National Report of Greece
to the International Union of Geodesy and Geophysics 1999-2002

Contributions in

Geodesy
Geomagnetism and Aeronomy
Hydrological Sciences
Atmospheric Sciences
Physical Sciences of the Ocean
Seismology and Physics of the Earth’s Interior
Volcanology and Chemistry of the Earth’s Interior

Prepared on the occasion
XXIII General Assembly of the
International Union of Geodesy and Geophysics (IUGG)
in Sapporo, Japan, June 30 – July 11, 2003

Athens 2003
### ΠΕΠΙΕΧΟΜΕΝΑ

1. GEODESY ................................................................. 4
   1.1 HELLENIC MILITARY GEOGRAPHICAL SERVICE (HMGS) .......... 4
   1.2 TOPOGRAPHIC SERVICE OF THE MINISTRY OF AGRICULTURE ... 16
   1.3 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA) ......... 17
   1.4 THE DEPARTMENT OF GEODESY AND SURVEYING, ARISTOTLE UNIVERSITY OF THESSALONIKI ................................................................. 22
   1.5 THE HELLENIC PETROLEUM CORPORATION ................................ 33
   1.6 KTIMATOLOGIO S.A. AND HELLENIC MAPPING AND CADASTRE ORGANIZATION ...... 35

2. GEOMAGNETISM AND AERONOMY .................................. 36
   2.1 THE INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION (IGME) 36

3. HYDROLOGICAL SCIENCES .............................................. 37
   3.1 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA) ............ 37

4. ATMOSPHERIC SCIENCES ................................................. 38
   4.1 HELLENIC NATIONAL METEOROLOGICAL SERVICE ..................... 38
   4.2 NATIONAL OBSERVATORY OF ATHENS ........................................ 47
       4.2.1 Institute for Environmental Research & Sustainable Development .47
       4.2.2 Institute for Space Applications & Remote Sensing ............ 54

5. PHYSICAL SCIENCES OF THE OCEAN ............................... 63
   5.1 HELLENIC NAVY HYDROGRAPHIC SERVICE ............................... 63
   5.2 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA) .............. 65

6. SEISMOLOGY AND PHYSICS OF THE EARTH’S INTERIOR .......... 66
   6.1 NATIONAL OBSERVATORY OF ATHENS - INSTITUTE OF GEODYNAMICS ......... 66
   6.2 Department of Geophysics, Aristotle University of Thessaloniki ....... 86
   6.3 Hellenic Petroleum S.A. ......................................................... 96

7. VOLCANOLOGY AND CHEMISTRY OF THE EARTH’S INTERIOR .... 96
   7.1 National Observatory of Athens - Institute of Geodynamics ........... 96
Foreword

This report was prepared under the direction of the Hellenic National Committee for Geodesy and Geophysics, the IUGG adhering organization for Greece, on the occasion of the XXIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Sapporo, Japan, June 30 – July 11, 2003.

The aim of the report is to communicate to both the Hellenic and international scientific communities the progress that has been achieved in Geodesy and Geophysics in Greece for the period 1999 to 2002 inclusive. The reported activities are presented in seven sections — one for each of the seven major scientific disciplines as represented by the respective Associations of IUGG. For each scientific area the contributions of each of the government and educational institutions involved in the respective activities is reported.

Each section is titled with the name of the corresponding society and was compiled by, or under the direction of, a member of the HNC/IUGG affiliated with that society. In the interest of compiling and disseminating this report in a timely fashion, no attempt has been made to edit or harmonize the styles of the different sections.

The Hellenic National Committee for Geodesy and Geophysics has decided that the full text of this report, including the extensive lists of publications, become available and in electronic form. The full National Report may be obtained via the Internet in Adobe® Portable Document Format (PDF), by retrieving the file with the following universal resource locator (URL):


The editors of this report acknowledge the work of all persons who have contributed material for the activities of their institutions, as well as the logistic support by the Hellenic Military Geographical Service for publishing the printable version of this report.

