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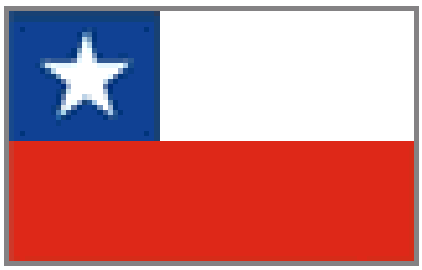

REPORT ON CARTOGRAPHY IN THE REPUBLIC OF CHILE 2007 - 2011

PRESENTED BY: CHILEAN NATIONAL COMMITTEE OF THE INTERNATIONAL CARTOGRAPHIC ASSOCIATION

SUBMITTED TO THE TWENTY-FIFTH GENERAL ASSEMBLY OF THE INTERNATIONAL CARTOGRAPHIC ASSOCIATION

MAY 2011

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Note: The text is structured hierarchically into Parts (Roman numerals), chapters (numbers), points or headings (letters), and sub-headings (underlined).

PART ONE: CHILEAN NATIONAL COMMITTEE AND THE ICA

I.1: Introduction

I.1.a. Preface from the ICA National Committee

"I wish to express my cordial greetings to all those who take part in the International Cartographic Association, speaking as Director of the Military Geographic Institute of Chile – IGM – and as representative of the Chilean State to this highly reputable scientific organization of yours.

The practice of cartography in our country has its place in the spheres of action of the ICA, in consideration of the activities summarised in this report, among them the contribution made by our country to the ICA by hosting the XXIV International Cartographic Conference (ICC 2009). On the subject of conferences, I wish to invite the cartographic community to participate in our next international scientific conference (UGI 2011, in conjunction with the International Geographic Union).

All of the above, together with the professional experience of the IGM in the fields of geospatial information, of geodesy and of territorial management leads us to recognise the scientific value at international levels of the ICA and of its links with the geo-cartographic institutions of Chile."

RODRIGO MATURANA NADAL
COLONEL

DIRECTOR OF THE MILITARY GEOGRAPHIC INSTITUTE OF CHILE

CHILEAN NATIONAL COMMITTEE OF THE INTERNATIONAL CARTOGRAPHIC ASSOCIATION

I.1.b The ICA National Committee of Chile

The Military Geographic Institute of Chile (IGM) sustains the National Committee of the ICA in Chile because it is the official authority and mapping agency representing the Chilean State in matters involving geography and the representation of Chilean territory in official cartography. The IGM represents the State in five international organizations which relate to geography and geo-spatial information[1], including the ICA. This representation is assigned specifically to the Director of the IGM, who leads the ICA National Committee. The IGM acts as secretariat for this National Committee, coordinating ICA-related activities in Chile, which can involve other local organizations.

I.1.c National Reports from Chile to the ICA

This report complements the previous report from this National Committee covering the period 2003 – 2007[2]; it does not repeat all of the information in the earlier report that is still valid. A new feature here is the bibliographic references in footnotes and Annex I. Images of cartographic products are not included because most of the institutions covered provide these at their own websites and geoportals, for which the URL addresses are stated here. The contact details are valid at the date of this report; but no guarantee can be given that these will remain valid for the remainder of the period 2011 – 2015. This report will be presented to the Executive Committee and to the 15th General Assembly of the ICA.

I.1.d. Contact Details for ICA National Committee in Chile

Director of IGM	rmaturana@igm.cl
IGM Geographic Secretariat	jriquelmem@igm.cl
IGM International Relations Section	hmanriquez@igm.cl
Contact for this report	ehunt@igm.cl
Contact for children's maps competitions	mriveros@igm.cl

Telephone: (56) – 2 – 4109314. Other contact details are those given for the IGM in III.1.

I.1.e. Presidents of the ICA National Committee in Chile

The Chilean National Committee of the ICA has been led by successive Directors of the IGM; in this period these have been:

- December 2006 to December 2008: Colonel Rodrigo Barriga Vargas
- December 2008 to March 2011: Colonel Juan Vidal Garcia Huidobro
- March 2011 to date: Colonel Rodrigo Maturana Nadal

I.2. Chilean ICA National Committee during 2007 - 2011

I.2.a Outline of National Committee Activities

For three years (2007, 2008, 2009), the activities of the National Committee of the ICA in Chile were mostly related to the 24th International Cartographic Conference; see below, I.3, for more about ICC 2009. The Executive Committee of the ICA gathered in Santiago, Chile, to hold its meetings twice in this period; firstly in November 2008, then again a year later at the ICC 2009 events. Moreover, the Director of the IGM and President of the Chilean ICA N.C. met in person with members of the ICA E.C. for working discussions on three other occasions (August 2007, July 2008, and June 2009). Among Chilean

[1] Decreto Nº 18, Sub-Secretaria de Guerra (Defence Ministry), in effect from 22nd January 1979, published in the "Diario Oficial" nº 30.307 on 6th March 1979.

[2] "Report on Cartography in the Republic of Chile", National Committee of the ICA in Chile, IGM-Chile, document as .pdf file, July 2007

contributors to the cartographic community, this interaction with the ICA before and during ICC 2009 has improved the understanding of the workings of the ICA.

In mid-2010 the Chilean National Committee proposed to the ICA Executive Committee that the ICA become a Patron of the major geosciences conference to be held in Chile in 2011; this is the Regional Geographic Conference – UGI 2011, to be held in November 2011. UGI 2011 is being organized by the IGM in conjunction with the International Geographic Union (IGU). On the basis of the mutual recognition between ICA and the IGU as scientific societies dedicated to the geo-sciences, also on the trust that the IGM, through holding ICC 2009, has earned in hosting this type of event, the ICA Executive Committee agreed to back UGI 2011 as a conference Patron.

In early 2011 the Chilean N.C. responded to the call for nominations (to be voted on at the 15th General Assembly) with one nomination for the chair of the Commission for Maps and Graphics for the Blind and Visually Handicapped.

I.2.b Chilean Member of ICA Executive Committee

The contribution of one individual Chilean as Vice–President of the ICA and as member of the Executive Committee should be noted. Pablo Gran Lopez (Geographic Engineer and formerly a General of the Chilean Army, now retired) had been especially active in the ICA during the period 2000 – 2004 when he was Director of the IGM. At the ICA General Assembly in 2007, he was elected as one of the incoming Vice-Presidents. His contributions have included assistance with preparations for ICC 2009 (being in frequent contact with the LOC), helping to develop an ICA policy on professional practice, and strengthening the ICA's presence in the Latin American region. The Chilean National Committee appreciates the efforts that Pablo Gran has made as Vice-President, the first ever Chilean to hold this office in the ICA.

I.2.c Children's Map Competitions in Chile

For the "Barbara Petchenik" competition managed by the Cartography and Children Commission of the ICA, the Chilean N.C. organised a competition starting in late 2008. The competition entries were received up to the deadline of 1st May 2009 and evaluated by a jury of representatives from IGM, UTEM and the Education Ministry. Nine outstanding designs, (first, second and third in each of the three categories) were selected; of these, six were sent for inclusion in the international competition. The Chilean National Competition was given special attention on this occasion because of the proximity to ICC 2009; the Chilean entries actually returned to Chile with the rest of the international competition entries for the exhibition of children's maps organised by LOC at ICC 2009.

For the following Barbara Petchenik competition, a national competition was initiated in late 2010. Due to a combination of factors outside the control of the N.C., the number of competition entries was far smaller than in 2009; nevertheless, six Chilean designs were sent in April 2011 to the Commission for inclusion in the international competition.

I.3. Chile and the ICA Conferences

I.3.a Twenty-Third International Cartographic Conference (2007)

At the XXIII ICC, held in Moscow, in the Russian Federation in August, 2007 the Chilean National Committee participated through the official IGM delegation and a few attendees from other Chilean institutions. Four papers were presented by Chilean authors. The IGM delegation announced and promoted the following conference, ICC 2009; for this purpose they ran a booth in the exhibition and a cocktail event at the local Chilean embassy.

I.3.b. Twenty-Fourth International Cartographic Conference – ICC 2009

	XXIV CONFERENCIA CARTOGRÁFICA INTERNACIONAL – ICC 2009	
www.icc2009.cl	*Slogan*	The World's Geospatial Solutions
	Date	15th – 21st November, 2009
	Venue	Military School, Las Condes, Santiago, Chile
	E-mail	info@icc2009.cl

Preparations for ICC 2009

Preparations for the 24th ICC began before the 23rd ICC; earlier in 2007 the slogan and logo had been defined. There was a substantial campaign to promote the event at global, Latin American and local levels. Two Call for Papers brochures were distributed [3], [4]. A web site was set up at www.icc2009.cl with links to several related on-line services.

The ICA Executive Committee ran the Travel Grant program (one awardee was Chilean[5]) and campaigned for ICC 2009 at international level[6], [7]; within the ICA they encouraged the Commission chairs to participate as abstract reviewers, meeting convenors and session moderators. In November 2008, the E.C. held joint coordination meetings in Santiago with the local organisers – IGM and the firm FISA S.A. - and toured the conference venue.

The IGM set up the Local Organising Committee (LOC), including the Chilean ICA N.C. and extending to an increasing circle of IGM and FISA staff. LOC coordinated the:

- professionals and academics from local organisations contributing to the Scientific Sub-Committee (SSC), which in turn coordinated the abstract reviewers, session scheduling, the local session moderators and the student helpers/stewards.
- units of the Armed Forces contributing the venues (for the main conference, for the technical visits and for the gala dinner) and running the orienteering event.
- local and international organisations backing the conference as Patrons.
- individuals invited to be keynote speakers.

The role of FISA S.A. as the event production firm was to run the logistics and commercial aspects. FISA managed the attendee registration and all payments (income and expenditures), set up the on-line Internet services, and coordinated the conference sponsors, the booth exhibitors in the technical trade exhibition, and the suppliers (interpreters, hotels, catering, registration clerks, panel & booth materials).

ICC 2009 Conference

The conference ran from Sunday 15th to Saturday 21st of November 2009, at the Military School site in Las Condes, Santiago. The activities took place largely as scheduled[8], [9]. The papers were published in the Proceedings CD (see Annex A.I.c) and also on the ICA web site. In parallel with the main conference, a meeting of SELPER (remote sensing) and the inaugural meeting of 'Red3iGeo' (see II.2.b. about PAIGH) were held; both of these involve regional scientific networks.

[3] "ICC 2009 First Call for Papers", ICC 2009 LOC, Instituto Geográfico Militar, 20-page paper brochure, March 2008
[4] "ICC 2009 Second Call for Papers", ICC 2009 LOC, Instituto Geográfico Militar, 32-page paper brochure, Nov. 2008
[5] "Retrieving hierarchical information from maps: the role of metric and configurational variables", Rodrigo Mora, Universidad Tecnica Federico Santa Maria, conference paper, "ICC 2009 Proceedings", November 2009.
[6] "24th ICC 2009", LOC for ICC 2009, IGM, article in ICA newsletter, "ICA News nº 50", June 2008.
[7] "24th ICC 2009 – Invitation to Chile", LOC for ICC 2009, IGM, newsletter article, "ICA News nº 52", June 2009.
[8] "ICC 2009 Full Program", ICC 2009 LOC, Instituto Geográfico Militar, paper 64-page brochure, Nov. 2009
[9] "ICC 2009 Summary Program", ICC 2009 LOC, Instituto Geográfico Militar, paper 24-page brochure, Nov. 2009

ICC 2009 Conference Results and Statistics

Scientific conference:

- 512 full papers and abstracts of posters included in the conference proceedings
- 339 oral presentations of papers given (out of 384 scheduled)
- 55 Posters displayed on panels

People:

- 737 registered attendees (including all four registration categories)
- 1,160 visitors (general public allowed short visits to the exhibitions only)

Exhibitions:

- 522 maps, atlases and other items displayed in the Cartographic Exhibition[10]
- 35 organisations with booths in the trade exhibition
- 160 children's map designs (Barbara Petchenik competition)[11]

Considering the financial aspects, there were only minor variations between the estimates (of costs, income and budget) made in the early stages of planning and the final results. The sources of income, revenue and in-kind services were managed towards covering the costs exactly, so there was neither profit nor loss in the final balance.

ICC 2009 included a Refereeing process for some of the papers and a category of digital cartography within the Cartographic Exhibition. The lessons learned from these innovations and from other aspects were provided by LOC to ICA[12] as an aid to future ICCs. A large part of ICA News Nº 53 [13] is dedicated to reporting on ICC 2009.

Chilean Participation in Exhibitions

The participation of Chile as an ICA member country in ICC 2009 should be distinguished from the role of Chile as conference host and organizer. Nevertheless, in the circumstances it was inevitable that Chile be represented very fully in all the exhibitions. The Trade Exhibition naturally featured many booths run by Chilean organisations, including several of those covered in this report.

The Chilean sector of the Cartographic Exhibition displayed items from 6 institutions; IGM (III.1.), SAF (III.3), SERNAGEMIN (III.5.), CCT (IV.3.c.), Las Condes Borough and the "Policia de Investigaciones" (Detectives). In the cartographic competition, one Chilean item received an award in the digital products category from the ICA jury[14].

The six Chilean entries to the Barbara Petchenik competition were included in the Children's Maps Exhibition. In the "public vote" run among conference attendees (distinct from the jury awards), one of the Chilean designs[15] received the highest vote.

I.3.c. Twenty-Fifth International Cartographic Conference – ICC 2011

At ICC 2009 in Chile, the organizers of the 25th ICC were given opportunities to announce and promote this coming event. The Chilean National Committee is currently preparing to participate in ICC 2011 and in the ICA General Assembly, scheduled for July 2011, in Paris, France. A sample of Chilean maps is being prepared for the ICC 2011 Map Exhibition.

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[10] "International Cartographic Exhibition Catalogue", José Compan & LOC for ICC 2009, IGM, 127-page printed catalogue, November 2009

[11] "Living in a Globalized World – Barbara Petchenik – Children's Map Competition 2009", Marcela Riveros & LOC for ICC 2009, IGM, 31-page printed catalogue, November 2009

[12] "Report of the 24th International Cartographic Conference (ICC 2009)", National Committee of the ICA in Chile & LOC for ICC 2009, IGM-Chile, document as .pdf file, December 2009

[13] Several articles and reports in newsletter "ICA News Nº 53", ICA, Dec. 2009.

[14] "Geografia Universal Interactiva", Instituto Geográfico Militar de Chile – IGM, multimedia CD-ROM atlas, 2004

[15] "The Related World", Constanza J. Soto Lopez, 'Unión Latinoamericana' school, design on paper, April 2009

PART TWO: MULTI-INSTITUTIONAL AND INTERNATIONAL ACTIVITIES

II.1. S.N.I.T. and the National Spatial Data Infrastructure of Chile

www.snit.cl	Secretaria Ejecutiva, **SISTEMA NACIONAL DE COORDINACIÓN DE INFORMACIÓN TERRITORIAL - SNIT,** **MINISTERIO DE BIENES NACIONALES** Alameda Bernardo O'Higgins 720 Santiago Región Metropolitana
Telephone	(56) – 2 – 9375804

II.1.a. Introduction and SNIT Secretariat

The Chilean SDI is the "National Territorial Information Coordination System" or S.N.I.T. Supervised by a committee of governmental ministries and facilitated by a central secretariat, the SNIT relies on a cooperative alliance of the Ministries, public agencies, institutions and local governments that develop and use territorial information.The SNIT secretariat is based at the Ministry for National Assets and Resources (MBN); however, most of its technical work is performed by contributions from the institutions participating.

II.1.b. Participants in SNIT and their groupings

The participating bodies are grouped into eight areas, these are:

Thematic Areas	*Coordinating Ministry*
Basic Territorial Information (GTIB)[16]	Defence
Natural Resources	Agriculture
Infrastructure	Public Works
Social	Planning
Territorial Planning	Housing and Urban Management
Heritage	Education
Property	Finance
Regions	Interior

II.1.c. Major achievements of the SNIT in this period

Many features of the NSDI that previously existed only as projects or proposals have now been implemented. SIRGAS has become the standard geodesic reference system for most state-owned institutions[17]. Governmental ministries and agencies, when needing spatial data for an application, have learned to use the communications channels and the information provided by the SNIT to check whether that data exists already in the holdings of other custodians. This, coupled with a willingness to share existing data, ensures that efforts are not duplicated and there are progressively fewer new datasets with divergent formats. The participating bodies have come to appreciate the value of coordinated efforts that optimize resources and share the burden of developing spatial data.

There are still challenges to face, such as the lack of financial resources. A new issue is that, as progress is made on integrating administrative boundaries among data custodians, it has become necessary to obtain interpretations with legal implications, which brings SNIT into contact with the authorities responsible for interpretating Chilean law.

[16] "Territorial Basic Information: an urgent need for development of the country", IGM-Chile & SNIT, Article in SNIT yearly journal, "Revista SNIT", 2008

[17] "Planning the migration to SIRGAS (WGS 84)" , Cesar Ocares B., Rene Zepeda G., Pablo Ortiz J., Ministry of Public Assets & Resources / UTEM, 'Revista SNIT', 2007

II.1.d. On-Line Resources of SNIT[18]

Associated with the web site (www.snit.cl), the Secretariat provides on-line access to:
- The SNIT Metadata Catalogue, now containing more than 11,600 metadata records
- The SNIT Geoportal, including a Map Viewer
- Datasets provided remotely through the "Geonode" system from some participating institutions for viewing in the Geoportal[19].

