gathered from the following sources:

- AIP (Spain, Morocco, Portugal and France)
- NOTAM's C AND MILITARY
- CIDEFO
- Air Bases and Airfields
- SESPA
- NGA
- Aeronautical easements concocted by the Photogrammetry Section CECAF
- Jeppesen aeronautical chart

In these CHARTs the following information is depicted: airways, radio aids, aerodromes, Prohibited areas (P), Restricted areas (R), Dangerous areas (D), Wildlife sensitive areas (F), reporting points, FIR, TMA, distances, magnetic bearings and other information that may be used for navigation by instruments (IFR).

**Instrumental Lower Airspace Chart Scale 1: 2,000,000**

Instrumental Lower Airspace Chart contains aeronautical information up to FL245 (24,500 feet).

The main use of these CHARTs is the instrumental navigation through airways, which are the routes followed by aircraft or the equivalent of the roads in land. They can be one-way or two-ways. Course and elevation are depicted in the chart for every airway. Different elevations within the airway determine level flight of the aircraft. The airways are composed of sections between two points. These points are nav aids or reporting points.

Radio aids (also called nav aids), are electronic equipment facilities used to provide course, range and/or altitude to aircrafts so that they can determine their position and in some cases the distance to them.

There are several types of radio aids, TACAN, VOR, DME, NDB, etc. It also takes into account the airspace restrictions highlighting restricted flight areas, indicating whether it is a dangerous area, prohibited, restricted, sensitive wildlife ...

**Instrumental Upper Airspace Chart, Scale 1:2,000,000**

It has the same features as the previous CHART but is used from FL245 (24,500 feet) and above.

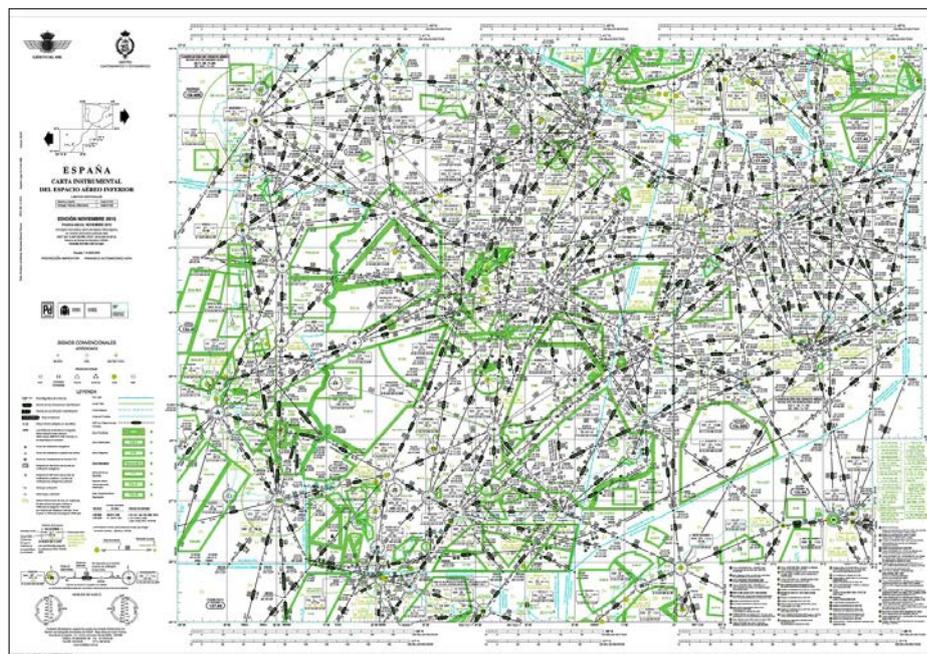


Figure 35. Instrumental chart 1:2,000,000

## Charts Of Terminals (Tmas) Areas

These charts provide information on the procedures for aircraft operating under IFR in the TMA's established in the Spanish territory. Its purpose is to provide information to move from the en route phase of flight to initial approach.

Scale: 1: 1,250,000 and 1:800,000, although it may vary according to the area to cover.

Projection: Lambert conformal.

In these CHARTs aerodromes affected by terminal routings and airways are represented, nav aids, radio frequencies, reporting points, distances, magnetic declination, holding patterns, magnetic bearings, areas P, D, R, altimetry data, CTR's, etc .

This chart is edited on a single sheet, using the front and back. We selected the eight most important TMA's. Four (Madrid, Galicia, Valencia, Zaragoza) on the front and the other four (Barcelona, Seville, Palma, and the Canary Islands) on the back. That provision has not been arbitrary; it has taken into account the folding of the sheet.

It is published in colour.

## Aeronautical Visual Chart

It offers flight information with reference to the terrain. The geodetic reference system is WGS-84 and its projection is Lambert Conformal Conic.

In these charts, airfields, radio navigation aids, different kinds of zones (P, D, R), obstacles, limits and FIR TMA's are depicted. Especially, altimetry data on each grid is presented to ensure flight safety over physical obstacles. Place names and hypsometric tints are of particular interest in these kind of visual charts.

This mapping is published in two separate sheets that completely cover the entire national territory (Sheet EAST and WEST). On the back of each of them it is reflected airspace restrictions, communications, graphic scales and conventional signs.

## Low Flying Chart 500,000

LFC's letter is represented by a Lambert Conformal Conic projection and Spain is divided into nine leaves. The chart is published annually.

Aeronautical information comes from both, the CECAF and the AIP-Spain.

Altimetry has been generated by CECAF while planimetry comes from different organisms, IGN, CEGET, CECAF.

This chart is designed primarily for visual flight. Aeronautical and topographical information is used to navigate with reference to landforms and unique elements.

LFC is used for mission planning as well.

Moreover, elements that can be dangerous for low altitude navigation, obstacles higher than 62 meters high (200 feet), wind farms or power lines are highlighted.

In the center of each grid of the map, there is a figure called MEF (Maximum Elevation Figure) indicating elevation in hundreds of feet. Above this altitude, the flight is considered safe from the point of view of obstacle clearance.

Aeronautical information represented are airports, heliports, runways, nav aids, reporting points, restricted areas and other data.

## **JOG 250,000**

Joint Operations Graphics 250.000 or the Chart of Joint Operations (Air), is designed primarily for visual flight.

It uses WGS 84 ellipsoid and UTM projection with four different zones: 28, 29, 30, 31. It is published every five years.

It consists of 44 sheets covering the national territory.

It is made using the topographic base from Spanish Army Geographic Center to which the aeronautical information layer necessary for air navigation has been added.

Aeronautical information comes from both the CECAF and the official Aeronautical Information Publication, AIP-Spain.

This chart matches the Joint Operations Graphic (Ground) published by the Army. Using the later as template, several elements needed for navigation has been added, including airports, provisional landing runways, nav aids and obstacles over 60 meters.

Aeronautical and topographical information allows instrumental and visual navigation.

Geographic features, as lakes, rivers, villages and mountains are taken as visual reference. The chart is also used for mission planning.

Altimetry shadows are also included to give a sense of relief to the chart.

In the centre of each map grid there is a figure called MEF (Maximum Elevation Figure) indicating elevation in hundreds of feet from where the flight is safe from the point of view without obstacles.

## Pilot Manual

The Pilot's Manual includes the following information:

- Instrumental Approach Procedures (IAC).
- Standard Instrument Departure Procedures (SID)
- Standard Arrivals (STAR)
- Visual Approach Procedures (VAC)
- Airport Diagrams (AD).



Figure 36. Web access to Pilot Manual

## INSTRUMENTAL approach charts (IAC)

For aircraft operating under instrument flight rules (IFR), an instrument approach or instrument approach procedure (IAP) is a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument meteorological conditions (IMC) from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually. The concept was also commonly known as a blind landing or blind approach when first introduced, although these terms are no longer common.

There are two main classifications for IAPs: precision and non-precision. Precision approaches utilize both lateral (localizer) and vertical (glideslope) information. Non-precision approaches provide lateral course information only.

Publications depicting instrument approach procedures are called Terminal Procedures, but are commonly referred to by pilots as approach plates. These documents depict the specific procedure to be followed by a pilot for a particular type of approach to an airport. They depict prescribed altitudes and courses to be flown, as well as obstacles, terrain, and potentially conflicting airspace. They list missed approach procedures and commonly used radio frequencies.

CECAF uses the NATO military criteria to design these charts, which is an extension of ICAO 8168 Vol II document.

To carry out these charts, also called plates, Universal Transverse Mercator Projection is used at the approximate scale of 1: 500,000 and 1: 1,000,000. These charts are included in the Pilot's Handbook and updated every 28 days (AIRAC cycles). Its use complements the consultation of NOTAM's (Notice to Airmen) and supplements (SUP's) in force.

