

PORTUGAL

**SECÇÃO PORTUGUESA DAS UNIÕES INTERNACIONAIS
ASTRONÓMICA E GEODÉSICA E GEOFÍSICA
(SPUIAGG)**

**INTERNATIONAL ASSOCIATION OF GEODESY
IAG**

NATIONAL REPORT

2007 – 2010

**PRESENTED TO THE XXV GENERAL ASSEMBLY
OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS**

HOLD AT MELBOURNE, 28 JUNE – 7 JULY 2011

Coordinated by

**Eng. João Manuel Agrida Torres,
National Correspondent of IAG**

CONTENTS

1 – FORWORD	1
2 - INSTITUTO GEOGRÁFICO PORTUGUÊS (PORTUGUESE GEOGRAPHIC INSTITUTE)	1
3 - INSTITUTO DE INVESTIGAÇÃO CIENTÍFICA TROPICAL (TROPICAL SCIENCE RESEARCH INSTITUTE)	9
4 - LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL (NATIONAL LABORATORY OF CIVIL ENGINEERING)	14
5 - FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DE LISBOA (FACULTY OF SCIENCES OF THE UNIVERSITY OF LISBOA)	23
6 - CENTRO DE INVESTIGAÇÃO EM CIÊNCIAS GEO-ESPACIAIS (GEO-SPACE SCIENCES RESEARCH CENTRE)	28
7 - OBSERVATÓRIO ASTRONÓMICO PROF. MANUEL DE BARROS DA FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DO PORTO (ASTRONOMICAL OBSERVATORY PROF. MANUEL DE BARROS OF THE FACULTY OF SCIENCES OF THE UNIVERSITY OF PORTO)	41

1 – FORWARD

The present report contains the information about the work carried out in Portugal in the field of Geodesy, covering the period 2007-2010.

Each one of the following chapters is dedicated to the institutions (governmental agencies, universities and research centres), who reported relevant geodetic work:

- *Instituto Geográfico Português* (Portuguese Geographic Institute) - report by Eng. Manuela Vasconcelos;
- *Instituto de Investigação Científica Tropical* (Tropical Science Research Institute) - report by Dr. Paula Santos;
- *Laboratório Nacional de Engenharia Civil* (National Laboratory of Civil Engineering) – report by Prof. João Casaca and Dr. José Nuno Lima;
- *Faculdade de Ciências da Universidade de Lisboa* (Faculty of Sciences of the University of Lisboa) – report by Prof. João Catalão;
- *Centro de Investigação em Ciências Geo-espaciais* (Geo-Space Sciences Research Centre) – report by Prof. José Pereira Osório;
- *Observatório Astronómico Prof. Manuel de Barros da Faculdade de Ciências da Universidade do Porto* (Astronomical Observatory Prof. Manuel de Barros of the Faculty of Sciences of the University of Porto) – report by Prof. Luisa Bastos.

It must also be mentioned the personal contribution to the work within the IAG structure, namely:

- João Ágria Torres (*SPUIAGG*) as President of the Regional Reference Frame Sub-commission of Commission 1 – Reference Frames.

2 - INSTITUTO GEOGRÁFICO PORTUGUÊS (PORTUGUESE GEOGRAPHIC INSTITUTE)

2.1 – INTRODUCTION

The Portuguese Geographic Institute (IGP) is the National Authority for Geodesy, Cartography and Cadastre. Therefore one of its main missions is the establishment and maintenance of the Portuguese Reference Systems and Frames.

In the Geodesy domain, IGP's most important projects are:

- the GNSS Continuously Operating Reference Stations (CORS) network;
- two tide gauges;
- the relative gravity stations network;
- the high precision levelling network;
- the geodetic network.

2.2 – ReNEP – THE GNSS CORS NETWORK

In 1997 IGP installed the first CGPS station in Cascais (CASC), near the reference tide gauge, which is in operation since 1882. In the following years, until 2002, seven more stations were installed, having as main goal the maintenance of the Portuguese reference frames.

Since 2006 IGP is being working on the densification and the upgrade of the GNSS CORS (Continuously Operating Reference Stations) network - ReNEP - with two main goals:

- i) the maintenance of the national reference frames;
- ii) to provide a real time precise point positioning service.

At the present time the network consists of 44 CORS: 38 in the mainland and 6 on the islands (Azores and Madeira Archipelagos). Most of the stations collect both GPS and GLONASS data and 10 are connected to the high precision levelling network.

INTERNATIONAL ASSOCIATION OF GEODESY
 NATIONAL REPORT OF PORTUGAL

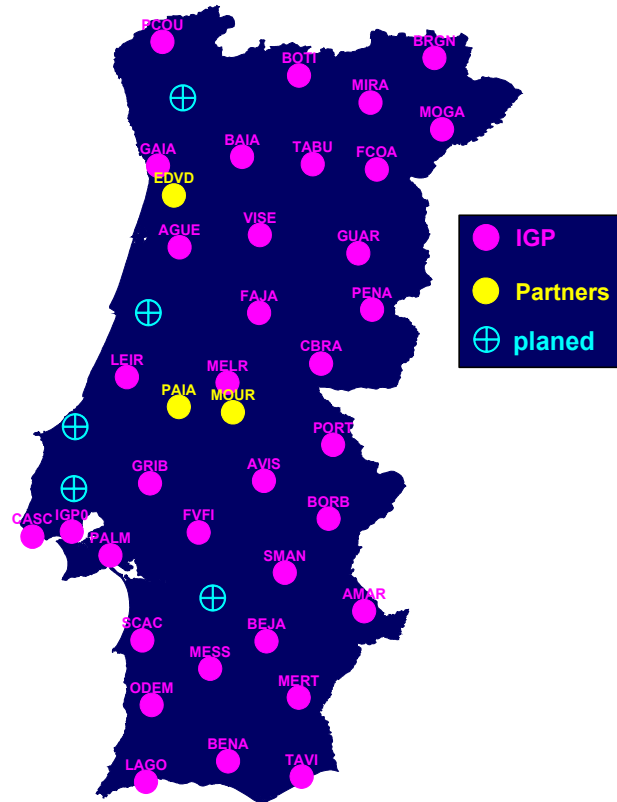


Figure 2.1 – ReNEP Status in Portugal Mainland.

ReNEP provides data for pos-processing (hourly RINEX files at 5 seconds rate) and real time applications.

The real-time corrections are distributed in RTCM format over the NTRIP protocol. There are three different types of products available: i) network coverage; ii) nearest-site; and iii) single-base station, for those users whose equipments cannot send NMEA messages. Presently there are more than 1000 registered users for real-time applications and about 500 daily connections to the server.

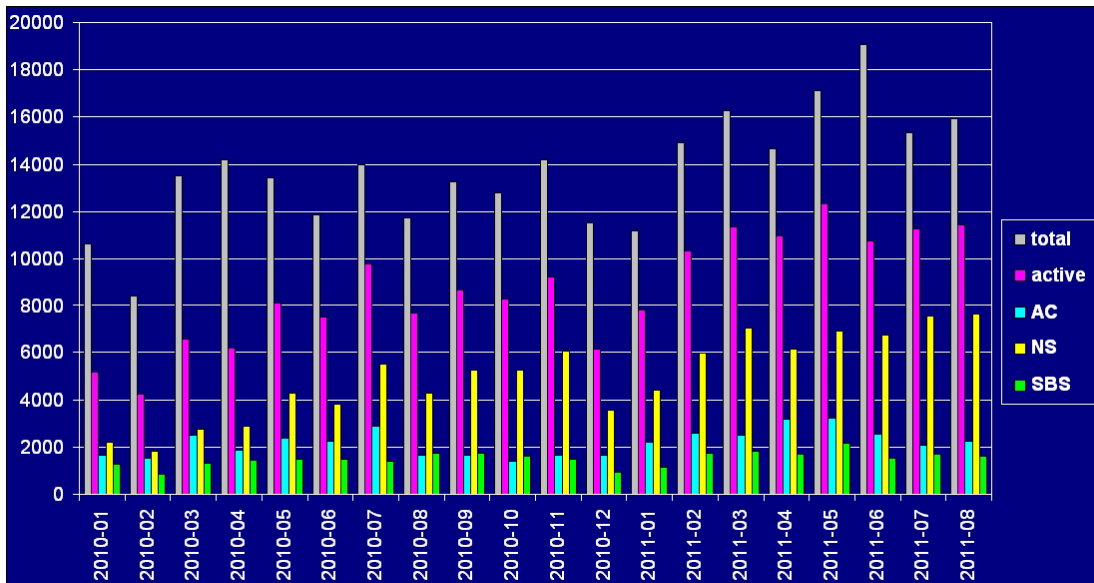


Figure 2.2 – Monthly accesses to ReNEP real-time products.
 AC: auto-cell network coverage; NS: nearest site; SBS: single base station.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

The tests done in order to evaluate the quality of the real-time positioning service show an average accuracy better than 5 cm in ETRS89, and better than 10 cm when working in the older classical reference systems.

Six of IGP's stations are part of the EPN (EUREF Permanent Network) and 3 of these also belong to the IGS (International GNSS Service) network, providing both RINEX data and the real-time streamings.

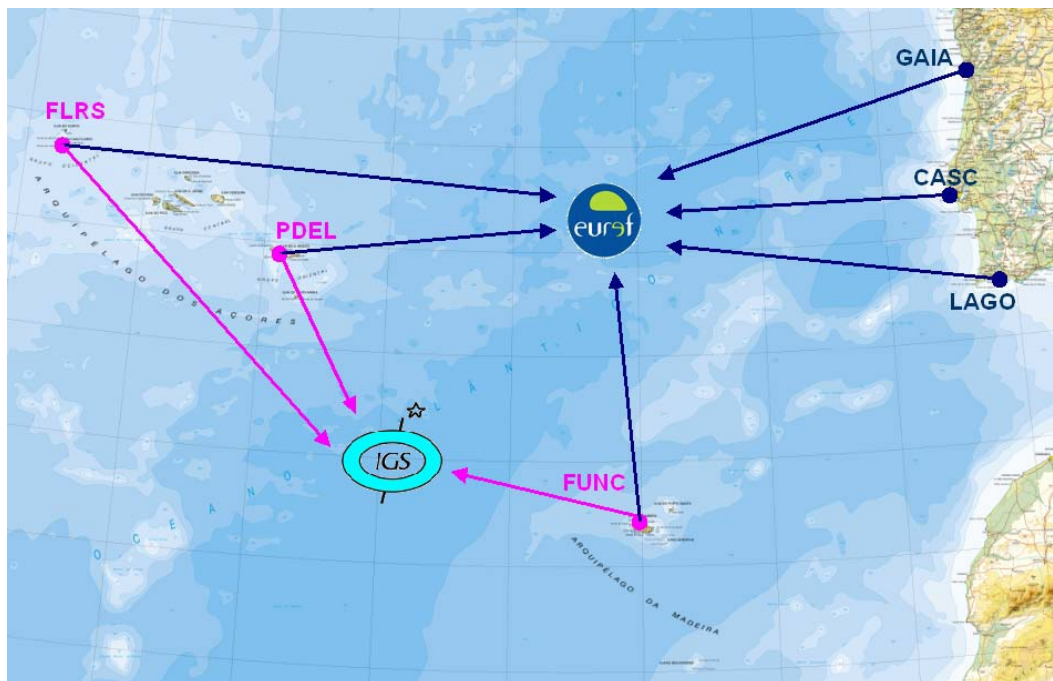


Figure 2.3 –ReNEP Stations belonging to EPN and IGS networks.

IGP participated in EUREF's project "Monitoring of official national ETRF coordinates on EPN web" with its three CORS located in the mainland. The next table shows the differences between the coordinates determined by EUREF and the official IGP coordinates, in ETRF2000 epoch 2000.0.

Table 2.1 –Differences between EUREF publish coordinates and IGP official coordinates for the 3 EPN stations in Portugal Mainland.

	Differences		
Station	X (m)	Y (m)	Z (m)
CASC	-0.020	0.012	-0.005
GAIA	0.022	-0.002	0.016
LAGO	0.001	0.020	-0.007

2.3 – MAINTENANCE OF ETRS89

In 1989 Portugal participated in the first GPS campaign promoted by EUREF (the IAG Sub-Commission for the European Reference Frame) with the purpose of connecting the European countries. Given that these measurements did not cover appropriately the Iberian Peninsula, a densification network was measured later on in the IBERIA 95 campaign. Between 1999 and 2004 the 1st and 2nd orders geodetic networks (around 1000 trig points) were measured with GPS and connected to the results of IBERIA95. The geodetic network of Portugal mainland is now a realization of the ETRS89, called PT-TM06/ETRS89.

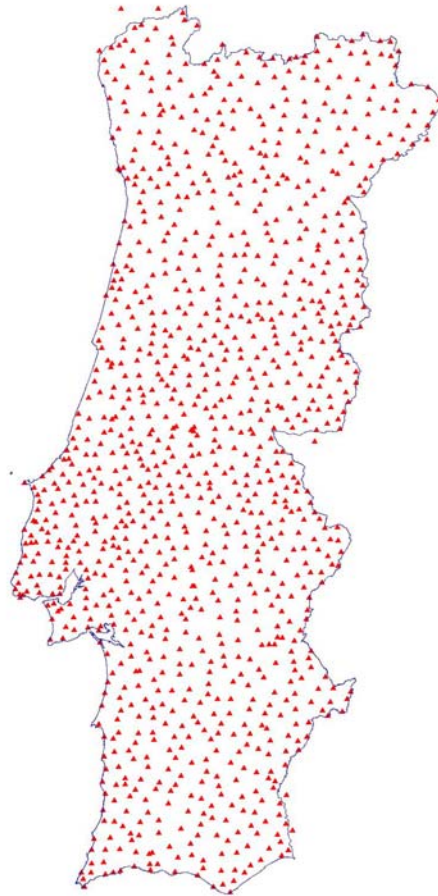


Figure 2.4 – Realization of ETRS89 in Portugal Mainland.

The Geodetic Network was connected to ReNEP with GNSS measurements. Since nowadays most of the operators make use ReNEP in real-time, it was important to evaluate the consistency between these two networks. To do that, IGP is performing RTK measurements in some points of the Geodetic Network. The differences between the official coordinates and the RTK coordinates are shown in the next table.

Table 2.2 –Differences between official PT-TM06/ETRS89 coordinates and coordinates obtained with RTK measurements.

Differences (m)	X	Y
Max	0.033	0.035
Average	0.000	0.009
Min	-0.018	-0.013
e.m.q.	0.012	0.014

In the Azores and Madeira archipelagos a group of points was measured in the international GPS campaign TANGO1994 (Trans-Atlantic Network for Geodynamics and Oceanography). In the subsequent years the geodetic networks of all the islands were measured with GPS and a realization of ITRS93 (PTRA08-UTM/ITRF93) was established as the reference frame for the archipelagos.

The parameters for coordinate transformation from the old geodetic reference systems to PT-TM06/ETRS89 and PTRA08-UTM/ITRF93 were determined. IGP also provide software for coordinate transformation and applications for the transformation of vector data to these new systems.

2.4 – TIDE GAUGES

IGP is responsible for two acoustic tide gauges, at Cascais and Lagos. The Cascais tide gauge is the reference for the mainland ordnance datum. At Cascais there is also a floating tide gauge, installed in 1882 that is still working.

The systems record sea level measurements at 5 seconds rate and all the data are streamed to IGP central office. Both tide gauges contribute with their data to SLEAC (Levels along the European Atlantic Coastline) and IOC (Intergovernmental Oceanographic Commission of UNESCO).



Figure 2.5 – Cascais Tide Gauges. Left: Borel Floating System. Right: Acoustic.

2.5 – GEOID MODEL

In 2009 the geoid model for Portugal mainland – GeodPT08 - was made available for public download in ASCII format. This model, calculated in a cooperation between IGP and FCUL (Faculty of Sciences of the University of Lisbon), is based in the gravity network measurements, and afterwards was adjusted to the levelling and geodetic networks.

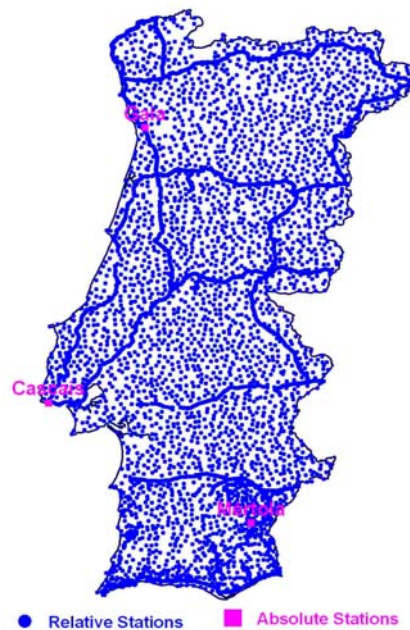


Figure 2.6 – Gravimetric Network of Portugal mainland.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

In order to evaluate the accuracy of the GeodPT08 RTK measurements were made in leveling benchmarks and geodetic trig points, which were not included in the geoid determination. The average difference between the official orthometric heights and the ones obtained from RTK and the geoid is 5cm for the leveling benchmarks and 8 cm for the geodetic trig points.

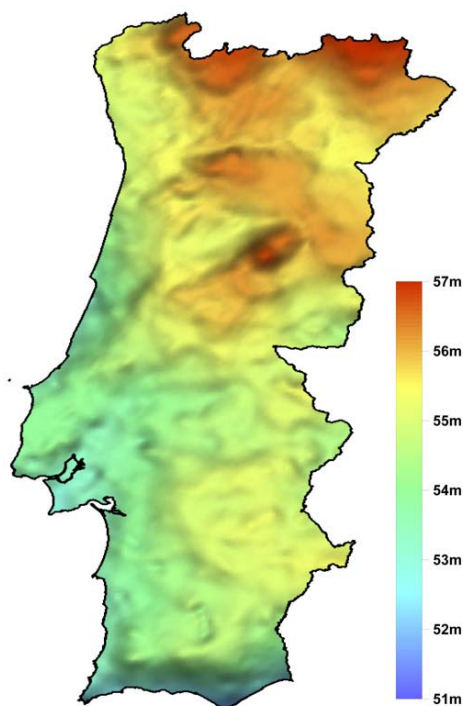


Figure 2.7 – GeodPT08.

2.6 – EUREF WEB SITE

Since its creation the EUREF web page is developed and maintained by IGP. In 2011 the structure and the lay out of the web page was rearranged.



Figure 2.8 – EUREF web site front page.

2.7 – HUMAN AND MATERIAL RESOURCES

The human resources of the Department of Geodesy of IGP are four surveying engineers and six surveying technicians. The equipment consists on:

- GNSS receivers;
- geodetic levels;
- optical-mechanics theodolites (astronomy, geodesy and surveying);
- 2 LaCoste & Romberg, model G gravimeters;
- Bernese software;
- and several software for processing the different kinds of geodetic measurements and data.