II.1.e. Standards and SNIT [20]

The "Basic Territorial Information Group" (GITB), one of the thematic groupings, has been developing official Chilean standards in collaboration with the National Standardization Institute (INN), which is the Chilean counterpart of the international ISO body. The program starts on the basis of the standards of ISO Technical Committee nº 211 for Geographic Information. About 19 standards already well-established at international level have been selected for an program of adaptation. The work needed has required special financial support, achieved through CORFO (a state corporation supervising several state-owned agencies and businesses). Each standard is being translated to Spanish followed by review and revision cycles producing a standard adapted to the Chilean technical and legal environments. The standards that have advanced furthest in this process are:

- 19101 Reference model: general requirements for standardisation
- 19101-2 Imagery
- 19103 Conceptual Schema Language (UML)
- 10104 Terminology for standards
- 19105 Conformance and Testing

II.1.f. S.N.I.T. and GSDI

Since the GSDI-9 conference held in Chile itself (2006), the SNIT has sustained its links with the Global Spatial Data Infrastructure Association through papers submitted at GSDI conferences (GSDI 10, 11 and 12, held in 2008, 2009 and 2010 respectively)[21], [22].

II.2 Pan-American Institute for Geography and History - PAIGH

www.ipgh.org	**INSTITUTO PAN-AMERICANO DE GEOGRAFIA E HISTORIA – IPGH**
Cartography Commission	ipghcart@igm.cl
Chilean National Section & Editor of "Revista Cartográfica"	hmanriquez@igm.cl

[18] "Enabling access to Chilean geospatial information", Ivan Lienlaf, SNIT Secretariat, Article in SNIT yearly journal, "Revista SNIT", 2010.
[19] "Geoportal Chile: a novel tool for publishing spatial data", Ivan Lienlaf, SNIT Secretariat, Article in SNIT yearly journal, "Revista SNIT", 2008.
[20] "Elaboration of National Standards for Geospatial Information Management. A Contribution to the Development of the Chilean SDI", Alvaro Monett, María Loreto Advis, María Viviana Barrientos, National Territorial Information System – SNIT, Conference paper, "GSDI 12 World Conference", October 2010.
[21] "SDI in Chile: National System of Coordination of Territorial Information (SNIT), State of the Art and Projections", Alvaro Monett, SNIT Secretariat, Conference paper, "GSDI 10 World Conference", February 2008.
[22] "Basis for the National SDI", M. L. Advis, IGM-Chile, Conference paper, "GSDI 11 World Conference", June 2009.

II.2.a. Introduction

The Pan-American Institute for Geography and History (PAIGH) is an international agency supervised by the Organization of American States (OAS). It promotes activities in the fields of Geography, Cartography, Geophysics and History that are organized by four Commissions, one for each of these fields. PAIGH coordinates a network of 21 National Sections, one in each of the PAIGH member states. The Chilean National Section has its headquarters at the IGM and is supported by several local institutions.

II.2.b. PAIGH and ICC 2009

ICC 2009 was held in a PAIGH member state (Chile), so it was appropriate for PAIGH to participate as a patron of this conference. PAIGH gave coverage and publicity to ICC 2009 in the media it manages (web site, bulletins, networking in Latin America). The President of the PAIGH Cartography Commission was also President of the ICC 2009 Scientific Sub-Committee. At ICC 2009 itself, the PAIGH Secretary General and numerous other figures active in PAIGH were present and were particularly active in setting up the inaugural meeting of the 'Red3iGeo' network of Latin American and Iberian geographic institutions.

II.2.c. PAIGH Cartography Commissions in Chile

In Chile, support is especially strong for the PAIGH Cartography Commission; in fact the headquarters of the international PAIGH Cartography Commission has been located in Chile itself since the year 2005, so Chilean institutions have been making a major contribution to Cartography throughout the region of the Americas.

The current President of the PAIGH Cartography Commission is a leading Chilean cartographer based at the UTEM, and is at this date also the Chilean nominee for an ICA Commission (see above, I.2.a). The functions of Commission Secretary and two of the Commission's four policy committees are also exercised by other Chileans.

The PAIGH National Section of Chile coordinates the four local Commissions that are the Chilean counterparts to the four international Commissions. The Chilean Cartography Commission, sustained by several of the institutions covered in this report, has been active in supporting the technical projects and technical committees formally coordinated by the international PAIGH Cartography Commission.

II.2.d. PAIGH Cartography Commission Technical Committees in Chile

A large part of the Cartography Commission's technical work is sustained by nine permanent technical committees; three of these have their headquarters in Chile:

- The "Revista Cartográfica" is the journal of the PAIGH in the cartographic field. One issue falls within this period (see Annex A.I.c). The current editor is at the IGM.
- The 'Tactile Cartography' Committee relates to a long-standing program of the PAIGH to support the development of tactile and 3D maps and representations of space; the headquarters of this Committee is at the Tactile Cartography Center (see IV.3.c.) of the UTEM, with some involvement from other PAIGH member states outside Chile.
- The 'Aeronautical Charts' Committee is sustained by the SAF (see III.3.) together with other bodies within PAIGH member states (perhaps we should say, within PAIGH airspace) that are involved in aeronautical navigation, and is also linked to the International Civil Aviation Organisation - ICAO.

The "Americas Global Map" technical committee was also coordinated from Chile until late 2010 before being transferred to Ecuador. Chilean organizations have been active in other technical committees, most particularly the 'Geocentric Reference System for the Americas' – SIRGAS – coordinated from Argentina with major contributions from Chile.

II.2.e. PAIGH Cartography Commission Projects in Chile

The 'Technical Cooperation Projects' differ from the Technical Committees in that they receive partial funding (the Committees receive no funds) but at the same time they are not permanent. The projects are international in scope, operating in several PAIGH member states, while having a center of operations or coordination in one country. Here too, a significant proportion of these projects are run from Chile; these have been:

- 2007: "Distribution of Hydrography manual in Spanish"
- 2008: "PAIGH/ICAO cooperation project for producing VFR electronic aeronautical charts at 1:1,000,000 and 1:500,000 (in parallel to the Aeronautical Charts Committee)
- 2007, 2008, : "Integrating the senses in the handling of geospatial information through tactile cartography" (project running in parallel to the Tactile Cartography Committee)
- 2009, 2010: "Creation of tactile cartography and teaching material for understanding global warming and its relation with natural disasters" (project running in parallel to the Tactile Cartography Committee)
- 2007, 2008, 2009: "Americas Global Map" (in parallel to the Committee of the same name)[23]
- 2010: "Design of an Atlas of environmental hazards"
- 2007, 2008, 2009: "Cartography of subjective spaces, for understanding urban crime hazards"
- 2010: "Cartography of routine mobility, subjective spaces and urban issues"

II.3. Response to the Earthquake of February 2010

II.3.a. Earthquake and Tsunami

Chilean territory lies on or close to the subduction zone where the South American and Nazca (south – east Pacific) tectonic plates interact. Due mainly to the subduction of the latter plate below the former, Chilean territory is subject to frequent seismic activity.

At 03:34 on Saturday, 27th of February 2010, a seismic event of 8.8 degrees on the Richter scale affected the central-southern area of Chile, with the strongest effects felt along the 600 kilometers between Santiago and the southern city of Los Angeles; this area was declared a "zone of catastrophe" and unfortunately happens to include much of the most densely populated and most highly developed (in terms of infrastructure) parts of central Chile. Triggered by the earthquake, a strong tsunami affected the coastal zone of central-southern Chile, severely damaging coastal settlements and pushing boats inland.

More than 400 fatalities were caused directly by the tsunami and the earthquake, hundreds more suffered injury, thousands more were either displaced from their homes or lost their sources of employment. There was severe damage to innumerable buildings, while the north-south road and rail communications were cut at various points due to fallen bridges . Electricity, water and telephone services were interrupted.

II.3.b. Maps and Images for Emergency Response

The emergency support began immediately. The authorities saw the need for cartographic material as an aid, so the IGM acted to provide this material as a matter of urgency[24]. Two teams of IGM staff were sent to the center of rescue and disaster relief operations in Talca and Concepción, where they worked in cooperation with the Army, Police, and ONEMI. IGM and INE base maps were marked up with information necessary for managing field

[23] "Integration of Vector Datasets from Central and South American Nations", Edwin Hunt, Armando Lobos, IGM-Chile & PAIGH, Conference poster and paper, "GSDI 11 World Conference", June 2009.
[24] "Cartographic Services Provided in the Response to the Great Earthquake of February 2010 in Chile", Juan Vidal Garcia-Huidobro, Edwin Hunt, IGM, conference paper, "GSDI 12 World Conference", October 2010.

operations; initially these were rescue operations, then urgent repairs to transport infrastructure and the restoration of basic services among other disaster-response tasks.

The SAF (see III.3) carried out 59 flights during the period after the earthquake up to 10th March 2010, capturing the following images:

Type of image	*Quantity of images*	*Camera (see III.3.2)*
1:5,833 & 1:20,000 scale	2698	DMC
Colour	1335	Analogue RC-10 & RC-30
Black & White	18	Analogue RC-10 & RC-30

SAF also obtained 11 EROS B satellite images captured in early March 2010. The aerial photo and satellite images provided by SAF and other bodies covered areas in the earthquake and tsunami zones of critical importance and used by ONEMI and other authorities to facilitate decision-making.

To coordinate the assistance given to ONEMI (see III.7.b.) and the affected populations, a work group for 'Multisector Geospatial Information' (GTMIG) was set up to coordinate the contributions of several institutions involved in geospatial data handling (including SNIT, IGM, SAF, CIREN, SERNAGEOMIN, INE, PUC, and University of Chile). With this backing the ONEMI itself has coordinated the production of some maps[25], [26], [27]showing the extent of flooding by the tsunami. CIREN (see III.4) has produced cartography based on satellite images aimed at identifying suitable places for depositing earthquake wreckage[28]. SERNAGEOMIN (see III.5) has produced 21 geological maps oriented towards identifying zones of landslides and other geological hazards altered and increased by the earthquake.

II.3.c. Mapping the Earthquake and Tsunami

The TIGO station (see IV.2.e.) was itself in the earthquake zone; consequently its instruments were shaken, however, it recovered operational status and has been ideally situated to measure, using GPS and other geodesic instruments, the horizontal and vertical displacement of the Concepción area resulting from the seismic forces. A coseismic displacement of 3.04 meters was recorded at TIGO, and the post-seismic movement has been monitored too.

The IGM was the first state body to publicly announce official figures for this displacement, and has continued to measure the subsequent postseismic deformation following the initial earthquake and its aftershocks. The IGM has observed the consquences of the horizontal displacement for existing cartography, observing how, in the areas affected by significant seismic forces, given points on the ground fixed in relation to surrounding features, also building footprints, have shifted in relation to map coordinates that are static in relation to the fixed geodesic reference framework. Small-scale cartography is not significantly affected; however, this situation has given added impetus to the production schedule of the IGM (see III.1.5.)

[25] "Constitución", ONEMI & SAF & INE, base image 'RapidEye' captured 27.Feb.2010, projection UTM, Datum WGS 84, 2010

[26] "Isla Robinson Crusoe", ONEMI & SAFE, base images 'Google Earth & Photomosaic from SAF captured 28.Feb.2010, projection UTM, Datum WGS 84, 2010

[27] "Talcahuano", ONEMI & SAF & INE, base image 'RapidEye' captured 27.Feb.2010, projection UTM, Datum WGS 84, 2010

[28] "Procesamiento y manejo de imágenes de alta y mediana resolución en respuesta a la catástrofe del terremoto y tsunami 27 febrero 2010", Marcelo Duran, CIREN, "II Seminario Internacional de Teledetección / Aplicaciones de Imágenes Satelitales", June 2010.

II.3.d Reference Systems and the Earthquake

The earthquake affected much of the National Geodesic Network (see III.1.2); the precision of nearly 200 was made invalid by the effects of the seismic activity during and after the main event; they can be recovered but their position needs to be re-determined. As an emergency measure following the earthquake several organisations established in the eathquake zone 40 new CGPS stations, linked using cellular and satellite connections for continuous recording of measurements. The collaboration effort was called the "Phoenix" project and included the IGM, three Universities of the United States (Ohio State, Memphis and Hawaii) and two Chilean Universities (see IV.2.e and IV.3.b.).

In addition, the IGM teams also measured about 40 of the pre-existing vertices and stations of the RGN; their new positions were determined and the difference between these and their previous positions was calculated. This difference enabled the horizontal displacement caused by the earthquake to be measured for the first time. The maximum shift, occurring near the city of Concepción, was just over 3 meters towards the south-west. This movement reversed the habitual trend.

Parts of the vertical and gravity networks were also affected by the earthquake. Even where monuments survived intact, their positions need to be re-measured. As work continues, the IGM expects the recovering RGN to return in 2011 to the operational status (number of working, accurately positioned stations) it enjoyed up to February 2010.

II.4. SSOT: Chilean Satellite[29], [30]

The "Satellite system for Terrestrial Observation" – SSOT - is the first remote sensing system to be commissioned, operated and owned by the Chilean state. The SSOT has already been built, in partnership with a European industry (EADS-Astrium), and will be launched in the near future. It includes a telescope and two cameras, one multi-spectral, the other panchromatic. Cartography could be derived from SSOT data at 1:25,000 scale.

Several governmental ministries and agencies sustain the SSOT program. SAF (see III.3.) will process the images, using tools such as "Pixel Factory" to handle the large volumes of data involved in generating the final image products. SAF is setting up a team for satellite exploitation with personnel specially trained for the purpose of working with SSOT images. ACE (see III.7.b.) is responsible for coordinating the applications, as various organizations in Chilean prepare to make use of SSOT sensing data and images for applications such as change detection over time, territorial planning, environmental monitoring, natural hazard management and surveying for infrastructure development.

[29] "Sistema Satelital de Observación de la Tierra de Chile: Una Contribución al Desarrollo de la Capacidad Espacial Nacional", Armando Osorio V., FACH, "II Seminario Internacional de Teledetección / Aplicaciónes de Imágenes Satelitales", June 2010

[30] "La Operacionalización de un Sistema de Teledetección Nacional", Rodrigo Fuentes Niedbalski, SAF, "II Seminario Internacional de Teledetección / Aplicaciónes de Imágenes Satelitales", June 2010

PART THREE: STATE AND PUBLIC INSTITUTIONS

III.1. Military Geographic Institute of Chile - IGM

www.igm.cl	**INSTITUTO GEOGRAFICO MILITAR DE CHILE** Nueva Santa Isabel 1640 Santiago Región Metropolitana
Telephone	(56) – 2 – 4109300 / (56) – 2 – 4109400
E-mail	ventas@igm.cl; informaciones@igm.cl

III.1.1. Introduction

The Military Geographic Institute (IGM) is the principal cartographic agency of Chile, being the official authority representing the state in matters involving geography, surveying and maps of Chilean territory. Its mission is to maintain the fundamental base cartography of Chilean terrestrial territory, together with other tasks involving the geo-sciences. The IGM is attached to the Army of Chile, staffed by a mix of uniformed and civilian personnel.

III.1.2. Reference Systems and Geodesy up to February 2010

The standard reference framework for accurate horizontal positioning in Chile is the "National Geodesic Network" (RGN in Spanish initials). By February 2010 the RGN consisted of about 650 temporary vertices and 22 fixed continuous stations. The RGN has completed its migration to the "SIRGAS-Chile" system, associated with epoch 2002.0. , Datum ITRF 2000 and ellipsoid GRS 80. SIRGAS-Chile is integrated with the international geodesic project covering the whole of the American continents called "Geocentric Reference System for the Americas" or SIRGAS in Spanish initials.

The IGM uses SIRGAS-Chile as a framework for survey information and cartography. In addition it is also used for the scientific purpose of contributing to the constant measurement of the velocity and direction of continental plate tectonics, which the IGM participates in. As a continent-wide system, SIRGAS serves as the standard under which the gradual drift of the South American continent is measured. IGM data confirms the tendency of the south-western part of the continent to move gradually north-eastwards[31].

Regarding the vertical component, the IGM participates in the ongoing international program of SIRGAS contributors to define a geoidal model for the whole continent. Currently, for vertical positioning the IGM uses the vertical survey network; this consists of altitudes measured along 12,000 kilometers measured upwards from Mean Sea Level at the coast, reaching up in some places to connections crossing the border into neighbouring countries. There is also a gravity network made up of 54 absolute gravity stations and 70 relative gravity stations, making up the gravity network; these supply data for the geoidal models and also to the International Gravity Bureau (IGB).

Concerning the situation of these networks after February 2010, see II.3.d above.

III.1.3. Main Map Series

The central production process of the IGM concerns its main products, the coverages of Chilean territory in map series portraying the relief and major physical terrain features.

[31] "Chilean Velocity Model", Lautaro Rivas R., IGM, conference paper, "ICC 2009 Proceedings", November 2009.