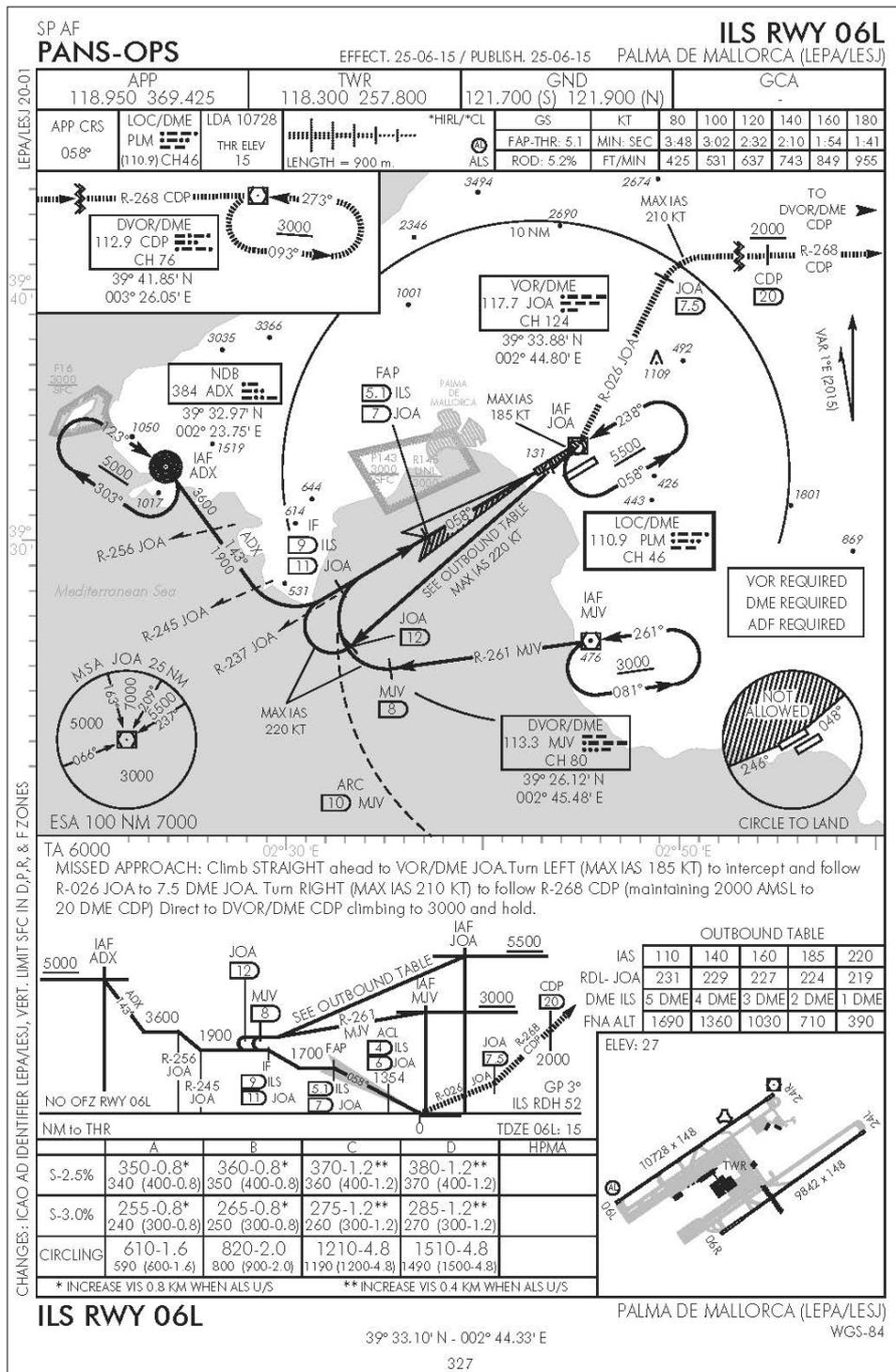


Figure 37. ILS Precision Approach Plate

### Standard Instrument Departures and Arrivals

Standard instrument arrivals: SID (Standard Instrument Departures) and STAR (Standard Arrival) describe the routes followed by the aircraft according to their destination, from the airport to the assigned airway and from Route to the starting point of the approximation, respectively. The function of these procedures is to allow simultaneous departures and arrivals at the airport control area without risk of collision. The data depicted in these charts are:

- Identification of each of the departures or arrivals represented in the letter.
- Identification of airport runways.
- Radio frequency contact with different ATC services.
- Date of entry into force of the letter.
- Transition altitude.
- Significant points: VOR, NDB, or GPS fixed points are used as reference in the chart and have the following information: Name of item, type and frequency (only aids), which identifies MORSE sequence (navaids only), latitude, longitude.

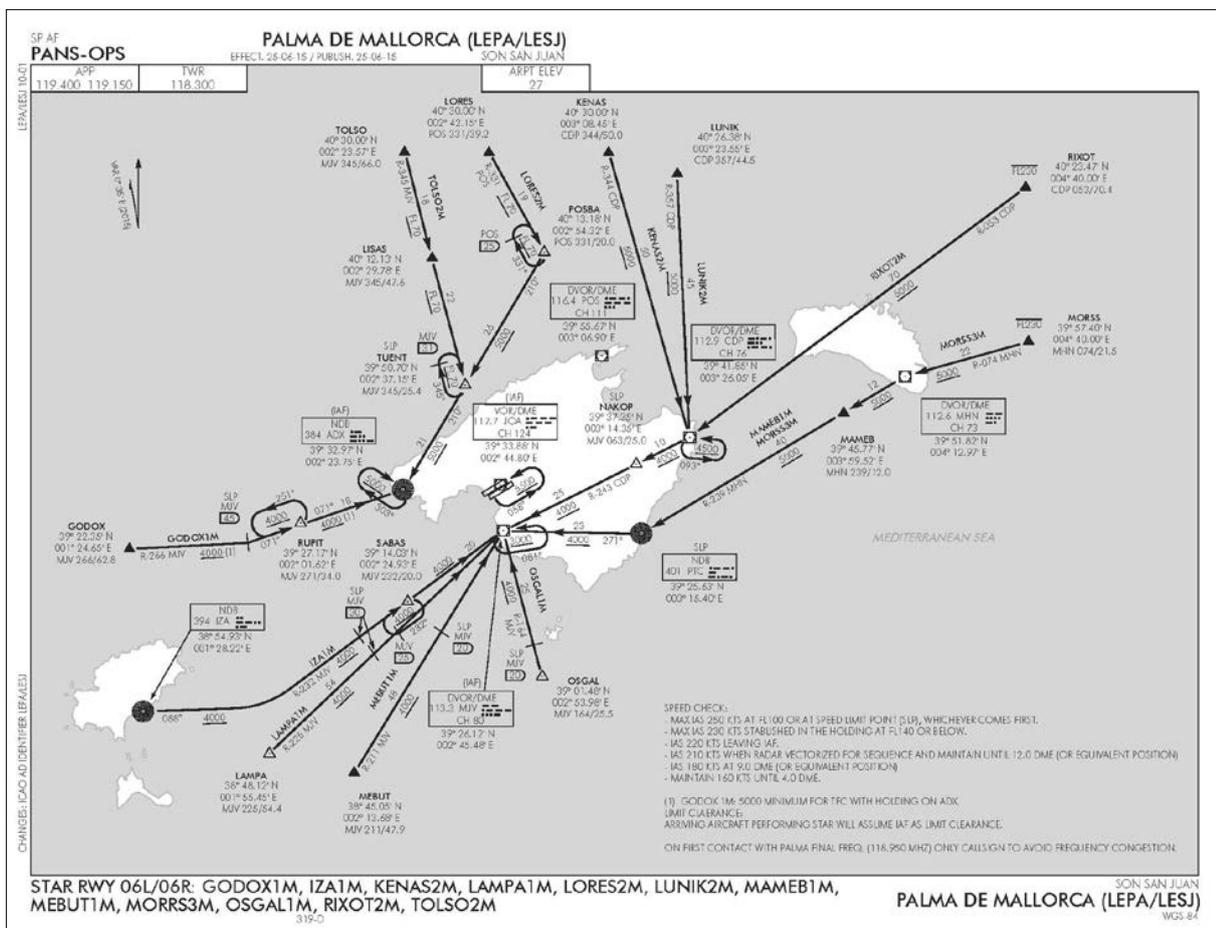


Figure 38. Standard Arrival (STAR) Chart

## Cokpit Digital Maps

CECAF provides different types of mapping utility for aeronautics in several standard formats of digital maps for use in the various weapons systems. These digital formats are:

- Arc Standard Raster Product (ASRP) is a NATO standard format.
- Compress Arc Digitized Raster Graphics (CADRG), this format is a standard compressed format ADRG NATO derivative.
- Controlled Image Base CIB, is a NATO standard format specific to ortho.
- Raster Spanish Format (FRE). Spanish proprietary format developed at the request of the Ministry of Defense.
- GEOTIFF. It is a standard TIFF file georeferenced.
- Vector Map Level 1 (VMap1) is a NATO standard vector format.
- Digital Terrain Elevation Data (DTED), is a form of digital terrain model and is distributed in levels 0, 1 and 2.

Among the types of maps provided, there are those generated by CECAF itself, and those provided by the CEGET and agencies of allied countries such as NIMA / NGA (National Image and Mapping Agency / National Geospatial-Intelligence Agency).

The types of charts supplied in digital form are:

- Global Navigation Chart (CNG) (1: 5,000,000)
- Jet Navigation Chart (JNC) (1: 2,000,000)
- Operational Navigation Chart (ONC) (1: 1,000,000)
- Tactical Pilotage Chart (TPC) (1: 500,000)
- Joint Operational Graphics (JOG) (1: 250,000)
- High Flying Range (HiFR) (1: 2,000,000)
- Low Flying Range (LFR) (1: 2,000,000)
- Letter of Visual Navigation (1: 1,000,000)
- Low Flying Chart (LFC) (1: 500,000)
- Topographic maps at 1: 50,000
- Orthophotos with diverse Ground Sample Distance (GSD)

## Aeronautical Servitudes

Aeronautical servitudes established in air bases, military airfields and heliports, respond to the need expressed in the Air Navigation Law 48/1960, Article 51, which states: "The land, buildings and facilities located around airports, airfields and aids to navigation are

subject to the easements established or to be established in special provisions concerning the maneuvering area and the approach airspace. The nature and extent be determined by decree agreed in Council of Ministers,...” Aeronautical servitudes define the airspace that ideally should be keep free of obstacles around the aerodrome in order to carry out safely aircraft operations.

