

RISCMAS. METHODOLOGIES FOR MANAGEMENT OF LAND MOVEMENT RISKS

In 2006, the European project RISCMAS was completed. The objectives of this project were the study of land movements by means of radar interferometry, geophysical study, the establishment of a leveling network to define land movement models, the production of risk maps, and the analysis of policies on insurance. Two study areas in Italy (Calabria and Sicily) and one in Catalonia (potassic basin) were defined.

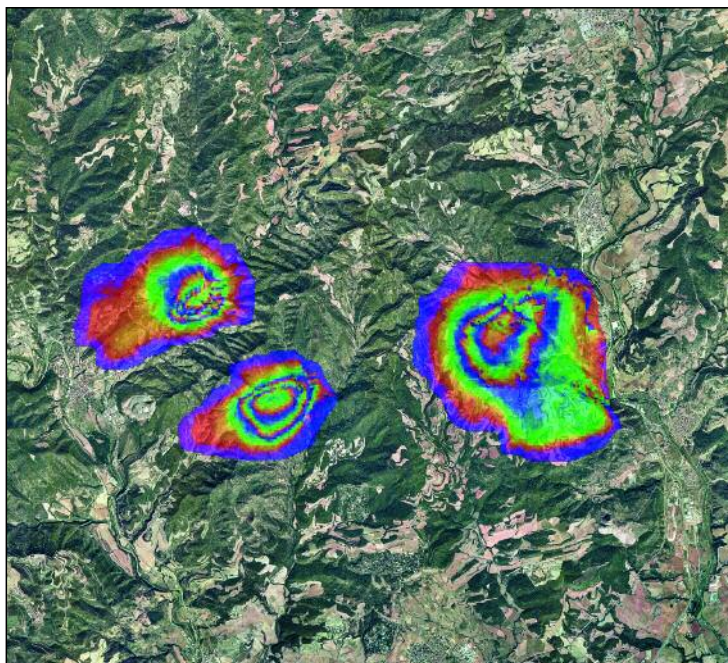
This project was led by the Region of Calabria (Italy), and the participants were the ICC, the Region of Sicily, the Region of Basilicata, CNR-IRPI and UNINA (Italy), NOA (Greece) and the University of Alicante. RISCMAS was financed by FEDER (Interreg IIIB MEDOCC program).

The ICC worked on a pilot area (potassic basin), analyzing the problems by means of radar interferometry, drawing up geophysical studies and establishing a leveling network. A database and a geographic information system relating to land movement risks in this area were also designed and implemented.

The Institute and the Universitat Politècnica de Catalunya (UPC) began to employ a new ground based radar system to detect small land movements. This radar, known as GB-SAR (Ground Based Synthetic Aperture Radar), can operate at various band frequencies: at X-band (9.65 GHz), at C-band (5.3 GHz) and K-band (17.5 GHz) by means of coupling.

The sensor moves on a rail of 2 to 6 meters, according to requirements, and it is equipped with six pyramidal antennas, two for continuous transmission and four for reception in polarimetric-interferometric configuration.

With a continuous data acquisition program on different dates, high-precision sub-



Phases of the differential interferogram between 3 February and 19 May 2005 (Bages region). Each color cycle corresponds to a displacement gradient of 2.8 cm.

sidence maps can be obtained using differential radar interferometry techniques (DInSAR).

“THE CONTRIBUTION MADE BY THE RISCMAS PROJECT HAS BEEN TO DEFINE LAND MOVEMENT RISK MODELS AND MAPS TO SUPPORT TERRITORIAL PLANNING AND TO ESTABLISH SOME POLICIES ON INSURANCE THAT ARE COHERENT WITH THE PARTICULAR PROBLEMS INVOLVED”

Thanks to this project, it has been possible to analyze land movements in potassic basins, and to develop a practical tool for managing the risk of these movements (subsidence).

SUMMARY

RISCMAS. Methodologies for management of land movement risks

DINSAR. Analysis of subsidence processes

Land registry cartography in Spain (18th-19th centuries)

DECIS. Detection of land use changes with satellite images

CORREA. Radiometric correction of atmospheric effects

Revista Catalana de Geografia. Now in digital form

VI Theoretical and practical training course on advanced cartographic techniques: Airborne laser altimeter