These map series are shaped by several requirements, conditions and considerations; they must:

- respond to the requirements of the state for the official portrayal of Chilean territory
- respond to the needs of the public in general and of their final users
- be accurate in terms of position, using the SIRGAS-Chile system as the geodesic reference framework
- be sold as the key part of the IGM's stock and commercial asset
- constitute the primary terrestrial base maps for the nation's spatial data infrastructure
- follow a common format in line with PAIGH cartographic portrayal conventions
- comply with the IGM's own rigorous internal quality system (based on ISO 9001)[32]

The primary map series is the 1:50,000 series; for many years this has served as a framework and source of data for the other map series. The series covers almost all of continental (i.e. South American) Chile with about 1145 sheets available to the general public in digital media; these include 561 sheets recently revised and re-published in this period and 72 completely new sheets covering areas in the far south of continental Chile, recently published for the first time; these are:

"K" section (between latitudes 49º and 52º South)

2	Isla Stosch	42	Isla Leyton	85	Isla Vancouver
3	Isla Angamos	46	Isla Tarlton	86	Isla Owen
4	Canal Machado	47	Isla Guarello	87	Río Geikie
5	Puerto Edén	48	Canal Concepción	88	Lago Bruch
12	Golfo Ladrillero	49	Canal Andrés	91	Estrecho Nelson
13	Península Singular	53	Cabo West Cliff	92	Islas Lobos
14	Seno Isla	54	Isla Duque de York	93	Canal Smyth
15	Paso del Indio	55	Canal Inocentes	94	Isla Piazzi
22	Isla Mornington	56	Isla Beltrand	95	Península Staines
23	Península Wharton	64	Cabo Ladrillero	96	Cerro El Morro
24	Seno Alpen	65	Isla Farrel	97	Cordón Monumento Moore
25	Isla Angle	66	Canal Sarmiento	101	Isla Ramírez
31	Península Corso	71	Sierra Contreras	102	Isla Contreras
32	Canal Picton	73	Isla White Horse	103	Canal Uribe
33	Brazo del Norte	74	Isla Valenzuela	104	Islas Rennell
34	Canal Wide	75	Isla Presidente Gabriel Gonzáles Videla	105	Isla Newton
39	Cabo Hawksworth	82	Isla Diego de Almagro	106	Cordillera Sarmiento de Gamboa
40	Isla Madre de Dios	83	Isla Jorge Montt	107	Isla Ballesteros
41	Isla Topar	84	Canal Castro		

"L" section (south of latitude 52º South)

54	Chañarcillo	121	Monte Cazuela	174	Cerro Luis de Saboya
55	Punta Catalina	136	Rusphen	187	Río Yendegaia
72	Cerro Sombrero	150	Lago Blanco	200	Isla Grande
83	Cabo Prat	164	Isla Tres Mogotes	211	Estero Doze
89	China Creek	173	Ventisquero Garibaldi	220	Isla Duperre
106	Onaisin				

The 1:250,000 scale series is now complete for continental Chile with 80 sheets; 64 of these maps have been substantially revised and re-published during this period, while six of them, (all in the far south of Chile), are recently published for the first time; these are:

68 Isla Jorge Montt	76 Monte Cazuela	78 Canal Beagle
73 Punta Catalina	77 Canal Cockburn	79 Isla Hoste

[32] "Quality management system of the cartographic process at the Military Geographic Institute of Chile", Rodrigo Barriga Vargas, IGM, Paper submitted to ICC, "XXIII ICC Proceedings", August 2007

The 70 new and revised sheets are available to the public on paper or as .jpg images. The remaining 10 sheets are awaiting authorisation (see III.7.b.) for circulation. Work is currently in progress to make the 1:250,000 map series available in the near future in vector digital media.

Three other series of older maps are not being updated, these are:

- 660 maps at 1:25,000 scale, covering areas with significant density of human activity. These are due to be replaced by the new 1:25,000 series (see III.1.5).
- 22 map sheets making up the 1:500,000 scale series
- 55 maps at 1:100,000 scale covering part of the extreme south of the country.

III.1.4. Main Cartographic Process

The central cartographic production process of the IGM has been outlined in the report of 2003 – 2007, together with the numerous technological and procedural changes and innovations of that period.

The most important raw material for the process is the images obtained from remote sensing. Previous to the current period, these were aerial photographs suitable for photogrammetric restitution[33]. The move to digital restitution stations has enabled an increasing amount of restitution to be performed using satellite images as input material[34], combined with the DEM used for altimetric control. Maps based on satellite imagery had been created at the IGM in previous periods through experiments, special trials[35] and client-specific contracts; now the technology has become part of the regular production line. In the process of restitution itself, while continuing to use the digital photogrammetric stereo workstation implemented earlier, the software used by operators to interface with that system has recently been changed from a CAD-based to a GIS-based tool.

Satellite data constituted a large part of the base for the last significant area of continental Chile still to be mapped at 1:50,000; this was a sector in the far south of Chile which had not previously been mapped due to its remoteness and very low population density. The "Austral" program has now been completed[36], [37] and the resulting cartography integrated into the central cartographic database of the IGM. Most of the rest of Chile had been covered at 1:50,000 scale for much longer, but has only recently completed conversion to the IGM database. Previous reports to the ICA have referred to progress in migrating the existing 1:50,000 series to the WGS 84 / SIRGAS reference system and to the GIS / database structures of the IGM's centralised production, publication and storage system; now this enormous task is finished as of 2010. Combined with the newer "Austral" maps, coverage of continental Chile at 1:50,000 in the database is now complete. The 1:250,000 series has also undergone the same process of conversion to the database.

III.1.5. New Coverage at 1:25,000 Scale

In 2011 the IGM is beginning to produce a completely new series of standard topographic base maps at 1:25,000 scale which will eventually cover the whole of Chilean territory in about 5,500 sheets. This program, which has been under development for several years

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[33] "Experience of the IGM in Technological Change for the Aerotriangulation Process", Carlos Sepulveda, IGM, conference paper, "ICC 2009 Proceedings", November 2009.

[34] "Proposal of a methodology and procedures for updating topographic cartography at 1:50,000 scale, using satellite images", Julio Neira, IGM, conference paper, "ICC 2009 Proceedings", November 2009.

[35] "Methodology for the horizontal validation of a satellite orthoimage to be used for updating IGM base topographic cartography at 1:50,000 scale", Ariel Arancibira & Claudio Morales, IGM, conference poster abstract, "ICC 2009 Proceedings", November 2009.

[36] "Interferometry applied in the generation of the layer of elevation of the geospatial database of the Military Geographic Institute of Chile", Cintia Andrade Leiva, , IGM, Article in SNIT yearly journal, "Revista SNIT", 2007.

[37] "Cartography of the southern zone of Chile, using RSTM", Cintia Andrade Leiva, Maria-Loreto Advis N., IGM, Paper submitted to ICC, "XXIII ICC Proceedings", August 2007.

as the “Latitud Sur” project, was given final approval and assigned financial support in 2010. The production process can be summarized thus:

(a) Gather the base datasets; these are panchromatic satellite orthoimages at a 1m /pixel resolution, and a Digital Surface Model with a density of one point per 10 m. or less, all of this being geoferenced to the RGN.
(b) Combine the images into a mosaic, use the DTM to generate altimetry and relief
(c) Create and insert vector features
(d) Edit, check, convert to the GIS-based central database repository

Practically all of these stages differ from those of the older processes applied to create the existing 1:50,000 series, so this is a radical shift in the configuration of IGM mapping processes. User applications for the new coverage and the consequent benefits are foreseen across a wide range of sectors, so this is a major advance for the IGM not only in technological terms but also in its overall strategy.

III.1.6. Hazard Mapping

The IGM, in conjunction with the ONEMI, is working on the prototype of the system known as the Integrated Information system for Emergencies (SIIE), which enables viewing of some of the natural hazards present in that part of northern Chile comprised by the XV, I, II and III regions, then the identification of sites of interest and of populations at risk from possible disasters. The long term objective is to push forward the creation of this integrated system of information for emergencies so that it covers all of Chilean territory.

The product of the SIIE is a Web Map Server providing digital cartography, **i**n which a base made up of images and cartography can be viewed, together with the applications that are the focus of the project; these enable both the queries oriented to disaster-prevention and the planning of rapid responses to actual occurrences. The bodies participating are those providing information input for the SIIE, also the public and Defence organisations managing territorial information.

III.1.7. Other IGM Projects, Products, Services and Activities

Apart from the map series described above, other products of the IGM include atlases, orthophotos, gravimetric maps[38], multimedia products, small-scale paper maps of Chile and the continents, books on geosciences topics, and the “Terra Australis” journal. IGM also provides services responding to the orders of individual clients for surveying or mapping locations specified by those clients.

Non-commercial activities include participation in international scientific organizations. Under its legal responsibilities, the IGM officially represents Chile in five of these:

- International Cartographic Association (ICA).
- Pan-American Institute for Geography and History (PAIGH).
- International Geographic Union (UGI).
- International Union for Geodesy and Geophysics (IUGG).
- International Society for Photogrammetry and Remote Sensing (ISPRS).

In addition to these, the IGM also contributes voluntarily to other international organizations (for example, Global Spatial Data Infrastructure Association - GSDI) and international projects (such as GeoSur – see http://www.geosur.info/geosur/). The IGM interacts with national mapping agencies outside Chile and has achieved concrete results

[38] “Development of 1:500,000 Scale Gravimetric Map of Chile”, Lautaro Diaz, IGM, conference paper, “ICC 2009 Proceedings”, November 2009.

in cooperation with several; these include the National Geospatial Intelligence Agency (NGA) of the USA, the "Servicio Geográfico Militar" of Uruguay and the CNIG of Haiti[39].

Within Chile at national level, the IGM cooperates with other local institutions in multi-institutional and bilateral programs. In the SNIT, the NSDI of Chile, the IGM is active in the "Basic Territorial Information" thematic group (see II.1.b.).

The IGM hosts public events related to its fields of interest, from small seminars up to major conference cycles, as has been demonstrated with ICC 2009. Currently the IGM is preparing for the Regional Geographic Conference to be held in 2011, see VI.2.

III.1.8. Publications in this Period

Books published include two texts on the work of the IGM involving the geodesic[40] and gravity[41] networks, an atlas for educational purposes[42] and a road guide[43] for drivers. Special maps published in this period include:

- "Mapa Politico Administrativo de Chile", IGM, 1:2,200,000 scale, Lallemand modified polyconic projection, 2008.
- "Carta Continental Antarctica", IGM, 1:5,000,000 scale, polar estereographic projection, 2009.
- "Peninsula Byers", INACH & IGM, 1:10,000 scale, projection UTM, 2010 (a series of four map sheets covering adjacent sectors of the Byers peninsula area)
- "Isla Rugged", INACH & IGM, 1:10,000 scale, projection UTM, 2010

III.2. Hydrographic and Oceanographic Service of the Chilean Navy – SHOA[44]

www.shoa.cl	**SERVICIO HÍDROGRÁFICO Y OCEANOGRÁFICO DE LA ARMADA – SHOA** Errázuriz 254 - Playa Ancha Valparaíso V Región
Telephone	(56) – 32 – 2266666
E-mail – general information	shoa@shoa.cl
E-mail – contact for this report	csobarzo@shoa.cl

III.2.1 Introduction

The Hydrographic and Oceanographic Service of the Navy (SHOA), has as its main mission the assurance of safety in navigation. It performs hydrographic surveys and produces the official nautical cartography of Chile as charts that comply with the technical standards established by international hydrographic cartography organizations. The staff of the SHOA includes highly-trained naval officers, seamen and civilian personnel.

[39] "Proyecto para la Generación de Cartografía Regular para la República de Haiti", Juan Vidal Garcia-Huidobro, IGM, Article in Journal of CEIUC / Catholic University, "Cuadernos de Difusión", 2010.
[40] "Nuevo Marco de Referencia Geodesico - RGN SIRGAS - Chile" (new geodesic reference framework), Geodesic Department, IGM, 2008.
[41] "Red Nacional de Gravedad" (national gravity network), Geodesic Department, IGM, 2009
[42] "Atlas Geográfico para la Educación" (geographic atlas for education), IGM, ISBN 978-956-202-077-0, local copywright record Nº 194.379, revised edition of August 2010
[43] "Guía Caminera" (highway guide), IGM, local copywright record Nº 192.183, April 2011.
[44] "Anuario Hidrográfico y Oceanográfico de la Armada de Chile – Año 2008", SHOA, ISSN: 0718-185X, 100-page book, May 2009.

III.2.2 Cartographic Process

SHOA performs hydrographic surveys, then processes the bathymetric data. It also uses aerial photographs and photogrammetric restitution to obtain the data for terrain above sea level immediately adjacent to continental and island coasts, also navigable rivers and lakes. The data captured in the field is processed, edited as maps, checked in QC and either printed on paper or adapted for use electronic navigation systems.

The system for updating and correcting existing charts underwent restructuring in 2008, incorporating new database and plotter resources. The printing facilities have recently been improved to be able to print charts on demand or in small print runs yet maintain the existing graphic quality, thus responding to the demand from clients in a shorter time and at the same reducing costs by producing only what is needed in the market.

SHOA has established a quality management system and had it certified in 2008 by external auditors under the ISO 9001:2008 standard; the process covered is, according to the scope, the "Planning, Data Capture, Processing, Edition, Selling, Updating and distribution of Nautical Charts and Publications".

III.2.3 Maps Published in this Period

Nautical Maps

Id. N°	*Status*	*Title*	*Scale*	*Year*
6265	New	Lago Pirehueico	1:25000	2007
10327	New	Canal Concepción – Canal Tres Cerros	1:25000	
9300	Updated	Acceso Norte a Canal Messier	1:100,000	
9311	Updated	Fondeaderos en Bahía Tarn y Canal Messier	1:20000 / 1:15000 / 1:10000	
9400	Updated	Acceso Sur a Canal Messier	1:100,000	
9520	Updated	Fiordos Eyre, Falcon y Exmouth	1:40000	
9530	Updated	Canales Grappler, Icy y Escape	1:40000	
9541	Updated	Canal Wide – Seno Antrim y Estero Gage	1:20000 / 1:15000	
11411	Updated	Rada de Punta Arenas y Zonas Portuarias	1:30000	
9531	Updated	Fondeaderos en Paso del Indio, Canales Grappler y Escape	1:20000 / 1:15000 / 1:10000	
9412	Updated	Fiordo y Caletas en el Canal Messier	1:40000 / 1:6000 / 1:5000	
14212	Updated	Islas Shetland del Sur – Bahía Fildes	1:30000	
14211	Updated	Islas Shetland del Sur – Caletas en Bahía Fildes	1:10000	
14330	Updated	Islas Shetland del Sur – Isla Decepción y Caleta Balleneros	1:15000 / 1:10000	
2210	New	Aproximación a Bahía Lavata	1:30000	2008
6232	New	Lago Calafquén	1:30000	
4100	Updated	Punta Poroto a Punta Lengua de Vaca	1:100,000	
4323	New	Caleta Horcón	1:15000	2009
8113	New	Archipiélago de los Chonos – Canales Chaffers y King	1:15000 / 1:20000 / 1:25000	
10642	New	Canal Unión – Bahía Año Nuevo	1:15000	
11310	New	Estrecho de Magallanes – Paso Inglés	1:50000	
4320	Updated	Bahía Quintero a Puerto Valparaíso	1:50000	
4321	Updated	Bahía Quintero[45]	1:10000	
8100	Updated	Boca del Guafo – Archipiélago Guaitecas	1:100000	
9511	Updated	Puertos en el Canal Messier y Paso del Indio	1:7000 / 1:20000 / 1:15000	
10200	Updated	Canal Trinidad	1:100000	
10732	Updated	Fondeaderos en Canales Smyth y Unión	1:10000 / 1:15000	
11600	Updated	Primera Angostura a Punta Dungeness	1:100000	
10730	New	Estrecho Collingwood y Canal Smyth, Paso Victoria a Paso Summer	1:50,000	2010
7400	Updated	Islas Desertores a Islas Guaitecas	1:90,000	
7465	Updated	Caleta Santa Bárbara y Ensenada Chaitén	1:20,000	
8200	Updated	Archipiélago Chonos, Canales Oceánicos	1:100,000	
9400	Updated	Isla Van der Meulen a Paso del Indio		
9500	Updated	Paso del Indio a Fiordo Penguin		
9510	Updated	Angostura Inglesa y Paso del Indio	1:20,000 / 1:40,000	
9541	Updated	Fiordo Ringdove, Caletas Chacabuco y Richmond	1:30,000	

[45] "Nueva Cartografía del Puerto Quintero, dando seguridad al desarrollo nacional", Claudio Sobarzo Espinoza, Miguel Vasquez Arias, SHOA, journal article, "Revista Cartográfica", 2008.