2.8 – PUBLICATIONS

- M. Vasconcelos, A. Bernardes, P. Patrício (2011) *Avaliação da Implementação do ETRS89 em Portugal Continental*. Resumos da VII Conferência Nacional de Cartografia e Geodesia, Porto, Portugal, pp. 105.
- A. Medeiro, A. Bernardes, M. Figueiredo, M. Vasconcelos (2011) *Comparação dos Registos dos Marégrafos Analógico e Acústico de Cascais entre 2004 e 2010*. Resumos da VII Conferência Nacional de Cartografia e Geodesia, Porto, Portugal, pp. 106.
- C. Martins, M. Vasconcelos (2011) *A Evolução da ReNEP: Produtos, Serviços e Utilizadores*. Resumos da VII Conferência Nacional de Cartografia e Geodesia, Porto, Portugal, pp. 107.
- A.C. Bernardes, A. Medeiro, M. Vasconcelos (2009) *Parâmetros de Transformação de Bursa-Wolf e Molodensky dos Data Locais para PTRA08-UTM/ITRF93*. Cartografia e Geodesia 2009 – Actas da VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, pp. 329.
- M. Vasconcelos, A. Bernardes, P. Patrício (2009) *Determinação de Coordenadas ETRS89/PT-TM06 para Vértices Geodésicos Não Observados com GNSS*. Cartografia e Geodesia 2009 – Actas da VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, pp. 391.
- C. Martins, G. Crisóstomo, M. Vasconcelos, H. Botelho (2009) *A Rede Nacional de Estações GNSS*. Cartografia e Geodesia 2009 – Actas da VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, pp. 392-400.
- M. Vasconcelos, H. Botelho (2008) *Implementação do ETRS89 em Portugal Continental*. Resumos da 6.ª Assembleia Luso-Espanhola de Geodesia e Geofísica, Tomar, Portugal, pp. 281-282.
- A. Medeiro, M. Vasconcelos, C. Martins, H. Kol (2008) *Revisão das Redes Geodésicas da Madeira e dos Açores*. Resumos da 6.ª Assembleia Luso-Espanhola de Geodesia e Geofísica, Tomar, Portugal, pp. 331-332.
- C. Martins, G. Crisóstomo, M. Vasconcelos, H. Botelho (2008) *Rede Nacional de Estações GNSS de Observação Contínua*. Resumos da 6.ª Assembleia Luso-Espanhola de Geodesia e Geofísica, Tomar, Portugal, pp. 206.
- M. Vasconcelos, J.A.G. Martins, L.F.P. Nunes (2007) *Informação Geográfica Institucional na Internet - GeoPortais do Instituto Geográfico Português e do Instituto Geográfico do Exército*. INGENIUM – Revista da Ordem dos Engenheiros, n.º 99, Maio/Junho 2007, pp. 71-72.
- A. Medeiro, H. Kol, C. Martins, M. Vasconcelos (2007) *Rede Geodésica dos Arquipélagos da Madeira e dos Açores*. Cartografia e Geodesia 2007 – Actas da V Conferência Nacional de Cartografia e Geodesia, Lisboa, Portugal, pp. 295-300.

2.9 –PRESENTATIONS

- M. Vasconcelos, A. Bernardes, C. Martins, A. Medeiro (2010) *National Report of Portugal*. Presented at the EUREF 2010 Symposium, Gävle, Sweden, 2010.
- M. Vasconcelos (2009) *ReNEP: Rede Nacional de Estações Permanentes GNSS*. Presented at the 3.º Congresso do Comité Português da URSI, Lisboa, November 2009.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- M. Vasconcelos (2009) *Sistemas Nacionais de Georreferenciação*. Presented at the Workshop “Sistemas de Referência Geo-espaciais: Desafios para a Região Autónoma dos Açores”, Angra do Heroísmo, Azores, October 2009. (invited)
- M. Vasconcelos (2009) *Sistemas Nacionais de Georreferenciação*. Presented at the Workshop “Sistemas de Referência Geo-espaciais: Desafios para a Região Autónoma dos Açores”, Ponta Delgada, Azores, June 2009. (invited)
- M. Vasconcelos (2009) *A adopção do ETRS89 em Portugal Continental: implementação, consequências e boas práticas*. Presented at the III jornadas de Engenharia Topográfica do Instituto Politécnico da Guarda, Guarda, June 2009. (invited)
- M. Vasconcelos, G. Crisóstomo, C. Martins, H. Botelho (2009) *National Report of Portugal*. Presented at the EUREF 2009 Symposium, Florence, May 2009.
- M. Vasconcelos (2008) *Consequências da adopção do ETRS89 e boas práticas a seguir*. Presented at the XIV Encontro Nacional de Engenharia Geográfica, Tomar, November 2008. (invited)
- M. Vasconcelos, C. Martins, G. Crisóstomo, A. Medeiro (2008) *National Report of Portugal*. Presented at the EUREF 2008 Symposium, Brussels, June 2008.
- M. Vasconcelos, H. Botelho, H. Kol, J. Casaca (2007) *The Portuguese Geodetic Reference Frames*. Poster presented at the XXIV IUGG General Assembly, Perugia, July 2007.
- H. Kol, M. Vasconcelos, G. Crisóstomo, C. Martins, A. Medeiro (2007) *National Report of Portugal*. Presented at the EUREF 2007 Symposium, London, June 2007.

3 – INSTITUTO DE INVESTIGAÇÃO CIENTÍFICA TROPICAL (*TROPICAL SCIENCE RESEARCH INSTITUTE*)

3.1 – INTRODUCTION

The Tropical Research Institute (IICT) promotes tropical knowledge by pursuing interdisciplinary research of relevance to countries in tropical regions. It has a special mandate towards the Community of Portuguese Speaking Countries (CPLP), whose members are Brazil, East Timor, five African nations and Portugal.

Established in 1883 as the Commission of Cartography, IICT is the oldest autonomous government agency that conducts research for development in human and natural sciences. In 1983 IICT became a state laboratory under the supervision of the Minister for Science, Technology and Higher Education.

Through the output of over 100 researchers, it seeks to increase the scientific and technical capacity of developing countries and also to ensure the preservation of its documental collections.

The strategic objectives underlying the work program are

- 1) helping promote the Millennium Development Goals with special emphasis on CPLP countries;
- 2) facilitating access of CPLP countries to its vast historic and scientific heritage, as recommended by the CPLP Ministers of Science and Technology in 2003. Two services open to the public, the Overseas Historical Archive and the Tropical Botanic Garden are included among the six research centers.

The Geoinformation for Development Centre (GeoDES) develops its activity based on geographic information management and processing to support the development of tropical countries, namely the Community of Portuguese Language Countries (CPLP). As this Centre is directly linked to the Commission of Cartography geographic information collections related with PALOP are part of its heritage (e.g., topographic and thematic maps, geodesic data, aerial photography, etc.).

The Portuguese participation on GMES and Africa initiative (an extension of the European GMES services and applications) is assured by IICT. The long-term cooperation strategy is developed based on applications and services proposed and developed within the scope of this Africa-Europe initiative.

Currently GeoDES covers a diverse number of fields, such as: land use and land cover using remote sensing information, assessment of natural and man-made hazards based on spatial analysis, geodesy, border monitoring and management of Geographical Information of CPLP countries existing at IICT.

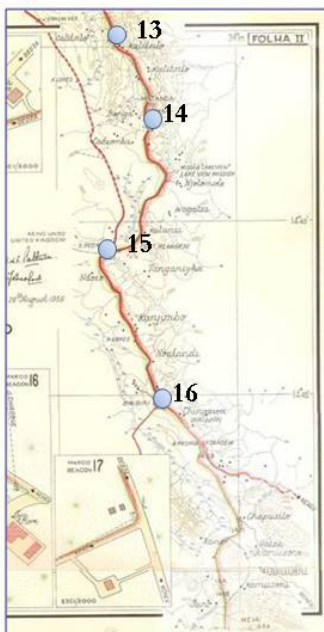
3.2 – RESEARCH & DEVELOPMENT PROJECTS

IICT/GeoDes activity is based on the implementation of research projects using geodesy and geospatial technologies (remote sensing, GIS, GPS) applied to studies contributing for the development of Tropical countries, namely CPLP countries. The following list provides a summary of the main geodetic research and development projects and initiatives lately developed at IICT/GeoDes as coordinator or participant:

- **Geodetic classical networks of CPLP countries:** after the adjustment of those networks, a database including all the benchmarks and associated information such as type, local, access and adjusted coordinates is being prepared in order to respond to many solicitations from geodetical institutions or companies from those countries. Since GPS observations are available, its also calculated the transformations parameters to the reference systems used by the GPS.
- **Study and organization of the diplomatic and technical information concerning CPLP countries boundaries** in order to help them to achieve the goals of the African Union Border program. With Mozambique is being prepared a cooperation project to construct a Boundary Geographical system to the management of its frontiers.

NYASALAND – MOZAMBIQUE FRONTIER

Agreement of Nov 18, 1954






From beacon 11 by the eastern loop (lake view road – Nyasaland) to beacon 15 erected at the junction of this road with the main Dedza-Ncheu road approximately 1 Km west of Fort Mlangeni demarcated by beacons 13, 14, and 15

Thence by the main Dedza-Ncheu road (Nyasaland), to beacon 17 erected at the road junction 1.5 km south of Biriwiri trading centre, demarcated by beacons 16 and 17

Thence by the road, inclusive to Nyasaland leading along the general line of the Zambezi-Shire watershed as far as beacon 24

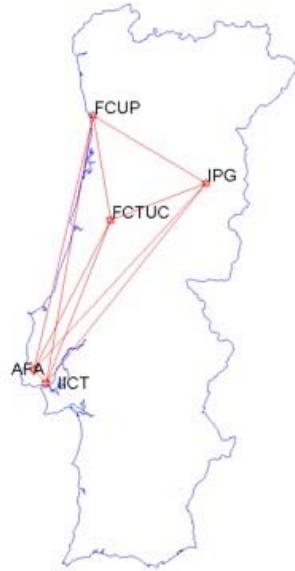
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NYASALAND – MOZAMBIQUE FRONTIER

No.	13	14	15	16	17	18
Location	At the foot of Panda Hill		At the road junction 1 Km west of Fort Mlangeni	Near the Vasco da Gama pillar at the junction of the Matengo Balama road		
						
Dist. prev. beacon	8.20 Km		9.00 Km	9.70 Km		
ordem	Principal		Principal	Principal		
Type	A		A	A		
Coords : φ (S)	14° 34' 40".5		14° 40' 53".2	14° 45' 12".6		
λ (E)	34° 31' 34".9		34° 31' 26".9	34° 32' 49".2		
Triangulation	no		No	no		
Last inspection	1954 / fair		1954 / fair	1954 / fair		

INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL

- Installation, tests, management and dissemination of a **GNSS Permanent Station** data included in a network of 5 stations implemented with international requests to serve the national geophysical network.



GNSS permanent network: GEONET



IICT GNSS permanent station

- **Knowledge and recognition in areas of Portuguese influence: registries, scientific missions, traditional knowledge and biodiversity in Subsaharian Africa and Insulindia**, interdisciplinary project with the History Centre financed by Fundação para a Ciência e Tecnologia (FCT-foundation for science and technology): identification and inventory of both the existent bibliography and the documentary sources relevant for the project; inventory and study of reports, field notes, photographs, maps, personal papers and other documents of the geographical (geodesy, astronomy, cartography and hydrography) missions of the 19th and 20th centuries; development of a Ms-Acess database to store and organize the thematic information collected. These databases will be ported, later on, to a GIS that will be available on-line.
-
- **Half a century of colonial science: crossing views on the archive and the scientific activity of the Comissão de Cartografia (1883-1936)**, interdisciplinary project with the history centre and the overseas historical archive financed by FCT: preservation treatment, description and contextualization of c. 1400 photographic items related to delimitation of boundaries and geodetical missions. Integration of those images in an informatic platform for on-line access. Scientific studies on the cartographic science in Portugal and the way it influenced the development of other disciplines, mainly regarding scientific missions to recognize the territories and local peoples past.
- **Exhibitions concerning old works of the geographical missions in Africa and its instruments**
- **Tribute exhibition to the admiral Gago Coutinho, a famous Portuguese geographer, responsible for the delimitation of several African boundaries and for the first geodetical mission in Africa.**

3.3 – HUMAN AND MATERIAL RESOURCES

The human resources is one Researcher (PhD equivalent).

The equipment consists on:

- GPS receiver TRIMBLE NetR5 with Zephyr Geodetic2 (TRM57971.00) antenna for GPS L1/L2, L2C, L5, GLONASS and Galileo and software
- 3 dual-frequency GPS receivers (Trimble 4000)
- 1 C/A code GPS receiver (Trimble Pathfinder Pro XL)
- 1 Gravimeter LaCoste & Romberg model G
- 2 Theodolite Total Stations
- Several optical-mechanics theodolites (Astronomy, Geodesy and Surveying)
- Several Geodetic Levels.
- Several Pentium Computers
- Bernese GPS Software Version 4.2
- GPSurvey Software (Trimble)
- Gravimetry Adjustment and Computation Software (LaCoste & Romberg)
- Gravimetry Adjustment and Computation Software (Finnish Geodetic Institute)
- Triangulation Adjustment and Computation Software
- Levelling Adjustment and Computation Software

3.4 – PUBLICATIONS

3.4.1 – Chapters of books

Santos, Paula; Frias de Barros, Francisco; Lima, J. Nuno - "Trabalhos Geodésicos no Arquipélago de Cabo Verde: Missão Geográfica de Cabo Verde (1918 - 1921, 1926 - 1931) e Missão Geo-Hidrográfica de Cabo Verde (1954 - 1959)" in *Álbum Cartográfico de Cabo Verde*, pp 86-101, editora IIPC, Lisboa 2010, ISBN: 978-989-96036-0-8

Santos, Paula; Morgado, Ana; Nunes, Carmo - "Informação Geográfica desde 1883, Fronteiras, Missões Geodésicas, Cartografia e Detecção Remota" in *Viagens e Missões Científicas nos Trópicos, 1883-2010*, pp 46 a 49. IICT, Lisboa, 2010. ISBN:978-972-672-988-4

Santos, Paula – "As Missões Geodésicas na Comissão de Cartografia (1883-1936)", in *Futuro e História da Lusofonia Global*, pp. 371-377, IICT, Lisboa 2008, ISBN: 978-972-672-977-8

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Santos, Paula – “125 anos de geodesia nos países da CPLP”, in Saber Tropical, pp. 71-88, IICT, Lisboa 2008, ISBN: 978-972-672-975-4

3.4.2 – Proceedings of national and international scientific meetings

Santos, Paula - “Operações Geodésicas: a Matemática na Construção de um Documento Cartográfico, vista através da Missão Geodésica da África Oriental”. Actas do V Encontro Luso-Brasileiro de História da Matemática (no prelo)

Santos, Paula – “Astronomical and Geodetical Instruments at the Instituto de Investigação Científica Tropical, Lisbon” Book of abstracts of the XXVII Symposium of the Scientific Instrument Commission, International Conference, pp 195

3.4.3 - On-line publications

Roque, Ana Cristina; Torrão, Maria Manuel; Santos, Paula - "Missões Científicas: do Património à Ciência, o Acervo de Gago Coutinho no Instituto de Investigação Científica Tropical" in Blogue de História Lusófona, IICT, Janeiro 2010, <http://www2.iict.pt/?idc=102&idi=15540>

Santos, Paula; Torrão, Maria Manuel; Soares, M.J. – “Roteiro da Mostra do acervo de Gago Coutinho no IICT”, Junho 2009, www2.iict.pt

Santos, Paula Cristina – “As Missões Geodésicas na Comissão de Cartografia (1883-1836) in Blogue de História Lusófona, IICT, <http://www2.iict.pt/?idc=102&idi=13774>

3.4.4 – Others publications

Santos, P., Torrão, M.M. - Catálogo da Exposição “Gago Coutinho no IICT, um Homem de Ciência para a História da Ciência”, IICT, Lisboa 2009

3.5 – ORAL PRESENTATIONS NOT PUBLISHED

3.5.1 – Scientific meetings

Santos, P.; Roque, A.C.; Torrão, M.M. - “Missões Científicas: do património à ciência. O acervo de Gago Coutinho no IICT. 1º Encontro Nacional de História da Ciência em Portugal, 21-22 Julho 2009, Centro Científico e Cultural de Macau, Lisboa.

Santos, Paula - “Astronomical and Geodetical Instruments at the Instituto de Investigação Científica Tropical”. (poster) XXVII Symposium of the Scientific Instrument Commission, 16 a 21 de Setembro 2008, no Museu da Ciência da Universidade de Lisboa

3.5.2 – Invited presentations

Santos, Paula - "Boas cercas fazem bons vizinhos: o caso das Fronteiras de Moçambique". Comunicação apresentada à reunião do Conselho de Orientação e Unidade de Acompanhamento do IICT prévia à abertura da Noite Europeia de Investigadores, no Jardim Botânico Tropical. Lisboa, 24 de Setembro de 2010

Santos, Paula - “Gago Coutinho, a vida em imagens”. Sociedade de Geografia de Lisboa, 21 de Outubro de 2010

Santos, P.; Soares, M.J.; Torrão, M.M. - “Acervo de Gago Coutinho no IICT”. 15 Outubro 2009, Centro de Documentação e Informação, IICT, Lisboa. Convite da Academia de Marinha

Santos, P.; Soares, M.J., Torrão, M.M., - Acervo de Gago Coutinho no IICT e SGL. Mesa **redonda** no âmbito do IV ciclo de conferências nos trópicos-Bloco Falar África, IICT, Centro de Documentação e Informação, 2 Junho 2009, Lisboa

3.5.3 - Other

Santos, P. Nunes, M. Carmo - “Como é que o GPS nos indica o caminho?” acção de divulgação integrada na Noite dos Investigadores, 24 de Setembro de 2010, IICT

4 – LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL (NATIONAL LABORATORY OF CIVIL ENGINEERING)

4.1 – R&D PROJECTS IN THE DOMAIN OF APPLIED GEODESY

4.1.1 Improving Methods of Applied Geodesy to the Observation of Engineering Works

This project is integrated in the Programmed Research Plan (*Plano de Investigação Programada – PIP*) of LNEC, and it includes a set of R&D activities developed with the aim of supporting the improvement and the updating of the important contribution provided, in a regular basis, by the Applied Geodesy Division (*Núcleo de Geodesia Aplicada – NGA*) to the monitoring of large engineering works (dams, bridges, etc.). The proposed project has a remarkable incidence in the engineering works observation activity, carried out in the Departments of Dams, Structures and Geotechnics. The geodetic observation activity plays an important role in the safety control of engineering works, and it demands a constant renewal of the measuring equipment, operative methods, and models for the observations processing, in order to offer a better accuracies and faster response times. The main purpose of this project consists on the study and improvement of the geodetic methods to the observation of large engineering works, essentially at two levels:

- i) Equipment for geodetic observation (including a GNSS permanent station and an EDM baseline test in LNEC campus).
- ii) Methods and models for the treatment of the observed data and quality evaluation of measurement and results.

In the scope of this project it was performed a test on automated dam displacement monitoring using a robotic total station (controlled by softwares Alert, from Chrzanowski & Associates, and GeoMoS from Leica Geosystems) and GNSS equipment (controlled by SPIDER and GeoMoS both from Leica Geosystems).

4.1.2 SUBSIn – InSAR Detection and Characterization of Subsidence and Landslide in the Lisbon Region (PTDC/CTE-GEX/65261/2006)

This project had financial support by the *Fundação para a Ciência e Tecnologia* (FCT, Portuguese Foundation for the Science and Technology), during the period of 2008 – 2010. The project aims were:

- i) Detect, quantify, and characterize ground deformation in the Lisbon region with synthetic aperture radar interferometry techniques (conventional InSAR and PSInSAR), together with permanent GPS data and leveling observations.
- ii) Isolate the seasonal groundwater-related regional deformation from other possible origins (e.g. tectonic) and diagnose the possibility of aquifer/aquitard irreversible compaction and associated risks of ground subsidence or coastal aquifer salinization.
- iii) Contribute to landslide mapping in the north of Lisbon region, discriminate between active and non-active areas, and improve the understanding of landslide activation mechanisms, namely rainfall accumulation and elevation of water-table levels.
- iv) Detect and inventory, with PSInSAR, localized of urban subsidence (edifices and structures) in Lisbon, and confirm/calibrate the results with data from databases of geodetic monitoring around tunneling or other engineering works in the area.