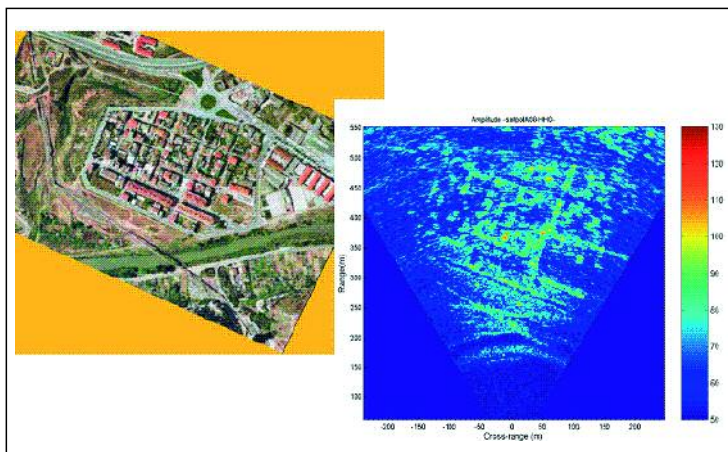
Spanish land occupation information system (SIOSE)

Symposium of the Catalan integrated geodetic positioning service (SPGIC 2007)

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Optical image and image obtained by ground based radar.

DINSAR. ANALYSIS OF SUBSIDENCE PROCESSES

Subsidence is the slow sinking of land due to a variety of causes. The traditional technology employed to measure subsidence has been topography, but recently experiments based on differential interferometry techniques have been conducted, and their results have been good enough to encourage the study of this type of phenomenon by satellite

“DINSAR: OPERATIONAL SYSTEM FOR THE PERMANENT CONTROL OF SUBSIDENCE PHENOMENA AT A LOW COST”

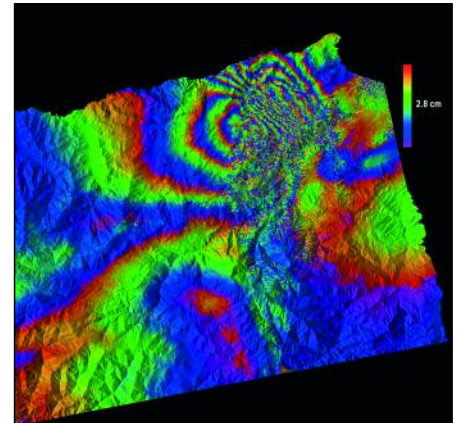
Radar provides two types of information: the strength of the signal return and a phase related with the distance between the sensor and the object observed. This phase is the information used by interferometry to extract the terrain elevations from two images taken from slightly different positions. When these positions are practically the same, but they are observed at two different moments in time, the differences in the terrain as a result of landslides, earthquakes or subsidence can be measured.

The ICC, with the collaboration of the Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA), has developed a system based on this technique to determine altimetric changes as small as 1 cm a year between two dates, using synthetic aperture radar (SAR) images from the ERS and ENVISAT satellites.

Actual cases of subsidence have been studied in the project, comparing the results obtained by means of differential interferometry with the high-precision leveling measurements taken in the field. The results have been good enough for this technique to be combined with the high-precision spot measurements in order to maintain the permanent control of a much more extensive area of land at a low cost.

The development of the tool continues, combining images from different (upward and downward) orbits, as well as integrating images from other SAR sensors: ground-based SAR, TerraSAR-X, Radarsat-2 and ALOS/PALSAR.

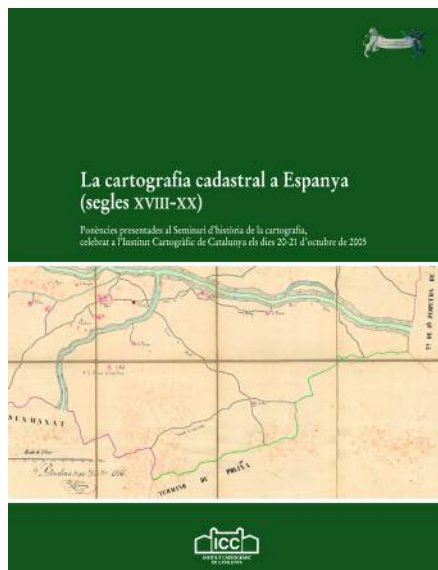
Among the practical cases to which the ICC has applied the DInSAR system, mention should be made of subsidence in the city of Bogotá (Colombia), Puebla de Zaragoza (Mexico), the volcano of Popocatepetl



Detection of the effects of the Al-Hoceima earthquake by DInSAR measurements based on satellite images.

(Mexico), the region of Al-Hoceima (Morocco), the potassic basin of Sallent, Súria and Cardona (Catalonia – through the European project RISCMASS) and various areas of the Ebro Delta (Catalonia).

LAND REGISTRY CARTOGRAPHY IN SPAIN (18TH-19TH CENTURIES)



This publication contains the papers presented at the History of Cartography Seminar held at the headquarters of the ICC on 20-21 October 2005 and organized by the Institute in collaboration with the Department of Human Geography of Universitat de Barcelona.