Three types of maps produced:

1. Aerodrome easements.
2. Radiofrequency easements.
3. Operations easements.

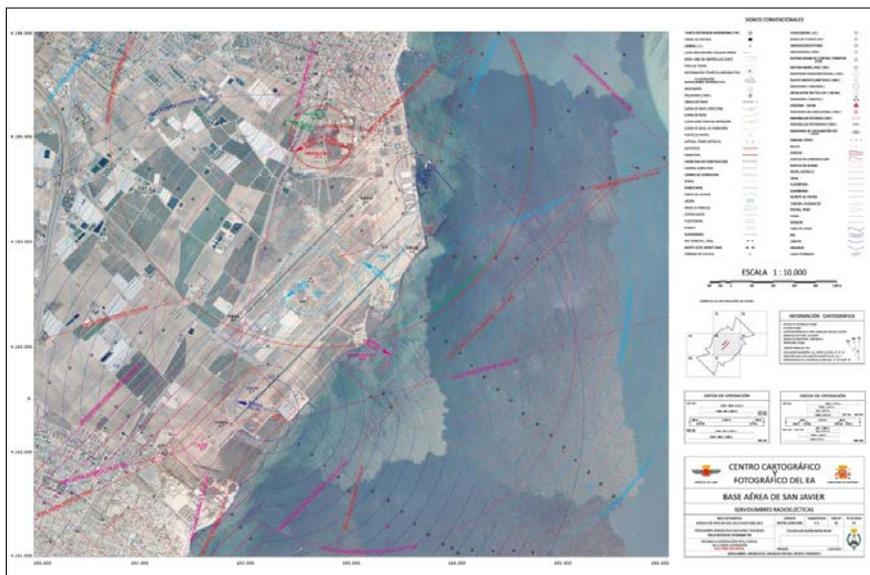
Aerodrome easements refer to those surfaces used to protect the runway.

Radio electrical servitudes refer to those surfaces, which protects the issuance of aeronautical radio aids.

Operations easements protect the instrumental procedures established around an airport.

Municipalities affected by servitudes must take in account these limitations for urban planning purposes.

The mapping used for this type of easements, meets the requirements of the Law and is entirely drawn up by the CECAF. The technical characteristics of base map are:



Scale 1: 10,000, for aerodrome and radio electric easements

Scale 1: 50,000, for operations easements

Cartographic projection U.T.M. (In the corresponding Zone).

Official Reference Systems (ED50 or ETRS89).

Contours with 5m or 20 m equidistance.

Figure 39. Radio electrical servitudes, scale 1:10,000

Graphical representation of any element greater or equal to 2 meters, except those of special interest for such cartography, which would be represented by conventional symbols.

## Infrastructure Cartography

Other facets of the Cartographic and Photographic Center are the preparation of topographic maps at different scales, from the photogrammetric flight to the cartographic product. These map products are obtained by photogrammetric triangulation and restitution processes and the generation of vector files.

The technical characteristics of the cartographic base are drawn up:

### Scale 1:1,000

Map projection U.T.M. (In the corresponding zone)

Official reference systems (ED50 or ETRS89).

Contours with equidistance of 1 meter.

Graphic representation of any element greater than or equal to 20 cm. Elements of special interest for this map scale would be represented by conventional symbols.

These maps are used for defining infrastructure works.

### Scale 1:5,000

Map projection U.T.M. (In the corresponding zone)

Official reference systems (ED50 or ETRS89).

Contours with equidistance of 2 meter.

Graphic representation of any element greater than or equal to 1 m. Elements of special interest for this map scale would be represented by conventional symbols.

These plans are used to define boundaries, buffer zones, infrastructure works, etc.

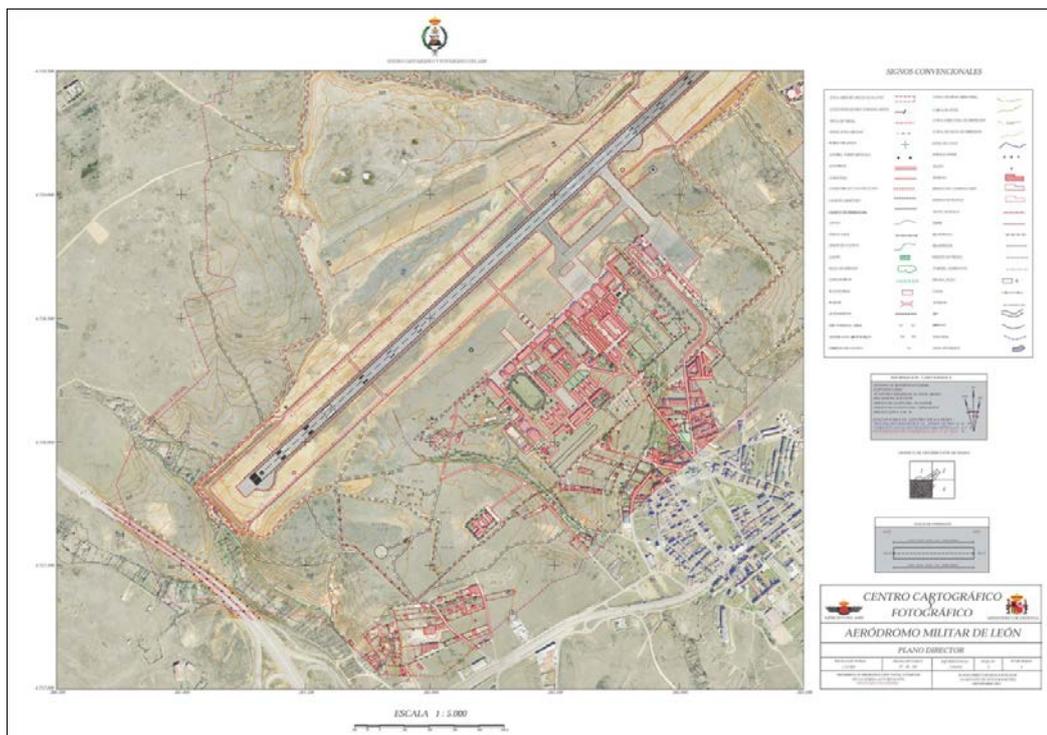


Figure 40. Infrastructure Director Plan, 1:5,000



## Nav aids Calibration and Flight Procedures Validation

The calibration of radio aids was assigned to CECAF on 9 December 2008. The aircraft (Cessna Citation 560) incorporates a calibration console UNIFIS 3000, which obtains and records the data necessary to perform the inspection of radio aids. Currently, the embarked UNIFIS 3000 console is operational and in a process of constant adaptation in order to fully assume the missions that fall within the role of calibration. The first real flight inspection of nav aids conducted by the TR20-03 was held on January 2, 2010, with a crew of CECAF supported by staff from 47 Joint Group of Armed Forces. The mission was to conduct periodic inspection of the ILS runway 09 at the Air Base of Albacete, leaving this radio aid in usable condition. Until the end of August 2010 the TR.20-03 has made more than 300 total flight hours, with more than 50 missions Flight Inspection, which has meant that more than 25 nav aids under responsibility of the Ministry of Defense continue in service and in usable condition.



Figure 42

CECAF also conducts flight validation and data verification of flight procedures design (FPD). To this end, several steps are mandatory:

- Verify for accuracy of terrain data, obstacle data, aerodrome data, aeronautical data, nav aid data.
- Validate the 'intended use' of FPD as defined by stakeholders and described in the conceptual design.
- Validate flyability and/or human factors.
- Validate safety case.

**Cessna Citation V C-560**

Dimensions:

Length: 23.56 mts.

Wingspan: 29.00 mts.

Height: 8.70 m.

Speed: Cruise: 525 Km / h.

High: 774 Km / h.

Max. 15 900 lb.

Scope: 3,632 kms.

Service ceiling: 45,000 ft.

**International participation**

CECAF, as aeronautical cartography institution, is involved in several international forums and working groups. For instance:

- NATO Geospatial Board
- NATO Ad-hoc Geospatial Aeronautical Working Group
- NATO Military Instrument Standardization Working Group
- Spanish Geospatial Data Infrastructure (IDEE)
- OPEN SKIES Treaty

And also organizes the Spanish Air Force Photointerpretation Trophy (TROFEA)



Figure 43. International Photointerpretation Trophy (TROFEA). Third edition 2015.

# Geological and Mining Institute of Spain

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**Fax: +34 91 4426216**

**T**he Geological and Mining Institute of Spain (IGME) is a public research department which has the elaboration and maintaining of country geological cartography among his main commitments. That was the reason of his creation in 1849 under the name "Madrid and Kingdom General Geological Map Commission". IGME is an institution with a wide experience on Earth Sciences. Thus, not only maintain geological mapping in several scales since then but grows his selection across the close and derived products. These are the so-called "Geotematical Maps" devoted to a research, practice or didactic function or to solve specific problems.

Since 1849, IGME develops systematic map series. First, as provincial maps until 1914. Later (1927-1970) as the Geological Map of Spain at 1:50,000 (1<sup>st</sup> Series) but unfinished. Currently the Geological Map of Spain (2<sup>nd</sup> Series) (MAGNA) is finished. Beginning of MAGNA plan was about 1970. Geological maps at 1:200,000 scale are linked with that program, as well as, marine geology of continental platform and adjacent margins (FOMAR). Since 1863, together with those middle scale cartographies, country broad or mural geological maps have been often published at 1:1,000,000 and 1:2,000,000 scale.