Electronic Nautical Maps

Id. N°	*Cell*	*Title*	*Scale*	*Year*
7300	CL3LL015	Golfo de Ancud, Isla Puluqui a Isla Quinchao	1:90000	2007
7320	CL3LL020	Seno Reloncaví	1:45000	
10722	CL4MA210	Canal Gray y Paso Summer	1:22000	
14330	CL3MA210	Isla Decepción	1:45000	
14330	CL5MA870	Caleta Balleneros y Accesos	1:8000	
4311	CL5CO010	Bahía Conchalí y Puerto Los Vilos	1:12,000	2008
7381	CL4LL040	Bahías en Isla Chiloé y Canal Caucahué	1:22,000	
7381	CL4LL065	Canal Caucahué	1:45,000	
7381	CL5LL048	Puerto Quemchi	1:12,000	
7400	CL3LL075	Golfo Corcovado – Islas Desertores a Islas Guaitecas	1:90,000	
7440		Isla Chaullín a Islotes Guamblím		
7400	CL3LL076	Golfo Corcovado – Islas Desertores a Islas Guaitecas	1:150,000	
7440		Isla Chaullín a Islotes Guamblím	1:60,000	
7470		Bahía Tictoc a Rada Palena	1:50,000	
7430	CL3LL090	Isla Lemuy a Isla Chaullín	1:90,000	
4320	CL3VA010	Bahía Quintero a Bahía Valparaíso	1:45,000	2009
4321	CL5VA005	Bahía Quintero	1:12,000	
4323	CL5VA004	Caleta Horcón	1:12,000	
8400	CL2AI084	Canal Moraleda, Islas Guaitecas a Isla Tuap norte	1:150,000	
	CL2AI085	Canal Moraleda, Islas Guaitecas a Isla Tuap sur		
8300	CL3AI025	Canal Pérez Norte y Pérez Sur	1:100,000	
	CL4AI040	Paso Estrecho	1:30,000	
8520	CL5AI040	Paso Galvarino	1:12,000	
	CL5AI045	Bahía Dorita	1:15,000	
	CL4AI045	Puerto Puyuguapi	1:30,000	
8610	CL4AI060	Fiordo Aysén	1:45,000	
8630	CL4AI080	Canal Darwin	1:50,000	
11310	CL4MA565	Estrecho de Magallanes – Paso Inglés	1:50,000	
11411	CL4MA570	Rada Punta Arenas	1:22,000	
	CL5MA570	Zona Portuaria	1:8,000	
	CL5MA571	Bahía Catalina		
7000	CL2LL070	Bahía Corral a Isla Guafo	1:500,000	2010
7410	CL3LL085	Isla Quinchao a Islas Desertores	1:70,000	
8113	CL5AI020	Puerto May	1:15,000	
	CL4AI015	Puerto Llanos	1:20,000	
	CL4AI010	Estero Level	1:25,000	
8160	CL3AI010	Canal Ninualac, Rocas Blanco a Roca Engaño	1:45,000	
	CL3AI020	Canal Ninualac, Roca Engaño a Bahía Adventure		
8620	CL3AI080	Isla Tuap a Isla Traiguén	1:70,000	
	CL5AI028	Caleta Vidal	1:20,000	
8640	CL3AI095	Canales Pulluche, Chacabuco y Adyacentes	1:50,000	
	CL5AI094	Canal Pulluche - Bajo Roepke	1:20,000	
8720	CL4AI110	Bahía Anna Pink	1:45,000	
10200	CL3MA130	Canal Trinidad	1:100,000	
11600	CL3MA590	Estrecho de Magallanes. Primera Angostura a Punta Dungeness		

Tsunami Hazard Maps - 2007

Id. N°	Status	Title	Scale
TSU-8611	New	Puerto Chacabuco	1:20000
TSU-8612	New	Aysén	1:10000

III.2.4 Cartographic Products

The main cartographic products are nautical charts developed through the process above (III.2.2) at various scales and intended for various uses. The final product has traditionally been a printed map on paper. The SHOA has also built up a large range of Electronic Nautical Maps; these have been derived mainly from the data of the pre-existing nautical maps and adapted for use in electronic navigation systems on board ships.

SHOA produces a series of maritime plans of coastal zones separately from the Nautical charts; the main difference is that whereas the nautical charts are primarily for supporting maritime navigation and other activities on board ships and boats, the coastal plans are intended as aids to development and activities on shore in coastal and inter-tidal terrain. The coastal plans are in the UTM projection, at 1:5,000 scale, referenced to WGS 84. SHOA also produces special maps of coastal urban centers over which the projected movements of water caused by Tsunami are portrayed graphically[46].

III.2.5 Books Published in this Period

- "Symbols, abbreviations and terms in use on nautical charts", 2008. This is an updated version of a book whose previous edition was in 1980. and presents the symbology and terminology used in SHOA cartography.
- "Atlas Hidrográfico de Chile", 2009. Updated version of the hydrographic atlas of Chile.
- "Geologia Marina de Chile", 2010; in conjunction with SERNAGEOMIN (see III.5) and the 'National Oceanographic Committee' – CONA – an atlas on the marine geology of Chile has been published[47].

III.2.6 Cooperation with ICA, ICC 2009 and other institutions

At local level, the SHOA has links with several Chilean organisations, and is a member of the GITB grouping in the SNIT (see II.1.b). In October 2008, SHOA hosted a joint workshop with the SNIT and other GITB members on geospatial data management issues.

In collaboration with branches of the Chilean Armed Forces, SHOA has run training courses for Armed Forces personnel in specializations including hydrographic surveys and nautical cartography.

In the cooperation of SHOA with international scientific organisations, the key organisation is the International Hydrographic Organisation – IHO. The SHOA represents Chile in the IHO and plays an active role in the international activities associated with the IHO concerning hydrography, nautical charts and navigation. Two papers[48], [49] presented at ICC 2009 concerned the contributions of SHOA to the development of standards for nautical maps within the framework of the IHO programs. The SHOA also cooperates with several scientific and naval hydrographic agencies of other countries.

For the ICA, during the current period a key member of the SHOA management has chaired the ICA Commission on Marine Cartography. The SHOA has supported this function by setting up a web page about the Commission, within the SHOA web site.

During preparations for ICC 2009, SHOA agreed at an early stage to participate as a conference patron. In conjunction with the ICA Commission on Maps and the Internet and a local hotel, the SHOA hosted a pre-conference symposium on the 14th of December with the title "The Future of Maps and the Internet". During the conference, on November 19th, the SHOA received a group of conference attendees who travelled to Valparaiso for a technical visit to the SHOA, including a tour of the cartographic facilities. SHOA also ran a booth in the exhibition area.

[46] "Mitigating the effects of a Tsunami", SHOA, article in SNIT yearly journal, "Revista SNIT", 2008
[47] "Geologia Marina de Chile", Juan Diaz-Naveas & Jose Frutos (editors), CONA/SHOA/SERNAGEOMIN/PUCV, atlas, ISBN 978-956-235-026-6, July 2010.
[48] "Official Nautical Chart: Development of a Standard", Claudio Sobarzo, SHOA, conference paper, "ICC 2009 Proceedings", November 2009.
[49] "IHO S-100: The New IHO Hydrographic Geospatial Standard", Mariano Rojas, SHOA, conference paper, "ICC 2009 Proceedings", November 2009.

III.3. Aero-Photogrammetric Service of the Air Force – SAF

www.saf.cl	**SERVICIO AEROFOTOGRAMÉTRICO DE LA FUERZA AEREA – SAF** Av. Diego Barros Ortiz Nº 2300 Aeropuerto Arturo Merino Benítez Pudahuel Región Metropolitana
Telephone	(56) – 2 – 3272000 ext. 7880
E-mail – general information	ventas@saf.cl
E-mail – contact for this report	jaime.valenzuela@saf.cl

III.3.1 Introduction

The Aerophotogrammetric Service is the state agency responsible by law for creating and standardizing the official aeronautical navigation cartography covering Chilean territory, also for providing the photogrammetric or satellite image coverages used in the creation of the official cartography of Chile. It is attached to the Chilean Air Force and now has its main headquarters at the main international airport of Santiago in the borough of Pudahuel, to which it moved from its previous location (in Cerillos) in 2008. At the same time it maintains a sales office at Encomenderos nº 270, in Las Condes borough.

Within the SNIT, the SAF is a member of the GITB grouping and has contributed to the work of the GITB working group dedicated to standards (see II.1.e and [50]).

III.3.2 Cartographic Process

The SAF uses its own aeroplanes, specially adapted for aerial photography, to carry not only analogue cameras but also, starting from this recent period, a digital multispectral camera and also a LIDAR-type laser sensor. Photographs from the conventional cameras are developed, scanned with a photogrammetric scanner and used as stereoscopic pairs in photogrammetric restitution. In combination with control points obtained by geodesic measurements in the field, the restitution produces the altimetric and other data that constitutes the base material for subsequent cartographic editing. The management of this material in a Geodatabase environment enables rules and geospatial relational models (such as those involving networks and topology) to be applied in order to maintain the integrity of the data as it undergoes editing, updates, multi-user access, publication and distribution to users.

III.3.3 Cartographic Products and Services

The main cartographic products of the SAF are three series of aeronautical maps oriented to flight planning and in-flight navigation; these are:

- 6 map sheets at 1:1,000,000 scale
- 25 map sheets at 1:500,000 scale
- 80 map sheets at 1:250,000 scale

Other products of the SAF include aerial photographs and multispectral images. Services offered by SAF include aerial surveys and mapping of specific areas to client specifications, also the photogrammetric restitution, or geo-referencing, or ortho-rectification of aerial photos provided by the client.

[50] "Standards and Geographical Information Systems in the establishment of a Spatial Data Infrastructure in Chile", Viviana Barrientos, SAF, conference paper, "ICC 2009 Proceedings", November 2009.

III.3.4 Current Progress on Aeronautical Cartography

Currently the main task for cartographic production at SAF is the ongoing revision of the aeronautical map series. The demand from both public users and private clients for information that is updated and ever more accurate makes this a permanent task for the SAF. To stay competitive the SAF applies quality principles[51] and is developing its production process around its Geographic Database.

Before and during the current period, most of the 1:250,000 scale maps covering northern and central Chile have completed the current cycle of revision, while the work on the maps covering southern Chile is well advanced at this date. Work has also started on the 1:500,000 maps of the same southern area; soon the two 1:1,000,000 sheets covering the same area will also be processed.

Other cartography currently under development or awaiting approval includes:
- Easter Island at 1:25,000 scale
- Map of Air Space controlled by Chile
- Aeronautical cartography at 1:2,000,000 scale, linking Chilean Antarctic Territory with the airspace controlled from Punta Arenas in southern Chile.

III.3.5 SAF and Satellite Remote Sensing

For some time SAF has been offering to local clients satellite images processed at SAF. In 2008 SAF established the first Chilean “Satellite Ground Station”, able to directly interact with and control satellites during the periods necessary for capturing images; so far agreements for working with satellites belonging to the USA (NASA), Israel and Europe (SPOT) have been established. The next step is for Chilean institutions, including SAF, to own and operate their own satellite; this is being achieved through the SSOT program (see above, II.4), in which SAF is a major participant.

III.3.6 Books Published in this Period

The book "Tecnologías Geoespaciales - experiencias aplicada al estudio y gestión del territorio"[52] (geospsatial Technologies – experiences applied to the study and management of territory), published in 2009, was jointly compiled by SAF in conjunction with CENGEO-Talca (see IV.3.b) with contributions from several other Universities. It covers remote sensing topics as an aid to the study of the subject at University level.

III.3.7 ICC 2009 and other events

SAF has organized several public events. The seminars “A Geospatial Capacity for Chile as a Contribution to National Development” and “Remote Sensing, Space and Opportunities for Social Development” were held in March 2007 and March 2008 respectively. In October 2010 the international symposium “Latin American Remote Sensing Week” – LARS – was held, organized by the SAF in conjunction with the International Society for Photogrammetry and Remote Sensing – ISPRS. For the ISPRS, LARS was its regional conference of 2010. LARS featured presentations from local and international speakers, including ISPRS representatives, mainly focused on remote sensing, also covering cartography, GIS, SDI, and image processing.

During preparations for ICC 2009, SAF agreed at an early stage to participate as a conference patron. SAF personnel contributed to the work of the LOC Scientific Sub-Committee as abstract reviewers and as session moderators. As authors, SAF personnel

[51] “Implementacion de un sistema de gestion y control de calidad bajo las normas ISO 9001:2000, 19113, 19114,19138 y 19115 en la producción cartográfica”, Joselyn Robledo C. & Giannina Reyes, SAF, refereed conference paper, “ICC 2009 Proceedings”, November 2009

[52] “Tecnologias geoespaciales - experiencias aplicada al estudio y gestion del territorio”, Dr. Carlos Mena Frau (editor), book, SAF & CENGEO-Talca, ISBN 978-956-7717-14-9, October 2009.

submitted two papers (refs. 50, 51). During the conference, on Nov. 18th, the SAF received a group of attendees at the premises in the airport for a technical visit, including a tour of the cartographic facilities. SAF also ran a booth in the exhibition area.

III.4. Natural Resources Information Center - CIREN

www.ciren.cl	**CENTRO DE INFORMACION DE RECURSOS NATURALES – CIREN** Avenida Manuel Montt 1164 Providencia Región Metropolitana
Telephone	(56) – 2 – 2008900 / 2008968
E-mail – general information	*Form on web site*
E-mail – contact for this report	evojkovic@ciren.cl

III.4.1 Introduction

CIREN is a state institution attached to the Agriculture Ministry dedicated to creating, gathering, maintaining and updating information related to natural resources and agriculture. It serves the public sector of agriculture and other state services requiring territorial information, also the private sector requiring information to guide its resource allocation and investment decisions. A significant part of its work involves spatially-referenced information, for this reason CIREN participates in the SNIT system as a member of the Basic Territorial Information thematic area (see II.1.b.).

III.4.2 Main Cartographic Holdings of CIREN

The previous report to the ICA summarized the central catalogue of CIREN, images covering most of those areas of interest to agriculture, to natural resources management and other significant human activity, serving as the base for three alternative thematic coverages in vector structure:
(a) cadastral data portraying property boundaries, particularly rural properties
(b) soil types and aptitude for agricultural use
(c) the hydrographic network, including wells, artificial irrigation and natural watercourses
Previous to this period the images mostly consisted of orthophotos obtained by aerial photography. Recently, the image base has been extended and updated increasingly by satellite ortho-images; the major update campaigns in this area have been:

- 2008: Most of the V (Valparaiso) Region, using mainly QuickBird II images in natural colour captured 2004 and 2008, plus a smaller area covered with 'Spotmaps', totaling 16.072 km², divided into 438 sheets.
- 2009: 15,417 km² in the Metropolitan (Santiago) Region covered by natural colour 'SpotMaps' captured in 2006 and 2007, divided into 385 sheets.
- 2009: 30,335 km² in the VII (Maule) Region covered by natural colour 'SpotMaps' captured in 2006 and 2007, divided into 900 sheets.
- 2010: 16,400 km² in the VI (O'Higgins) Region, covered by QuickBird II images captured 2003 – 2008, divided into 453 sheets.
- 2010: 16,873 km² in the XIV (Arica - Parinacota) Region, covered by natural color SpotMaps images, captured 2006 – 2007, divided into 365 sheets.
- 2011: work has started on coverage of the VIII (Bio Bio) and IX (Araucania) Regions, using 'SpotMaps' captured in 2008 – 2009, with 1,150 sheets expected for the VIII Region and 885 for the IX.

The resolution of the Quickbird II images is 60 cm, while that of the 'Spotmaps' is 2.5 m. The mosaics of images thus produced are structured with boundaries located at regular

intervals of 3' 45" (both latitude and longitude) and are georeferenced to the "SIRGAS-Chile" (WGS-84) reference framework. As image-maps, the output has UTM plane coordinates in meters and prints with a scale of 1:10,000.

Regarding the thematic overlays, in 2008 – 2009 the property boundary coverage for the V (Valparaiso) Region was updated, with 22,000 existing property lots (mainly agricultural) plus 16,000 new polygons added through this project. Each polygon is linked to a BD with attributes for identification, area, and capacity for use, also to an application for maintaining the records, used by the valuations unit of the internal tax service of Chile.

III.4.3 Thematic Cartography and other Projects

Two projects involving further thematic cartography (in addition to that of III.4.2) are:
Erosion: this study of the current and potential erosion of the soil and ground combined the main ortho-image and thematic map series with other satellite coverages to enable the analysis. The results are presented with Chilean territory portrayed region by region in the thematic maps making up an atlas[53].
Fruit Cultivation : The survey of agricultural areas dedicated specifically to fruit production began in 2007 with the VII (Maule) Region, continuing with the V (Valparaiso) Region in 2007–2008, the VI (O'Higgins) Region in 2008–2009 and finally the Metropolitan (Santiago) Region in 2009–2010. Each lot is uniquely identified and classified in terms of the species and agricultural usage, with plantation systems and supporting infrastructure also recorded. The map sheets portray the distribution of the types of fruit cultivation.

CIREN has established a web application titled 'Rural Territorial Information System' (SITR) oriented towards borough administrations located in mainly rural areas with limited resources. These Boroughs can freely access on-line descriptive and geographic information from CIREN and other state organisations. The map viewer, set up with Open source software, displays base images (derived from aerial photos and satellite images) together with about 19 different layers of thematic cartography overlaid on the images, including the new property data from the V Region (see III.4.2.). So far 100 boroughs have been included in the project ; CIREN expects to add about 25 more every year, also to train employees of boroughs and other public services to use the information effectively.