Researchers from nine universities took part in this Seminar, as well as specialists from the Barcelona Regional Land Registry Office, the Cartographic Institute of Andalusia and the ICC itself.

“THE 14 PAPERS THAT WERE PRESENTED HAVE BEEN GROUPED INTO FOUR PARTS”

The papers have been grouped according to historical and thematic criteria. The first part, entitled “The illustrated projects”, contains two papers about the land registry cartography produced from the establishment of the Bourbon dynasty up until the liberal reform of the Treasury in 1845.

The second part, “The liberal tax reform and land registry cartography”, comprises five papers which cover a wide range of aspects and works of land parcel cartography produced in Spain between the establishment, in 1845, of the Property, Crop and Livestock Tax, and the introduction, in 1895, of a general land registry of the country by crop mass.

The third part, “Land registry and cartography in the 20th century”, consists of four papers. These papers focus on the

relationship between the urban land tax and the creation of the urban land registry in Spain between 1893 and 1935; the relationship between the land registry and aerial photography; rural land registry cartography produced in the province of Granada in the 20th century; and the evolution of the urban land registry in contemporary Catalonia.

The fourth and final part of the book is entitled “Applications of land registry cartography and new perspectives”. This part contains three papers which reflect the interest of land registry cartography in studies on the historical and cultural transformation of the landscape.

“THE BOOK HAS VARIOUS AIMS”

This work aims to enrich the history of land registry cartography in Spain, to open up new perspectives that will assist future research work in this field, and to serve as a guide for all scholars who are interested in the use of land registry cartography as a tool for analyzing landscape transformation and the fiscal history of the country.

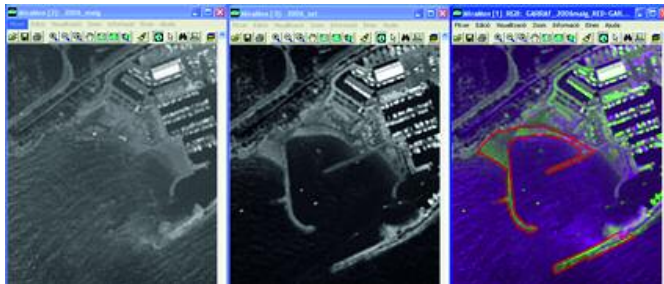
DECIS. DETECTION OF LAND USE CHANGES WITH SATELLITE IMAGES

The ICC is undertaking the DECIS project. This project uses a multitemporal set of satellite images to detect significant territorial changes, in particular, the new communication and transport infrastructures and the evolution of urban areas.

Changes are detected by using temporal series of images from the SPOT, Landsat-5 and Landsat-7 satellites, as well as from the DMC (Disaster Monitoring Constellation). Prior to detection, the images are homogenized by applying atmospheric corrections (CORREA project). The results are validated with established cartography (land use, road network, orthophotos, etc.).

"STUDIES OF LAND USE CHANGES HAVE BEEN MADE WITH DECIS IN THE REGIONS OF BAIX LLOBREGAT, BARCELONÈS, GARRAF, MARESME, VALLÈS OCCIDENTAL AND VALLÈS ORIENTAL"

DECIS is the continuation of the earlier project DECIL, in which images from the Landsat-7 satellite were used. In the course of the DECIL project, analysis was made of the problem of detecting and eliminating clouds and shadows, as well as water masses.



Change detection in Garraf (port Ginesta, Sitges). Pancromatic SPOT-5 images. First (left), 17-05-2006; second (center), 03-09-2006, and third (right) RCG combination of the previous ones, where the change has been highlighted (in red).

CORREA. RADIOMETRIC CORRECTION OF ATMOSPHERIC EFFECTS

The project is concerned with the analysis, design and implantation of an atmospheric correction system for satellite-borne and airborne optical remote sensing sensors.

"THE AIM OF THE PROJECT IS TO REDUCE THE IMPACT OF GASEOUS ABSORPTION, AND RAYLEIGH AND MIE SCATTERING WHICH THE ATMOSPHERE CAUSES IN IMAGE RADIOMETRY"

The method is based on the calculation of parameters of the radiative transfer equation and radiation data in a set of points with simulations of the 6S code. The multiple adjustment process estimates some aerosol and water vapor concentrations, minimizing the radiometric differences with respect to points with known values or points obtained on different strips, at different heights or with different sensors.

With these data, calculation can be made of the reflectance atmospherically corrected by interpolation of the pixels situated between the calculation points. The method includes the possibility of recovering the contrast lost due to scattering of the

sensor-atmosphere system and the effect of the topography, and it enables apparent reflectance to be calculated.