Starting about the middle of the last century, special Geological cartography has been made, preferably related with recent geology: geomorphologic maps, quaternary maps, etc. A most demanded cartography in the last decades. Examples are hidrogeological, geotechnical, metalogenetic and industrial rocks and mineral rocks resources maps. Recently environmental geology maps focused on land uses and planning have been set up. Social and economic impact of natural disasters promotes definitely the making of Geological risk and/or Geological danger.

Nowadays, IGME tries to cope with the increasing demand of information about environment and the technological chances given by computer applications such as spatial information management. Both drive to the need of development of new map products in a systematic way or under user demand. The target is defining a methodology in order to elaborate a Integrated Geoscientific Cartography using the Continuous Geological Map (GEODE) of Spain as a basis. It's about delivering analytical map symbolized information, in other words, normalized Geoscientific Cartography related with systematic maps at many scales with application in Geological research, underground prospecting combined with geophysical data and test drillings, underground water and aquifer distribution and characteristics, mechanical behaviour of regional materials, origin, location and relationships between mineral resources, land planning, economic and social impact of natural disasters, erosion, desertification, environment and civil engineering.

## Land Geological Cartography (MAGNA) and Continuous Geological map (GEODE)

After 35 years, the second series of Geological Map of Spain (MAGNA) at 1:50,000 (or 1:25.000) scale is finished, but the edition works continued today. Each sheet has two maps: a geological and a geomorphologic one (since 1991) and an explanatory report. As well as complementary documentation with paleontological, petrological and sedimentological works, photographs, geological sites, etc. (IGME Documentation Center).

From 2013 to 2015, 19 sheets of the Geological Map of Spain at 1:50,000 scales (MAGNA Series) with Geological and Geomorphological map and Memoir, have been published.

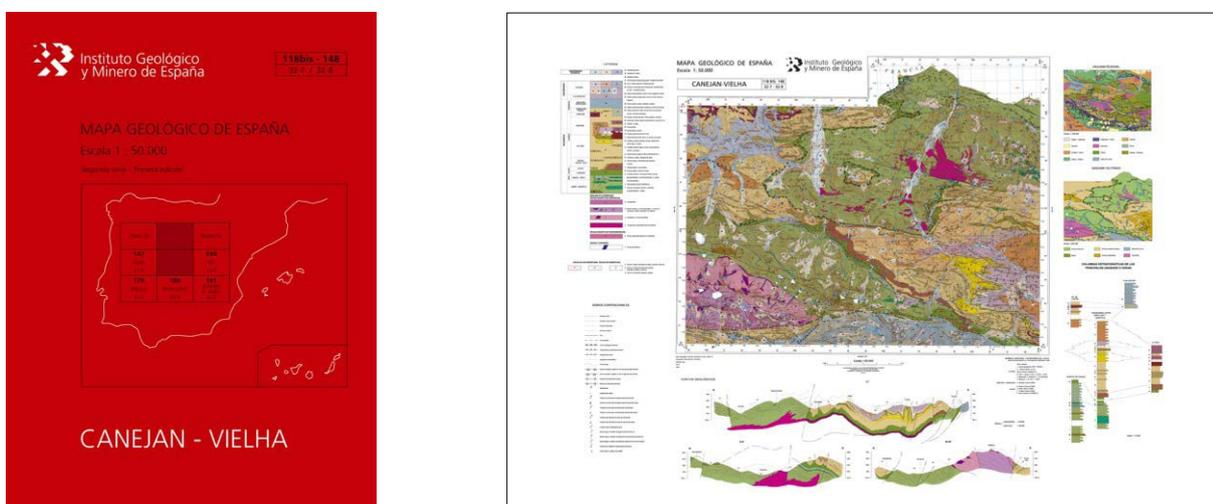


Figure 44. Image of one of the geological maps published in 2013: Sheet 118 bis-148 Caneján-Vielha, and its notice

## New Geological Map of Spain at 1:50,000 (or 1:25.000) in Digital Edition

In order to pick up more complete information, a new Program of the Geological Map at 1:50,000 scale (or 1:25.000) is going on. It tries to update MAGNA series and takes account of the surface geology and underground information. Every sheet of the new Geological Map of Spain at 1:50,000 scale in Digital Edition, contains a Geological, Geomorphological and Active Process map and a complete descriptive memoir.

This new digital series is distributed in interactive DVD format, which includes a GIS client accessing maps, reports and auxiliary information. In this media, a difference of the traditional MAGNA series, all the information obtained during the elaboration of the map is included and fully consultable.

Three interactive CD of the new Digital Edition of Geological Map of Spain at 1:50,000 scales were published in 2013-2015.



Figure 45. Example: Cieza sheet (891)-DVD

In order to improve the dissemination and the usefulness of the geological mapping, a new **Continuous Geological Map, GEODE project** was developed. The aim of this project is create a new, seamless 1:50,000 geological map avoiding discontinuities between sheets and to deliver information in a quick, modern and efficient way to the user. This product, entirely digital, and accessible only by web browsers, includes a map and a legend, both unified according to 20 regional units. Also it can be used as a geological base reference for other geotematic maps.

### Regional synthesis, mural and popular maps

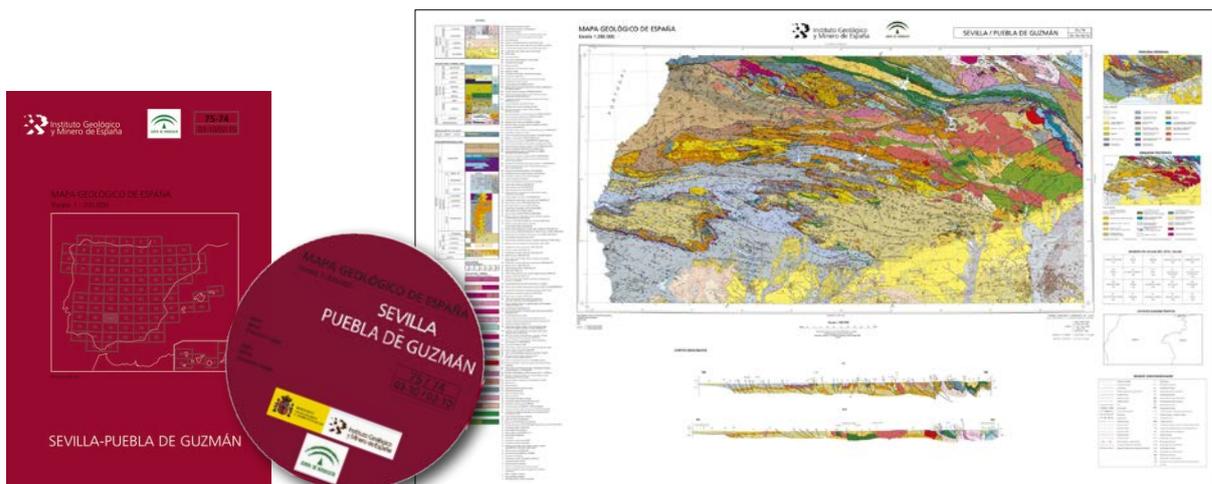


Figure 46. Geological Map of Spain at 200,000 series. Sevilla sheet (75-74). The edition contains Geológica map, memoir and CD/DVD

The geological maps at 1:200,000 scale is a systematic series with discontinuous elaboration, which at this moment covers 50% of the territory of Spain. Integrating the new cartography obtained in the GEODE project, the scale of these maps (between 1:100,000 and 1:400,000) is particularly well suited to show regional geological synthesis.

From this Geological Map of Spain at 200,000 series, 4 new maps are now ready for print. These maps were made in collaboration and partially funded by the Junta de Andalucía. As a new innovation, with regard to the previously published maps, they include a DVD with all the complementary information available from samples and reports.

Periodic preparation of mural maps showing Spanish country is a traditional activity and a way to show “the state of the art” of broad Spanish geological knowledge. In the course of this year, a new version of the geological map of Spain and Portugal at 1:1,000,000 scale will be published. As a novelty this map includes the geological delineation of the marine platform.