NGA's participation in this Project, led by Instituto Superior Técnico (IST, School of Engineering), was to validate SAR results by using data from permanent GPS stations and levelling observations.

4.2 – ORGANIZING SYMPOSIUM

4.2.1 Joint Symposium “Measuring the Changes” of the FIG 13th Symposium on Deformation Measurement and Analysis and the IAG 4th Symposium on Geodesy for Geotechnical and Structural Engineering

The second jointly held symposium on deformation measurements and analysis was held May 12- 15, 2008 in Lisbon, Portugal. The symposium was a combined meeting of FIG Commission 6, Working

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Group 6.1, Deformation Measurements and Analysis (13th FIG Symposium on Deformation Measurements and Analysis) and the IAG Sub-commission 4.2, Applications of Geodesy in Engineering (4th IAG Symposium on Geodesy for Geotechnical and Structural Engineering). The theme of the symposium “Measuring the Changes”, reflects the importance, and demand, for fully automated, continuous, and reliable deformation monitoring in civil engineering, mining, and energy sectors. In addition there is a strong trend to incorporate deformation systems into new structures from the very beginning, driven by concerns for whole-of-life structural health monitoring. Automation, multi-sensor integration, continuous data collection, integrated analysis and physical interpretation, and enhanced accuracy and reliability are the key developments in new monitoring systems. These issues are the subject of studies of these two international working groups.



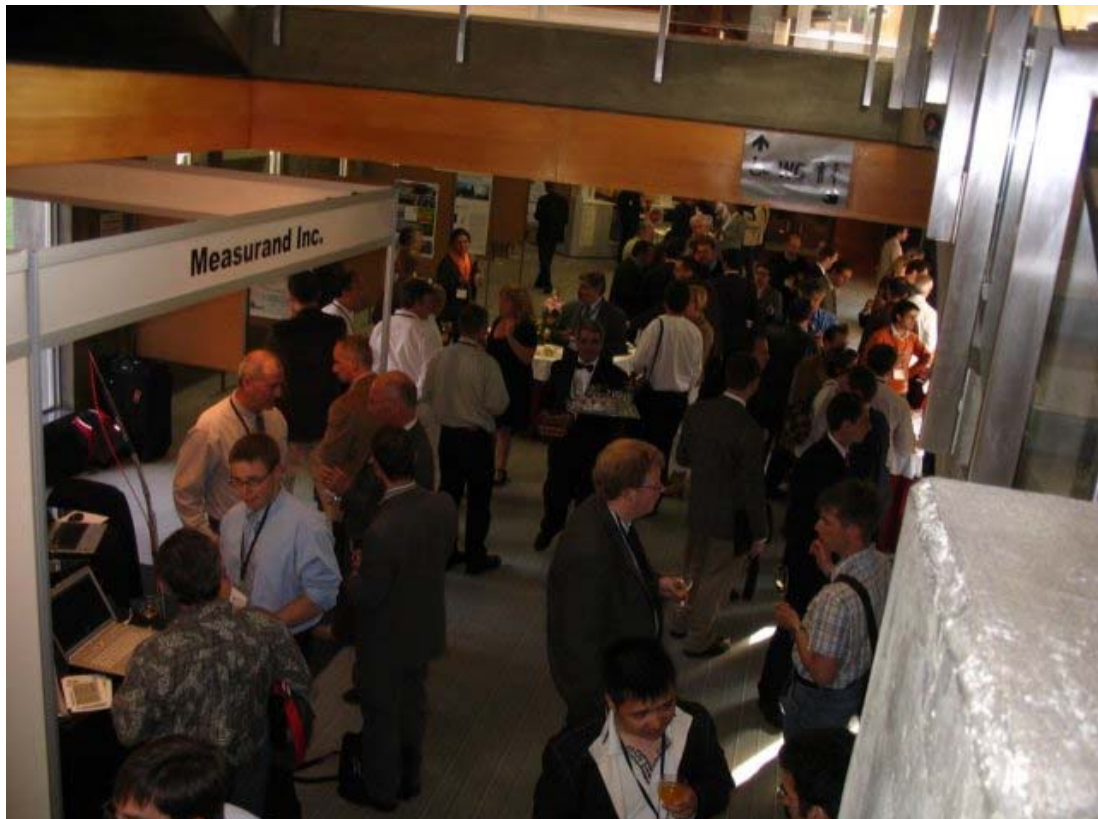
The symposium was attended by about 160 delegates from 30 countries (information about the symposium can be found at the official site of the organizers: <http://measuringchanges.lnec.pt>).

The symposium had 20 technical sessions with topics ranging from modeling (4 sessions), monitoring of structures (3 sessions), GNSS (2 sessions), geodeformations (2 sessions), radar (2 sessions), equipment (2 sessions), laser scanning, engineering geodesy, multi-techniques and posters papers (2 sessions). In addition, there was a special session for those interested in fiber optic sensors hosted by the FIG WG 6.4 (Engineering Surveys for Construction Works and Structural Engineering) task force on fiber optic sensors.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Keynote presentations by each chair of the two organization started off the symposium and were followed by many excellent presentations and posters papers throughout the event.

There was also great participation by supporting vendors in the exhibitor's session. There were exhibits from Leica Geosystems, Sokkia Europe, Topcon, Fiber Sensing, Trimble and Measurand Geotechnical. These exhibitors were very active participants with all types of equipment demonstrations taking place inside and outside of the symposium event hall. Many attendees received personalized and hands-on experience with the equipment.



Another aspect of the symposium is the great support the organizing committee received from the vendors to help sponsor this event. The vendors that sponsored the symposium at platinum level were Leica Geosystems, Topcon and Trimble. At the silver level support was received from GAUSS, SPGO, Portuguese Geographic Institute (IGP), Sokkia Europe, Sol Data Iberia and Technasol FGE. The organizers and chair of the symposium sincerely express their appreciation for the support these organizations provide for these meetings to take place.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

It is also important to stress that several organization provided financial support for seven young colleagues to attend the symposium. The grants were supported by: IAG (3), Topcon (1), *Ordem dos Engenheiros* (Engineers Association of Portugal, 3).

No symposium is complete without a social event to “loosen up” the attendees for a night of mingling and making new friends and connections. The LNEC provided a wonderful evening of fun by hosting a dinner at Lusitania Horse Training Center. The evening started with a show of the horse’s skill in historic battlefield maneuvers and was followed by an excellent dinner with a show of the traditional Portuguese *fado* music.



**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

The day after the symposium end was a technical field trip to visit Alqueva Dam and the three Alamos dams. This trip provided attendees the opportunity to observe the Portugal countryside and to see the issues that Portuguese dam engineers and surveyors face close up.



Scientific Committee

João Casaca (Portugal), Chair;

Lúisa Bastos (Portugal), Fritz Brunner (Austria), Dorota Brzezinska (USA), Adam Chrzanowski (Canada), Xiaoli Ding (Hong Kong), Antonio Gil (Spain), Svend Johansen (Denmark), Alojz Kopacik (Slovakia), Gyula Mentés (Hungary), Wolfgang Niemeier (Germany), Witold Proszynski (Poland), Chris Rizos (Australia), Gethin Roberts (United Kingdom), Fernando Sanso (Italy), Stathis Stiros (Greece), Yukio Tamura (Japan).

Local Organizing Committee

Maria João Henriques (Portugal), Chair;

Rui Manuel Fernandes (Portugal), José Nuno Lima (Portugal), João Agria Torres (Portugal), Manuela Vasconcelos (Portugal).

4.2.2 II Encontro Nacional de Geodesia Aplicada (2nd National Meeting of Applied Geodesy)

The Meeting was held October 12 – 13, 2009 in Lisbon, at Congress Centre of National Laboratory of Civil Engineering. The main purpose of this meeting was to join technicians, professors and researchers interested in different applications of the methods of the Geodesy. The Meeting received more than 20 contributions on applications of Geodesy in several areas, namely: geodynamic studies, displacements monitoring of small and large structures such as dams or bridges, embankments, undergrounds or maritime works; conversion of data problems; processing and analysis of data.

The Meeting was attended by about 60 participants and more than 20 papers. Leica Geosystem, EDP, Mota-Engil and InlandGEO/Topcon sponsored the Meeting.

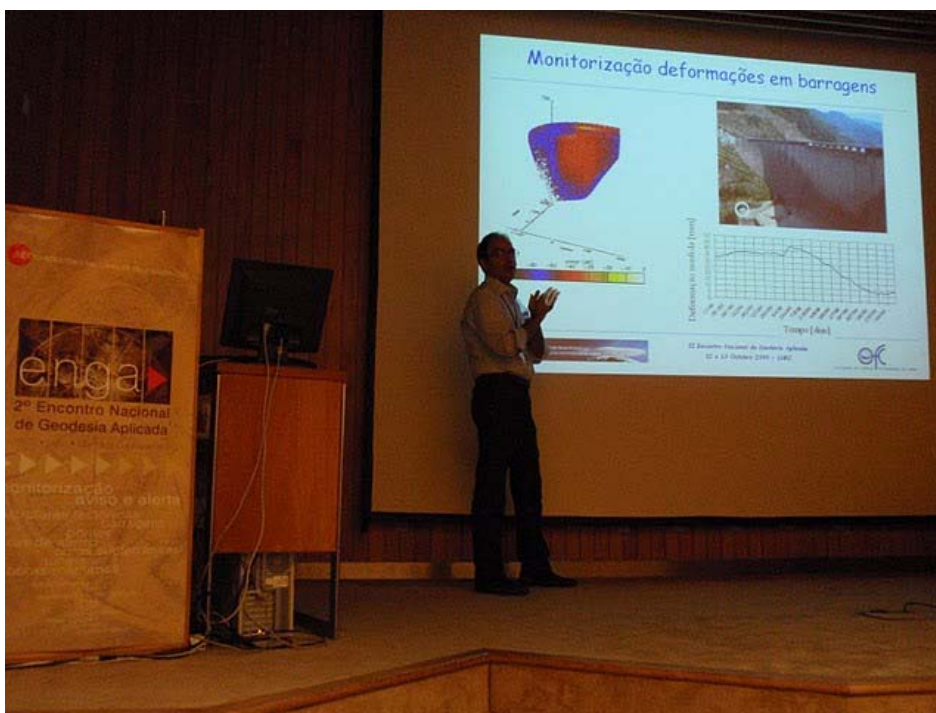
**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Scientific Committee

João Casaca (LNEC, Portugal), Chair;
António J. Gil (University of Jaen, Spain), António Tavares de Castro (LNEC, Portugal), João Agria Torres (IAG, Portugal), João Catalão Fernandes (University of Lisbon, Portugal), João Matos (Technical University of Lisbon, Portugal), José Alberto Gonçalves (University of Porto, Portugal), Luís Oliveira Santos (LNEC, Portugal), Luisa Bastos (University of Porto, Portugal), Rui Fernandes (University of Beira Interior, Portugal), Sandra Heleno (Technical University of Lisbon, Portugal), Virgílio Mendes (University of Lisbon, Portugal).

Organizing Committee

Maria João Henriques (LNEC, Portugal), Chair;
Ana Fonseca (LNEC, Portugal), Carlos Antunes (University of Lisbon, Portugal), Elisa Almeida (EDP, Portugal), José Nuno Lima (LNEC, Portugal), Manuela Vasconcelos (IGP, Portugal), Teresa Sá Pereira (Lisbon Harbour Office, Portugal), Vítor Charneca (University of Algrave, Portugal).





4.3 – PRESENTATIONS, ARTICLES AND OTHER R&D PUBLICATIONS IN THE DOMAIN OF APPLIED GEODESY

- Casaca, J. & Falcão, A.P. – *A Gravidade Normal e as Altitudes Normais*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Casaca, J. & Lima, J.N. – *Análise da Autocovariância de Séries Temporais GPS Estacionárias*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Henriques, M.J.; Costa, M.I.; Mateus, P.B. & Santos, R.C. – *O Efeito da Orientação de Alvos Retro-Reflectores*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Henriques, M.J.; Mateus, P.B. & Costa, M.I. – *O Efeito da Vibração Atmosférica em Grandezas Medidas com um Taqueómetro Motorizado*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Lima, J.N. & Casaca, J. – *A Suavização de Séries Temporais GPS com Filtros de Kalman Iterativos*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Lima, J.N.; Henriques, M.J. & Casaca, J. – *A Incerteza de Vectores GNSS em Função do Comprimento e da Duração da Sessão*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Mateus, P.B. & Henriques, M.J. - *Testing: uma Aplicação para Taqueómetros Motorizados*. Present in V Conferência Nacional de Cartografia e Geodesia, Lisbon, Portugal, May 2007.
- Lima, J.N. – *GNSS: a Maioridade do GPS*. INGENIUM, II Série, nº 101 - Ordem dos Engenheiros, Lisboa, Setember/October 2007, 32 – 33.
- Casaca, J. – *A Predição de Campos Vectoriais Aleatórios Isotrópicos*. LNEC, Collection ICT, INCB 12, 2007.
- Casaca, J. – *A Decision Approach to the Design of Acceptance-sampling Plans*. LNEC, Collection ICT, INCB 13, 2007.
- Casaca, J. – *Application of Bayesian Inference Methods to Engineering Geodetic Networks*. LNEC, Collection ICT, INCB 14, 2007.
- Casaca, J. & Lima, J.N. – *Spectral Characterization of GNSS Time Series*. Presented in 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica, Tomar, Portugal, February 2008.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Lima, J.N.; Henriques, M.J. & Casaca, J. – *A Utilização do GNSS na Medição de Deslocamentos Superficiais em Barragens de Aterro*. Presented in XI Congresso Nacional de Geotecnia, Coimbra, Portugal, April 2008.
- Henriques, M.J.; Mateus, P.B.; Palma, P. & Cruz, H. – *Modelling the Behaviour of a Large Span Glulam Arch of Atlântico Pavillion*. Presented in International Symposium Measuring the Changes, Lisbon, Portugal, May 2008.
http://www.fig.net/commission6/lisbon_2008/papers/pas12/pas12_01_henriques_mc106.pdf
- Lima, J. Nuno & Casaca, J. – *Smoothing GNSS Time Series with Asymmetric Moving Averages*. Presented in International Symposium Measuring the Changes, Lisbon, Portugal, May 2008.
http://www.fig.net/commission6/lisbon_2008/papers/pas11/pas11_03_lima_mc031.pdf
- Tavares de Castro, A. & Henriques, M.J. – *Monitoring Planimetric Displacements in Concrete Dams*. Presented in International Symposium Measuring the Changes, Lisbon, Portugal, May 2008.
http://www.fig.net/commission6/lisbon_2008/papers/pas05/pas05_02_tavaresdecastro_mc127.pdf
- Veiga Pinto, A. & Henriques, M.J. – *Contribution of the Applied Geodesy to the Prevention of Accidents and to the Rehabilitation of Fill Structures*. Presented in International Symposium Measuring the Changes, Lisbon, Portugal, May 2008.
http://www.fig.net/commission6/lisbon_2008/papers/pas10/pas10_01_pinto_mc004.pdf
- Casaca, J. & Lima, J.N. – *O Ruído na Observação Contínua GNSS*. INGENIUM, II Série, nº 105 - Ordem dos Engenheiros, Lisbon, May/June 2008, 57.
- Falcão, A.P.; Casaca, J. & Matos, J. – *Algumas Considerações sobre Altitudes Normais*. Presented in V Congresso Luso-Moçambicano de Engenharia, Maputo, Mozambique, September 2008.
- Casaca, J. & Falcão, A.P. – *A Revolução Altimétrica do Sec. XXI*. Revista Engenharia e Vida, nº 45, 2008.
- Casaca, J.; Henriques, M.J. & Coelho, J. – *O Teste de Equipamento de Nivelamento Geométrico de Precisão Segundo a Norma ISO 17123-2:2001(E)*. LNEC, Report May 2008.
- Casaca, J.; Charneca, V. & Mateus, P.B. – *A Análise Estatística de Amostras com Recurso à Distribuição Gama*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Helena, S.; Frischknecht, C.; d'Oreye, N.; Lima, J.N. & Kervyn, F. – *Influência Troposférica em Interferogramas de Radar. Casos de Estudo em Cabo Verde e nos Camarões*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Henriques, M.J.; Lima, J.N. & Fernandes, D. – *Experiência de Monitorização em Modo Contínuo da Barragem do Cabril*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Henriques, M.J.; Candeias, H. & Catrau, F. – *Controlo de Qualidade de Distanciómetros Electromagnéticos*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Lima, J.N. – *A Utilização do Filtro Adaptado às Séries Temporais GNSS*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Lima, J.N.; Henriques, M.J.; Helena, S.; Fonseca, J. & Falcão, A.P. – *A Monitorização Altimétrica da Zona de Lisboa com GNSS e Nivelamento Geométrico*. Presented in VI Conferência Nacional de Cartografia e Geodesia, Caldas da Rainha, Portugal, May 2009.
- Casaca, J. – *Introdução aos Espaços de Decisão Discretos*. Revista Portuguesa de Engenharia de Estruturas, Série II, nº 5, May 2009.
- Casaca, J. – *Uma Reflexão sobre as Regiões de Erro*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Casaca, J.; Henriques, M.J.; Coelho, J. & Candeias, H. – *O Papel do Quadro de Referência na Monitorização de Deslocamentos*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Casaca, J.; Henriques, M.J. & Mateus, P.B. – *O Ajustamento de Grandezas Heterogéneas pelo Método das Componentes de Variância*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Henriques, M.J. – *Sistemas para Medição de Inclinações. Resultados de um Teste de Repetibilidade Efectuado em Ambiente Termicamente Estável*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Henriques, M.J.; Coelho, J.; Vieira, J.; Candeias, H. & Catrau, F. – *O Sistema para Controlo de Deslocamentos Verticais da Ala Ocidental do Terreiro do Paço*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Henriques, M.J.; Lima, J.N.; Falcão, A.P. & Heleno, S. – *Validação com Nivelamento Geométrico da Subsidência Detectada na Cidade de Lisboa com PSInSAR*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
http://sismologia.ist.utl.pt/ENGA/Henriques_2009.pdf.
- Lima, J.N. – *O Efeito da Carga Oceânica nas Séries Temporais GNSS*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Lima, J.N. & Casaca, J. – *A Identificação de um Sinal em Ambiente GNSS*. Presented in 2º Encontro Nacional de Geodesia Aplicada, Lisbon, Portugal, October 2009.
- Casaca, J. – *História Breve do Calendário*. LNEC, 2009.
- Casaca, J. & Piteira Gomes, J. – *A Comparação de Distribuições Anteriores Alternativas em Modelos Bayesianos*. Presented in Encontro Nacional Conservação e Reabilitação de Estruturas, Lisbon, Portugal, June 2010.
- Henriques, M.J.; Lima, J.N. & Oliveira, S. – *Medição de Inclinações numa Barragem de Betão: Resultados de um Ensaio*. Presented in Encontro Nacional Conservação e Reabilitação de Estruturas, Lisbon, Portugal, June 2010.
- Heleno, S.; Henriques, M.J.; Falcão, A.P.; Lima, J.N.M.; Fonseca, A.M.; Mancuso, M.; Fonseca, J. & Pinheiro, A. – *Measuring Subsidence in the Centre of Lisbon with Persistent Scatterers Interferometry (PSI), CGPS and Levelling Surveys*. Presented in ESA Living Planet Symposium, Bergen, Norway, July 2010.
http://www.congrex.nl/10a04/sessions/CXNL_10a04_865978.htm
- Casaca, J. & Piteira Gomes, J. – *Uma Abordagem Bayesiana à Amostra Aleatória Normal*. Revista Portuguesa de Engenharia de Estruturas, Série II, n.º 7, July 2010.
- Henriques, M.J.; Lima, J.N.; Casaca, J. & Inocentes, G. – *Apoio Geodésico à Construção de um Túnel Rodoviário*. Presented in Encontro Nacional sobre o Espaço Subterrâneo e a sua Utilização, Lisbon, Portugal, November 2010.
- Lima, J.N. – *GNSS (GPS+GLONASS+GALILEO) e a Engenharia*. Ingenium, II Série, n.º 120, November/December 2010, 26-27.
- Heleno, S.; Frischknecht, C.; d'Orey, N.; Lima, J.N.; Faria, B.; Wall, R. & Kervyn, F. – *Seasonal Tropospheric Influence on SAR Interferograms near the ITCZ – the Case of Fogo Volcano and Mount Cameroon*. Journal of African Earth Sciences, Geological Society of Africa e Elsevier, Vol. 58, Issue 5, December 2010, 833-856, doi:10.1016/j.jafrearsci.2009.07.013.