III.5 National Geological and Mining Service – SERNAGEOMIN

GOBIERNO DE CHILE SERVICIO NACIONAL DE GEOLOGIA Y MINERIA **www.sernageomin.cl**	**SERVICIO NACIONAL DE GEOLOGÍA Y MINERIA – SERNAGEOMIN** Avenida Santa Maria 0104 Providencia Región Metropolitana
Telephone	(56) - 2 - 482 55 00
E-mail – general information	*Form on web site*
E-mail – contact for this report	pgana@sernageomin.cl; shuerta@sernageomin.cl

III.5.1 Introduction

SERNAGEOMIN is the State organization attached to the Mining Ministry that creates and maintains geological knowledge of Chilean territory, performs studies to define the

[53] "Determinación de la Erosión Actual y Potencial de los Suelos de Chile", CIREN, catalogued on-line at http://bibliotecadigital.ciren.cl/ as a series of separate .pdf files, 2010.

geological characteristics and distribution of minerals, energy resources and underground waters, also other studies of environmental geology aimed at supporting territorial planning. The results of these studies are shown in basic and thematic maps, also in specialized documents and databases. SERNAGEOMIN participates in the SNIT system as a member of the Natural Resources thematic group (see II.1.b.).

III.5.2 SERNAGEOMIN Cartography

The basic geology of the territory is represented in four map series:

- 1:1,000,000 = One single map of the whole country; the 'Geological Map of Chile'
- 1:250,000 = 10 map sheets, covering mainly areas in the far south of Chile
- 1:100,000 = 52 maps sheets so far; in the plan for the period 2011 – 2020, the goal is to expand this series to cover all of continental Chile to the north of latitude 47º South.
- 1:50,000 = 25 maps of specific study areas

To create these maps, information from outside sources - mainly IGM base cartography (see II.1) and georeferenced aerial photographs and satellite images – is combined with with the results of field surveys performed by the geologists of SERNAGEOMIN.

SERNAGEOMIN also provides thematic cartography of its own creation concerning mineral and energy resources, environmental geology, hydrogeology, magnetic fields and gravimetric fields. The previous report (2003 – 2007) gives an outline of these categories and the scales at which they have been mapped.

III.5.3 Recently published cartography

The on-line catalogue (see III.5.4) includes the following items published in this period:

Type	*Id. code*	*Title*	*Scale*	*Year*
Digital maps	10125	Geología del complejo volcánico Mocho-Choshuenco, región Los Ríos	1:50,000	2007
	10126	Geologia del área Carrizal Bajo-Chacritas: región de Atacama	1:100,000	2008
	10127	Microzonificación Sísmica de la Ciudad de Concepción	1:20,000	2010
Paper maps	22782	Geologia del área Lanco-Loncoche, regiónes Araucania y Los Rios	1:100,000	2007
	22766	Cartas Mejillones y Peninsula de Mejillones, región de Antofagasta		
	22781	Carta Oficina Domeyko		
	22784	Geologia del área Nireguao-Baño Nuevo		
	22792	Geologia del área urbana de la ciudad de Antofagasta	1:50,000	
	22783	Geologia del complejo volcánico Mocho-Choshuenco, región Los Ríos		
	22798	Gravimetria de la Hoja Copiapó, región de Atacama	1:500,000	2008
	22796	Geologia del área Chile Chico-Rio de las Nieves, Región Aisén	1:100,000	
	22795	Geologia del complejo volcánico Nevados de Chillán, región Bio Bio	1:50,000	
	22797	Geologia de las ciudades de Iquique y Alto Hospicio	1:25,000	
	22791	Geologia del área Queule-Toltén: regiones Araucania y Los Rios	1:100,000	
	22790	Geologia del área Carrizal Bajo-Chacritas: región Atacama		
Digital images for printing	40244	Geología del complejo volcánico Mocho-Choshuenco, región Los Ríos	1:50,000	2007
	40188	Cartas Mejillones y Peninsula Mejillones	1: 100,000	
	40189	Carta Oficina Domeyko	1:100,000	
	40252	Peligros del Complejo volcánico Tarapaca, región Arica y Parinacota	1:50,000	
	40238	Geologia del área Nireguao-Baño Nuevo	1:100,000	
	40251	Geologia del área urbana de la ciudad de Antofagasta	1:50,000	
	40256	Gravimetria de la Hoja Copiapó, región de Atacama	1:500,000	2008
	40233	Geologia del complejo volcanico Nevados de Chillan, Region BioBio	1:50,000	
	40236	Geologia del Volcán Parinacota, región de Tarapacá		
	40232	Geologia del Area Chile Chico - Rio de Las Nieves, Region de Aisen	1:100,000	
	40253	Geologia del área Queule-Toltén: regiones Araucania y Los Rios		
	40255	Geologia del área Pucón-Curarrehue, regiones Araucania y Los Rios		
	40254	Geologia del área Monte Patria-El Maqui, región de Coquimbo		
	40250	Geologia del área Carrizal Bajo-Chacritas: región de Atacama		
	40227	Geologia del area Ovalle-Peña blanca		
	40239	Geologia de las ciudades de Iquique y Alto Hospicio	1:25,000	
	401047	Geologia de la región de Sierra Exploradora. Latitud: 25S-26S	1:50,000	2009
Atlas	70007	Atlas de Deformaciones Cuaternarias de los paises andinos	-	2007

Cartography recently created but yet to be released includes the 21 geological risk maps (see II.3.b), some Tsunami hazard maps (again, arising from the February 2010 Tsunami) and about 20 other maps of varying scales and thematic content produced in 2010.

III.5.4 On-line services

The basic catalogue of products available for sale or for free distribution is on-line at http://sigeo.sernageomin.cl/ . For the general public, there is also a web map server at http://geoportal.sernageomin.cl/ geovisor/GeoVisor/index.html. Used in conjunction with an on-line catalogue of metadata, some of SERNAGEOMIN's own holdings can be viewed. For specialists in the mining sector, there is an "On-line National Mining Information System"[54] in which users can register and then access the cadastral data of SERNAGEOMIN; this includes mining concessions as layered, georeferenced spatial data that users can query in a viewer.

III.6. National Forestry Corporation – CONAF

www.conaf.cl	**CORPORACION NACIONAL FORESTAL – CONAF** Paseo Bulnes 285 of. 201 Santiago Región Metropolitana Chile
Telephone – general information	(56) - 2 – 6630000 / 6630125 / 6630219
E-mail – general information	consulta.oirs@conaf.cl; sit@conaf.cl
Telephone – contact for this report	(56) - 2 – 6630284 / 6630265 / 6630269
E-mail – contact for this report	hugo.rivera@conaf.cl; eugenio.solis@conaf.cl

III.6.1 Introduction

The "Corporacion Nacional Forestal" (National Forestry Corporation – CONAF) participates in the SNIT system, providing Metadata records to the national metadata catalogue and information land use and woodland types to the Natural Resources thematic grouping (see II.1.b.), of which it is a member. CONAF has provided a text especially for this report, inserted whole (translated) below as III.6.2. Previous Chilean national reports to the ICA have summarized the vegetation survey carried out in the 1990's and reported on the subsequent program of revision applied to the survey data; here CONAF brings us up to date on that process.

III.6.2. "Summary of Cartographic Activities – Period 2007-2011"

"The National Forestry Corporation is the institution dependant on the Agriculture Ministry, responsible for contributing to the development of the country through the sustainable management of forest ecosystems and the mitigation of the effects of climate change, by encouraging the development of and monitoring compliance with legislation on forest and environmental issues, the protection of vegetation resources and the management of the protected woodland areas of the State.

Among the activities performed by the Corporation, there is the revision of the "Survey and Evaluation of Native Vegetational Resources of Chile", known as the 'survey of native forest'. This project was performed during the period 1993 to 1997 at national level, constituting the base line for cartographic information on vegetation in Chile, used in

[54] "Mining concession cadastre in the web", Gonzalo Palet Muñoz, Karl Fischer Wolf, SERNAGEOMIN, article in SNIT annual journal, "Revista SNIT", 2007.

governmental management for environmental matters and for policies concerning the management and conservation of these resources. This information is periodically updated through continuation projects at the level of Chile's regions, with the objective of monitoring the changes occurring between periods and explaining their causes.

During the period 2007 – 2011, one of the most relevant activities was to continue with the process of monitoring and updating the native forest survey. In this period the information for the 'Araucania' (2007), Biobio (2008), Maule (2009) and finally, in 2010, the southern part of the Aysen region was updated. These areas cover more than 14.1 million hectares. In the first half of 2011 and part of the second half, it is planned to update the northern sector and the sea channels of the Aysen region, this being an area of more than 6.5 hectares. Thus, towards the end of 2011, more than 25% of continental Chilean territory will have been revised cartographically with changes in land use monitored.

It can be pointed out that, in the course of the performance of these projects there has also been technological progress, given that initially the Survey was carried out using aerial photographs of varying scales – 1:20,000, 1:30,000, 1:60,000 – later on colour photographs at 1:115,000. Currently, the access to better technologies, both software and hardware, have enabled convergence on a methodology that makes it possible to correct defects or errors arising from the instruments being used in the early stages, thus obtaining greater accuracy in the definition of the polygon boundaries portraying the current use of the land originally interpreted for the Survey. Moreover, the use of orthophotos makes it possible to create ortho-rectified cartography of land use based on the first updates, given greater accuracy to the information. Currently, always being alert to the new technologies available for use, the application of multispectral SPOT-5 satellite images has been incorporated into the performance of projects, while awaiting the images of the Chilean Satellite SSOT" (see II.4).

"Another important step forward for this institution is the creation of the Territorial Information System 'SIT-CONAF', a web map server, initially designed for queries about information created in the native forest survey and its subsequent monitoring of changes and updates. This can be used by both internal and external users, that is, it is open to the public. This web platform, specialized in publications of maps in GIS format, has functions to facilitate queries and the display of information, moreover it includes geoprocessing tools enabling the export of the data queried to a graphic format compatible with ArcView and integrating the information with Google Earth. During 2010 and the first half of 2011 presentations and training have been provided about this system to allow the information to be made known and used in new and various types of analyses.

Another achievement related to this area had its origin in a meeting held in the town of Puerto Varas in the last quarter of 2010, where representatives of the GIS sections in practically all the regions of the country gathered together to set up a work group of Chilean GIS operators responsible for interacting, getting training, sharing information associated with this theme, making criteria for data management homogenous, and getting to know new technologies and work methods.

Finally, given that as from the year 2008 the new law nº 20.283 on 'Recovery of Native Forest and Support for the Forestry sector' deals with 'Xerophyte Formations of High Ecological Value', the need has arisen to have more detailed information about these vegetation formations. So in 2008 the 'Survey of Xerophyte formations' was carried out in areas defined as priority for conservation, in the regions of the Atacama and and Coquimbo, continuing in 2009 with this survey in priority sites in the region of Antofagasta. The resulting georeferenced digital cartography enables greater knowledge to be obtained these undervalued vegetational groupings."

III.6.3. Comments from N.C. on the report from CONAF

The address of the Unit for Monitoring Forest Ecosystems (which is involved in most of these activities) at Paseo Bulnes 259 of. 204, is slightly different from the main address of CONAF. The URL of the Territorial Information System is http://conaf2010.siigsa.cl/. More about this System, and about the vegetation survey update program, is at the article[55].

Mapping xerophyte vegetation is significant because, while natural vegetation is abundant in central and southern Chile, botanists, conservationists and others have tended to give less attention to the sparser but still valuable vegetation of the drier northern deserts.

III.7. Government Ministries and Specialized Agencies

III.7.a. National Statistics Institute

Instituto Nacional de Estadísticas **www.ine.cl**	**INSTITUTO NACIONAL DE ESTADÍSTICAS** Paseo Bulnes 418 Santiago Región Metropolitana
Telephone	(56) – 2 - 892 4000
E-mail – general information	ine@ine.cl

The National Statistics Institute – INE – is the governmental agency that provides official statistics and manages the official census. INE organises a large part of its statistical research and publications using maps of Chile's political-administrative divisions and large-scale plans adapted for census tasks[56]. In advance of the next major census (2012), INE has been improving its base maps. These are based on sources such as the IGM 1:50,000 maps. For urban and densely-populated areas, these are at scales large enough to show the city blocks and individual property parcels[57]. The sources, methodology and base maps developed are described in a paper presented at ICC 2009[58].

INE participates in Chile's NSDI as a member of the SNIT thematic area dedicated to Basic Territorial Information (GITB). In 2010 it was active in the GTMIG (see II.3.b.).

III.7.b. Other State Ministries and Agencies

Ministry of Public Works - MOP

Official Name:	**Ministerio de Obras Públicas** - MOP
Address:	Morandé 59, Santiago, Región Metropolitana
Web site:	www.mop.cl
Telephone:	(56) – 2 - 449 3000 / 449 4000

The Ministry of Public Works (MOP) uses geo-spatial data for engineering and surveying

[55] "Information technology for management and use of data in the vegetation resources cadastre of Chile and its updates", Mauricio Gomez Carrasco, CONAF, article in SNIT yearly journal "Revista SNIT", 2010.
[56] "División geográfica censal", Juan Pradenas, INE, conference presentation, "La cartografía censal en América Latina", November 2008.
[57] "Cartografía digital y marco maestro de viviendas", Myriam Villarroel, INE, conference presentation, "La cartografía censal en América Latina", November 2008.
[58] "Census Cartography - Core base of census- and survey-taking", Myriam Villarroel, INE, conference paper, "ICC 2009 Proceedings", November 2009

purposes involving the country's transport networks, water resources, and public works in general. The Division responsible for the roads and highways ("Dirección de Vialidad") has published road guide maps for motorists. In the Chilean NSDI, MOP coordinates the SNIT thematic area dedicated to Infrastructure. There is a map server at www.mapas.mop.cl .

Department for Frontiers and Limits of the State - DIFROL

Official Name:	**Departamento de Fronteras y Limites del Estado** – DIFROL
Address:	Teatinos 180 piso 7, Santiago, Región Metropolitana
Web site:	www.difrol.cl
Telephone:	(56) – 2 - 827 5900 / 3810179 (*fax)*
E-mail :	infodifrol@minrel.gov.cl

DIFROL is where maps, charts and geo-spatial products are checked to ensure that they comply with Chilean laws[59], [60], before they are authorised for distribution or sale in Chile.

DIFROL, together with the IGM, SHOA, SAF and the Chilean Antarctic Institute (INACH - see www.inach.cl), participates in the "National Committee for Antarctic Geographic Names". Formally constituted[61] in 2006, this Committee has begun to provide guidance to the determination of place names included in Chilean maps of areas in or close to Antarctica, and has begun to interact cooperatively with the relevant instances in SCAR. Both DIFROL and INACH are attached to the Foreign Relations Ministry.

Environment Ministry and SINIA

Official Name:	**Sistema Nacional de Información Ambiental** – SINIA
Address:	Teatinos 254/258, Santiago, Región Metropolitana
Web site:	www.sinia.cl
Map server:	http://territorial.sinia.cl
Telephone:	(56) – 2 - 2411800 / 2405758 (*fax)*

The Environment Ministry manages thematic data involving environmental impact studies and runs the system known as the National Environmental Information System – SINIA - a collection of documents and information services about environmental issues, resources, nature reserves and protected biodiversity areas. The spatially referenced information can be accessed through the public map server called the 'Geographic Environmental Information System'; this provides coverages in aerial photos and thematic maps.

National Emergency Office – ONEMI

Official Name:	**Oficina Nacional de Emergencia –** ONEMI
Address:	Beaucheff 1637 / 1671, Santiago, Región Metropolitana
Web site:	www.onemi.cl
Map server:	http://www.onemi.cl/html/servicios/servicio_194.html
Telephone:	(56) – 2 – 2524200

The National Emergency Office, attached to the Interior Ministry, is the agency responsible for coordinating the actions of the state in relation to natural disasters; it advises on preparations that mitigate the effects of natural hazards, coordinates the immediate response to a crisis, and advises on recovery from disasters. Natural hazards considered here include earthquakes, tsunamis, volcanic eruptions, large-scale forest-fires, landslides, mudslides, avalanches and floods. Within the ONEMI, its 'Territorial Management Unit' handles geographic information and provides public access to its "Mapoteca Digital"; these

[59] "Decreto con Fuerza de Ley Nº 5: Reglamenta la internación de mapas y cartas geográficas", Ministerio de Relaciones Exteriores, law decree, 1963.
[60] "Decreto con Fuerza de Ley Nº 83: Estatuto organica de DIFROL", Ministerio de Relaciones Exteriores, 1979.
[61] "Decreto con Fuerza de Ley Nº 361" Ministerio de Relaciones Exteriores, law decree, 6th November 2006

are mostly maps locating seismic and tsunami-related occurrences. The ONEMI hosted a technical visit during the ICC 2009 conference. Since February 2010 a great deal of its work has involved the response to the earthquake and tsunami of February 27th (see II.3.).