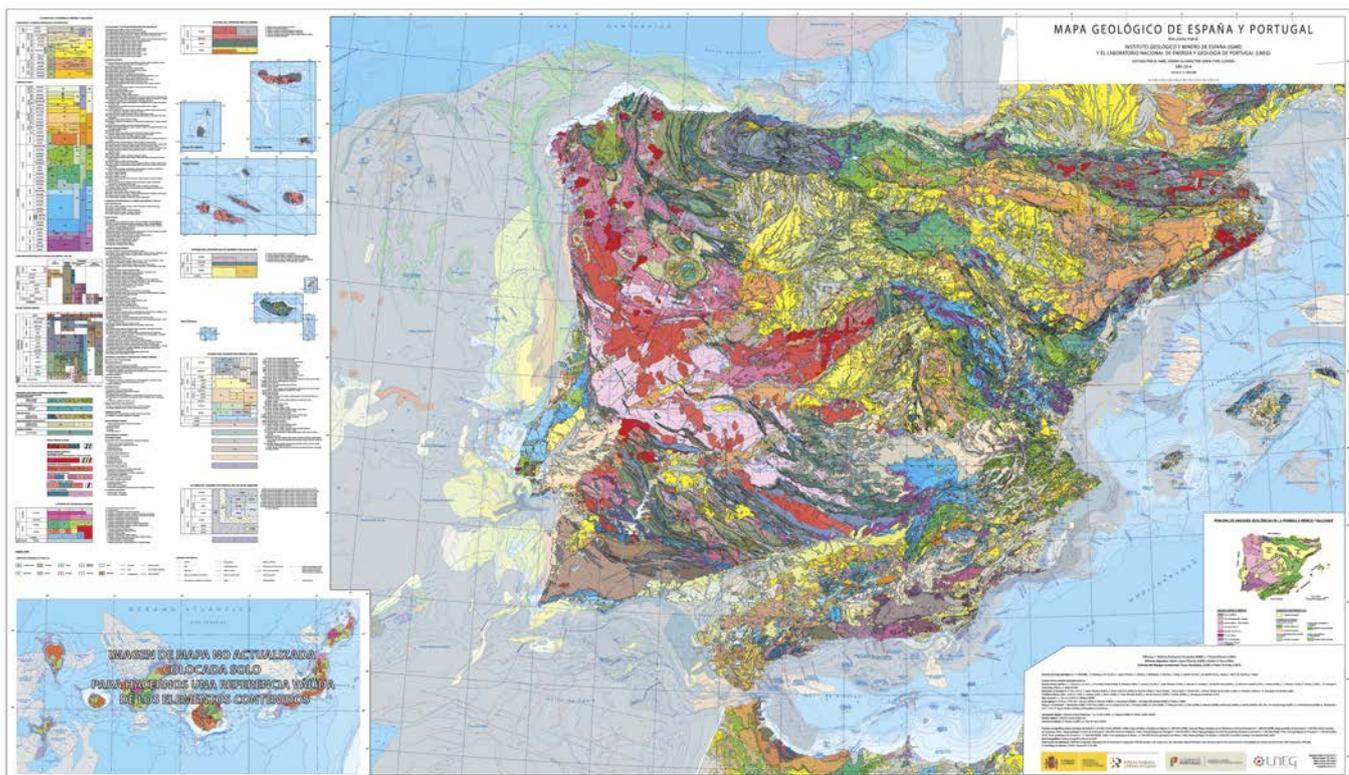


Figure 47. The new geological map 1:1,000,000 scale of Spain and Portugal to be published in 2015

Popular subjects are about maps included in the **Geological Guides of National Parks**. This Series deals with nature tourism demand of information. It shows relationships between geology, relief and vegetation. Also includes some itineraries of interest.

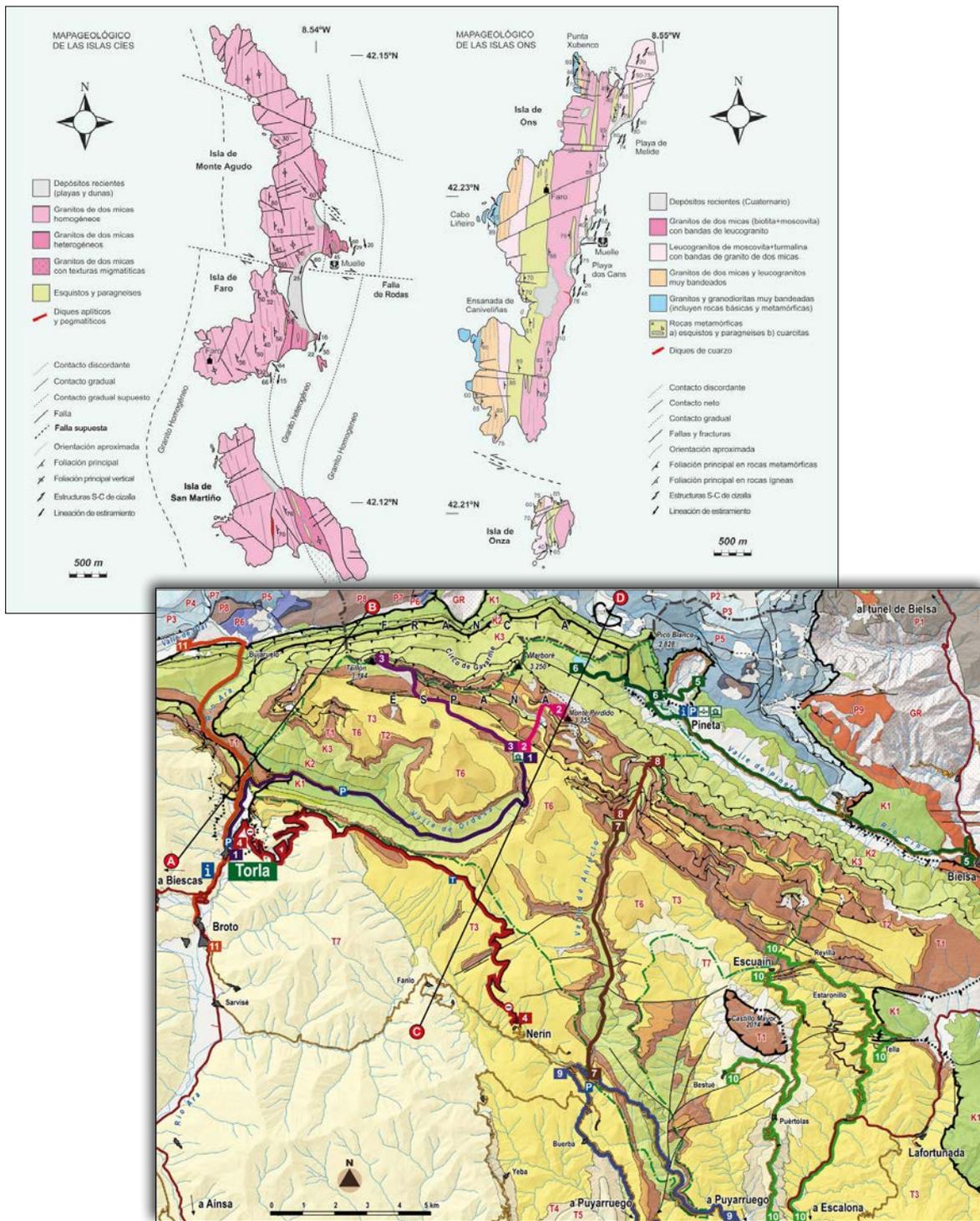


Figure 48. Images from geological maps included in the geological guides, left Islas Atlánticas, right, Ordesa and Monte Perdido National Park.

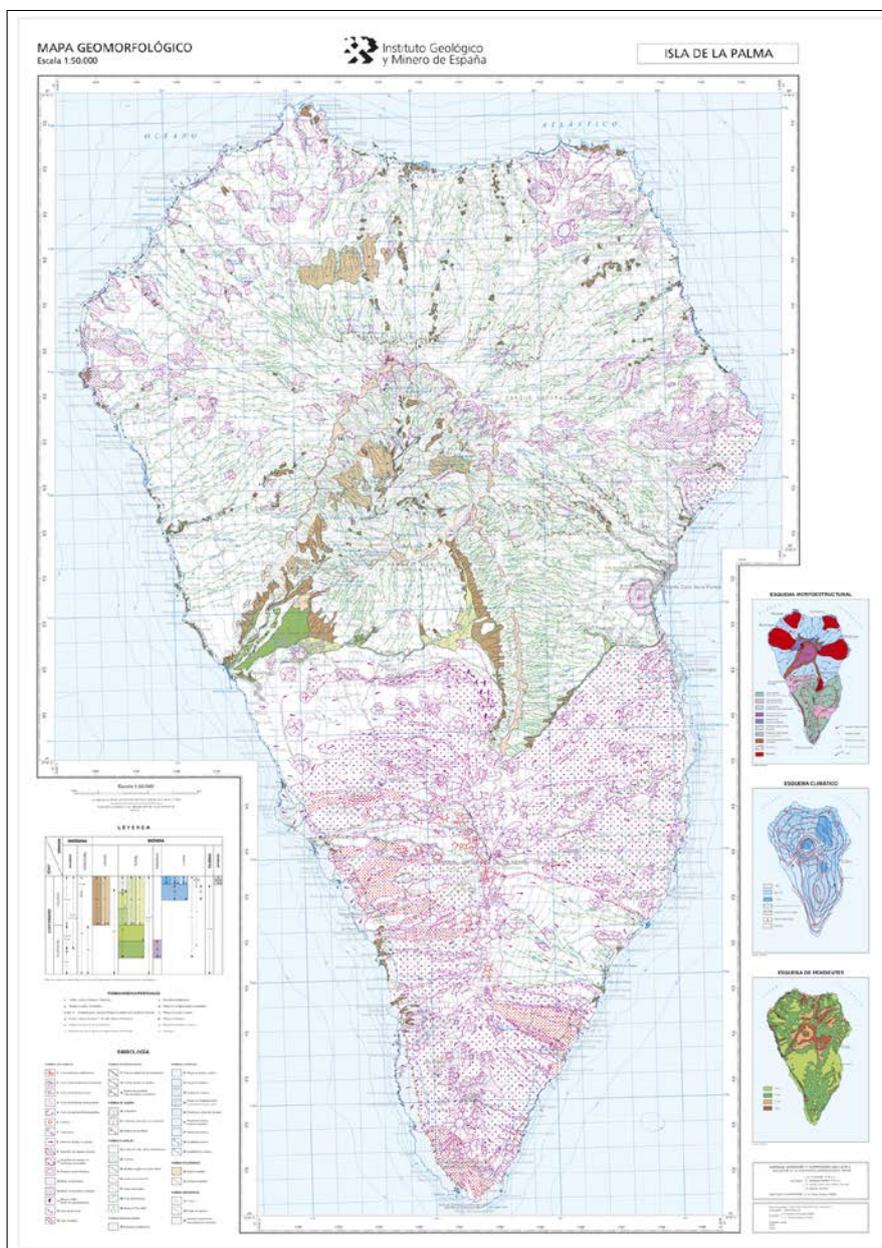
### Marine Geological Cartography (Marine Platform Geological Map and Digital Map, GEODEMAR)

The published Marine Geological Cartography of continental platform and margins at 1:200,000 scale covers the 40% of the area.