5 – FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DE LISBOA (FACULTY OF SCIENCES OF THE UNIVERSITY OF LISBOA)

5.1 – INTRODUCTION

In the last 4 years, the research of the group has been focused on the following topics: (a) GNSS data processing and analysis for geodynamics studies, (b) Improvement of Reference Frames, (c) GPS meteorology, (d) Gravity field modeling and Geoid, and (e) Ground deformation monitoring using radar interferometry.

5.2 – PROJECTS

MegaHazards (PTDC/CTE-GIX/108149/2008): Eventos de escorregamentos de massa ao longo da evolução geológica das ilhas Açoreanas: cronologia, recorrência, mecanismos, e consequências (MEGA hazards); Director: FERNANDO MANUEL ORNELAS GUERREIRO MARQUES.

Estudo do impacte das alterações climáticas nos sistemas de regadio e definição de medidas de adaptação. (PTDC/AAC-AMB/113639/2009); Director: José Luis Monteiro Teixeira.

“SHA-AZORES” - Seismic Hazard Assessment in the AZORES through neotectonics and paleoseismology studies. Fundação para a Ciência e a Tecnologia (PTDC/CTE-GIX/108637/2008), 2010-2012

5.3 – PAPERS PUBLISHED IN INTERNATIONAL JOURNALS (with referees)

Omira R, MA Baptista, L Matias, JM Miranda, **C Catita**, F Carrilho and E Toto (2009). Design of a Sea-level Tsunami Detection Network for the Gulf of Cadiz. *Nat. Hazards Earth Syst. Sci.*, 9, 1327–1338, 2009.

Morujão, D.B. and V.B. Mendes (2008). “Investigation of Instantaneous Carrier Phase Ambiguity Resolution with the GPS/GALILEO Combination using the General Ambiguity Search Criterion”. *Journal of Global Positioning Systems*, Vol. 7, No. 1, pp. 35-45.

Fernandes, M. J., C. Lázaro, A. L. Nunes, N. Pires, L. Bastos, and V. B. Mendes (2010). “GNSS-derived path delay: an approach to compute the wet tropospheric correction for coastal altimetry”. *IEEE Geosci. Rem. Sens Lett.*, 7, 3, pp. 596-600.

V. V. Lima, J. M. Miranda, M. A. Baptista, J. Catalao, M. Gonzalez, L. Otero, M. Olabarrieta, J. A. Alvarez-Gomez, and E. Carreno, 2010. Impact of a 1755-like tsunami in Huelva, Spain. *NATURAL HAZARDS AND EARTH SYSTEM SCIENCES* Volume: 10 Issue: 1 Pages: 139-148.

Omira, R., Baptista, M. A., Miranda, J. M., Toto, E., Catita, C., Catalão, J., 2010. Tsunami vulnerability assessment of Casablanca-Morocco using numerical modelling and GIS tools. *NATURAL HAZARDS* Volume: 54 Issue: 1 Pages: 75-95. DOI:10.1007/s11069-009-9454-4.

Catalão, J., Sevilla, M.J.. Mapping the geoid for Iberia and the Macaronesian Islands using multisensor gravity data and the GRACE geopotential model. *Journal of Geodynamics*, doi:10.1016/j.jog.2009.03.001

Navarro, A., J. Chorowicz, J. M. Miranda and J. Catalão (2008), “Analysis of geometry of volcanoes and faults in Terceira Island (Azores): Evidences for reactivation tectonics at EUR/AFR plate boundary in the Azores triple junction”. *Tectonophysics*, doi:10.1016/j.tecto.2008.10.020 .

Catalão, J., Bos, M.S. (2008), Sensitivity analysis of the gravity geoid estimation: A case study on the Azores plateau, *Physics of the Earth and Planetary Interiors* 168, pp. 113-124, DOI: 10.1016/j.pepi.2008.05.010.

5.4 – COMMUNICATIONS TO INTERNATIONAL MEETINGS (with publication of extended abstract or publication of communication on acta book)

Omira R., Baptista M.A., Matias L. , Catita C., Miranda J.M., Toto E. (2008). Design of a Tsunami Detection Network for the Gulf of Cadiz. 31st General Assembly of the European Seismological Commission ESC 2008, Hersonissos, Crete, Greece, 7-12 September 2008.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Catita, C., J. Catalão, L.M. Víctor (2008). Cinemática das ilhas Faial e Pico deduzida a partir de observações GPS. Actas da 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica, Tomar, Portugal, Fevereiro 2008, pp 195-196.
- Santos, L. and V. B. Mendes (2007). "Impact of ocean tide models on GPS observations." Proceedings of The Institute of Navigation 2007 National Technical Meeting, San Diego, CA, USA, 22-24 January 2007, pp. 473-479.
- Hulley, G., E.C. Pavlis, and V.B. Mendes (2007). "Validation of improved atmospheric refraction models for satellite laser ranging (SLR)." In Dynamic Planet: Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools; IAG Symposium, Cairns, Australia, August 22-26, 2005, International Association of Geodesy Symposia, Vol. 130, P. Tregoning and C. Rizos (Eds), Springer, pp. 844-852.
- Morujão, D and V. B. Mendes (2007). "Investigation of instantaneous ambiguity resolution with the GPS/Galileo combination for precise kinematic positioning." Proceedings of the ION GNSS 20th International Technical Meeting of the Satellite Division, September 25-28, 2007, Fort Worth, Texas, pp. 808-817.
- Morujão, D. B., V. B. Mendes, and G. Xu (2007). "Instantaneous ambiguity resolution for precise kinematic positioning with the GALILEO and the modernised GPS." 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica, 11-14 Fevereiro, Tomar, pp. 211-212.
- Santos, L. and V. B. Mendes (2007). "Impact of ocean tide models on GPS coordinates." 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica, 11-14 Fevereiro, Tomar, pp. 265-266.
- Bargão, A., S. Correia, V. Prior e V. B. Mendes (2007). "Aplicações em Meteorologia do Sistema de Posicionamento Global." 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica, 11-14 Fevereiro, Tomar, pp. 101-102.
- Afonso, A., R. Teodoro and V. B. Mendes (2008). "SERVIR: The Portuguese Army CORS Network for RTK." FIG Working Week 2008, June 14-19, Stockholm, (http://www.fig.net/pub/fig2008/papers/ts06f/ts06f_09_afonso_etal_2961.pdf).
- Trota, A., V. Mendes, P. Amaral, R. Rodrigues, J. Gaspar, G. Queiros, T. Ferreira (2009). "Deformation source modelling of a probable magma intrusion in the Fogo/Congro area (S. Miguel Island, Azores)." Proceedings of the 13th IAIN World Congress, 27-30 Outubro, Stockholm, Suécia (<http://www.congex.com/nnf/iain2009/proceedings.asp>).
- P. Mateus, G. Nico and J. Catalão, "Interpolating MERIS and GPS measurements of precipitable water vapour (PWV) to estimate atmospheric phase delay maps", Proc. SPIE 7827, 782713 (2010); doi:10.1117/12.864731
- Pedro Mateus, Giovanni Nico and João Catalão, "Mapping temporal evolution of water vapour in troposphere by interferometric SAR data", Proc. SPIE 7827, 782712 (2010); doi:10.1117/12.864727
- P. Mateus, G. Nico, R. Tomé, J. Catalão and P. Miranda, "Comparison of precipitable water vapor (PWV) maps derived by GPS, SAR interferometry, and numerical forecasting models", Proc. SPIE 7827, 782714 (2010); doi:10.1117/12.864733
- G. Nico, S.C. Oliveira, J. Catalão, J.L. Zêzere, R.A.C. Garcia. Landslide susceptibility mapping based on Persistent Scatterers inventories. ESA Living Planet 2010. ESA as Special Publication SP-686.
- João Catalão, G. Nico, Ramon Hanssen, Cristina Catita (2010). Measuring the vertical deformation in Azores Islands: enhanced PS-InSAR processing by tropospheric phase delay correction. . ESA Living Planet 2010. ESA as Special Publication SP-686.
- Jorge, Marco; Vieira, Gonçalo; Catalão, João; Ramos, Miguel. Rock glacier activity in the South Shetland Islands: DINSAR, ground-truth and GIS analysis. Methodology and first results. ESA Living Planet 2010. ESA as Special Publication SP-686.
- Mateus, Pedro; Nico, Giovanni; Tome, Ricardo; Catalao, Joao; Miranda, Pedro On the Tropospheric Water Vapour Mapping: GPS, SAR Interferometry and Numerical Forecasting Models. . ESA Living Planet 2010, ESA as Special Publication SP-686.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Pedro Mateus, Giovanni Nico, Ricardo Tomé, João Catalão, and Pedro Miranda, 2010. Study on the properties of the Integrated Precipitable Water (IPW) maps derived by GPS, SAR interferometry and numerical forecasting models. Geophysical Research Abstracts, Vol. 12, EGU2010-5414, 2010, EGU General Assembly 2010.
- Giovanni Nico, Pedro Mateus, and João Catalão, 2010. Building a time series of water vapour maps: A first step towards assimilation of Interferometric SAR data in forecasting models. Geophysical Research Abstracts, Vol. 12, EGU2010-5238, 2010, EGU General Assembly 2010.
- Catalao, J., Nico, G., Catita, C., 2010. Present day vertical deformation of Pico and Faial islands revealed by merged INSAR and GPS data. Geophysical Research Abstracts, Vol. 12, EGU2010-8624, 2010, EGU General Assembly 2010.
- Catalao, J., Represas, P., Montesinos, F., Antunes, C., Madeira, J., Mata, J., 2010. Analysis of gravity anomalies in Maio Island, Cape Verde. Geophysical Research Abstracts, Vol. 12, EGU2010-8359, 2010, EGU General Assembly 2010.
- Catalão, J., Nico, G., Hanssen, R. and Catita, C., 2009. Integration Of Insar And Gps For Vertical Deformation Monitoring : A Case Study In Faial And Pico Islands. FRINGE 2009 -Advances in the Science and Applications of SAR Interferometry. ESA ESRIN, 30th Nov. - 4th Dec. 2009, Frascati, Italy. ESA as Special Publication SP-677.
- Mateus, P., Nico, G., Tomé, R., Catalão, J., Miranda, P. 2009. Approaches to mitigate atmospheric artifacts in SAR interferograms: GPS vs WRF model. FRINGE 2009 -Advances in the Science and Applications of SAR Interferometry. ESA ESRIN, 30th Nov. - 4th Dec. 2009, Frascati, Italy. ESA as Special Publication SP-677.
- Nico, G., Oliveira, S., Catalão, J., Zêzere, J.L., 2009. On The Statistical Properties Of Persistent Scatterers Location To Discriminate Landslide Predisposing Factors. FRINGE 2009 -Advances in the Science and Applications of SAR Interferometry. ESA ESRIN, 30th Nov. - 4th Dec. 2009, Frascati, Italy. ESA as Special Publication SP-677.
- Nico, G., Benevides, P., Catalão, J., 2009. Persistent Scatterers analysis of InSAR time series Geophysical Research Abstracts, Vol. 11, EGU2009-8071, 2009
- Nico, G., R. Tomé, P. Benevides, J. Catalão, and P. Miranda, 2009. Interferometric SAR analysis of atmospheric water vapor properties. Geophysical Research Abstracts, Vol. 11, EGU2009-7904, 2009
- Nico, G. Oliveira, S., Catalão, J., Zêzere, J.L., 2009. Statistical assessment of Persistent Scatterers location in different landslide prone geological units. Geophysical Research Abstracts, Vol. 11, EGU2009-8011, 2009
- Catalão, J., Sevilla, M.J. (2008). "The use of ICAGM07 geoid model for vertical datum unification on Iberia and Macaronesian islands". Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract G51B-0612, 15-19 December, San Francisco, California.
- Lima, V., Miranda, J., Baptista, M. Catalão, J., Gonzalez, M., Olabrieta M., (2008) "Inundation patterns in Huelva, SW Europe, due to tsunami impact. Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract OS53B-1304, 15-19 December, San Francisco, California.
- V. V. Lima, J. M. Miranda, M. A. Baptista, J. Catalão, P. M. M. Soares (2008) Tsunami Inundation for Cádiz and Huelva, Spain In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, realizada em Tomar, 11 a 14 Fevereiro de 2008. CD. Cambridge Univ Press ISB 84-8320-373-1. pp.523-524
- Navarro, A., J. Catalão e J.M. Miranda (2008). GPS derived strain rate field in Terceira Island (Azores) retrieved from data acquired from 1999 to 2006. In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, realizada em Tomar, 11 a 14 Fevereiro de 2008. CD. Cambridge Univ Press ISB 84-8320-373-1, pp. 177-178.
- M. J. Sevilla, J. Catalão y R. Quirós (2008). CANGEO_2007. A new gravimetric geoid for Canary. In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, realizada em Tomar, 11 a 14 Fevereiro de 2008. CD. Cambridge Univ Press ISB 84-8320-373-1, pp. 271-272.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Catalão, J., Sevilla (2008), "A gravimetric geoid model for Iberia and Macaronesia – ICAGM07". In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, realizada em Tomar, 11 a 14 Fevereiro de 2008. CD. Cambridge Univ Press ISB 84-8320-373-1, pp. 233-234.

Martins, J. and J. Catalão (2008). InSAR monitoring of Faial and Pico islands (Azores). In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, realizada em Tomar, 11 a 14 Fevereiro de 2008. Cambridge Univ Press ISB 84-8320-373-1, pp. 247-248.

Catita, C., J. Catalão e L.M. Victor (2008). Kinematics of Faial-Pico Islands (Azores Archipelago) deduced from repeated GPS. In: Proceedings of VI Assembleia Luso Espanhola de Geodesia e Geofísica, Tomar, 11 a 14 Fevereiro de 2008. CD. Cambridge Univ Press ISB 84-8320-373-1, pp. 195-196.

Martins, J., Catalão, J., Marinkovic, P., Hanssen, R., (2007). INSAR monitoring of faial and pico islands (azores), first results. FRINGE 2007, Advances in SAR Interferometry from ENVISAT and ERS Missions, 26th – 30th November 2007, ESA ESRIN, Frascati, Rome, Italy. European Space Agency, (Special Publication) ESA SP Issue 649 SP, 2008, 3p.

Rebello, C., Catalão, J., 2007. Aplicação da Técnica INSAR na geração de Modelos Digitais do Terreno. In: Cartografia e Geodesia 2007, Eds. João Casaca e J. Matos, Actas da V Conferência Nacional de Geodesia e Cartografia, LNEC, Lisboa, 19 e 20 Abril de 2007, 113-126,.

Ruben, S., Catalão, J., 2007. Determinação de movimentos verticais na ilha do Faial, 1937-2001. In: Cartografia e Geodesia 2007, Eds. João Casaca e J. Matos, Actas da V Conferência Nacional de Geodesia e cartografia, LNEC, Lisboa, 19 e 20 Abril de 2007, 273-282.

5.5 – COMMUNICATIONS TO NATIONAL MEETINGS

(with publication of extended abstract or publication of communication on acta book)

Afonso, A., F. Martins, R. Dias. e V.B. Mendes (2007). "O Projecto SERVIR do IGeoE e suas aplicações." Cartografia e Geodesia 2007, Actas da V Conferência de Cartografia e Geodesia, 19-20 de Abril, Lisboa, Lidel – Edições Técnicas, Lda, pp. 409-421.

Trota, A., V.B. Mendes, P. Amaral and R. Coutinho (2008). "Modelação da Fonte de calor do sistema hidrotermal do Fogo, Ilha de S. Miguel (Açores), com base em GPS." As Geociências no Desenvolvimento das Comunidades Lusófonas, Universidade de Coimbra, 13 -14 Outubro, Coimbra.

Trota, A.N., V.B. Mendes, P. Amaral, and J.L. Gaspar (2008). "The contribution of geodetic monitoring to risk evaluation in volcanic active regions. The experience from S. Miguel island (Azores)". V Seminário Recursos Geológicos, Ambiente e Ordenamento do Território, Universidade de Trás-os-Montes, 16 – 18 de Outubro, Vila Real.

Trota, A., V. B. Mendes, P. Amaral (2010). "Subsidência generalizada nas ilhas de S. Miguel e Terceira (Açores) detectada por GPS." Cartografia e Geodesia 2009, Actas da VI Conferência Nacional de Geodesia e Cartografia, 7-8 de Maio de 2009, Caldas da Rainha, Lidel-Edições técnicas, pp. 330-335.

Nico, G., Tomé, R., Benevides, P., Catalão, J., Miranda, P., 2009. Propriedades Estatísticas e Mapas do Vapor de água Atmosférico por interferometria radar. In: Cartografia e Geodesia 2009, Colégio Nacional de Engenharia Geográfica da Ordem dos Engenheiros, Actas da VI Conferência Nacional de Geodesia e Cartografia, Caldas da Rainha, 7 e 8 Maio de 2009, 129-138.

Benevides, P., Catalão, J., Nico, G., 2009. Inventário de Deslizamentos de Terra Baseado na Interferometria Radar. In: Cartografia e Geodesia 2009, Colégio Nacional de Engenharia Geográfica da Ordem dos Engenheiros, Actas da VI Conferência Nacional de Geodesia e Cartografia, Caldas da Rainha, 7 e 8 Maio de 2009, 139-148.

Catalão, J., 2009. GeodPt08- Um modelo de Geóide para Portugal Continental. In: Cartografia e Geodesia 2009, Colégio Nacional de Engenharia Geográfica da Ordem dos Engenheiros, Actas da VI Conferência Nacional de Geodesia e Cartografia, Caldas da Rainha, 7 e 8 Maio de 2009, 319-328.