Chilean Space Agency - ACE

Official Name:	**Agencia Chilena del Espacio** – ACE
Address:	Av. Libertador Bernardo O'Higgins 1449, Santiago, Región Metropolitana
Web site:	www.agenciaespacial.cl
Telephone:	(56) – 2 – 4733745
E-mail :	info@agenciaespacial.cl

The Chilean Space Agency – ACE – began as an advisory Commission and is now attached to the Economy Ministry. For the government and in coordination with several other organizations, ACE performs studies and develops policies involving space. Within the SNIT framework, ACE is a member of the "Basic Territorial Information" thematic group. Remote sensing from satellite platforms is a major part of its work, so ACE is involved in the new SSOT project (see II.4). The ACE web site includes the on-line proceedings of two seminars organized by ACE, both held in 2010 (see Annex A.I.c).

III.8 Regional and Local Government Bodies

III.8.a. Regional and local bodies, and the influence of SNIT

Chile has three levels of local government; firstly the 15 Regions, then 54 Provinces, and 346 Borough or Municipal units at the lowest level. In the regions and in many boroughs significant progress has been made in developing capabilities and resources for handling and spatial data[62], [63], [64] , [65], impelled forward mainly by the institutional coordination, training and other outreach activities of the SNIT structure (see II.1). The Third ("Atacama") and Fourteenth ("Los Rios") regional administrations have implemented local 'Geonodes' linked to the Geonode publications system of the SNIT, allowing their spatial data to reach the public through the SNIT Geoportal.

III.8.b. On-line resources

Several local government administrative units have set up map servers, portals or similar on-line services that provide access to digital cartography, much of the data being derived from the planning and other administrative tasks of these bodies. Some of these are:

Regions:
- Fifth "Valparaíso" Region: http://200.68.39.4/sw/entrada/siriv.phtml
- Metropolitan Region: http://otas.gorerm.cl/gore/home.aspx
- Sixth "O'Higgins" Región: http://nuevavisionsig.goreohiggins.cl/v2/entrada/sirig/sir.htm

Municipal boroughs:
- Las Condes: http://www.lascondesonline.cl/Archivos Generales/asp/portalsit.asp
- Maipú: http://portal.maipu.cl/sitma/index.html
- Central Santiago: http://planoregulador.munistgo.cl/

[62] "The cadaster of Santiago: a proposal of integration of territorial information", Claudio Contreras Carvajal, Borough of Santiago, Article in SNIT yearly journal, "Revista SNIT", 2007.
[63] "Territorial Information System: Las Condes", Luis Valenzuela Olivares, Borough of Las Condes, Article in SNIT yearly journal, "Revista SNIT", 2007.
[64] "Gestionando el Mundo Rural de Aysén a partir de la Ordenación Territorial y la Teledetección Espacial", Cristian López, SAG – Aysen, "II Seminario Internacional de Teledetección / Aplicaciones de Imágenes Satelitales", June 2010.
[65] "'S.I.T. Las Condes' for the development of the community", Luis Valenzuela O., Borough of Las Condes, conference paper, "ICC 2009 Proceedings", November 2009.

PART FOUR: ACADEMIC, EDUCATIONAL AND TRAINING SECTOR

IV.1 Metropolitan Technological University – UTEM

www.cartografia.utem.cl	Departamento de Cartografía, Facultad de Humanidades y Tecnologías de la Comunicación Social, **UNIVERSIDAD TECNOLÓGICA METROPOLITANA** San Ignacio 171 Santiago Región Metropolitana
Telephone	(56) – 2 – 7877507 / 7877506 / 7877504
E-mail – general information	jespinoz@utem.cl
E-mail – contact for this report	acoll@utem.cl

IV.1.a Cartography at UTEM

The Metropolitan Technological University (UTEM) contains the leading center in Chile for cartography in the academic sector, made up of three interlinked units attached to the Faculty for Humanities and Social Communications Technologies; these are the Cartography Department, the Cartography School and the Center for Tactile Cartography (see IV.3.c.). The School for Cartography runs the course in cartography leading to a degree as professional cartographer, consisting of five years of class-based instruction followed by an internship and a graduation research project. This is the main local source of qualified cartographers. There are also Diploma-level courses lasting a few months each in Geomatics subjects. Since 2007, a course in Geo-statistics has been run annually.

IV.1.b Activities of the UTEM Cartography Department

The Cartography Department staff manage activities aimed at research and development; the most important lines of research are:

- Cartography of subjective spaces and spatial behaviour[66].
- Cartography as a tool of support in environmental management.
- Urban spaces; components, features and technologies for studying and teaching them.

The results of these activities are channeled by means of journal articles[67], conference papers, presentations at events and, where appropriate, interaction with the PAIGH[68]. The Department has been a major contributor to the PAIGH. At international level the Head of Department has been President of the PAIGH Cartography Commission since 2006 and may continue in this post until 2013. Until 2010, members of the Department also coordinated the local counterpart of this Commission, that is, the Cartography Commission of the Chilean National Section of the PAIGH, and have been active at both national and international level in a number of the committees, programs and projects of the PAIGH.

IV.1.c UTEM and ICC 2009

The UTEM was one of the organizations acting as patrons of ICC 2009. The Head of the Cartography Department (also President of the PAIGH Cartography Commission) chaired the Scientific Sub-Committee (SSC) attached to the ICC 2009 LOC, while other members

[66] "Mapping of subjective space: a methodological challenge for understanding urban problems", Jorge Espinoza N., UTEM, conference paper, "ICC 2009 Proceedings", November 2009.

[67] "La Cartografia en el contexto de las ciencias: aproximaciones teoricas de la disciplina", Pablo Azocar Fernandez, UTEM / Cartography Department, article in "Revista Geográfica de Chile – Terra Australis", June 2009.

[68] "Atlas de Riesgos Ambientales a nivel Iberomaricano", Marcela Salinas, UTEM / Dpto. Cartografia, presentation at internacional seminar organised by IPGH, "Desastres y Ordenamiento Territorial en las Americas", November 2010.

of the Department contributed to SSC as abstract reviewers and, during the event itself, as session moderators. Immediately before the main conference, the Department hosted a pre-conference event in conjunction with the ICA Commission for Geospatial Standards. The Commission chair and several of its members held a meeting and also participated in presentations open to staff and students of the UTEM Cartography Department and School. Three of the papers presented in ICC 2009 technical sessions and published in the proceedings were from members of the UTEM Cartography Department.

IV.2. Universities

IV.2.a. Catholic University of Chile – PUC

www.geo.puc.cl	Instituto de Geografía, Facultad de Historia, Geografía y Ciencia Política, **PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE** Campus San Joaquin Avenida Vicuña Mackenna 4860 San Joaquin Región Metropolitana
Telephone	(56) – 2 – 3544716
E-mail – general information	farenasv@uc.cl
E-mail – contact for this report	msim@uc.cl

Within the structure of the Catholic University and associated with its Faculty for History, Geography and Political Sciences, the Geography Institute is a leading centre in Chile for the study of Geography. Its resources include a cartographic library with maps (old and new) and aerial photos. The courses run by the Institute include the following:

- 'Geography', full-time four year course mainly focused on geographic disciplines and territorial planning, includes thematic and topographic cartography, remote sensing, GIS and geomatics, leading up to a first qualification at "Licenciatura" level. By continuing to study for further year and also completing a practical intenship at a local entitity, the student then can obtain the qualification of 'Professional Geographer'.
- 'Geography and Geomatics', 1½ years of classes weekday evenings (can be paralell to a day job), then ½ a year for a graduation project, leading up to "Magister" degree.
- 'Geomatics', a course of three months leading up to a diploma qualification

The publications of the Institute include the journal "Revista de Geografia – Norte Grande" (see Annex A.I.c) and an Atlas[69] for which the Institute prepared content (maps, text, statistics) in collaboration with the Spanish publishers.

The lines of research in academic mode with activities carried out by the institute geographers in this period include "Geomatics applied to studies of natural resources and to territorial planning" [70], [71], [72]. One research and atlas production project was reported in

[69] "Atlas Geografico de Chile y del Mundo", Pilar Cereceda Troncoso, Ana María Errázuriz Körner, PUC / Instituto de Geografía & "Vicens Vives", Atlas, ISBN: 9789568385354, 2010.

[70] "Geoprocesos utilizando sistemas de información geográfica", Luis Carvacho, Univ. Catolica, conference presentation, "La cartografía censal en América Latina", November 2008.

[71] "GIS and systematic conservation planning in Chile", Vanezza Morales, PUC / Instituto de Geografía, conference poster abstract, ICC 2009 Proceedings", November 2009.

[72] **"**Incorporación de criterios de fragilidad ambiental y riesgo en la planificación territorial de la costa de Chile central", Belisario Andrade J., Federico Arenas V., Marcelo Lagos L., Catholic University / Geography Institute, Article in Journal of the PUC Geography Institute, "Revista de geografía Norte Grande" – late 2010

an ICC 2009 paper[73]. Other research is performed through the "Geografía UC Proyectos" service managed by the Institute on a semi-commercial basis; this includes a line of work titled 'Geomatics' covering the design of GIS, analysis and processing of satellite images, production and updating of basic cartography, and field surveying.

The Catholic University was one of the Patrons of ICC 2009; in practice, it was the Geography Institute that sustained this contribution, as it was one of the academics of this Institute who participated as a full member of the Scientific Sub-Committee (SSC).

IV.2.b. University of Chile

www.fau.uchile.cl	Departamento de Geografía Facultad de Arquitectura y Urbanismo **UNIVERSIDAD DE CHILE** 3º Nivel, Torre Chica Portugal 84 Santiago Región Metropolitana
Telephone	(56) – 2 – 9783095
E-mail – general information	dgeograf@uchilefau.cl; avalenci@uchilefau.cl

Within the structure of the University of Chile and associated with its Faculty for Architecture and Urban Management (FAU), the Geography Department runs research programs in the geosciences[74] (usually in partnership with other organizations) and runs the courses in Geography. The main course is a full-time four year course mainly focused on geographic disciplines and territorial planning, including remote sensing, GIS and geomatics subjects, leading up to a first qualification at "Licenciatura" level. By completing a graduation project and also a practical internship at a local entity during a further fifth year, the student then can obtain the qualification of 'Professional Geographer'.

The University of Chile was a Patron of ICC 2009; one of the Geography Department academics participated as a full member of the ICC 2009 Scientific Sub-Committee.

Other entities attached to the University of Chile (outside the FAU) that create primary thematic data of interest to spatial data specialists are:
- Seismological Service (http://ssn.dgf.uchile.cl/)
- Space Studies Center ('Centro de Estudios Espaciales' – CEE)
- Astronomy Department / National Astronomic Observatory

IV.2.c. Bernardo O'Higgins University

www.ubo.cl	Facultad de Ingenierìa y Administración, **UNIVERSIDAD BERNARDO O'HIGGINS** Avenida Viel 1497 / Ruta 5 Sur, Santiago Región Metropolitana
Telephone	(56) – 2 – 4774189 / 4774110
E-mail – contact for this report	afuentes@ubo.cl

[73] "Socio-demographic atlas of the Vilarica sub-basin using geographic information systems and Redatam + SP", Cristian Henríquez Cristian, Catholic University – PUC / Instituto de Geografía, conference paper, "ICC 2009 Proceedings", November 2009.

[74] "Use of Geographical Information Systems (GIS) in the evaluation of dynamics and changes in the rural landscape of central Chile", Fernando Pino, University of Chile / Geography Department, Paper submitted to ICC, "XXIII ICC Proceedings", August 2007.

The Engineering and Management Faculty of the Bernardo O'Higgins University runs the course titled "Ingeniero en Geomensura y Cartografía" ('engineer in surveying and cartography'). The previous report to the ICA (2003 – 2007) mentioned that the courses in cartography and surveying had both been expanded from what had been previously technician-level courses to a longer sequence of training up to the level of Engineer. Both before and after this change, many of the course components were shared, in common to both courses. Recently the courses in surveying and cartography have been fully merged into a single course covering both disciplines. It consists of 4 years of classes on campus; if the student completes sufficient course components after about 2 or 3 years, an intermediate level of qualification at technician's level is possible. After 4 years, there is a further period for completing a graduation project and a practical internship, after which the student receives a qualification as Engineer together with a diploma in geomatics.

IV.2.d. University of Santiago

usach **www.digeo.cl**	Departamento de Ingeniería Geográfica, Facultad de Ingenería **UNIVERSIDAD DE SANTIAGO DE CHILE - USACH** Schatchtebech 03 Estación Central Región Metropolitana
Telephone	(56) - 2 - 718 2200 / 718 2202 / 718 2206
E-mail – general information	yessica.ugarte@usach.cl
E-mail – contact for this report	juan.espinoza@usach.cl

The University of Santiago Engineering Faculty includes the Department of Geographic Engineering. The courses it runs include the following:

- Civil engineering in Geography –six years, for a first engineer-level degree
- Engineering in Surveying - four years, for a first degree as surveyor
- Geomatics – two years, for a post-graduate degree or "magister"

The Department of Geographic Engineering academic and scientific staff manage research projects; in the current period these have included:

- Urban territorial and environmental planning[75]
- Cartography of environmental impact on natural systems
- Use of GIS to locate urban activities
- Use of remote sensing products for urban spatial analysis

The USACH was one of the Patrons of ICC 2009; the Director of the Dept. of Geographic Engineering sustained this contribution by participating as a member of the SSC.

IV.2.e. Other Universities

University of Concepción

The University of Concepción has two campuses in the Eighth (Biobio) region. At the Concepción main campus, the Geography Department runs a four-year course, including course components on cartography, remote sensing, GIS and spatial modeling. A fifth year for a practical internship and a thesis leads to a qualification as Geographer. At the Los Angeles Campus the Department of Geodesic Sciences and Geomatics runs a 5-year course in Geomatics Engineering, focused on geomatics and surveying, with components

[75] "Geomatica aplicada en el catastro de predios fiscales en Isla de Pascua", Victor Herrera Gonzalez, Jose Borcosque Diaz, USACH, "Revista Geográfica de Chile – Terra Australis" , June 2009.

covering photogrammetry, technical drawing and GIS.

Official Name	Departamento de Geografía, Facultad de Arquitectura Urbanismo y Geografía, **UNIVERSIDAD DE CONCEPCIÓN**	Departamento de Ciencias Geodésicas y Geomática, **UNIVERSIDAD DE CONCEPCIÓN**
Address:	Calle Victoria S/N, Barrio Universitario, Concepción, VIII Región	J.A. Coloma 0201, Los Angeles, VIII Región
Web site:	www2.udec.cl/~depgeografia/	www2.udec.cl/~geomatic/
Telephone:	(56) - 41-2203233	(56) - 43 – 405206
E-mail :	faug@udec.cl	geomatic@udec.cl

Academics attached to these Departments perform research[76], [77] and submitted 2 papers[78], [79] to ICC 2009. The University participates in the "Phoenix" project (see II.3.d.) and in the consortium that manages the Transportable Integrated Geodesic Observatory - TIGO - (see www.tigo.cl), centered on a station close to the main Concepción campus.

Catholic University of Valparaíso

Official Name:	**Instituto de Geografía – Pontificia Universidad Católica de Valparaíso**
Address:	Avenida Brasil 2241, Valparaíso, V Región
Web site:	www.geografia.ucv.cl
Telephone:	(56) – 32 – 2274081
E-mail :	rudy.allesch@ucv.cl

The Geography Institute, attached to the Catholic University of Valparaiso (PUCV), runs a four-year course including course components covering cartography, hydrography, remote sensing, topography, and GIS. A fifth year for producing a thesis leads to a qualification as Geographer. Academics of the Institute also perform research[80].

IV.3 Organizations Associated with the Academic & Training Sector

IV.3.a. Military Polytechnic Academy

www.acapomil.cl	**ACADEMIA POLITÉCNICA MILITAR – ACAPOMIL** Avenida Valenzuela Llanos 623 La Reina Región Metropolitana
Telephone:	(56) – 2 – 2994307 / 2994325 / 2994365 / 2994359

The Chilean armed forces provide training and education at university level at the 'Military Polytechnic Academy' (ACAPOMIL), which runs five-year full-time courses for officers equivalent to University engineering courses. These start with a grounding in basic

[76] "Transformación de datum cartográfico clásico a SIRGAS (WGS 84), una alternativa de desarrollo", Oscar Cifuentes Zambrano, Patricio Virano Reyes, Concepción University - Geography Dep., journal article in "Anales – Sociedad Chilena de Ciencias Geograficas - 2006" (Yearbook), October 2007

[77] 4D Visualisation of George VI Ice Shelf using Radar Backscattering Coefficient", Guido Staub, University of Concepción, "ICC 2009 Proceedings", November 2009

[78] "Cartography and spatial analysis of urban sprawl", Carolina Rojas, Refereed paper, "ICC 2009 Proceedings", Nov. 2009

[79] "Application of kinematic geodetic reference systems in the use of SIRGAS-Chile", Juan Carlos Baez, University of Concepción, conference paper, "ICC 2009 Proceedings", November 2009

[80] "Methodological proposal for the geo-referencing of elements issuers and its implementation through a GIS", Dayhann Araya Muñoz, PUCV / Geography Institute, "Tiempo y Espacio; Historia, Geografia - 2008", May 2009.

engineering subjects common to all the engineering courses, then starting to specialize; one of these specializations is titled 'Information and Communications Technological Systems', within which the options for final specialization includes 'Geography'. Those who complete the 10-semester course including the geography specialization, not only graduate as Military Polytechnic Engineers but also acquire skills in surveying, geography, cartography, remote-sensing, geo-informatics and allied disciplines in the geo-sciences. This qualification is a pre-requisite for the officers assigned to technical-scientific management posts at the IGM. At ICC 2009, ACAPOMIL ran a booth in the Exhibition.