Nowadays a new Digital Cartography is planned (GEODEMAR) in collaboration with other institutions (IEO and CSIC) and structured as a National Marine Geological Database (SIGEMAR).

### Geomorphology, Active Processes and Geomorphological Units

The Geomorphological Map of Spain series at 1:50,000 scale is a set of thematic maps derived from the geological map, but focusing in surficial geology and landscape interpretation. It is composed by three related individual maps: *Geomorphological map* that delivers information about landforms. *Active processes*, a geodynamic activity inventory (seismic, geotectonic, volcanic, landslides, erosion, floods, antropic activities and sedimentary processes associated with some lithologies) drawn by the forms that they generate. The third map, *Geomorphological Units map*, divided the territory in homogenous areas from a geomorphologic point of view, as a summary of previous cartographies.



Starting its publication in 1991 in full colour and at 1:50,000 scale, the Geomorphological Map is the result of several releases and improvements during three decades. Nowadays the 40% of the Spanish territory is covered by this series.

Starting its publication in 1991 in full colour and at 1:50,000 scale, the Geomorphological Map is the result of several releases and improvements during three decades. Nowadays the 40% of the Spanish territory is covered by this series.

Figure 49. Geomorphological map 1:50,000 scale of La Palma Island published in 2015

## Soils

This map, at scale 1:25,000 or 1:50,000 is focused on research and description of polluted soils (general reference levels, environmental indicators, solving, etc)

Information inside these maps refer to soil typology (Soil Taxonomy/WRB) his geographical distribution and capacity-vulnerability indicators and data about surficial and subsurficial aspects, lithology, geomorphology and vegetation.

## Geological Hazard

Research, forecast, prevention and mitigation of hazards generated by natural processes of geological origin is an IGME commitment. They deal with earthquakes, tsunamis, volcanism, floods, landslides (subsidence and slope), avalanches and those related with coastal processes.



Include field observations, soil samples, digital elevation models and a qualitative and quantitative zoning as a result of the multifactorial analysis using GIS.

Scale varies from regional to 1:5,000/1:25,000 when the study areas are high populated. In 2012 was implemented a new web service that

Figure 50. Image of QAFI web service (<http://info.igme.es/qafi/>)

hosted the QAFI (database of active faults of Iberia). QAFI is a database containing a compilation of faults showing geological evidence of activity during the Quaternary (last 2.6 million years according to the official limit set by IQS in 2009). Its main practical application is to improve seismic hazard estimations by means of including geological data from active faults. The database is hosted and maintained by the Geological Survey of Spain (IGME) and is accessible to the research and technical community and to society in general (<http://www.igme.es/infoigme/aplicaciones/QAFI/>).

## Geophysics

Geophysical Maps (gravimetric, magnetic and radiometric maps) are a main tool to underground knowledge delivering important information about internal structure. The IGME has gravimetric stations as a result of the geological and mining field exploring during last 50 years. Resulting databases can be managed to produce homogeneous layers (Bouguer Anomaly maps). Also includes magnetic, aeromagnetic and radiometric data as a base to other layers such as potential and radiometric field anomalies, usually at 1:50,000 and 1:200.000 scale. The aim is to develop a map in digital format joining all the resulting data from processing and interpretation (2D and 3D). Anomalies will be coloured combined with a recent vectorial geological base (GEODE).

## Geotechnical characteristics

Geotechnical Maps are displayed usually at 1:5,000 scale covering municipalities, but can be published at smaller scales such 1:50,000/1:200.0000) for reference purpose.

Maps shows several zonings: specific related with some geotechnical field feature (subsidence, consolidate layer thickness, etc) or related with geological hazards according to three danger levels.

They are useful as base information to make decisions in land planning assessment.

## Hydrogeology

IGME's hidrogeological maps show regional aquifer features as well as exploitation aspects as a basic information for further detail works.

The Hidrogeological Map of Spain at 1:1,000,000 (1972) is previous to a systematic series at 1:200,000 carried out between 1982 and 1990. Since then hydrogeology is included as a complementary information in the Geological Map at 1:50,0000 (MAGNA). Hidrogeological and Hidroenvironmental Atlas are made in collaboration with regional and provincial institutions.

## Metallogenic Geology, Geochemistry and Industrial rocks and minerals

Metallogenical Maps are essential tools to know potential mining of an area. They display metal, non-metal and energy mineralization evidences on a geological base. Publishing scale is usually 1:200,000 or regional and provincial layouts (1:100,000/1:400,000).

Geochemistry cartographies contribute to the knowledge of a wide set of chemistry elements geographical distribution related with superficial formation such as alluvium and soils. 1:100,000 and 1:600,000 are common regional scales. Association or anomalies maps have a more straightforward application with concrete objectives such as mining exploration, land planning or health issues.

The Industrial Rocks Map at 1:200,000 scale had an old development based on deposits with an associated inventory card. Current proposal, the Industrial Rocks and Minerals Map

(MANARMIN) is a geological-mining map that summarizes current knowledge of industrial rocks and minerals mining and its potential use. Regional maps, issued from collaboration with regional authorities are also published as the new "Industrial rocks and minerals maps of the Principado de Asturias published in 2013.

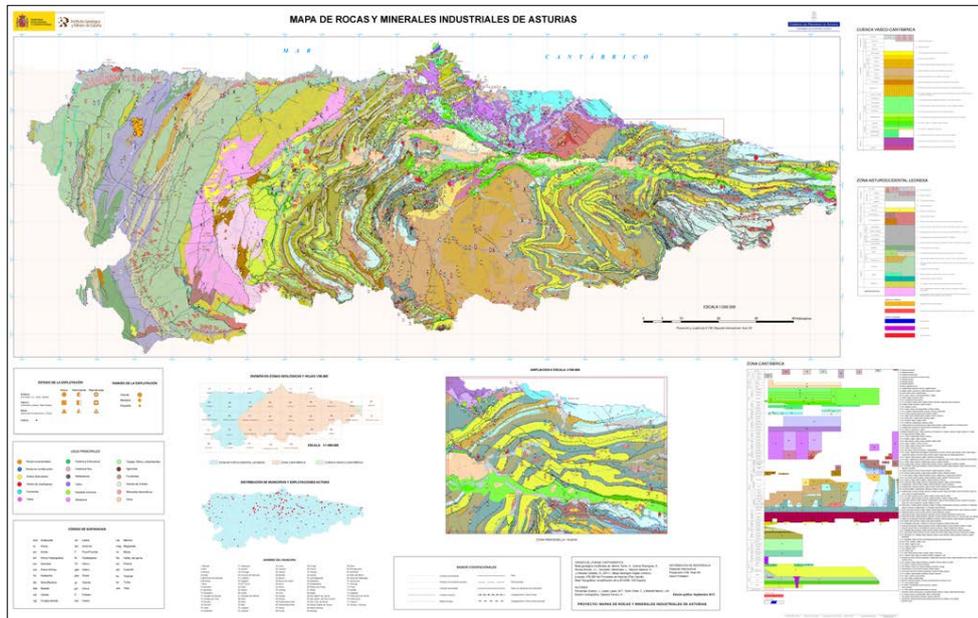


Figure 51. Industrial Rocks and Minerals Maps at 1:200,000 of Asturias published in 2013

## Geological Patrimony and Geodiversity

Domain Geological cartography is a good chance to study geodiversity through geological sites (LIGs) linked to his pedagogical and tourism potential use. Vulnerability is evaluated as well as interest degree, both infers protection priorities. Developed in

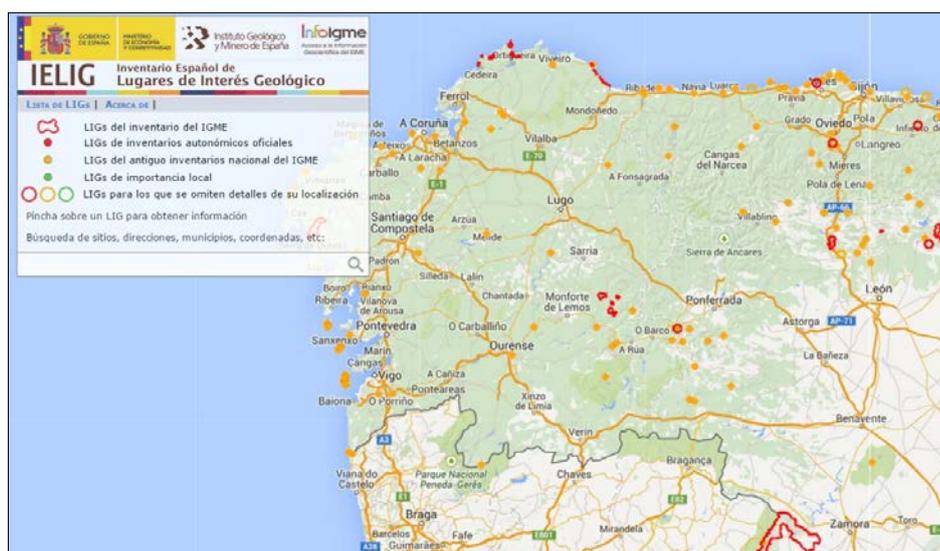


Figure 52. Image of the IELIG (<http://info.igme.es/ielig/>) web service which hosts the inventory of Sites of Geological Interest of Spain

recent times, the IELIG (<http://info.igme.es/ielig/>) web service is a new tool which hosts the inventory of Sites of Geological Interest of Spain.