**5.6 – COMMUNICATIONS TO NATIONAL AND INTERNATIONAL MEETINGS
(without publication of extended abstract or publication of communication on acta book)**

- Catalão, J., C. Catita, R, Santos. Use of geoid, leveling and GPS for vertical deformation monitoring.. 13th FIG International Symposium on Deformation Measurements and Analysis. 4th IAG Symposium on Geodesy for Geotechnical and Structural Engineering. LNEC, Lisbon, May 2008.
- Romero, I., A. Rodríguez-Santana, V. Mendes, J.A. Montiel-Nelson, P. Abad-Real, M. Martín-Betancor (2007) "GPS Observations and analysis from Macaronesia and Western Africa: the Canary GNSS Center (CGC), an effort to promote space-geodetic data and techniques." Presented at the AGU 2007 Fall Meeting, 10-14 December, S. Francisco, CA. (Eos Trans. AGU, 88(52), Fall Meet. Suppl., Abstract G21C-0660).
- Romero, I., A. Rodriguez-Santana, P. Abad-Real, V. Mendes, J.A. Montiel-Nelson, M. Martin-Betancor (2008). "The Canary GNSS Center (CGC), an effort to promote space-geodetic data and techniques." IGS Analysis Center Workshop 2008, 2-6 June, Miami Beach, Florida, USA.
- Nunes, A. M.J. Fernandes, C. Lázaro, N. Pires, L. Bastos, V.B. Mendes (2008)."The wet tropospheric correction for coastal altimetry based on GNSS path delay measurements." Ocean Surface Topography Science Team meeting, 10 -12 November, Nice.
- Fernandes, M.J., A.L. Nunes, C. Lázaro, N. Pires, L. Bastos, V.B. Mendes (2008). "Wet Tropospheric Correction for Coastal Altimetry based on GNSS path delay measurements." Presented at the 2nd Coastal Altimetry Workshop, Pisa (Italy), 6-7 November 2008.
- Trota, A., R. Rodrigues, J. Okada, P. Amaral, J. L. Gaspar, T. Ferreira, V. Mendes (2009)." Geodetic monitoring challenges using GPS for the active volcanic systems in the Azores: Overview and recent results from S. Miguel Island" (Poster). European Geosciences Union General Assembly 2009, Vienna, Austria, 19 – 24 Abril.
- Fernandes, M. J., A. L. Nunes, C. Lázaro, L. Bastos, V. B. Mendes, N. Pires (2010). "Correcção do atraso troposférico nas medidas de altimetria por satélite em zonas costeiras usando técnicas GNSS." VI Conferência Nacional de Geodesia e Cartografia, 7-8 de Maio, Caldas da Rainha.
- Fernandes, J., A. Nunes, C. Lázaro, N. Pires, L. Bastos, V. Mendes, P. Cipollini (2009) "GNSS-derived path delay (GPD) – a method to obtain the Wet Tropospheric correction for coastal altimetry." Poster at 2009 Ocean Surface Topography Science Team meeting, Seattle, Usa, 22-24 June 2009. Abstract in Abstracts & Program, p. 69-70
- Trota, A., V.B. Mendes, P. Amaral, R. Rodrigues, J. Gaspar, G. Queiros, T. Ferreira, J. Madeira (2009). "Avaliação da deformação actual da ilha Terceira (Açores) através da técnica GPS." Actas do 2º Encontro Nacional de Geodesia Aplicada, 12-13 Outubro, Laboratório Nacional de Engenharia Civil, p. 57 (Resumo).
- Fernandes, M. J. , C. Lazaro, A. L. Nunes, N. Pires, L. Bastos, V.B. Mendes, S. Barbosa, P. Cipollini (2009). "GNSS-Derived Path Delay: A Method to Compute the Wet Tropospheric Correction for Coastal Altimetry." Presented at 3rd Coastal Altimetry Workshop, ESA/ESRIN, Frascati, Italy, 17-18 September 2009. (abstract in abstract book)
- Barbosa, S., V. Mendes, and R. Fernandes. (2010). "Coastal sea-level change at Cascais (Portugal) from tide gauge, GPS and satellite altimetry data." EGU General Assembly 2010, Geophysical Research Abstracts, Vol. 12, EGU2010-8107-1.
- Antunes, C. R. Taborda, and V.B. Mendes (2010) "Analysis of the most recent data of Cascais Tide Gauge." EGU General Assembly 2010, Geophysical Research Abstracts, Vol. 12, EGU2010-12253.
- Romero, I., E. Hernandez, A. Rodriguez-Santana, P. Abad-Real, R. Fernandes, V. Mendes, J.A. Montiel-Nelson (2010). "The Canary GNSS Center (CGC), an effort to promote Space-Geodetic Data and Techniques.". IGS Workshop and Vertical Rates Symposium, 28 June - 2 July, Newcastle upon Tyne, England.

6 – CENTRO DE INVESTIGAÇÃO EM CIÊNCIAS GEO-ESPACIAIS (GEO-SPACE SCIENCES RESEARCH CENTRE)

6.1 – MAIN AREAS OF ACTIVITY IN GEODESY

In the period 2007-2009, the activities of this research Unit, belonging to different fields of the Earth and Space Sciences, were organized in three Groups:

- Satellite Positioning and Navigation, Radioastronomy and Reference Systems;
- Sea level change and ocean circulation studies from satellite altimetry and multi-sensor data;
- Remote Sensing, Image Processing and GIS.

Since 2010 January 1, the organization is the following:

Group 1 – Satellite Positioning and Navigation, Coastal Zones, Space Weather and Reference Systems;

Group 2 – Remote Sensing, Image Processing and GIS.

6.2 – FIELDS OF EXPERTISE

Group 1 - Satellite Positioning and Navigation, Coastal Zones Applications, Space Weather and Reference Systems

- Satellite Positioning and Navigation: GNSS Applications in different areas of human activity (plate tectonics and volcanism, aeronautics, agriculture, environment, mobile phones, urban traffic control, atmospheric studies and outer space); GNSS Permanent Network (GEONET), as part of the National Geophysical Network; GPS Software Receiver for Location-Based Services.
- Coastal Zones Applications: Retrieving TSM concentration from multi-spectral satellite data; Estimation of river plume size based on image segmentation; Beach hydromorphological behavior analysis through remote sensing data and image processing techniques; Bathymetric estimation through principal components analysis using satellite data; Extraction of a sand spit (Cabedelo - Douro estuary) from IKONOS-2 satellite images through image processing techniques; Breakwater stability analysis through a non permanent DGPS network – Madeira Harbour, Portugal.
- Space Weather: Solar Energetic Particle Events: models of particle propagation in the interplanetary medium and particle interaction with detectors in space; Large Scale Structure of the Solar Wind; Solar Radio Emissions associated with flares, CMEs and shocks using data from our radio-telescope operating in the 100 MHz to 1 GHz frequency range; Models of Near Earth Radiation Environment.
- Reference Systems: GAIA – Global Astrometric Interferometer for Astrophysics. To translate the position precision of Gaia into astrometric accuracy a Primary Reference Frame formed by thousands of Quasi-Stellar Objects (QSOs) will be used during satellite observations. We have been involved in the selection and characterization of those QSOs, in terms of intrinsic properties (host galaxy, variability, redshift, etc.) in correlation to the accuracy and stability of the object's centroid coordinates. The main goal is to produce a list of confirmed and well studied QSOs that can help on defining the alignment between International Celestial Reference Frame (ICRF) and the Gaia Extragalactic Celestial Reference Frame (GCRF).

Group 2 - Remote Sensing, Image Processing and GIS

- Image Classification, Image Segmentation, Biomedical Applications of Image Processing.
- Digital Photogrammetry, Terrestrial Photogrammetry, Image orientation and DEM extraction from high resolution satellite images, Geometric Corrections of Satellite Imagery, Airborne and Terrestrial Laser Scanning, GIS data capture.
- Biogeography, Spatial Biology, Ecological Modelling, Precision Agriculture, Remote Sensing of Vegetation, Natural Resources Management.

6.3 – MAIN PROJECTS

COST Action MP0905 – “Black Holes in a Violent Universe”.

ERIG – Education, Research and Innovation in the field of GNSS, Large European Consortium supported by the European GNSS Supervisor Authority (GSA).

GEONET – GNSS Permanent Network (FCUP, FCTUC, IICT, IPG and AFA), as part of the National Geophysical Network (supported by FCT).

SOFTWARE RECEIVER – GPS Software Receiver for Location-Based Services, developed within the framework of a PhD thesis.

GNSS Applications – Different Projects on the use of GNSS in several areas of human activity (plate tectonics and volcanism, aeronautics, agriculture, environment, mobile phones, urban traffic control, atmospheric studies and outer space).

GAIA – Global Astrometric Interferometer for Astrophysics, European Space Mission, member of the coordination unit CU3 – Core Processing (national participation supported by FCT).

GREAT – Gaia Research for European Astronomy Training

Working Group C3 “Quasars”; Working Group C2 “Astrometry Reference Frame”.

TSM Concentration – Retrieving TSM concentration from multispectral satellite data by linear regression and artificial neural networks.

RIVER PLUME SIZE – Estimation of the Douro river plume size based on image segmentation of MERIS scenes (ESA, Earth Observation Program, Category-1- ID#5899).

Beach classification - Beach hydromorphological classification through remote sensing data and image processing techniques.

SANDY - Cabedelo SAND Spit MorphoDYNAMIC Evolution and Modelling using IKONOS data – Douro River, Portugal (ESA, Earth Observation Program, Category-1- ID#6495).

MoZCo - Advanced methodologies and techniques development for coastal zone monitoring.

The Near-Earth radiation environment is being modelled through collaboration with LIP, as part of an effort funded by FCT. This work included both the modelling of particle propagation through interplanetary space and GEANT4 modelling of radiation monitors on board spacecraft.

Energetics of Propagating Coronal Mass Ejections are being studied through a SHINE collaboration with the University of California at Berkeley. Researchers from CICGE are involved in the analysis, reconstruction and calibration of radio images obtained through interferometric means. CICGE/ADFCUP is part of a Portuguese consortium including members from IT/Aveiro, CENTRA/IST, and Evora University, working to bring the **European Square Kilometre Array (SKA)** test site to Portugal. A site was selected in Herdade da Contenda in Moura. A demonstrator of the EMBRACE system was successfully tested in front of Portuguese authorities at Logica-EM headquarters in Moura, on March 2010. The prototype should be installed at its final site during 2011.

Laser Scanning / DEM Generation

- FCT Project “Forest and Fuel Variables Estimation and Digital Terrain Modelling with Airborne Laser Scanning and High Resolution Multi-Spectral Images”
- DEM extraction from ALOS-PRISM data

Agriculture / Vegetation

- LAMESAT_XXI, FCT, 2007-2010, Ancestral irrigation management on mountain semi-natural meadows using remote sensing
- Remote Sensing for vineyard monitoring

Biodiversity / Biogeography

- Expansion model for a tree frog

Biogeography of crocodiles

Image Processing Applications

6.4 – PUBLICATIONS

2008

Publications in peer review Journals

- Teodoro, A. C., Fernando Veloso-Gomes and Hernâni Gonçalves, “Statistical techniques for correlating TSM concentration with seawater reflectance using multispectral satellite data”, 2008, *Journal of Coastal Research*, Vol. 24, Issue sp3, 40–49 (ISI Web of Science index).
- Ana Teodoro, Hernâni Gonçalves, Fernando Veloso-Gomes, and José A. Gonçalves, “Estimation of the Douro River plume dimension based on image segmentation of MERIS scenes”, 2008, *Proc. SPIE Vol. 7104*, 71040F.
- Ant’on et al., The colour of the narrow line Sy1-blazar 0324+3410, 2008, *A&A*, 490, 583.
- Garcia et al., Science case for 1 mas spectro-imaging in the near-infrared, 2008, *SPIE* 7013,146.
- Heleno, S.I.N., Frischknecht, C., d’Orey, N., Lima, J.N., Faria, B., Wall, R. & Kervyn, F.(2008) – Seasonal Tropospheric Influence on SAR Interferograms near the ITCZ – the Case of Fogo Volcano and Mount Cameroon . *Journal of African Earth Sciences*, Geological Society of Africa e Elsevier.
- J.C. Brito, X. Santos, J.M. Pleguezuelos, N. Sillero (2008), Inferring Evolutionary Scenarios with Geostatistics and Geographical Information Systems [GIS] for the viperid snakes *Vipera latastei* and *V. monticola*, *Biological Journal of the Linnean Society* 95, 790–806.
- C. M. R. Caridade, A. R. S. Marçal, T. Mendonça (2008). The use of texture for image classification of black & white air-photographs, *International Journal of Remote Sensing*, Vol.29, No.2, 593-607.
- Marçal, A.R.S., Cunha, M. (2008). Image Processing of Artificial Targets for Automatic Evaluation of Spray Quality', *Transactions of the ASABE*, Vol.51, No.3, 811-821.
- F. Martínez-Freiría, N. Sillero, M. Lizana, J.C. Brito (2008), GIS-based niche models identify environmental mechanisms sustaining the location of a contact zone between European vipers [*Vipera aspis*, *V. latastei* and *V. seoanei*], *Diversity and Distributions*, 14, 452-461.
- Alexandra S. L. Nunes, André R. S. Marçal, Robin A. Vaughan (2008). Fast over-land atmospheric correction of visible and near-infrared satellite images, *International Journal of Remote Sensing*, Vol.29, No.12, 3523-3531.
- Ribeiro, H., Cunha, M. e Abreu, I. (2008). Quantitative forecasting of olive yield in Northern Portugal using a bioclimatic model. *Aerobiologia* 24(3):141-150.
- Sabugosa-Madeira, B., Ribeiro, H., Cunha, M. and Abreu, I. (2008). The Importance of plantain (*Plantago* spp.) as a supplementary pollen source in the diet of honey bees. *Journal of Apicultural Research and Bee World* 47(1): 77-81.
- N. Sillero (2008), Mortality Levels of Amphibians on Spanish Country Roads, *Descriptive and Spatial Analysis, Amphibia-Reptilia* 29, 337-347.
- N. Sillero, R. Ribeiro, J.C. Brito, E. García-Meléndez (2008). Estimating altitude in distribution records of amphibians and reptiles, a comparison study between topographic maps and SRTM DEM, *Amphibia-Reptilia* 29, 121-126.

Other publications International

- Araújo, E., “Performance Improving algorithms for handheld processors-based GNSS Software Receivers”, 2008, NAVITEC 2008, ESA ESTEC, Netherlands.
- Ana Teodoro, Fernando Veloso-Gomes, Hernâni Gonçalves and José A. Gonçalves, “Douro river plume identification through image segmentation techniques and as a function of the water volume, tide height and wind speed”, 2008, *Proceedings of Littoral 2008*.
- Casaca, João & Lima, José Nuno, “Spectral Characterization of GNSS Time Series”, 6ª Assembleia Luso-Espanhola de Geodesia e Geofísica. *Actas da Assembleia*, Tomar, p. 249 – 250, Organizada pela Comisión Española de Geodesia y Geofísica, pela Secção Portuguesa das Uniões Internacionais Astronómica, Geodésica e Geofísica, pelo Instituto Nacional de Meteorologia, pelo Instituto Geográfico Português e pelo Instituto Politécnico de Tomar.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Santos, Paula, "Astronomical and Geodetical instruments at IICT", Proceedings of the XXVII SIC Symposium, University of Lisbon, 2008.
- M.A. Carretero, N. Sillero, E. Ayllón, A. Kaliontzopoulou, A. Lima, P.L. Hernández-Sastre, R. Godinho, D.J. Harris, (2008), Multidisciplinary approaches for conserving Southern isolates of Atlantic lizards in the Iberian Peninsula, *Herpetologia Sardiniae*, 251-255.
- Gonçalves, J. (2008). Orientation and DEM extraction from ALOS-PRISM images using the SRTM DEM as ground control. *International Archives Photogrammetry, Remote Sensing and Spatial Information Sciences*. Vol. XXXVII. Part B1, 1777-1181. Beijing 2008.
- Gonçalves, J., Morgado, A. (2008). Use of the SRTM DEM as a geo-referencing tool by elevation matching. *International Archives Photogrammetry, Remote Sensing and Spatial Information Sciences*. Vol. XXXVII. Part B2, 879-883. Beijing 2008
- Sérgio R. Madeira, José A. Gonçalves, Luísa C. Bastos, (2007). Implementation of a Low Cost Mobile Mapping System". Proceedings of The 5th International Symposium on Mobile Mapping Technology, Padua, Italy.
- Loureiro, A.; Sillero, N. (2008): Metodología. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O.: Atlas dos Anfíbios e Répteis de Portugal. Instituto de Conservação da Natureza e Biodiversidade, Lisboa. 257 pp.
- J. Maeda, A. Kawano, S. Yamauchi, Y. Suzuki, A.R.S. Marçal, T. Mendonça (2008). Perceptual Image Segmentation Using Fuzzy-Based Hierarchical Algorithm and Its Application to Dermoscopy Images, Proceedings of the IEEE Conference on Soft Computing in Industrial Applications, 25-27 June 2008, Muroran, Japan, 66-71.
- André R. S. Marçal (2008). Alternative methods for counting overlapping grains in digital images, Springer Lecture Notes in Computer Science, No. 5112, 1051-1060.
- André R. S. Marçal, Arlete S. Rodrigues (2008). A Framework for the Evaluation of Multi-Spectral Image Segmentation, G.J .Hay, T. Blaschke and D. Marceau (Eds), GEOBIA, 2008 - Pixels, Objects, Intelligence: Geographic Object Based Image Analysis for the 21st Century, University of Calgary, Calgary Alberta, Canada, August 05-08. ISPRS Vol. No. XXXVIII-4/C1., 6pp.
- André R.S. Marçal, Mário Cunha (2008). Vineyard monitoring in Portugal using multi-sensor satellite images, Proceedings of the 27th EARSeL Symposium, Geoinformation in Europe, edited by Mario Gomarasca, Millpress, Rotterdam, 327-335.
- Sabugosa-Madeira, B., Ribeiro, H., Cunha, M. e Abreu, I. 2008. Anemophilous and entomophilous pollen flows of *Castanea sativa* in the northeast of Portugal. *Acta Horticulturae (ISHS)* 784:133-136.
- Sillero, N. (2008): *Chalcides bedriagai*. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O.: Atlas dos Anfíbios e Répteis de Portugal. Instituto de Conservação da Natureza e Biodiversidade, Lisboa. 257 pp.
- Sillero, N. (2008): *Chalcides striatus*. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O.: Atlas dos Anfíbios e Répteis de Portugal. Instituto de Conservação da Natureza e Biodiversidade, Lisboa. 257 pp.
- N. Sillero (2008), *Ranita meridional - Hyla meridionalis*, Enciclopedia Virtual de los Vertebrados Españoles, Carrascal, L. M., Salvador, A. (Eds.), Museo Nacional de Ciencias Naturales, Madrid, <http://www.vertebradosibericos.org/>.
- N. Sillero (2008), On the correct form to refer the authorship of *Hyla meridionalis*. *Boletín de la Asociación Herpetológica Española* 19, 129.
- J.C. Brito, M. Feriche, T. Herrera, A. Kaliontzopoulou, F. Martínez-Freiria, D. Nesbitt, D. Omolo, D. Ontiveros, L. Quiñoz, J.M. Pleguezuelos, X. Santos, X.; N. Sillero (2008), En los límites de su distribución: anfibios y reptiles paleárticos en el noroeste de Túnez, *Boletín de la Asociación Herpetológica Española*, 19, 75-82.
- R. Ribeiro, J. Torres, M.A. Carretero, N. Sillero, G.A. Llorente (2008), New observations of the Iberian Worm Lizard (*Blanus cinereus*) and the Bedriaga's Skink (*Chalcides bedriagai*) bring reliability to the historical records from Porto region (NW Portugal), *Boletín de la Asociación Herpetológica Española*, 19, 49-50.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Gonçalves H., Gonçalves J.A., Corte-Real L. (2008). Automatic image registration based on correlation and Hough transform", in Image and Signal Processing for Remote Sensing XIV, Bruzzone L, Notarnicola C, Posa F, Eds., vol. 7109. SPIE, p. 71090J.

Other publications National

Osório, J. Pereira, "Sistemas de Referência Internacionais", Academia das Ciências de Lisboa, Fevereiro 2008.