The project provides algorithms that make it possible to homogenize images and therefore facilitate the analysis and processing of multitemporal data in the various thematic and cartographic remote sensing projects.

Until now, this method has been applied to Landsat, SPOT and CASI images.

Effect of the geometric and atmospheric conditions on the radiometric measurement of CASI images.



Date: 4 May 2006
Solar time: 13:58:10
Original image

Date: 4 May 2006
Solar time: 14:10:55
Corrected image

REVISTA CATALANA DE GEOGRAFIA. NOW IN DIGITAL FORM

In May 2007, *Revista Catalana de Geografia* embarked on a fourth stage in its development, taking advantage of the latest technologies to become available in digital form. The Journal was an initiative of the Societat Catalana de Geografia (Catalan Geographic Society) in 1978, financed by the member and patron Josep Maria Puchades i Benito (1913-1982). Following the death of Mr. Puchades, the Journal was acquired by the ICC. Since then, two further stages in the development of Journal may be observed. From 1985 to 1993, two full color issues were published every year. In 1994, the Journal broadened its disciplinary scope to embrace all the earth sciences, adopting the name of *TERRA*, under which it was published until 1996.

"NOW, MORE THAN TWENTY YEARS AFTER THE FIRST ISSUE PUBLISHED UNDER THE ICC, REVISTA HAS REAPPEARED"

Every month, articles and observations on new books will appear, and up-to-date information on events will be available. All published information will be accessible and free, and could be consulted through the search.

From a linguistic point of view, articles are accepted in any language of use in our country and international cartographic community.

"THE AIM IS TO OFFER A RAPID AND FLEXIBLE PLATFORM FOR THE DIFFUSION OF INFORMATION RELATING TO THESE DISCIPLINARY FIELDS"

The system adopted by the publication will also allow readers to post their comments on the articles published.

The website of *Revista Catalana de Geografia* is:

www.rcg.cat

and the email address to which articles should be sent is: editor@rcg.cat



BRIEF NOTES

SPANISH LAND OCCUPATION INFORMATION SYSTEM (SIOSE)

The *Sistema de Información de la Ocupación del Suelo de España* (SIOSE) is a collaborative project between the Public Administration and various Autonomous Communities, started in 2006. Its aim is to define a single land occupation data model.

Different working groups have defined the characteristics of this model in urban, agricultural and forest environments.

A homogeneous set of SPOT-5 images will be used as a basis for interpreting the polygons. These images have been geometrically and radiometrically corrected, and they are available to those performing the interpretative work. In Catalonia the land cover map of Catalonia of the CREAf will be used on the orthophoto 1:5 000 (ICC).

SYMPOSIUM OF THE CATALAN INTEGRATED GEODETIC POSITIONING SERVICE (SPGIC 2007)

The ICC currently offers the centimeter positioning service in real time (RTK) throughout Catalonia.

After one year of operation of this service, which has been very well received by the community of users, this second Symposium was held on 27 April 2007 at the headquarters of the ICC.

Its purpose was, on the one hand, to make the service known and explain how it is used to future users, and on the other hand, to present the new features planned for the service to the current users.

To bring the Symposium to a close, several manufacturers gave practical demonstrations of how the service operates.

A total of 150 people attended this event.

VI THEORETICAL AND PRACTICAL TRAINING COURSE ON ADVANCED CARTOGRAPHIC TECHNIQUES: Airborne laser altimeter

On 12-23 February 2007, the "VI Theoretical and practical training course on advanced cartographic techniques: Airborne laser altimeter" was held at the headquarters of the ICC. This course was aimed at DIGSA cartographic institutions (directors of geographic institutes in South America, Spain and Portugal) and it formed part of the series of training sessions devoted to advanced cartographic techniques.

The course was organized by the ICC in collaboration with the Instituto Nacional de Estadística, Geografía e Informática (INEGI, Mexico) and the Instituto Geográfico Nacional (Spain), and with the support of the Centro Geográfico del Ejército (Spain).

The purpose of the course was to introduce participants to this technology, and it was aimed at data users and technicians with no previous experience of its use. The theoretical fundamentals were dealt with, the principal applications were shown and practical experience was gained using real data.

The course was complemented by the opportunity to attend the 7th Geomatics Week, whose main theme was "High resolution sensors and their applications". This event included technical sessions about geodesy and navigation, photogrammetry and topography, cartography and geographic information systems. The total duration of the course was 60 hours, divided into theoretical and practical sessions lasting 6 hours a day.

Training on the use of the airborne laser altimeter and geodetic positioning was given by experts from the ICC.

A total of 20 technicians took part, from 8 different countries: Argentina, Brazil, Chile, Colombia, Mexico, Panama, Portugal and Venezuela.



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