### International Activity

IGME spreads his activities abroad through developing countries, especially those with a geographical or cultural proximity such as Latin America or Maghreb. Joined with European institutions, the IGME carries out his cartographic activity with geological and geothematic maps.

A new series of Geothematic maps of Antarctic territories was developed in the last years. This collection includes geologic and geomorphologic maps carried out by an international team of researchers belonging to the Instituto Antártico Argentino (IAA), and the IGME.

Four maps belonging to this series were published in 2013: the Geological and Geomorphological maps of Marambio/Seymour Island and Bahía Esperanza/Hope Bay a 1:10.000 /20.000 scales.

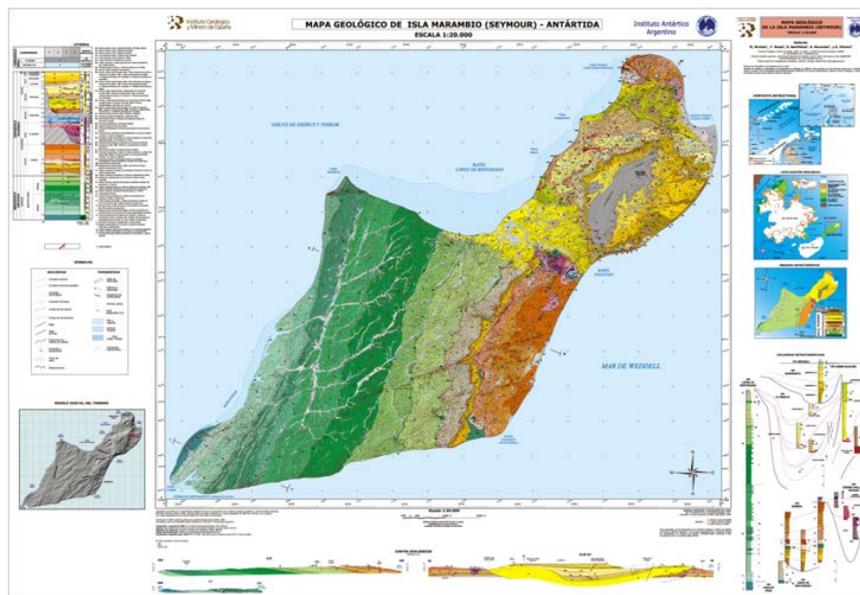


Figure 53. Geological map of Marambio/Seymour island (2013). 1:20.000 scale

### Awards and honorary mentions

The Official Committee of the International Cartography Association (ICA/ACI), in the course of the XXIV International Cartographic Conference held in Santiago de Chile in August 2009, gave a 2<sup>nd</sup> award for excellent in cartography to the IGME for the Pyrenees Geologic Map 1:400,000 made in collaboration with the French (BRGM) geological survey, in the "Thematic Map" category.

# Spanish Institute of Oceanography

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**Fax: +34 91 41355 94**

The Spanish Institute of Oceanography (IEO), founded in 1914, is the oldest Oceanographic Research Institution in Spain. It develops cartographic activities basically through the marine geology department (Multibeam Cartography Group), where it is developing systematic cartographic projects of the Exclusive Economic Zone and adjacent coastal areas.

## **Topobathymetric map of Asturias**

The Topobathymetric Map in relief of the continental margin of Asturias is a product intended for scientific divulgation and education. It has been done after the results of several studies of the Spanish Institute of Oceanography (IEO) and the General Secretariat of Fisheries (GSP) on the seabed and its geology. It is therefore a product of scientific and technological activity of IEO and the GSP.

This map is the fifth of a series showing the Spanish seabed, and is part of a campaign of dissemination of marine science that the IEO started to contribute to improving the scientific literacy of the Spanish society and knowledge it has the Institute and its activities.

The map of Asturias has been possible thanks to the support and contribution of the Direction General for Fisheries of Asturias and the IEO. It is a relief map of the seabed thermoformed in PVC. The map includes the topography of the adjacent continental margin of Asturias land area; its dimensions are 72 x 102 cm.

Land topography is overlapped with information of highways and cities.

The submarine morphology presents colour-coded to give a sense of height and depth, as appropriate, achieving better viewing.

For a better understanding and be more didactic, the map is built at two different scales. The horizontal scale is 1: 550,000 around the map; however, the vertical scale is 1: 125,000 in the marine area and 1: 150,000 in the earth. This is due to the exaggeration of seamounts, to highlight the most, without deforming, reliefs and forms.

The maximum depth displayed on the map is 5684 meters, and is located in the abyssal plain to the northeast of the Cantabrian seamount. In the underwater part we had drawn

some bathymetric curves and specific depths, so they can identify the real depths in meters.

The place names on earth has labeled following the mapping specified in the National Geographic Institute. Underwater bottoms were labeled with place names in the Gazetteer of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission (IHO-IOC) of the including some classic names of Asturias fishing grounds and some new names assigned to morphological elements described for the first time.

For advanced users, on the map are indicated the most important geological and geomorphological features as submarine canyons, active faults, and areas affected by large landslides or basement elevations.

At the bottom of the map, there is a sketch of the physiographic provinces, as well as some characteristic bathymetric profiles.

The map is accompanied by a 28-page brochure entitled "How is the seabed and geology in the margin of Asturias".

### Mapa geomorfológico del Mar Balear y Golfo de Valencia

M. GÓMEZ BALLESTEROS <sup>1</sup>, J. ACOSTA <sup>1</sup>, O. TELLO <sup>1</sup>, A. MAESTRO <sup>2</sup> and E. LLAVE <sup>2</sup>

(<sup>1</sup>) *Instituto Español de Oceanografía*

(<sup>2</sup>) *Grupo de Geología Marina. Instituto Geológico y Minero de España*

In this geomorphologic map, a detailed study of the submarine geomorphology surrounding the Balearic Promontory (western Mediterranean) is presented from a multi-beam bathymetry and high-resolution low-penetration seismic reflection profiles acquired within the framework of the Spanish Exclusive Economic Zone project. The

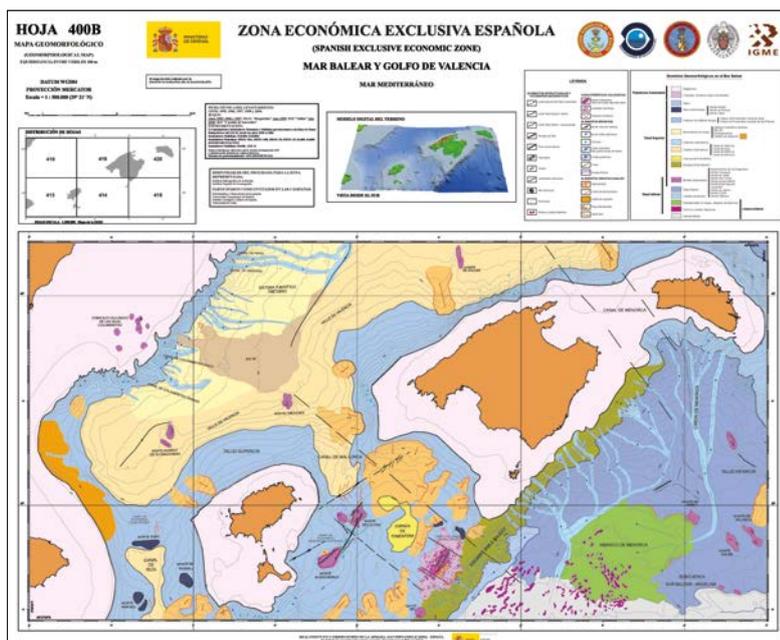


Figure 54

map identifies the main features in the surrounding submarine area of the Balearic Islands, showing a variety of seafloor relief as result of several geologic processes, which ultimately control the transport of sediment from the shallower areas to the deep basin. The most important processes are erosion of the shelf and upper slope (terraces associated with different Quaternary sea-level stands and canyons), transport and sediment deposition in the lower slope and base-of-slope by turbidity currents,

volcanism and instability processes (landslides scarps and debris lobes). The swath data show that tectonics plays an important role in shaping the submarine slopes of Ibiza and Formentera, as well as its interplay with sedimentary processes, especially mass wasting. Volcanic reliefs have been described on the Valencia Trough seafloor related to two magmatic events developed in the Western Mediterranean margin during the Cenozoic, and morphologies associated with saline dynamic processes have been mapped in the Liguro-Provençal Abyssal Plain. Finally, several areas show evidence of pockmarks, which indicate that fluid migration take place in the sediments, probably conditioning several other processes such as mass wasting.