Osório, J. Pereira, "Professor M. G. Pereira de Barros – No centenário do seu nascimento", Academia das Ciências de Lisboa, Maio 2008.

Santos, Paula, "125 anos de Geodesia nos países da CPLP", 125 Anos de Saber Tropical, IICT 2008, pp 73 - 94 (ISBN 978 - 972 - 672 - 975-4).

Santos, Paula, "As Missões Geodésicas na Comissão de Cartografia", Futuro e História da Lusofonia Global, IICT 2008, pp. 371 - 377 (ISBN 978- 972 - 672 - 977-8).

Casaca, João e Lima, J. Nuno, "O Ruído na Observação Contínua GNSS", INGENIUM, II Série, nº 105 - Ordem dos Engenheiros, Lisboa, Maio/Junho de 2008, p. 57.

Lima, J. Nuno e Casaca, J., "Smoothing GNSS Time Series with Asymmetric Moving Averages", 2008, Simpósio Internacional Measuring the Changes, Organização conjunta FIG, IAG e LNEC, Lisboa.

Lima, J.N.; Henriques, M.J. e Casaca, J., "A Utilização do GNSS na Medição de Deslocamentos Superficiais em Barragens de Aterro", XI Congresso Nacional de Geotecnia, Sociedade Portuguesa de Geotecnia, Actas do congresso, Volume II, Coimbra, p. 297 – 304, Organizado pela Sociedade Portuguesa de Geotecnia, Coimbra, 7 a 11 de Abril de 2008.

José A. Gonçalves, Sérgio R. Madeira, Joaquim J. Sousa (2008). Topografia – Conceitos e Aplicações. 1ª Edição. Lisboa: Lidel. ISBN: 978-972-757-485-8.

Ribeiro, H., Cunha, M. e Abreu, I. (2008). Using a pollen emission model to define the main Poaceae and Urticaceae pollen seasons in the atmosphere of Porto. Revista Portuguesa de Imunoalergologia 16(3): 285-297.

Master and Ph.D. thesis completed

PhD. Thesis

Araújo, Eduardo, "Building a GPS Software Receiver for Location-Based Services", Faculty of Sciences, University of Porto, 2008.

Helena Ribeiro (2008), Previsão da Fenologia e Produtividade da Olea europea L.

MSc. Thesis

Pinto, Sérgio Duarte Cruz, "Utilização do GPS no levantamento cadastral de redes de abastecimento de água e de águas residuais", Faculty of Sciences, University of Porto, 2008.

Arlete da Silva Rodrigues, Metodologia de avaliação de fusão de imagens baseada em imagens sintéticas, 2008.

Filipe Stokler Maia, Aplicação da Detecção Remota à Análise da Paisagem – Caso do Parque Nacional da Peneda-Gerês, 2008.

Pedro Arala Chaves, Detecção Remota nas Vinhas – Previsão de Colheita, 2008.

Rui José Pires Fernandes, Sistema de Extração de Informação de Tráfego a partir de uma câmara de vídeo fixa, 2008.

Lisete Monteiro Alves, Comparação de Modelos Digitais de Elevação Obtidos com a Missão SRTM e com Altimetria RADAR, 2008.

2009

Publications in peer review Journals

Teodoro, A. C., Hernâni Gonçalves, Fernando Veloso-Gomes, and José A. Gonçalves, (2009). "Modelling of the Douro river plume size, obtained through image segmentation of MERIS data". IEEE Geoscience and Remote Sensing Letters, Vol. 6, Nº. 1, 87-91.

INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL

- Pais-Barbosa, J., Veloso-Gomes, F., Taveira-Pinto, F., 2009. Portuguese Northwest Beach Classification Using Aerial Photographs and GIS Tools, *Journal of Coastal Research*, SI 56 (Proceedings ICS2009), Lisboa, Portugal, pp 1552-1556.
- Rosa-Santos, P., Veloso-Gomes, F., Taveira-Pinto, F., Silva, R., Pais-Barbosa, J., 2009. Evolution of Coastal Works in Portugal and their Interference with Local Morphodynamics, *Journal of Coastal Research*, SI 56 (Proceedings ICS2009), Lisboa, Portugal, pp 752-756.
- Veloso-Gomes, F., Costa, J., Rodrigues, A., Taveira-Pinto, F., Pais-Barbosa, J., das Neves, L., 2009. Costa da Caparica Artificial Sand Nourishment and Coastal Dynamics, *Journal of Coastal Research*, SI 56 (Proceedings ICS2009), Lisboa, Portugal, pp 678-682.
- Taveira-Pinto, F., Pais-Barbosa, J., Veloso-Gomes, F., 2009. Coastline Evolution at Esmoriz – Furadouro stretch (Portugal), *Journal of Coastal Research*, SI 56 (Proceedings ICS2009), Lisboa, Portugal, pp 673-677.
- Taveira-Pinto, F.; Petan, S; Mikos, M, Pais-Barbosa, J., 2009. Application of GIS tools for Leca River Basin soil erosion (Northern Portugal) evaluation, 5th International Conference on River Basin Management, MALTA, RIVER BASIN MANAGEMENT V, pp 267-278 (ISI Web of Science index).
- Heleno, S. I. N., Frischknecht, C., d'Oreye, N., Lima, J.N.P., Faria, B., Walf, R. e Kervyn, F., Seasonal tropospheric influence on SAR interferograms near the ITCZ – The case of Fogo Volcano and Mount Cameroon, *Journal of African Earth Sciences*, (available online 3 August 2009).
- Gonçalves H, Gonçalves, J A, Corte-Real L (2009). Measures for an Objective Evaluation of the Geometric Correction Process Quality. *IEEE Geoscience and Remote Sensing Letters* 6(2) 292-296.
- Kaliontzopoulou, A., Sillero, N., Martínez-Freiría, F., Carretero, M.A., Brito, J.C. (2009): *Podarcis hispanica* complex (North African Wall Lizard). *Arboreal Behavior. Herpetological Review* 40(2):224-225.
- André R. S. Marçal, Arlete S. Rodrigues (2009). A method for multi-spectral image segmentation evaluation based on synthetic images, *Computers & Geosciences* Vol. 35, No. 8, 1574-1581.
- Ribeiro H., Cunha M., Abreu I. (2009). A bioclimatic model for forecasting olive yield, *Journal of Agricultural Science*, Vol. 147, 647-656.
- R. Ribeiro, X. Santos, N. Sillero, M.A. Carretero, G.A. Llorente (2009). Biodiversity and Land Uses: Is Agriculture the Biggest Threat for reptiles' assemblages? *Acta Oecologica*, Vol. 35, No. 2, 327-334.
- X. Santos, J. Caro, A.J. Abril, M. Lorenzo, J.C. Brito, J.M. Pleguezuelos, N. Sillero, N. (2009). Ecological modelling predicts habitat suitability and extinction proneness in isolated populations of endangered species. *Biological Conservation*, Vol. 142, No. 2, 344-352.
- N. Sillero (2009). Modelling a species in expansion at local scale: is *Hyla meridionalis* colonising new areas in Salamanca, Spain? *Acta Herpetologica*, Vol. 4, No. 1, 37-46.
- N. Sillero, J.C. Brito, A. Skidmore, A.G. Toxopeus (2009). Biogeographical Analysis of Species and Species Density Distribution of Amphibians and Reptiles From the Iberian Peninsula with Predictive Modelling, GIS and Remote Sensing. *Amphibia-Reptilia*, Vol. 30, No. 2, 185-206.
- Margarida Silveira, Jacinto C. Nascimento, Jorge S. Marques, André R. S. Marçal, Teresa Mendonça, Syogo Yamauchi, Junji Maeda, Jorge Rozeira (2009). Comparison of Segmentation Methods for Melanoma Diagnosis in Dermoscopy Images. *IEEE Journal of Selected Topics in Signal Processing*, Vol. 3, No. 1, 35-45.

Other publications International

- Osório, Isabel, A Feasibility study on the use of GLONASS signals for GNSS Meteorology, *Festschrift - 60 Birthday of Prof. Guenter Hein*, 2009, University of the Armed Forces, Munich, Germany pp.187-196.
- Osório, J. Pereira and Isabel Osório, GNSS Education activities in FCUP, 2009, 1st ESA GNSS Education Workshop, ESAC, Madrid.
- Osório, J. Pereira, 500 years of astronomical instrumentation in Portugal, 2009, *Proc. of the Symposium Astronomy and its Instruments Before and After Galileo*, Venice, Italy (in press).

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Teodoro, A. C., Pais-Barbosa, J., Veloso-Gomes, F., and Taveira-Pinto, F., 2009. Beach hydromorphological classification through image classification techniques applied to remotely sensed data. Vol. 7478: Remote Sensing for Environmental Monitoring, GIS Applications, and Geology IX, Ulrich Michel; Daniel L. Civco, Editors, 747827.
- Joaquim Pais-Barbosa; Ana C. Teodoro; Fernando Veloso-Gomes; Francisco Taveira-Pinto, 2009, "Classification of beach hydromorphological behavior through image classification algorithms and geographic information technologies", Proceedings of the Geoinformatics Forum, Salzburg 2009. Car/Griesebner /Strobl (Eds.).
- Petan, S., Pais-Barbosa, J., Mikoš, M., Taveira-Pinto, F., 2009. GIS-based RUSLE modelling of Leça River Basin, Northern Portugal, in two different grid scales, Geophysical Research Abstracts, Vol. 11, EGU2009-9334 EGU General Assembly 2009.
- Lobo, C., Antón, S., Coelho, B. Marquez, I., Magosa, J., 2009, AGN feedback and quenching of star formation: a multiwavelength approach, Multi-wavelength astronomy and the Virtual Observatory, ESAC, 35.
- Filho, M, Lobo, C., Antón, S., Brinchmann, J, Optically Faint Radio-loud AGN in galaxy cluster fields, (in prep.)
- J.S. Borges, A.R.S. Marçal, J.M. Biucas-Dias (2009). Hyperspectral image segmentation using FSMLR with Jeffreys prior, Proceedings of the 28th EARSeL Symposium, Remote Sensing for a Changing Europe, edited by Derya Maktav, IOS Press, Amsterdam, 378-385.
- C.M.R. Caridade, A.R.S. Marçal, T. Mendonça, A.M. Pessoa, S. Pereira (2009). An automatic Method to identify and extract information of DNA bands in Gel Electrophoresis Images, Proceedings of the 31st Annual International Conference of the IEEE EMBS - EMBC 2009, 1024-1027.
- J. Correia, R. Bencatel, A.R.S. Marçal, A. Puga, J.B. Sousa, G.M. Gonçalves (2009). Video Based Motion Tracking and River Detection with an Unmanned Aerial Vehicle', Proceedings of the 33rd International Symposium on Remote Sensing of Environment (ISRSE), Stresa, Italy, ICRSE, 4pp.
- H. Gonçalves, J.A. Gonçalves, L. Corte-Real (2009). Automatic image registration through the segmentation of images preprocessed by joint histogram analysis. Proc. SPIE, Vol. 7477, 74770R (2009); doi:10.1117/12.829958.
- J.A. Gonçalves, J. (2009). An Empirical Model for Orientation of ALOS-PRISM Images of Level 1-B2. ISPRS Workshop - High-Resolution Earth Imaging for Geospatial Information, Hannover, Germany, June 2009. Proceedings in CD-ROM.
- Keizer J.J., Ferreira R.S.F., Fernandes I.A.C., Nunes J.P., Sande Silva J., Coelho C.O.A., Maia P.A.A., Malvar M.C., Mertopawiro C., Pereira L.M.G., Pereira V.M.F.G., Toonen R., Varela M.E.T., Ferreira A.J.D., Magalhães M.C.F.S. (2009). Erosfire-II – Initial results. FESP2009- International meeting of fire effects on soil properties, 2nd edition, Marmaris.
- S.Madeira, J.A.Gonçalves, L.Bastos (2009). Application of a Low Cost Mobile Mapping System to Coastal Monitoring. Proceedings of the 6th International Symposium on Mobile Mapping Technology, Presidente Prudente - São Paulo Brasil.
- S.Madeira, J.A.Gonçalves, L.Bastos (2009). Fast Camera Calibration for Low Cost Mobile Mapping. Proceedings of the 6th International Symposium on Mobile Mapping Technology, Presidente Prudente - São Paulo, Brasil.
- André R. S. Marçal, Isabel R. Gonçalves (2009). Automatic recognition of road signs in digital images for GIS update, IMAGAPP 2009 - International Conference on Imaging Theory and Applications, INSTICC, 129-134.
- A.R.S. Marçal, C.M.R. Caridade, P. Albuquerque, M.V. Mendes, F. Tavares (2009). Automatic Detection of Molecular markers in Digital Images, Proceedings of the 31st Annual International Conference of the IEEE EMBS - EMBC 2009, 6710-6713.
- André R. S. Marçal, Arlete Rodrigues, Mário Cunha (2009). The Synthetic Image Testing Framework (SITEF) for the evaluation of multi-spectral image segmentation algorithms, IEEE IGARSS 2009 Proceedings, Cape Town, South Africa, IV - 236-239.
- Morgado, A., Kane, R., Maathuis, B. (2009). Chapter1. Capacity Building. – GMES and Africa Action Plan - Draft 0. 20pp.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- I. Pôças, M. Cunha, A.R.S. Marçal, L.S. Pereira (2009). Remote sensing monitoring to preserve ancestral semi-natural mountain meadows landscapes, Proceedings of the 28th EARSeL Symposium, Remote Sensing for a Changing Europe, edited by Derya Maktav, IOS Press, Amsterdam, 102-108.
- Queiroz, J., Cunha, M., Magalhães, A., Guimarães, D., Sousa, M., Borges, L. e Castro, R. 2009. Mountain viticulture and new training systems in narrow terraces - Douro region. 16th International GiESCO Symposium, University of Califórnia, Davis, USA, 487-492.
- Arlete S. Rodrigues, André R.S. Marçal, Mário Cunha (2009). Evaluation of data fusion value for agricultural monitoring based on land parcels, Proceedings of the 28th EARSeL Symposium, Remote Sensing for a Changing Europe, edited by Derya Maktav, IOS Press, Amsterdam, 125-133.

Other publications National

- Osório, J. Pereira, Sistemas Globais de Navegação por Satélite, GNSS, 2009, Academia das Ciências de Lisboa (to be published in Memórias da Academia).
- Osório, J. Pereira, Gago Coutinho -140 anos do seu nascimento e 50 anos da sua morte, 2009, Boletim da Sociedade de Geografia de Lisboa (in press).
- Osório, J. Pereira, Professor Manuel Gonçalves Pereira de Barros - Notável Cientista e Professor, no 101º Aniversário do seu Nascimento, 2009, Câmara Municipal de Esposende.
- Joaquim Pais-Barbosa; Ana C. Teodoro; Fernando Veloso-Gomes; Francisco Taveira-Pinto, "Identificação e Classificação de Hidroformas e Hidromorfologias Utilizando Técnicas de Classificação de Imagem", 4^{as} Jornadas de Hidráulica, Recursos Hídricos e Ambiente da FEUP, FEUP, 2009.
- Soares, M.J., Torrão, M.M., Santos, P., Acervo de Gago Coutinho no IICT e SGL, Mesa redonda e exposição, 2009, Centro de Documentação e Informação, IICT, Lisboa.
- Roque, A.C., Torrão, M.M., Santos, P., Missões Científicas: do património à ciência. O acervo de Gago Coutinho no IICT, 2009, 1º Encontro Nacional de História da Ciência em Portugal, Centro Científico e Cultural de Macau, Lisboa.
- Soares, M.J., Torrão, M.M., Santos, P., Acervo de Gago Coutinho no IICT, 2009, Centro de Documentação e Informação, IICT, Lisboa. (convite da Academia de Marinha).
- Santos, P., Gago Coutinho, a vida em imagens, 2009, Sociedade de Geografia de Lisboa.
- Lima, J.N., Henriques, M. J., Monitorização da deformação de pontes com o GNSS, 2009, Actas do Congresso Segurança e Conservação de Pontes, ASCP09, Lisboa.
- Lima, J.N., Casasa, J. M.M., A Identificação de um Sinal em Ambiente GNSS, 2009, Actas do 2º Encontro Nacional de Geodesia Aplicada, LNEC, Lisboa.
- Lima, J. N., O Efeito da Carga Oceânica nas Séries Temporais GNSS, 2009, Actas do 2º Encontro Nacional de Geodesia Aplicada, LNEC.
- J. A. Gonçalves, (2009). Conversões de Sistemas de Coordenadas Nacionais para ETRS89 Utilizando Grelhas. Actas da VI Conferência Nacional de Cartografia e Geodesia.
- J.A. Gonçalves, L. Bastos, H. Granja, A. Magalhães, S. Madeira (2009). Criação de Modelos Digitais do Terreno de Praias e Zonas Dunares a Partir de Fotografia Aérea Digital. Actas da VI Conferência Nacional de Cartografia e Geodesia.
- S.Madeira (2009). Sistema Móvel de Levantamento Terrestre. III Jornadas de Engenharia Topográfica. Instituto Politécnico da Guarda, Guarda, Portugal.

Master and Ph.D. thesis completed

PhD. Thesis

- Janete da Silva Borges, Bayesian hyperspectral image segmentation with discriminative class learning, Doutoramento Interdisciplinar de Ciências da Faculdade de Ciências, FCUP, 23 Outubro 2009.
- Bernardo Sabugosa Madeira. Estudo comparativo dos fluxos polínicos anemófilos e entomófilos (*Apis mellifera*) e respectivo contributo na produtividade agrícola e qualidade dos produtos da colmeia.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

Doutoramento em Ciências Agrárias, Faculdade de Ciências da Universidade do Porto, 7 Janeiro 2009.

Mariana Moreira. Aplicación y selección de indicadores de calidad ecológica en la utilización de fertilizantes orgánicos para la producción de forraje. Doutoramento em Ecologia Aplicada, Universidad Santiago Compostela.

MSc. Thesis

Ramos, A. V. Garrido, Determinação de Posições e Velocidades de uma Rede GNSS, Faculty of Sciences, University of Porto, 2009.

Moura, A. C. Oliveira, Criação de uma base de dados georreferenciada de parcelas de terrenos expropriadas, Faculty of Sciences, University of Porto, 2009.

Santos, I. Oliveira, Análise e modelação da evolução morfológica da restinga do rio Douro (Cabedelo), Faculty of Sciences, University of Porto, 2009.

Aguiar, R. E. B. Silva, Classificação de hidroformas costeiras associadas às praias do Porto, usando técnicas de processamento de imagem e análise espacial em ambiente SIG, Faculty of Sciences, University of Porto, 2009.

Cátia Cristina Esteves. Avaliação do Desempenho de um Sistema Móvel de Levantamento Terrestre. FCUP, Dezembro de 2009.

Alexandra Pinho, Modelos Digitais do Terreno para Detecção de Alterações e Avaliação do Perigo Geológico em Castelo de Paiva, Mestrado em Detecção Remota, FCUP, 16 Abril 2009.

Isabel Ribeiro, Reconhecimento automático de sinais de trânsito em imagens video digitais, Mestrado em Detecção Remota, FCUP, 7 Outubro 2009.

Organization of conferences

Young European Radio Astronomers' Conference - YERAC 2009

2009, CICGE-FCUP in collaboration with RadioNet

YERAC has been held annually since 1968, circulating round Europe. This was the first time that the event took place in Portugal. More information can be found in <http://www.fc.up.pt/yerac/yerac-2009>" 42 students attended, from France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Russia, South Africa, Spain and UK, and gave oral presentations. There were 4 local chairs and 3 additional organisers.