IV.3.b Technological Center for Geomatics at the University of Talca[81]

http://geomatica.utalca.cl	**CENTRO TECNOLÓGICO DE GEOMÁTICA – CENGEO, UNIVERSIDAD DE TALCA** Casa Central 2 Norte 685 Talca VII Region
Telephone:	(56) – 71 – 200200
E-mail – contact for this report	cmena@utalca.cl; ymorales@utalca.cl

The Geomatics Center - CENGEO - is a technological center attached to the University of Talca, whose staff specializations, workshop facilities and equipment are focused on:

- the processing, interpretation and use in practical applications of data derived from aerial photography, satellites and geodesic/GPS surveying.
- digital cartography and GIS, DEM, modeling spatial data, design of maps and atlases.
- application of geomatics to the needs of sectors such as forestry, agriculture, cadastral.

CENGEO provides support to several of the University's courses (in agriculture, forestry, informatics, architecture, and engineering fields) by teaching the geomatics course components and by providing study facilities and equipment. In addition, it provides specialized advice, consultancy and training services to public, academic and private institutions outside the University of Talca and performs research projects on cooperation with these external bodies. CENGEO has been particularly active in developing techniques for processing and interpreting satellite sensor data for applications specific to the needs of Chilean institutions. CENGEO participates in the "Phoenix" project – see II.3.d. At ICC 2009, the Director of CENGEO participated as a session moderator.

IV.3.c. Center for Tactile Cartography of the UTEM

Centro de Cartografía Táctil - UTEM http://www.utem.cl/investigacion/centros/centro-de-cartografia-tactil-2/	Centro de Cartografía Tactil, Facultad de Humanidades y Tecnologías de la Comunicación Social, **UNIVERSIDAD TECNOLÓGICA METROPOLITANA** Dieciocho 414 Santiago Región Metropolitana
Telephone	(56) – 2 – 7877392 / 7877362 / 7877361
E-mail – general information	ctactil@utem.cl
E-mail – contact for this report	acoll@utem.cl

The Center for Tactile Cartography (CCT) is a research center attached to the

[81] "Experiencias en la enseñanza de nuevas tecnologías; el Centro de Geomática de la Universidad de Talca", Carlos Mena Frau, Jaime Latorre Alonso, John Gajardo Valenzuela, Yohana Morales Hernandez, Yony Ormazabal Rojas, University of Talca (Geomatics Center), Journal article, "Revista Cartografica", 2007

Metropolitan Technological University (UTEM). It interacts closely with the Cartography Department of the UTEM (see IV.1.a) and performs research and training in the area of tactile cartography and multi-sensorial communication. The main lines of research include:

- Development and implementation of systems supporting the transfer of spatial information based on a model of inclusion
- Tactile and braille production
- Adaptation and preparation of educational and bibliographic material

CCT has issued articles and papers [82], [83], [84], and produces tactile maps and materials oriented to the blind and the visual handicapped. It is the only academic center in Chile dedicated to this area, and has become a leader in its field at regional level through its contacts in Latin America. Recent research has expanded its scope to areas such as the training of teachers in the use of tactile material and to other forms of handicap (besides blindness) in relation to spatial information.

CCT is aware of the ICA Commission on Maps and Graphics for Blind and Partially Sighted People; however, its main partner at international level has been the PAIGH, which has supported several joint projects involving tactile cartography[85]. At ICC 2009, tactile maps from CCT were included in the Cartographic Exhibition. The tactile maps produced by CCT in this period are:

Title	*Scale*	*Dimension*	*Date*
Mapa físico Volcán Antuco y laguna de la Laja	1 : 50000	47,5 x 51	2007
Globalización Chile : Una nueva mirada	1 : 9.600	43 x 42,5	
Mapa Municipio de Sao Paulo de la Región Metropolitana	1 : 381000	48 x 48	2009
Mapa Político de la Región Metropolitana de Sao Paulo	1 : 273000	48 x 48	
Mapa Físico Región Metropolitana de Sao Paulo	1 : 447000	48 x 48	
Mapa Político Región Metropolitana, Chile	1 : 450000	48 x 48	
Mapa Político de la Provincia de Santiago, Chile.	1 : 140000	48 x 48	
Mapa Físico de la Región Metropolitana, Chile.	1 : 450000	48 x 48	
Mapa Físico del Cusco, Perú	1 : 1300000	48 x 48	
Mapa Político del Departamento del Cusco, Perú	1 : 1200000	48 x 48	
Plano Táctil Universidad del Valle Cali, Colombia	1 : 2.500	52,4 x 52,4	
Cambio del equilibrio del Carbono 1896 -1900	1 : 68100000	48 x 48	2010
Cambio del equilibrio del Carbono 1996 – 2000	1 : 68100000	48 x 48	
Distribución del Dengue en la Américas	1 : 5000000	48 x 48	
Hielo Polar Hemisferio norte Septiembre 1980	1 : 50000000	21,6 x 27,9	
Hielo Polar Hemisferio norte Septiembre 2008	1 : 50000000	21,6 x 27,9	
Dinámica de los Glaciares Sector Noroccidental Península	1 : 474000	43,5 x 45,6	

[82] "Cartografia, Educacion y capacidades sensoriales diferentes" Teresa Barrientos Guzman, Alejandra Coll Escanilla, Ximena Vidal Mella, Metropolitan Tecnological University - UTEM (Tactile Cartography Center), Yearbook article, "Anales – Sociedad Chilena de Ciencias Geograficas", 2007

[83] "Caracteristicas de los alumnos con discapacidad visual que utilizan mapas táctiles", Victor Huentelemu Ramirez, UTEM (Tactile Cartography Center), Yearbook article, "Anales – Sociedad Chilena de Ciencias Geograficas", 2007

[84] "Implementation of a system of cartographic symbols on tactile maps for teaching the impacts associated with global warming", Alejandra Coll E., UTEM / CCT, conference paper, "ICC 2009 Proceedings", November 2009.

[85] "Impact of Tactile Cartography on the Teaching of Geography in Latin America", Alejandra Coll, Fernando Pino, UTEM (Tactile Cartography Center), Paper submitted to ICC, "XXIII ICC Proceedings", August 2007.

V: PRIVATE SECTOR

V.1 The Private Sector: List of Organisations

Cartography as a business and trade continues to evolve in the private sector as outlined in the previous report. Inclusion in this listings is intended only as reference information and does not constitute an endorsement or recommendation of those organisations. As follows a list of those private organizations known to the National Committee (there may be others) that offer services and products related to the geo-sciences.

Address	*Telephone*	*Fax*	*E-mail*	*Web site*
Data Research				
Manuel Antonio Prieto 0152, Providencia, Santiago, Región Metropolitana	(56)-2-6651730	(56)-2-6659201	ginaghio@dataresearch.cl	www.dataresearch.cl
Digimapas Chile Ltda.[86]				
Santa Victoria 41, Santiago Centro, Región Metropolitana	(56) – 2 - 6657811/ 6345357		info@digimapas.cl	www.digimapas.cl
Dmapas (Mapas Digitales S.A.)				
Avenida Manquehue Sur 520 Of.222, Las Condes, Santiago, Región Metropolitana	(56) – 2 – 4314400	(56) – 2 – 4314401	*Form on web site*	www.dmapas.cl
Eagle Mapping Sudamerica S.A.				
Encomendero 2006 of.12, Las Condes, Santiago, Región Metropolitana	(56) -2 - 3343677 / 2330679	(56) -2 – 3354272	*Form on web site*	www.eaglemapping.cl
ESRI Chile S.A.[87], [88]				
Marchant Pereira 201 Piso 9, Providencia, Santiago, Región Metropolitana	(56) - 2 - 4819000	(56)-2– 4819099	info@esri-chile.com	www.esri-chile.com
Geaintec Ltda.				
Bahamonde 82, Concepción, VIII Región	(56) – 41– 786451	(56)-41– 2786451	info@geaintec.cl; moisescamp@geaintec.cl	www.geaintec.cl
Geocen				
Avenida Nueva Tajamar 481 of. 1408 Torre Norte, Las Condes, Santiago, Región Metropolitana	(56)-2– 9460703	(56)-2– 9460723	infor@geocen.cl	www.geocen.cl
Geocom				
Avenida Salvador 1105, Providencia, Santiago, Región Metropolitana	(56) - 2 - 4803600	(56) - 2 - 2049535	ventas@geocom.cl; servicio@geocom.cl	www.geocom.cl
GeoInfo				
San Pio X 2433, Providencia, Santiago, Región Metropolitana	(56) – 2 - 4317900	(56) – 2 - 4317910	geoinfo@geoinfo.cl	www.geoinfo.cl
Geoingeniería Digital				
Cerro Colorado 5030 of. 504, Las Condes, Santiago, Región Metropolitana	(56) – 2 – 223 7943		geoing@vtr.net	

[86] "Aplicaciones prácticas de imágenes digitales e información de sistema LiDAR aerotransportado", Markus Rombach, DIGIMAPA, seminar presentation "II Seminario Internacional de Teledetección / Aplicaciónes de Imágenes Satelitales", June 2010.
[87] "El Impacto de las Imágenes en el Gobierno de Hoy", Juan E. Silva, ESRI-Chile, "II Seminario Internacional de Teledetección / Aplicaciónes de Imágenes Satelitales", June 2010.
[88] "La Importancia de los Sistemas de Información Geográfica en la Gestión Gubernamental y Planificación Territorial", Daniel Flores, ESRI-Chile, "III Seminario Internacional: Aplicaciones de las Tecnologías Espaciales", Nov. 2010.

GeoSoluciones				
Pedro de Valdivia 1783 Of.188, Providencia, Santiago, Región Metropolitana	(56)-2-2091431	(56)-2-2091431	*Form on web site*	www.geosoluciones.cl
Geospatial				
Luis Thayer Ojeda 0191 Of. 1101, Providencia, Santiago, Región Metropolitana	(56)-2-3350707	(56)-2-3332907	ventas@geospatial.cl; p.sliva@geospatial.cl	www.geospatial.cl
IKOM				
Monseñor Sotero Sanz 55 Piso 5, Providencia, Región Metropolitana	(56) – 2 – 5192523	(56) – 2 – 5192530	emanriquez@ikom.cl	www.ikom.cl
Mapcity Chile S.A.				
San Sebastián 2952 Piso 3, Las Condes, Santiago, Región Metropolitana	(56) – 2 – 8295000	(56) – 2 – 3330482	contacto@mapcity.com	://clasico.mapcity.com
Microgeo				
Camino del Cerro 5154, Huechuraba, Santiago, Región Metropolitana	(56) – 2 – 6580800	(56) – 2 – 6580804	microgeo@microgeo.cl; Ventas.geodesia@microgeo.cl	www.microgeo.cl
Oriondata[89]				
Antonio Bellet 77 of. 1002/1003, Providencia, Santiago, Región Metropolitana	56 – 2 – 2356444	56 – 2 – 2641824	*Form on web site*	www.oriondatachile.com
SIIGSA / Servicios Integrados en Información Geográfica S.A.				
Avenida 11 de Septiembre 1881 of. 615, Providencia, Santiago, Región Metropolitana	56 - 2 – 3359961	56 – 2 – 3414869	contacto@siigsa.cl	www.siigsa.cl
Solfa (Fotogrametría Percepción Remota e Ingeniería S.A.)				
Jose Domingo Cañas 560, Ñuñoa, Santiago, Región Metropolitana	(56)–2–696 20 38 / 2045981 / 2046083	(56) - 2 – 2045936	solfa@solfa.cl	www.solfa.cl
Terra Remote Sensing Ltda. / Servicios Ingeniería Geomática				
Av. Tupungato 3850, Parque Industrial Curauma, Valparaíso, V Región	(56) – 32 - 314 3752 / 314 3753	(56) - 2 - 5951999	alfredo.solorza@terraremote.com	http://terraremote.cl/

Several of the firms and organisations listed above participated in ICC 2009 by running a booth in the technical exhibition[90], either directly or jointly with their international partners.

Concerning publications oriented towards the general public, there are in addition to the above a few organisations and brands that publish maps and atlases intended for the tourism, road travel and education markets; these include:

- Chiletur Copec (*formerly Turistel/Turiscom*)
- Editorial ZigZag
- Fundación TrekkingChile / ViaChile Editores
- Mapas JLM Mattassi

[89] "Complement of Optical satellite image and Radar satellite image in the construction of Cartographic Bases", Orlando Cifuentes, OrionData, conference poster abstract, "ICC 2009 Proceedings", November 2009.
[90] "Catalogue of the Technical-Commercial Exhibition", FISA S.A. & LOC for ICC 2009, CD-ROM, November 2009

PART SIX: CLOSING OBSERVATIONS

VI.1. Trends in Chilean cartography by analysis of publications

As a way of detecting trends in Chilean cartography and the concerns of Chilean practitioners, also to help ICA Commissions find Chilean publications relevant to their respective fields, some of the bibliographic references of this report are listed here, classified in relation to the sub-disciplines of Cartography. The criteria for selecting these are:

- The authors are Chilean, affiliated to a Chilean institution and/or dealing with matters involving Chile in the subject matter
- Published and in one way or another available to the public
- For the purposes of comparison the item is a journal articles, conference submission or seminar presentation, excluding other types of publication (books, maps, etc.)
- Each item can be related to the scope of an ICA Commission or ICA Working Group

Reference Numbers	*Total Refs.*	*Name of ICA Commission or WG*	*Reference Numbers*	*Total Refs.*	*Name of ICA Commission or WG*
	0	Cart. & Children		0	Atlases
	0	Digital Tech. in Cart. Heritage		0	Planetary Cartography
81, 108, 118, 119	4	Education & Training	67	1	Theoretical Cartography
107	1	Generalisation & Multiple Representation		0	Ubiquitous Mapping
70, 74, 78, 104, 105, 117	6	Geospatial Analysis & Modeling		0	Underrepresented Groups
17, 20, 21, 22, 48, 49, 50	7	Geospatial Data Standards	5, 18, 63, 112,	4	Use and User Issues
19, 77, 93, 94, 115	5	Geovisualization		0	Art and Cartography
96, 101, 110	3	History of Cartography	24, 28, 46, 68,	4	Early Warning & Crisis Management
32, 33, 34, 35, 37, 51,	6	Management & Economics of Map Production	56, 57, 58	3	Census Cartography
29, 30, 36, 86, 89, 99, 109, 111,	8	Satellite Imagery	39, 55, 64, 65, 71, 114	6	GIS & Sustainable Development
103	1	Map Projections		0	Mapping Africa
82, 83, 84, 85	4	Maps & Graphics for Blind & Partially Sighted		0	Open Data Access & Intellectual Property Rights
16, 62, 73, 88, 98	5	Maps and Society		0	Open Source Geospatial Technology
18, 19, 54, 102	4	Maps and the Internet	97	1	Tourist Cartography
45	1	Marine Cartography	66	1	Crime Mapping
	0	Mountain Cartography			

These publications tend towards reporting development projects and practical applications more than pure scientific research. For some categories, all the items within a specific category come from just the one institution most closely associated with that theme (CCT and maps for the blind; SHOA and Marine, INE and Census, SERNATUR and Tourist). The absence of articles and conference submissions for the Atlas and Children categories does not prove an absence of activities in these areas; this report covers the Childrens Map Competitions and several Atlases.

VI.2. Invitation to UGI 2011, for the Cartographic Community

www.ugi2011.cl	Comité Organizador Local **CONFERENCIA GEOGRÁFICA REGIONAL – UGI 2011** Instituto Geográfico Militar Nueva Santa Isabel 1640 Santiago Región Metropolitana
Telephone	(56) – 2 – 4109422 / 4109314
E-mail	info@ugi2011.cl

As noted in I.2.a., the ICA is one of the organizations backing, as a patron, the Regional Geographic Conference UGI 2011, scheduled for the 14th to 18th of November 2011. For the International Geographic Union (IGU), this event is part of their sequence of world-level conferences. At ICC 2009, the President of the IGU met the ICA E.C. to discuss cooperation between the IGU and the ICA, as both are scientific organizations dedicated to the geo-sciences, accredited by the ICSU and members of the JBGIS.

The Organizers of UGI 2011 invite the ICA and the world cartographic community to participate in this conference, where the geographers of the world will make them welcome. In particular, cartographers will find conference track Nº 12, "Geographic Information Sciences" of special relevance to their field.

For those who participated in ICC 2009, several elements in UGI 2011 will be familiar; the local organizers (IGM and FISA), the venue (the Military School) and some of the Patrons are the same, so contributors to the ICA will feel 'at home' at UGI 2011. However, rather than simply repeat the same formula, the organizers aim to improve upon ICC 2009; in particular, the geographic field trips will be a new and special feature. Attendee and submissions statistics are expected to equal or surpass those for ICC 2009.