**Distribution and abundance of *Cymodocea nodosa* meadows and *Pinna nobilis* populations in the Mar Menor coastal lagoon (Murcia, SE of Spain)**

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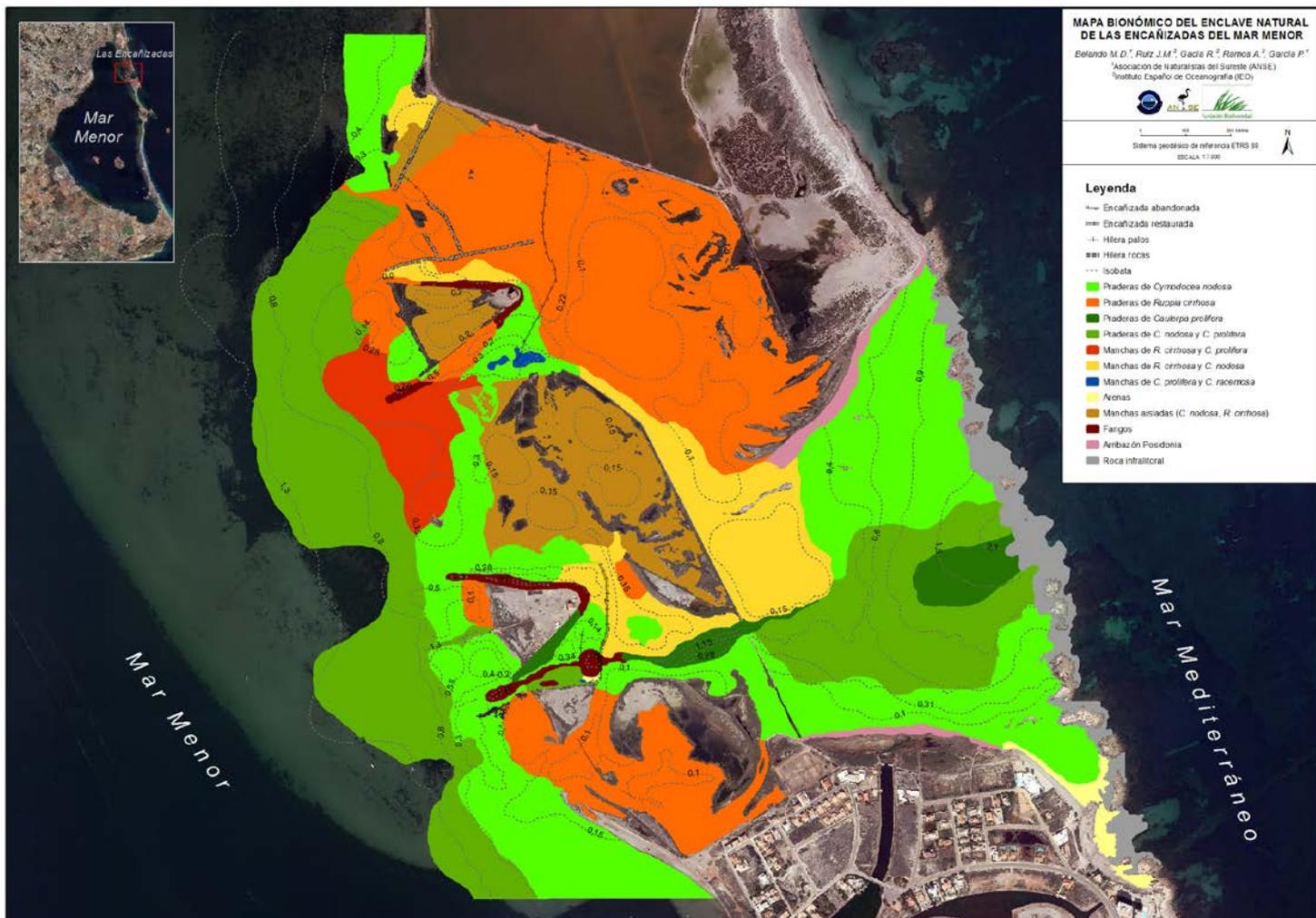


Figure 55

The Mar Menor (135 km<sup>2</sup>) is one of the most important hypersaline coastal lagoons in the Western Mediterranean Sea, its bottoms were originally colonized by monospecific meadows of the seagrass *Cymodocea nodosa*. However, since the 1970's, drastic hydrographic changes caused by various human activities has seen the expansion of a number of species common in the adjacent Mediterranean waters, of which development had been limited up to now due to high salinities and temperatures. Among these species, the seaweed *Caulerpa prolifera* and the endangered fan mussel *Pinna nobilis* are those experiencing a broader spread in the lagoon and with a great potential to interact through both bottom-up and top-down processes have, as a result of which they have become key species of the lagoon ecosystem. In fact, previous maps of benthic vegetation suggest a huge decline of seagrass populations as *C. prolifera* has expanded. Moreover, both the algae and the filter feeder could play a key role in the control of planktonic communities, which development in the lagoon waters could have been accelerated in the last decades due to the great enhancement of eutrophication and pollution processes.



Figure 56



Figure 57

Therefore, quantification of benthic vegetation communities, in particular *C. nodosa* meadows, and *P. nobilis* populations are crucial for the understanding of the Mar Menor ecosystem, but overall for the management of human activities and the implementation of conservation actions given its current protection status and the urgent need to obey European Directives (Habitats, Water Framework and Marine Strategy). In this context, precise maps of the distribution and abundance of benthic vegetation and *P. nobilis* in the Mar Menor was obtained during the spring-summer of 2014 by means of direct measurements (macrophytes cover, density and biomass and *P. nobilis* density) performed on 57 sampling points and qualitative observations (presence/absence) performed on 189 additional points as well as on 155.5 km of lineal transects using a trawled videocamera. Data obtained suggests that seagrass abundance in the lagoon is much higher than that reported in some previous studies and does not support the hypothesis of a long-term decline. *P. nobilis* has spread over a surface area 56.8% of the lagoon seafloor with a mean density of 2.17 ind.·100 m<sup>-2</sup> and maximum values (up to 22.5 ind.·100 m<sup>-2</sup>) located in the northern part of the lagoon under the maximum influence of the Mediterranean waters.

## Concentration distribution maps of representative Polycyclic aromatic hydrocarbons

Authors: MARINE GIS IEO and Contamination Team of Marine Strategy IEO. June 2015.

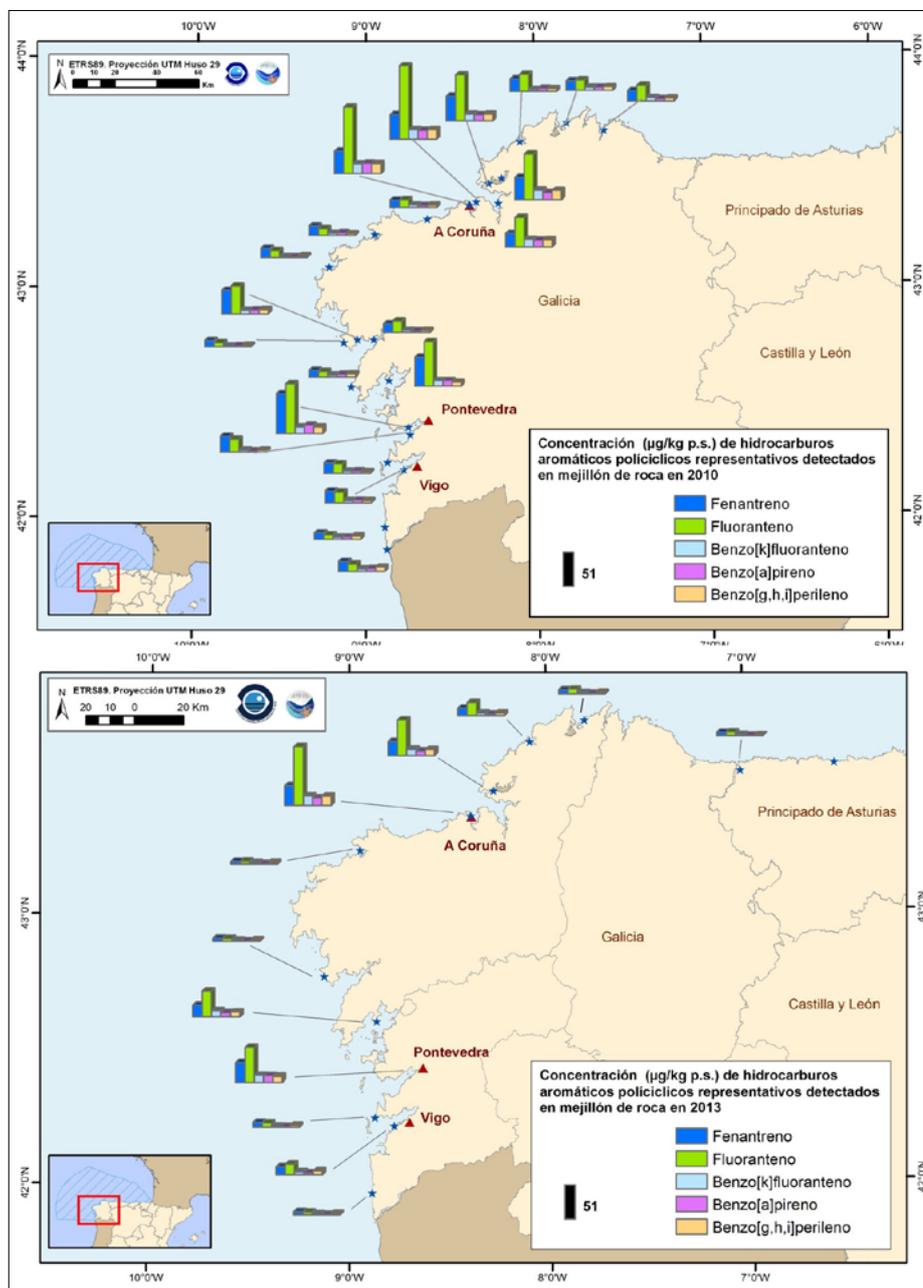


Figure 58

PAHs: Fenantreno, Fluoranteno, Benzo[k]fluoranteno, Benzo[a]pireno, Benzo[g,h,i]perileno, detected in mussel rock in 2010. And Concentration distribution maps of representative Polycyclic aromatic hydrocarbons PAHs: Fenantreno, Fluoranteno, Benzo[k]fluoranteno, Benzo[a]pireno, Benzo[g,h,i]perileno, detected in mussel rock in 2013.

The comparative study of these maps, allows studying the evolution of the concentration of PAHs in mussels in the Galician coast. This study has been carried out within the framework of the monitoring programs of the Marine Strategy Directive (Directiva 2008/56/C) in 2015.