2010

Publications in peer review Journals

Blanco Rodríguez, J., Kneer, F., 2010, "Faculae at the poles of the Sun revisited: infrared observations", *Astronomy and Astrophysics*, Volume 509, id.A92.

M. Pick, A. Vourlidas, A.J. Tylka, D.J. Filipe Maia, A. Bouteille, "Radio Imaging Observations as Tracers of Energetic Electrons during the Genesis of Impulsive Coronal Mass Ejections", *Astrophysical Journal* (for publication).

Osório, Isabel, 2010, "A Feasibility Study on the Use of GLONASS Signals for Meteorology in RTK Positioning", *European Journal of Navigation*, Vol.8, No. 3, pp. 10-15.

Taris et al., 2011, "Astrophotometric variability of CFHT-LS Deep 2 QSOs", *Astronomy and Astrophysics*, Volume 526.

Cunha, M., Marçal, A. e Silva, L. 2010. Very early season prediction of wine production based on satellite data from VEGETATION. *International Journal of Remote Sensing*, 31(12): 3125-3142.

Diels, J., Cunha, M., Manaia, C., Sabugosa-Madeira, B. and Silva, M. 2010. Association of financial conflict of interest to research outcomes on health risks or nutritional assessment studies of genetically modified products. *Food Policy*. doi:10.1016/j.foodpol.2010.11.016.

Sillero, N. (2010): Modelling suitable areas for *Hyla meridionalis* under current and future expansion scenarios. *Amphibia-Reptilia* 31: 37-50. (IP= 0.78, C=0).

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Kaliontzopoulou, A.; Carretero, M.A.; Sillero, N. (2010): Geographic patterns of morphological variation in the lizard *Podarcis carbonelli*, a species with fragmented distribution. *Hepetological Journal* 20 (1): 41-50.
- Sillero, N.; Tarroso, P. (2010): Free GIS for herpetologists: free data sources on Internet and comparison analysis of proprietary and free/open source software. *Acta Herpetologica* 5 (1): 63-85.
- Brito, J.C.; Álvares, F.; Martínez-Freiría, F.; Sierra, P.; Sillero, N.; Tarroso, P. (2010): Data on the distribution of mammals from Mauritania, West Africa. *Mammalia* 74: 449-455.
- García-Muñoz, E.; Sillero, N. (2010): Two new types of noose for capturing herps. *Acta Herpetologica* 5 (2): 259-263.

Other international publications

- Ana Teodoro, Hernâni Gonçalves, Joaquim Pais-Barbosa, 2010, "Bathymetric estimation through principal components analysis using IKONOS-2 data", *Remote Sensing for Agriculture, Ecosystems, and Hydrology XII*, Christopher M. U. Neale, Antonino Maltese, Editors, 782419. DOI: 10.1117/12.864565.
- Ana Teodoro, Joaquim Pais-Barbosa, Francisco Piqueiro and Ricardo Aguiar, 2010, "Quantitative and qualitative coastal water quality parameters monitoring using field data and aerial photography: Porto (Portugal) beaches", *Earth Resources and Environmental Remote Sensing/GIS Applications*, Ulrich Michel, Daniel L. Civco, Editors, 78311M. DOI: 10.1117/12.864568.
- Andrei, A. et al., 2010, "The construction of the LQRF", 2010, *Extragalactic Science with Gaia meeting*, Paris.
- Bo Li, Dalmiro J. F. Maia and Milan Maksimovic, "Solar and Interplanetary Radio Emissions", 2010, *IAGA Special Sopron Book Series*, Vol. 4 Miralles, Mari Paz; Sánchez Almeida, Jorge (Eds.), pp. 223-233.
- E. Araújo, "Kalman Filter Dynamic Cadence Adjust for Optimal Processing Burden", *Proceedings of the ENC GNSS 2010*, Braunschweig, Germany, 19-21 October 2010.
- M. Eren et al., *NATO RTO SET-1=7 RTG "Navigation Sensors and Systems in GNSS Denied Environments"*, 2010..
- Osório, Isabel and Mário Cunha, 2010, "The role of the TRS in precision agriculture: DGPS with EGNOS and RTK Positioning using data from NTRIP streams", *REFAG-Reference Frames for Applications in Geosciences*, IAG Com. 1 Symposium 2010, 4-8 October 2010, Marne-La-Vallée, France (submitted for publication).
- Osório, J. Pereira, "GNSS Education activities at the Univ. of Porto, Portugal", 2nd *ESA GNSS Education Workshop*, ESA/ESAC, Madrid, Spain, July 2010.
- Osório, J. Pereira, "500 years of Astronomical Instrumentation in Portugal", *Proceedings of the IAU Symposium Astronomy and its Instruments Before and After Galileo*, Italy, 2010, pp. 127-140.
- Pais-Barbosa, J., Veloso-Gomes, F. & Taveira Pinto, F., 2010, "GIS Applications for Coastal Morphodynamics' Analysis of the Portuguese West Coast", *Coastal and Marine Geospatial Technologies* (book series: Coastal Systems and Continental Margins), Ed Green, DR, Springer, pp. 275-283.
- Pais-Barbosa, J., Teodoro, A. C., Veloso-Gomes, F., Taveira-Pinto, F., Gonçalves, H., 2010, "How can remote sensing data/techniques help us to understand beachhydromorphological behavior?", *Littoral 2010*, Londres, Inglaterra. <http://coastnet.org.uk/jpbarbosa/how-can-remote-sensing-datatechniques-help-us-understand-beach-hydromorphological-behavior>
- Sandra Heleno, Maria Joao Henriques, Ana Paula Falcao, Nuno Lima, Ana Maria Fonseca, Malva Mancuso, Joao Fonseca, Andre Pinheiro, "Measuring Subsidence in the Centre of Lisbon with Persistent Scatterers Interferometry (PSI), CGPS and Levelling Surveys", *ESA Living Planet Symposium*, Poster Session - Hazards Assessment & Mapping, Bergen, Norway, 28 June – 2 July 2010.
- (http://www.congrex.nl/10a04/sessions/CXNL_10a04_865978.htm)
- S. Antón et al., "Supermassive Black Holes & hosts in the Gaia era", 2010, *Extragalactic Science with Gaia meeting*, Paris.

INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL

- Sonia Antón, Domingos Barbosa, Leonid Gurvits , Editors, "The Square Kilometer Array: Paving the way for the new 21st century radio astronomy paradigm", Astrophysics & Space Science Series, Springer, in prep.
- Teodoro, A. C., Gonçalves, H., Pais-Barbosa, J., Veloso-Gomes, F., and Taveira-Pinto, F., 2010, "Identification of beach features/patterns through artificial neural networks techniques using IKONOS data", In: Wagner W., Székely, B. (eds.): ISPRS TC VII Symposium – 100 Years ISPRS, Vienna, Austria, July 5–7, 2010, IAPRS, Vol. XXXVIII, Part 7B, 574-579.
- C.M.R. Caridade, A.R.S. Marçal, T. Mendonça, A.M. Pessoa, S. Pereira (2010). Automatic information extraction from gel electrophoresis images using GEIAS, Springer Lecture Notes in Computer Science, Vol. 6112, 185-194.
- C.M.R. Caridade, A.R.S. Marçal, T. Mendonça, P. Albuquerque, M.V. Mendes, F. Tavares (2010). Automatic analysis of macroarrays' images, Proceedings of the 32nd Annual International Conference of the IEEE EMBS - EMBC 2010, (in press).
- Cunha, M.; Poças, I.; Marçal, A.R.S.; Rodrigues, A.; Pereira, L.S. 2010. "Evaluating MODIS vegetation indices using ground based measurements in mountain semi-natural meadows of Northeast Portugal," Geoscience and Remote Sensing Symposium (IGARSS), 2010 IEEE International, 1525-1528 pp.
- Cunha, M., Marçal, A. Rodrigues, A. 2010. A Comparative Study of Satellite and Ground-Based Vineyard Phenology. Imagin[e,g] Europe- Proceedings of the 29th Symposium of the European Association of Remote Sensing Laboratories, Chania, Greece, Edited by Ioannis Manakos, Chariton Kalaitzidis, 68-77pp.
- Marçal, A.R.S.; Rodrigues, A.; Cunha, M. 2010. "Evaluation of satellite image segmentation using synthetic images," Geoscience and Remote Sensing Symposium (IGARSS), 2010 IEEE International, 2210-2213 pp.
- Pôças, I., Cunha, M., Marçal, A. R. S., and Pereira, L. S. 2010. Aplicação da detecção remota à monitorização de lameiros, regadios ancestrais de montanha. In L. S. Pereira, F. R. Victoria, P. Paredes, M. Garcia, E. Palacios, & A. Torrecillas (Eds.), Tecnologias para o Uso Sustentável da Água em Regadio, Edições Colibri e CEER, Lisboa, 42-45pp.
- Ribeiro, R.; Torres, J.; Gomes, V.; Carretero, M.A.; Sillero, N.; Llorente, G.A. (2010): Unsuspected richness near home. New herpetological records in Porto Metropolitan Area (NW Portugal). Boletín de la Asociación Herpetológica Española 21: 27-30.
- Matos, C.; Sillero, N.; Soares, A. (2010): New records of Pelodytes spp. and Pleurodeles waltl outside their distribution range in northern Portugal. Herpetology Notes 3: 293-294.
- Sillero, N.; Barbosa, M.A.; Martínez-Freiría, F.; Real, R. (2010) Los modelos de nicho ecológico en la herpetología ibérica: pasado, presente y futuro. Boletín de la Asociación Herpetológica Española 21: 2-24.
- Sillero, N.; Ribeiro, R. (2010): Reproduction of Pelophylax perezi in brackish water in Porto (Portugal). Herpetology Notes 3: 337-340.
- Sillero, N. (2010): The herpetofauna of Pessegueiro Island, including the first Portuguese insular population of *Blanus cinereus*. Herpetology Notes 3: 27-31.
- Gomes Pereira, L., Gonçalves, G. Accuracy of a DTM Derived from Full-waveform Laser Scanning Data under Unstructured Eucalypt Forest: A Case Study. XXIV FIG International Congress 2010, Sydney, Australia.
- Gonçalves, G., and Gomes Pereira, L.. Assessment of the performance of eight filtering algorithms by using full-wave form LiDAR Data of Unmanaged Eucalypt Forest. Silvilaser2010, the 10th International Conference on LiDAR Applications for Assessing Forest Ecosystems, September 14th - 17th, 2010, Freiburg, Germany
- Ferraz, A., Bretar, F., Jacquemoud, S., Gonçalves, G, Gomes Pereira, L. 3D segmentation of forest structure using an adaptive mean shift based procedure. Silvilaser 2010, the 10th International Conference on LiDAR Applications for Assessing Forest Ecosystems, September 14th - 17th, 2010, Freiburg, Germany.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Ferraz, A., Bretar, F., Jacquemoud, S., Gonçalves, G., Gomes Pereira, L. 3D segmentation of forest structure using an mean shift based algorithm. ICIP2010, International Conference on Image Processing, September 26-29, Hong Kong.
- Cambra, S., Gomes Pereira, L., Keizer, J. Effect of the Resolution and Accuracy of DTM Produced with Aerial Photogrammetry and Terrestrial Laser Scanning on Slope and Catchment-scale Erosion Assessment in a Recently Burnt Forest Area: a Case study. Geophysical Research Abstracts, Vo. 12, EGU2010-6880, General Assembly 2010.
- Vieira, D., Keizer, J., Nunes, J., Fernandes, I., Ferreira, R., Gomes Pereira, L., Prats, S., Rial, M., Varela, M., Hydrological and erosion response at micro-plot to catchment scale following forest wildfire, north-central Portugal. Geophysical Research Abstracts, Vo. 12, EGU2010-14401, EGU General Assembly 2010.

Other national publications

- Filgueiras, O., Pais-Barbosa, J., Teodoro, A. C., 2010, "Optimização de um sistema de informação geográfica para a zona costeira portuguesa", 1as Jornadas de Engenharia Hidrográfica, Instituto Hidrográfico 2010.
- Inês Santos, Ana Teodoro e Francisco Taveira-Pinto, 2010, "Análise da evolução morfológica da restinga do rio Douro", 5ªs Jornadas de Hidráulica, Recursos Hídricos e Ambiente da FEUP, FEUP, 2010.
- Joaquim Pais-Barbosa, Ana C. Teodoro, Fernando Veloso-Gomes, Francisco Taveira-Pinto, 2010, "Classificação Hidromorfológica de Praias Utilizando Técnicas de Classificação de Imagem", Cartografia e Geodesia, Actas da VI Conferência Nacional de Cartografia e Geodesia, Lidel, 199-209, ISBN:978-972-757-627-2.
- José Nuno Lima, "Portos dos Açores: Plano do Sistema de Observação Geodésica com o GNSS", LNEC, Relatório 258/2010 – DBB/NGA, Julho de 2010.
- José Nuno Lima, "GNSS (GPS+GLONASS+GALILEO) e a Engenharia", XVIII Congresso Nacional da Ordem dos Engenheiros – A Engenharia no Século XXI, Aveiro, 4 a 6 de Novembro de 2010.
- José Nuno Lima, "GNSS (GPS+GLONASS+GALILEO) e a Engenharia", Ingenium II Série, nº 120, Novembro/Dezembro de 2010, pág. 26 e 27.
- Osório, J. Pereira, "Almirante Gago Coutinho – 140 anos do seu nascimento-50 anos da sua morte", Boletim da Sociedade de Geografia de Lisboa, Série 128ª-Ns. 1-12, pp.17-50.
- Pais-Barbosa, J., Veloso-Gomes, F. & Taveira Pinto, F., 2010, "Análise de formas e padrões costeiros como indicadores de erosão na zona costeira noroeste de Portugal", Revista da Associação Portuguesa de Recursos Hídricos, (APRH), Volume 31#2, pp 15-26.
- Petan, S., Taveira-Pinto, F., Mikoš, M., Pais-Barbosa, J., 2010, "Modelação da erosão do solo da bacia hidrográfica do Rio Leça, com a Equação RUSLE e SIG", Revista da Associação Portuguesa de Recursos Hídricos, (APRH), Volume 31#1, pp 99-110.
- P. Santos, Francisco Frias de Barros, Nuno Lima, "Trabalhos Geodésicos no Arquipélago de Cabo Verde", Álbum Cartográfico de Cabo Verde, Comissão de Cartografia (1883-1936), IIPC, Lisboa 2010, pp 86-101, ISBN: 978-989-96036-0-8.
- P. Santos, A. Morgado e C. Nunes, "Missões Geodésicas, Cartografia e Detecção remota", Catálogo da Exposição Viagens e Missões Científicas nos Trópicos (1883-2010), IICT, Lisboa, 2010, pp.46-49.
- Santos, Paula (2010) - "Boas cercas fazem bons vizinhos: o caso das Fronteiras de Moçambique". Comunicação apresentada à reunião do Conselho de Orientação e Unidade de Acompanhamento do IICT prévia à abertura da Noite Europeia de Investigadores, no Jardim Botânico Tropical. Lisboa, 24 de Setembro de 2010.
- Sabugosa-Madeira, B., Cunha, M. e Abreu, I. 2010. Calendário de meladas no litoral Norte de Portugal. O Apicultor 67:12-15. ISSN – 0873-2981
- Sabugosa-Madeira, B., Cunha, M. e Abreu, I. 2010. As abelhas, a vinha e os pesticidas. O Apicultor 70:23-25. ISSN – 0873-2981

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- Carneiro, A. Cunha, M., Pereira, O. Queiroz; J. 2010. Avaliação nutricional da videira pelo sistema integrado de diagnóstico e recomendação (DRIS). 8º Simpósio de Vitivinicultura do Alentejo, 2010: 487-495 - Évora.
- Mota, T., Menezes, J., Garrido, J., Cunha, M., e Queiroz; J. 2010. Efeito da aplicação do regulador de crescimento 'Prohexadiona de Cálcio' (REGALIS®) na casta Alvarinho (V. Vinifera L.) na região dos Vinhos Verdes. 8º Simpósio de Vitivinicultura do Alentejo, 2010: 17-27, Évora.
- Queiroz; J., Cunha, M., Fonseca, A., Machado, M., Borges, L., Castro, R., Sousa, M., Magalhães, A. e Guimaraens, D. 2010. Viticultura em forte declive e condução de videiras em patamares estreitos na região do douro – 4 anos de resultados. 8º Simpósio de Vitivinicultura do Alentejo, 2010: 209-219 – Évora.
- Loureiro, A.; Sillero, N. (2010): Metodología. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O. (Coords.): Atlas dos Anfíbios e Répteis de Portugal. Esfera do Caos, Lisboa. 256 pp.
- Sillero, N. (2010): Chalcides bedriagai. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O. (Coords.): Atlas dos Anfíbios e Répteis de Portugal. Esfera do Caos, Lisboa. 256 pp.
- Sillero, N. (2010): Chalcides striatus. In: Loureiro, A.; Ferrand, N.; Carretero, M.A.; Paulo, O. (Coords.): Atlas dos Anfíbios e Répteis de Portugal. Esfera do Caos, Lisboa. 256 pp.
- Gonçalves, G., Gomes Pereira, L. Integração de dados LIDAR e Orto-Imagens CIR na Extração de Modelos Digitais de Terreno de Zonas Urbanas: Resultados Preliminares. Conferência Ibérica ESIG 2010
- Keizer J.J., Nunes J.P., Sande Silva J., Gomes Pereira L., Vieira D.C.S., Varela M.E.T., Prats S.A., Pinheiro J., Pereira V.M.F.G., Mendes H., Malvar M.C., Maia P.A.A., Ferreira R.S.F., Faria S., Coelho C.O.A., Albuquerque A., Abrantes N.J., Benali A., Santos A.S.F., Magalhães M.C.F.S., Ferreira A.J.D., Fernandes I.A.C., Cambra S. The study of soil, hydrological, erosion and vegetation processes following wildfire in the Colmeal study area, central Portugal. 6th International Conference on forest Fire Research, 15-18 Nov 2010, Coimbra, Portugal.

Ph.D. thesis completed

2010. Isabel Pôças. Os lameiros no contexto das paisagens de montanha. Monitorização por detecção remota em diferentes escalas espaço-temporais. Doutoramento em Ciências Agrárias, Faculdade de Ciências da Universidade do Porto.

Organization of conferences

Joint European National Astronomy Meeting - JENAM 2010

www.jenam2010.org, as LOC

NATO Lecture Series on "Low-Cost Navigation Sensors and Integration Technology", Local Enrollment Coordinator.

Preparation of a GREAT-Gaia Research for European Astronomy Training workshop, to be held next June, at CICGE, with financial support from European Science Foundation (ESF) and INAF-OATo (Italy).

7 – OBSERVATÓRIO ASTRONÓMICO PROF. MANUEL DE BARROS DA FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DO PORTO (ASTRONOMICAL OBSERVATORY PROF. MANUEL DE BARROS OF THE FACULTY OF SCIENCES OF THE UNIVERSITY OF PORTO)

7.1 – INTRODUCTION

Presently the main areas of research at the Astronomical Observatory of the University of Porto (OAUP) are essentially satellite positioning and navigation, with applications in geodynamics, environmental monitoring, mobile mapping and airborne gravimetry.

The most relevant activities in the period 2007-2010 were:

- A new algorithm based on GPS/INS integration for airborne gravimetry was successfully implemented involving software development and hardware integration.

The system was applied in the acquisition of real data for regional geoid improvement in the Madeira Archipelago (Portugal).