VI.3. Acknowledgements

The National Committee of the ICA in Chile gives special thanks for the assistance received in the preparation of this report. Special thanks are due to the **Military Geographic Institute** of Chile for the coordination, drafting and delivery of this report, together with contributions of information from members of staff. The other institutions which provided information specially for this report include:

- SERVICIO HIDROGRAFICO Y OCEANOGRAFICO DE LA ARMADA – SHOA
- SERVICIO AEROFOTOGRAMETRICO DE LA FUERZA AEREA – SAF
- CENTRO DE INFORMACIÓN DE RECURSOS NATURALES - CIREN
- SERVICIO NACIONAL DE GEOLOGIA Y MINERIA - SERNAGEOMIN
- CORPORACIÓN NACIONAL FORESTAL – CONAF
- UNIVERSIDAD TECNOLOGICA METROPOLITANA – UTEM
- PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE - PUC
- UNIVERSIDAD BERNARDO O'HIGGINS – UBO
- CENTRO GEOMATICA – CENGEO (TALCA UNIVERSITY)
- UNIVERSIDAD DE SANTIAGO DE CHILE - USACH

May, 2011

ANNEXES

Annex I. Bibliography and Further Reading

A.I.a. Additional Bibliography and Further Reading

The following sources, while not related specifically to any individual chapter of the main text – and for that reason not included in the main text – are relevant to this report as a whole. The numbering is a continuation of the main text bibliographical notes.

Books & Long Reports

91 “Report on Cartography in the Republic of Chile 1999 – 2003”, IGM / Chilean N.C. of ICA, May 2003.
92 “Monumenta Cartographica Chiloensia. Misión, Territorio y Defensa 1596 - 1826”, Gabriel Guarda & Rodrigo Moreno Jeria, Universidad Adolfo Ibáñez, ISBN.9561605007, 2008.
93 “Atlas Historico Militar de Chile”, Academia de Historia Militar, ISBN 978-956-8989-00-2, August 2010

Journal Articles

94 “System of geographic information of the Agrarian Innovation Foundation - FIA - using SVG (scalable vector graphics)”, Marcelo Canepa Guerra, Agriculture Ministry (Agrarian Innovation Foundation), Article in SNIT yearly journal, “Revista SNIT”, 2007.
95 “Geographic Information System to support the development of agriculture, cattle and forestry”, Mario Ahumada C., Rodrigo Lacomas B., Luis Cordero L., Ana Luisa Tapia T., Eduardo Camacho S., MBN / UTEM, Article in SNIT yearly journal, “Revista SNIT”, 2007.
96 “Primeros levantamientos cartográficos generales de Chile con base científica: los mapas de Claudio Gay y Amado Pissis”, José Ignacio González Leiva, Catholic University / Geography Institute, Article in Journal of the PUC Geography Institute, “Revista de geografía Norte Grande 38” - 2007
97 “Successful incorporation of GIS to planning and tourism management”, Humberto Rivas O., Arlette Levy A., National Tourism Service – SERNATUR, Article in SNIT yearly journal, “Revista SNIT”, 2008
98 “An experience of participatory mapping”, Loreto Rojas Symmes, "Ciudad Viva " network, Article in SNIT yearly journal, “Revista SNIT”, 2008
99 “Uso de imágenes Satelitales en el Ministerio de Vivienda y Urbanismo (MINVU)”, Pedro Muñoz Aguayo, Ministry of Housing and Urban Management – MINVU, “Revista Cartografica”, 2008
100 “Avaliacao de modelos de transformacao bidimensional para a compatbilizacao de bases cartograficas asociadas a diversos sistemas geodesicos de referencia”, Leonardo Molina Pino, Henrique Firkowsky UTEM (Dpto. Cartografia) / Universidad Federal de Paraná, article in bulletin of University of Parana, Brazil, “Boletín de Ciencias Geodésicas”, April 2009.
101 “Geography and Nation: Claudio Gay and the first maps of Chile”, Rafael Sagredo Baeza, Catholic University - PUC / History Institute, “Estudios Geográficos”, June 2009.
102 “Government creates a Web mapping site for registering information on traffic accidents in the Great Santiago”, Gabriele Rosende Bustos, National Traffic Safety Commission – CONASET, Article in SNIT yearly journal, “Revista SNIT”, 2010.

Papers, Poster Abstracts and Presentations from Conferences and Seminars

103 “Conceptos de geo-referenciación y uso de imágenes”, Carlos Pattillo, CPRSIG-Chile, conference presentation, "La cartografía censal en América Latina", November 2008.
104 “Sistema de Posicionamiento Global (GPS): Conceptos, Funcionamiento, Evolución y Aplicaciones", Gina Ghio, SELPER-Chile, conference presentation, "La cartografía censal en América Latina", Nov. 2008.
105 “Portable geographic information system of red tide (SIGMARO) as an aid in the analysis of data and decision-making” Christian D. Espinoza A., Instituto de Fomento Pesuqero – IFOP, conference refereed paper, “ICC 2009 Proceedings”, November 2009.
106 “A simple physical model to estimate global solar radiation in the Central Zone of Chile”, Luis Morales, University of Chile / Faculty of Agronomy, conference paper, “ICC 2009 Proceedings”, November 2009.
107 “Land Information System for Tourism and Housing Uses in Patrimonial Valparaiso”, Esteban Soto-Marquez, UTEM, conference paper, “ICC 2009 Proceedings”, November 2009.
108 “Progress Map for geography in Chile: cartographic materials in primary and secondary schools”, Fabián Rodrigo Araya P., La Serena University, conference paper, “ICC 2009 Proceedings”, Nov. 2009.
109 Hyperspectral remote sensing images applied to three cases in the central zone of Chile”, Natacha Oyola, ‘Centro de Ecología Aplicada’ (CEA), conference paper, “ICC 2009 Proceedings”, November 2009.
110 “Charcas in the Map of South America, engraved in Madrid in 1775”, Felix Gajardo, IPGH, conference paper, “ICC 2009 Proceedings”, November 2009.

111 “Summary of capacities and potential applications of the first Chilean hyperspectral system”, Marco Peña, ‘Universidad Mayor / Centro de Estudio de Recursos Naturales Oterra’, conference paper, “ICC 2009 Proceedings”, November 2009.
112 “From graphical presentation to users´ comprehension of Transantiago network map” Jose Allard, Catholic University – PUC, conference paper, “ICC 2009 Proceedings”, November 2009.
113 “GIS, management solution for the sanitary sector”, Carlos Arias, ‘Aguas Andinas’, conference paper, “ICC 2009 Proceedings”, November 2009.
114 “Territorial Information System, regional service of housing and urban development” Igor Bacigaluppi, ‘Servicio de la Vivienda y Urbanizacion’ conference paper, “ICC 2009 Proceedings”, November 2009.
115 “Creation of an individually-configured model for cartographic publication and for optimizing editing times”, Cesar Sebastian Rozas C., IGM, Poster abstract, “ICC 2009 Proceedings”, November 2009.
116 “Human occupation evolution in the Chilean semiarid coastal zone, by GIS”, Hermann Manriquez T., IGM, conference Poster abstract, “ICC 2009 Proceedings”, November 2009.
117 “Map-matching problems in transportation-related applications”, Carola Blazquez, Andres Bello University, conference Poster abstract, “ICC 2009 Proceedings”, November 2009.
118 “Cartografia y educacion; la perspectiva geotecnologica como desafio docente”, Edmond Khzam Diaz, Universidad Autonoma de Chile – Talca campus, Seminar paper in published proceedings, “Presente y Futuro de la Educación Geográfica en Chile”. October 2009.
119 “La formación y capacitación en percepción remota para el mejoramiento productivo”, Celso Navarro C., Catholic University of Temuco (Forestry Sciences School), “III Seminario Internacional: Aplicaciones de las Tecnologías Espaciales”, November 2010.

Recent Articles about Chile from non-Chilean authors

120 “The Most Important earthquake Ever”; John Stenmark, article in ‘Point of Beginning’ magazine, Aug. 2010
121 “Country focus – Chile – Like fine wine”, Bhanu Rekha, “Geospatial World”, December 2010
122 “Chile’s strategic cities: The unknown Soviet military mapping program of major Chilean urban centers”, Kent Lee, East View Cartographic, “Revista Cartográfica”, 2011

A.I.b. Guide to Bibliographic References

In each reference to a publication (both the footnote references linked to the main text and the list of additional bibliography in Annex I.a.), the title is first, then the name of either the author or of the institution responsible for the content (usually both), finally the date of publication. Optionally other information is included if it has been available to the editor:

- ISBN, ISSN number or local intellectual property registration
- Media; brief description to indicate format and media
- For maps only; scale and cartographic projection, in some cases the dimensions
- For journal articles and conference publications only; title of journal or conference, as per ‘Title’ column in the list of Journals and Conferences in Annex A.I.c.

A.I.c. Sources for Journal Articles and Conference Submissions

The bibliography given as footnote references in the main text or listed in Annex I.a. have been selected from the journals and conference proceedings listed as follows:

Title (also in main text references)	*Date*	*Publisher*	*Number*	*URL*	*Description (ISBN/ISSN, format, media, language, comments)*
Revista de Geografia – Norte Grande	2007	Catholic University - PUC (Geography Institute)	38	http://www.geo.puc.cl/html/revista.html	Journal, on-line, Spanish. Journal of the Geography Institute of the Catholic University
Revista SNIT 2007	2007	SNIT		www.snit.cl	Annual journal, on-line and printed, Spanish, of the SNIT
XXIII ICC Proceedings	August 2007	Local Scientific Committee for XXIII ICC & ICA	23	www.icaci.org	Conference proceedings, CD, English, available at conference web site
Anales – Sociedad Chilena de Ciencias Geograficas – 2006	October 2007	Chilean Society for Geographic Sciences – SOCHIGEO		www.sociedadchilenadecienciasgeograficas.cl	ISSN 0717-3946, yearbook, Spanish, abstracts presented at SOCHIGEO conference of 2006, published as articles in 2007
Revista Cartografica (2007)	December 2007	PAIGH	83		ISSN 0800-2085, journal of Cartography Commission of PAIGH, paper, Spanish & English.

GSDI-10 World Conference	Februar y 2008	LOC for GSDI-10 (UWI, Trinidad) & GSDI Association	10	www.gsdi.org	Conference proceedings, CD, English
Revista SNIT 2008	2008	Sistema Nacional de Información Territorial - SNIT		www.snit.cl	Annual journal, on-line and printed, Spanish, of the SNIT
ICA News	June 2008	ICA	50	www.icaci.org	Bulletin, printed, English. Newsletter of the ICA
Anales – Sociedad Chilena de Ciencias Geograficas – 2007	October 2008	SOCHIGEO		www.sociedad chilenadecienci asgeograficas. cl	ISSN 0717-3946, yearbook, Spanish, papers presented as abstracts at SOCHIGEO conference of 2007, published as articles in 2008
La cartografía censal en América Latina	Novemb er 2008	CELADE / CEPAL (UN)		www.cepal.cl/c elade/censos2 010/	Slide presentations in .pdf or .ppt files as the proceedings of regional workshop, Spanish.
Revista Cartografica (2008)	Decemb er 2008	Pan-American Institute for Geography and History – PAIGH	84	www.ipgh.org	ISSN 0800-2085 , journal of the Cartography Commission of the PAIGH, paper, Spanish & English. See also II.2.d.
Boletín de Ciencias Geodésicas	April 2009	Universidad de Paraná, Brasil	Vol. 15 Nº 2		Journal of a Faculty of Parana University
Tiempo y Espacio; Historia, Geografia – 2008	May 2009	"Universidad del Bio Bio"	21		ISSN 0014-1496, journal of articles, paper, Spanish. Articles gathered in 2008, printed in 2009
Estudios Geográficos	June 2009	Consejo Superior de Investigaciones Cientificas – CSIC (Spain)	Vol. LXX, nº 266	http://estudiosg eograficos.revi stas.csic.es/	ISSN 0014-1496, journal, paper, Spanish. Biannual journal of a state-owned scientific research agency. This issue was devoted to Chilean geography.
Revista Geográfica de Chile – Terra Australis	June 2009	IGM	51 / 52		ISSN 0378-8482, journal of the IGM
ICA News	June 2009	ICA	52	www.icaci.org	Bulletin, printed, English. Newsletter of the ICA
GSDI-11 World Conference	June 2009	LOC for GSDI-11 (Netherlands) & GSDI Association	11	www.gsdi.org	Conference proceedings, CD, English
ICA News	Septem ber 2009	ICA	Spe-cial Issue	www.icaci.org	Bulletin, printed, English. Newsletter of the ICA
Presente y Futuro de la Educación Geográfica en Chile	October 2009	University of La Serena, PAIGH, SOCHIGEO,			ISBN 978-956-7393-40-4, confe-rence proceedings, English, publication of seminar May 2009
ICC 2009 Proceedings	Novem-ber 2009	LOC for ICC 2009 & ICA	24	www.icaci.org	ISBN 978-1-907075-02-5 Conf. proceedings, CD, English
ICA News	Decemb er 2009	ICA	53	www.icaci.org	Bulletin, printed, English. Newsletter of the ICA
II Seminario Internacional de Teledetección – Valparaíso / Primer Taller Internacional en Aplicaciónes de Imágenes Satelitales	June 2010	Agencia Chilena del Espacio – ACE	II	www.agenciae spacial.cl ("Publicaciones " page)	Seminar proceedings, files on-line, Spanish, available at ACE web site
Cuadernos de Difusión	2010	Center for Interna-tional Studies of Catholic University	5		Journal, paper, Spanish, of CEIUC, with Nº 5dedicated to a seminar about Haiti
Revista SNIT 2010	2010	SNIT		www.snit.cl	Annual journal, on-line and printed, Spanish, of the SNIT
Revista de Geografia – Norte Grande	Late 2010	Catholic University (Geography Institute)	45	http://www.geo. puc.cl/html/revi sta.html	Journal, on-line, Spanish. Journal of the Geography Institute of the Catholic University
Point of Beginning	Sept. 2010	POB Magazine		www.pobonline .com	Web site version of journal for mapping & surveying profession

GSDI-12 World Conference	October 2010	LOC for GSDI-12 (SLA, Singapore) & GSDI Association	12	www.gsdi.org	Conference proceedings, CD, English
III Seminario Internacional: Aplicaciones de las Tecnologías Espaciales para el Mejoramiento de la Gestión de los Procesos Productivos	November 2010	Agencia Chilena del Espacio – ACE	III	www.agenciaespacial.cl ("Publicaciones" page)	Conference proceedings, files on-line, Spanish, available at ACE web site
Desastres y Ordenamiento Territorial en las Americas	November 2010	IPGH (local organizers; IGN – Peru)			International Seminar held as part of several IPGH events in Lima, Peru. Abstract proceedings .
Geospatial World	December 2010	GIS Development	Vol.1 issue 5	www.geospatialworld.net	International magazine, based in India
Revista Cartografica (2011)	June 2011	PAIGH	84		Journal of PAIGH Cartography Commission, Spanish & English.

Annex II: List of Acronyms Used

A.II.1 Spanish language acronyms

ACE - Agencia Chilena del Espacio
CCT – Centro de Cartografía Tactil
CEE – Centro de Estudios Espaciales
CENGEO - Centro Tecnológico de Geomática
CIREN - Centro de Información de Recursos Naturales
CONA – Comité Oceanográfico Nacional
CONAF – Corporación Nacional Forestal
CORFO – Corporación de Fomento
DIFROL – Departamento de Fronteras y Límites
GTMIG – Grupo de Trabajo Multisectorial de Información Geográfico
IGM – Instituto Geográfico Militar
INACH - Instituto Chileno Antártico
INE - Instituto Nacional de Estadística
MBN – Ministerio de Bienes Nacionales
MOP - Ministerio de Obras Públicas
PUC - Pontificia Universidad Católica de Chile
PUCV - Pontificia Universidad Católica de Valparaiso
RGN – Red Geodésico Nacional
SAF - Servicio Aerofotogramétrico de la Fuerza Aérea
SELPER - Sociedad Percepción Remota
SERNAGEOMIN - Servicio Nacional de Geología y Minería
SERNATUR – Servicio Nacional de Turismo
SHOA - Servicio Hidrográfico y Oceanográfico de la Armada
SIIE - Sistema Integrado de Información para Emergencias
SNIT - Sistema Nacional de Información Territorial
SOCHIGEO - Chilean Society for Geographic Sciences
SSC – Scientific Sub-Committee
USACH - Universidad de Santiago de Chile
UTEM - Universidad Tecnológico Metropolitana

A.II.2 English language acronyms

GSDI - Global Spatial Data Infrastructure
ICC – International Cartographic Conference
ISPRS – International Society for Photogrammetry and Remote Sensing
JBGIS – Joint Board of Spatial Information Societies
LOC – Local Organising Committee (for international conferences)
N.C. – National Committee (of the ICA)
PAIGH - Pan-American Institute for Geography and History
SCAR - Scientific Committee for Antarctic Research
TIGO - Transportable Integrated Geodesic Observatory