- The group continued the work on coastal monitoring for vulnerability and risk assessment through the synergetic exploitation of several geodetic techniques. Environmental monitoring was based on different assessment tools with the exploitation of Mobile Mapping techniques (with videogrametry) for the morphodynamic characterization of sandy littorals and the assessment of sediments transfer.

Improvements were introduced in the OAUP Mobile Mapping system based on the integration of GPS measurements with data from dead-reckoning sensors and videogrametry.

New data was acquired in the scope of the sandy littorals monitoring program, using a multi-technique approach with the integration of data acquired with Mobile Mapping Technologies and airborne imagery data to build Digital Terrain Models (DTM) for the characterization of the morphodynamic evolution of sandy littorals.

- Maintenance of permanent GPS stations in the Azores region for geodynamic studies.

Continuation of the improvement of the algorithms for GPS time-series analysis, aiming at the detection and interpretation of seasonal signals.

An online GPS time-series analysis provider was implemented (GEODAC - www.geodac.net) in collaboration with the University of Beira-Interior. GEODAC is an initiative associated with the activities of the Inter Commission Project of the International Association of Geodesy, WEGENER). This facility allows the estimation of trends (in GPS time series) with realistic error bars. The time-series analysis software estimates, using MLE, the velocities of the North, East and Up component and the associated errors under the assumption that the noise is well described by a white plus power-law noise model.

The results can be returned in the form of tables and figures and/or archived in a MySQL database.

- The following list of publications and communications, resulting from the developed activities, expresses the main results achieved.

7.2 – COMMUNICATIONS AND PUBLICATIONS

Peer-review articles in international scientific journals

Luisa Bastos, Machiel Bos and Rui Manuel Fernandes (2010) – “Deformation and Tectonics: Contribution of GPS Measurements to Plate Tectonics – Overview and Recent Developments”. Sciences of Geodesy – I, Advances and Future Directions. Xu, Guochang (Ed.). 1st Edition., 2010, XVII, 507 p. 100 illus., Hardcover. ISBN: 978-3-642-11740-4

GENG, Y., R. DEURLOO, R. AND L. BASTOS (2010). “Hybrid Derivative-free Extended Kalman Filter for Unknown Lever-arm Estimation in Tightly-coupled DGPS/INS Integration”, GPS Solutions. DOI: 10.1007/s10291-010-0190-8.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- J. J. SOUSA, A. M. RUIZ, R. F. HANSEN, L. BASTOS, A. J. GIL and J. GALINDO-ZALDÍVAR (2010). "PS-InSAR processing methodologies in the detection of field surface deformation - study of the Granada basin (Central Betic Cordilleras, Southern Spain)". *Journal of Geodynamics* 49 (2010), pp. 181-189. DOI 10.1016/j.jog.2009.12.002.
- M.S. BOS, L. BASTOS, R.M.S. FERNANDES (2010). "The influence of seasonal signals on the estimation of the tectonic motion in short continuous GPS time-series". *Journal of Geodynamics* 49 (2010), pp. 205-209. DOI 10.1016/j.jog.2009.12.002.
- FERNANDES M. J., LÁZARO, C., NUNES, A. L., PIRES, N., BASTOS, L., MENDES, V. B. (2010). "GNSS-derived Path Delay: an approach to compute the wet tropospheric correction for coastal altimetry". *IEEE Geoscience and Remote Sensing Letters*, DOI:10.1109/LGRS.2010.2042425
- MADEIRA, S. BASTOS, L., GONÇALVES, J. (2009). "Photogrammetric mapping and measuring application using MATLAB". *Computers and Geosciences*, 36-6 (699-706).
- M.S. BOS, L. BASTOS, R.M.S. FERNANDES (2009). "The influence of seasonal signals on the estimation of the tectonic motion in short continuous GPS time-series". *Journal of Geodynamics* DOI 10.1016/j.jog.2009.10.005.
- BOS, M.S., R.M.S. FERNANDES, S.D.P. WILLIAMS, AND L. BASTOS (2007). "Fast error analysis of continuous GPS observations". *Journal of Geodesy*, DOI 10.1007/s00190-007-0165-x, 2007.
- BAPTISTA, P., BASTOS, L., BERNARDES, C., CUNHA, T., DIAS, J., Monitoring Sandy Shores Morphologies by DGPS (2007). A Practical Tool to Generate Digital Elevation Models. *Journal of Coastal Research*. DOI: 10.2112/07-0861. 2007.
- FERNANDES, R.M.S., MIRANDA, J.M., MEIJNINGER, B.M.L., BOS, M.S., NOOMEN, R., BASTOS, L., AMBROSIUS, B.A.C., RIVA, R.E.M., "Surface Velocity Field of the Ibero-Maghrebian Segment of the Eurasia-Nubia Plate Boundary", *Geophysical Journal International*, Vol.

Other Publications and Communications

- GENG, Y., R. DEURLOO, R. AND L. BASTOS (2011). A Method for Automatic Lever-arm Estimation in Loosely-coupled GNSS/INS Integration System using Unscented Particle Filter. *Proceedings of 2011 International Technical Meeting, ITM 2011, January 25-27, San Diego, USA.*
- GENG, Y., R. DEURLOO, R., L. BASTOS AND J. SOUSA (2011). A Low-cost MEMS IMU/DVL/Pressure Sensor Integrated Navigation System for Autonomous Underwater Vehicle. *Proceedings of 2011 International Technical Meeting, ITM 2011, January 25-27, San Diego, USA.*
- H. GRANJA, L. BASTOS, J. PINHO, J. GONÇALVES, R. HENRIQUES, A. BIO, J. MENDES, A. MAGALHÃES (2010). Risk Assessment in Coastal Zones Based on a Comprehensive Short Term Monitoring Programme. 12º Encontro Nacional de Ecologia, Porto, 18-20 October 2010.
- M.S. BOS, R.M.S FERNANDES, I.B. ARAÚJO and L. BASTOS (2010). Error analysis of Cascais absolute sea-level change. 2nd International conference on Data Analysis and Modelling in Earth Sciences DAMES'2010 will be held at IDL, University of Lisbon, Portugal, 22 - 24 September 2010.
- H. GRANJA, L. BASTOS, J. PINHO, J. GONÇALVES, R. HENRIQUES, A. BIO (2010). Small Harbours Risks: Lowering for Fishery and Increasing Erosion. The Case of Portinho da Aguda (NW Portugal). *Proceedings of Littoral 2010, London, 21-23 September, 2010.*
- J. A. GONÇALVES; L. BASTOS, H. GRANJA, J. L. PINHO, R. HENRIQUES, A. MAGALHÃES (2010). "Monitorização de praias e dunas usando fotografia aérea digital com georeferenciação directa". *ESIG 2010.*
- J. J. SOUSA, A. M. RUIZ; A. J. HOOPER, R. F. HANSEN; L. C. BASTOS; A. J. GIL; J. GALINDO-ZALDÍVAR and C. SANZ DE GALDEANO (2010). Anthropogenic subsidence revealed by MTI in an area of active tectonics: Granada basin. *Proceedings (DVD) of ESA Living Planet Symposium, 28 June – 2 July, 2010, Bergen, Norway.*
- J. J. SOUSA, A. M. RUIZ; A. J. HOOPER, R. F. HANSEN; L. C. BASTOS; A. J. GIL; J. GALINDO-ZALDÍVAR and C. SANZ DE GALDEANO (2010). Evaluation of MTI Feasibility for Monitoring Millimetric Deformation in Mountainous Areas. *Proceedings (DVD) of ESA Living Planet Symposium, 28 June – 2 July, 2010, Bergen, Norway.*

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- J. A. GONÇALVES, L. BASTOS, H. GRANJA, J. L. PINHO, R. HENRIQUES, A. Magalhães, 2010. "Monitorização de praias e dunas usando fotografia aérea digital com georreferenciação directa". Actas do ESIG2010 - Encontro Nacional de Utilizadores de Informação Geográfica.
- J. SOUSA, A. HOOPER, R. HANSEN AND L. BASTOS (2009). Comparative Study of Two Different PS-InSAR Approaches: DePSI vs. StaMPS, presented at the Fringe 2009 Workshop, ESA ESRIN, 30th November - 4th December 2009, Frascati, Italy.
- JOANA FERNANDES, C. LÁZARO, L. BASTOS, N. PIRES, A. NUNES, V. MENDES, S. BARBOSA, P. CIPOLLINI (2009) - GNSS-Derived Path Delay: a Method to Compute the Wet Tropospheric Correction for Coastal Altimetry, 3rd Coastal Altimetry Workshop, 17-18 September 2009, Frascati, Italy.
- DEURLOO, R. BASTOS, L., M.S. BOS (2009). On the Use of UAVs for Strapdown Airborne Gravimetry, poster presented at the IAG2009 Assembly, Buenos Aires, Argentina, August-September 2009.
- BASTOS, L., MADEIRA, S., GONÇALVES, J. (2009). A Land Based MMS for Coastal Monitoring, presented at the IAG2009 Assembly, Buenos Aires, Argentina, August-September 2009.
- BASTOS, L., MADEIRA, S., GONÇALVES, J. (2009). A Land Based MMS for Coastal Monitoring, presented at the IAG2009 Assembly, Buenos Aires, Argentina, August-September 2009.
- GONÇALVES J.A., MADEIRA S. and BASTOS L.(2009). Application of a Low Cost Mobile Mapping System to Coastal Monitoring. 6th International Symposium on Mobile Mapping Technology (MMT09), 21-24 July, Presidente Prudente, São Paulo, Brazil.
- MADEIRA, S., GONÇALVES, J., BASTOS, L.(2009). Fast Camera Calibration for Low Cost Mobile Mapping. Presented at 6th International Symposium on Mobile Mapping Technology (MMT09), 21-24 July 2009 - Presidente Prudente, São Paulo, Brazil.
- RUI VILAR, S. BABICHENKO, L. BASTOS, J. T. PALENZUELA, J. MARTÍN-HERRERO, A. B. UTKIN, A. LAVROV (2009). Detection and Evaluation of Oil Spills by Optical Methods, "4th EARSeL Workshop on Remote Sensing of the Coastal Zone", Chania (Crete), Greece 18-20 June 2009.
- J. J. SOUSA; A. M. RUIZ; R. F. HANSEN; L. BASTOS; A. J. GIL; J. GALINDO-ZALDÍVAR; C. SANZ DE GALDEANO (2009). Estudo Comparativo: Processamento PS-InSAR para Detecção de Deformações da Crusta Terrestre – Caso de Estudo: Bacia de Granada (Cordilheira Bética, Sudeste de Espanha). VI Conferência Nacional de Cartografia e Geodesia (CNCG 2009), 7 e 8 de Maio 2009, Caldas da Rainha.
- RICHARD DEURLOO; BASTOS, L., BOS, M. (2009). Assessing the Use of UAV's for Airborne Gravimetry. VI Conferência Nacional de Cartografia e Geodesia (CNCG 2009), 7 e 8 de Maio 2009, Caldas da Rainha.
- L. BASTOS, BIO, A., SILVA, A. J. (2009). Evolução da restinga do Douro face às condições meteorológicas, hidrométricas e de agitação marítima, 2002-2008. WORKSHOP "Douro e Minho – estuários e zona costeira", 16 e 17 de Abril 2009, APDL, Matosinhos.
- L. SOBRINHO-GONÇALVES, P. OLIVEIRA, R. CATARINO, A. J. SILVA, L. BASTOS, T. MOITA (2009). Indicadores fitoplanctónicos de diferentes massas de água durante o Inverno na costa NO Ibérica (NICC 2006-07). WORKSHOP "Douro e Minho – estuários e zona costeira", 16 e 17 de Abril 2009, APDL, Matosinhos.
- A. J. da SILVA, I. MARTINS, A. SANTOS, L. BASTOS (2008). NW Iberian Coastal Current: a feature of extreme freshwater and wind conditions. Presented at the International Symposium on the Effects of Climate Change on the World's Oceans, Gijón, Spain, May 2008.
- A. J. da SILVA, I. MARTINS, A. OLIVEIRA, L. BASTOS (2008). An Intermittent Northwest Iberian Coastal Current. Presented at the 5th EuroGOOS Conference "Coastal to Global Operational Oceanography: Achievements and Challenges", Exeter, U.K., May 2008.
- L. BASTOS and SILVA (2008). "Use of GPS based drifters in the study of Coastal Currents", poster presented at the 13th FIG Symposium on Deformation Measurements and Analysis, May 12-15, 2008, Lisbon, Portugal.

**INTERNATIONAL ASSOCIATION OF GEODESY
NATIONAL REPORT OF PORTUGAL**

- J. J. SOUSA, A. M. RUIZ, R. F. HANSSSEN, Z. PERSKI, L. BASTOS, A. J. GIL and J. GALINDO-ZALDÍVAR (2008). Ps-InSAR measurement of ground subsidence in Granada area (Betic cordillera, Spain). 13th FIG Symposium on Deformation Measurements and Analysis and 4th IAG Symposium on Geodesy for Geotechnical and Structural Engineering, 12-15 May 2008, LNEC, Lisbon (Portugal).
- SILVA, A.J., MARTINS, I., BASTOS, L. (2008). An intermittent coastal current generated by buoyancy and wind forcing, Geophysical Research Abstracts, Vol. 10 (CD-ROM), EGU2008.
- J. J. SOUSA, A. M. RUIZ, R. F. HANSSSEN, Z. PERSKI, L. BASTOS, A. J. GIL and J. GALINDO-ZALDÍVAR (2008). Monitorização de deformações na Bacia de Granada usando PS-InSAR. Luso-Spanish Assembly of Geodesy and Geophysics. 11-14 February 2008, Tomar, Portugal.
- A. M. Ruiz, J. Sousa, R. F. Hanssen, Z. Perski, A. J. Gil, L. Bastos and J. Galindo-Zaldívar (2008). Measurement of ground subsidence in the Granada area (Southern Spain) using PS-InSAR. International Congress on Geomatics and Surveying Engineering. 18-21 February, Valencia (Spain).
- A. J. da SILVA, I. M. MARTINS e L. BASTOS (2008) - Assessing the Existence of a Northwest Iberian Coastal Current. Actas da 6ª Assembleia Luso Espanhola de Geodesia e Geofísica, 11-14 de Fevereiro, 2008, Tomar, Portugal.
- J. Sousa, R. F. Hanssen, L. Bastos, A. M. Ruiz, Z. Perski and A. J. Gil (2007). Ground subsidence in the Granada city and surrounding area (Spain) using DInSAR monitoring. 2007 American Geophysical Union Fall Meeting, 1014 December, San Francisco, CA, (USA).
- BAPTISTA, P., BASTOS, L., GRANJA, H., GAMA, C., BERNARDES, C. (2007). Methodological approaches to shoreline assessment: short-term analysis of beach erosion rates. 8th International Symposium on GIS and Computer Mapping for Coastal Zone Management (Coastgis07). Santander, Spain. 8-10 October 2007.
- BASTOS, L., M.S. BOS, J. CATALÃO AND R. DEURLOO (2007) - "Optimizing the flight-path for airborne gravimetry campaigns". Oral presentation at IUGG 2007 Assembly, Perugia, Italy, July 2007.
- FERNANDES, R.M.S., J.M. Miranda, L. Bastos, J. Catalão (2007) - "Understanding the Azores Triple Junction using Space-Geodetic Observations". Oral presentation at IUGG 2007 Assembly, Perugia, Italy, July 2007.
- MADEIRA, S. BASTOS, L., GONÇALVES, J. (2007) - "Implementation of a Low Cost Mobile Mapping System". Proceedings of 5th the International Symposium on Mobile Mapping Technology (MMT'07), Padua Italy, May 2007.
- SOUSA, J., HANSSSEN, R., BASTOS, L., FERNANDES, R., PERSKI, Z., RUIZ, A., GIL, A.J. (2007) – "Monitorização de deformações na Bacia de Granada recorrendo à interferometria radar: Resultados preliminares". Actas da V Conferência Nacional de Cartografia e Geodesia, pp. 185-196, 19 e 20 de Abril 2007, Lisboa.
- M. S. BOS., C. LÁZARO, L. BASTOS (2007) – "Analysis of the Gravity Campaigns made in Faial, Azores". Actas da V Conferência Nacional de Cartografia e Geodesia, Lisboa, Portugal 19 e 20 de Abril de 2007.
- FERREIRA, A. R., CLARA L., FERNANDES, M. J., BIO A., SOBRAL, M. C., BASTOS L., GONÇALVES, J. A. (2007) – "Base de Dados de Informação de Satélite para a Zona do Atlântico Nordeste". Actas da V Conferência Nacional de Cartografia e Geodesia, Lisboa, Portugal 19 e 20 de Abril de 2007.
- BOS, M.S., FERNANDES, R.M.S, VAN DAM, T.; BASTOS, L. (2007) - "Modeling atmospheric loading using BLQ files". Presented at "EGU General Assembly 2007", Vienna, Austria, April 2007.
- KHALIL, H., MAHMOUD, S., RAYAN, A., FERNANDES, R.M.S; MIRANDA, J.M., BASTOS, L.(2007) - "Crustal deformation patterns in Northern Egypt derived from GPS campaign data". Presented at "EGU General Assembly 2007", Vienna, Austria, April 2007.
- Ruiz, A.M.; Sousa, J.J.; Hanssen, R.F.; Perski, Z.; Bastos, L. and Gil, A.J. (2007). Deformation in the Granada Basin (Southern Betic Cordillera) studied by PS-InSAR: preliminary results. ENVISAT SYMPOSIUM 2007, 23-27 April, Montreaux (Switzerland).

Invited talks

BASTOS, L., BIO, A., SILVA, A. J. (2009) - Evolução da restinga do Douro 2001/2009 - dinâmica e possíveis causas. Apresentado na sessão pública sobre o futuro Plano de Ordenamento do Estuário do Douro promovida pela ARH. 23 de Novembro, 2009, ICBAS, Porto.

BOS, M.S., PENNA, N.T., BAKER, T.F. SCHERNECK, H.-G. and BASTOS, L. (2008): "Current state of ocean tide loading displacement modelling". EGU 2008, Vienna, Austria.

7.3 – PROJECTS

- Detection and Evaluation of Oil Spills by Optical Methods (DEOSOM) - AMPERA
- Unmanned Air Vehicles development program (PITVANT) – Ministry of Defense
- Kinematics of the African Margins (KINEMA) - FCT
- Measuring the geoid over Madeira (GEOMAD) – EUFAR (7FP)
- Coastal Dynamics and Stability of Water Defense Structures Monitoring by Satellite Radar Interferometry (Northern Portugal) – ESA
- Northwest Iberian Coastal Current (NICC) – FCT
- A Tool for Improving the Performance of Airborne Gravity systems (TIPGRAV) – FCT
- Estuarine COntributions to Inner Shelf dynamics (ECCOIS) - FCT
- Kinematics And Rheological Modeling of the Nubian-Eurasian plate boundary in the Azores (KARMA) - FCT
- Integration of Digital Surface Models With Multi -Spectral Images for Classification and Modeling of the Earth Surface (MOCTIM) - FCT

7.4 – PHD THESIS CONCLUDED OR UNDER DEVELOPMENT IN 2007 - 2010

- Evaluation of urban growth based on 3D city models extracted from high resolution digital images (in development)
- GNSS precise dynamic absolute positioning – application in oceanographic buoys (in development).
- Development of a Kalman filter integrating system and measurement models for a low-cost strapdown airborne gravimetry system (2010, waiting for defense).
- Integration of DInSAR and DGPS for location and characterization of active faults (2009, concluded).
- Sistema Móvel Terrestre de Levantamento com Integração em SIG (2007, concluded)