Editorial Board

Prof. Ch. Billiris
National Committee for Geodesy and Geophysics
National Technical University of Athens

Assistant Prof. D. Delikaraoglou
National Technical University of Athens
1. GEODESY

The Institutes involved in geodetic activities in Greece during the reporting period were:

- The Hellenic Military Geographical Service
- Topographic Service of the Ministry of Agriculture
- The School of Rural And Surveying Engineering, National Technical University of Athens
- The Department of Geodesy and Surveying, Aristotle University of Thessaloniki
- The Hellenic Petroleum Corporation
- Ktimatologio S.A. and Hellenic Mapping and Cadastre Organization

1.1 HELLENIC MILITARY GEOGRAPHICAL SERVICE (HMGS)

I. Leveling

1. The first order leveling lines KORINTHOS-TRIPOLI and PIRGOS-PATRA have been measured.
2. The instruments WILD N3 and INVAR LEVELLING RODS were used in the First Order Levelling.
3. The aller-retour leveling method has been used and carried out by different observers and sets of instruments. Maximum length of site for each leveling observation was 25 meters. Geopotential numbers and orthometric heights were computed for every benchmark.
4. The difference between the aller and retour ways was always kept below 1mm/km.

II. Satellite Geodesy

HMGS planned, established, measured and adjusted the national GPS network for the entire Greece.

During the years of 1998 and 1999 office preparations and planning took place, and pillar selection was done in the field. On the top of the pillars used, there was placed a special metal structure which secures a stable antenna, so that to ensure that the same center and antenna height is used for each new measurement.

The GPS measurements were performed during the years 2000 and 2001. As a primary-reference station, it was used the permanent GPS station of Dionysos Satellite Observatory in Athens.

This network consists of:

- 27 reference stations
- 200 stations (pillars of triangulation network)
- 9 tide stations (SELF program)
- 5 SLR stations (WEGENER program)

Additionally there were measured several triangulation pillars and leveling points (benchmarks-repers) as auxiliary and control points.

The processing of the network baselines was completed in May 2003 using the Bernese v. 4.2 software. Furthermore the adjustment of reference stations was performed using the Columbus v. 3.2 software.

Chart 1 below depicts all of the stations included in the Hellenic GPS network 2002.

![Chart 1: Hellenic GPS Network 2002](image)

III. Gravimetry

1. In the Second Order Gravimetric Network **55** from **86** stations in the areas of Peloponesus, East Macedonia-Thrace, Kyklades, Sporades, and Dodecanisa have been re-measured and the corresponding temporal variances of the gravity charts between the years 1990 and 2000 were compiled.

2. Gravity measurements have been carried out at **182** benchmarks of the First Order Leveling Lines VEROIA-KOZANI-GREVENA and KORINTHOS-
TRIPOLIS. Geopotential numbers and Orthometric heights were computed for each occupied benchmark.

3. The absolute gravity has been re-measured at 39 Leveling Bases of the First Order Leveling Line GREVENA – KOZANI – THESSALONIKI – KAVALA - ALEXANDROUPOLIS in order to calculate the gravity variation and its effect on the orthometric heights. The orthometric height differences were compared to the corresponding ellipsoidal height differences, which have been determined from GPS measurements.

4. Gravity Base of First Order Gravity Network has been established in IGSN’71 in the new National Airport of Athens in Spata.

5. The instruments LACOSTE and ROMBERG MODELS G730 and D107 have been used for the First and Second Order Gravimetric Networks.

6. The ladder-sequence loop method was used.

7. The charts, which follow, depict in order of appearance
   - The temporal variations of Gravity between 2001-1990 in the islands of KYKLADES (Chart 2a), and SPORADES, PELOPONESUS and DODECANISA (Chart 2b).
   - The temporal variations of gravity between 1998-1988 around the area of earthquake epicenter in Athens in September of 1999 (Charts 3).
   - The temporal variations of gravity between 1999-1988 in East Macedonia and Thrace (Charts 4).

Publications

TEMPORAL VARIANCES OF GRAVITY BETWEEN 1999-1999 IN ISLANDS OF KYKLADES.
REFERENCE STATION: THE GRAVIMETRIC STATION OF KALIMNOS
(THE MEASUREMENTS HAVE TAKEN PLACE FROM 7 JUN 1999 TO 8 JUL 1999
BEFORE THE EARTHQUAKE OF ATHENS IN 7 SEP 1999)

THE ISOLINES ARE IN mgals.

TEMPORAL VARIANCES OF GRAVITY IN THIRD VIEW
FOR ABOVE DIAGRAM IN KYKLADES.

Charts 2a
TEMPORAL VARIATION OF GRAVITY BETWEEN 2001-1990 IN PELOPONNEUS AND AEGEAN SEA ISLANDS

THE ISOLINES ARE IN 20 μgals

Charts 2b
TEMPORAL VARIANCES OF GRAVITY BETWEEN 1998-1988 IN REGION OF ATHENS (BEFORE EARTHQUAKE IN 7 SEP 1999)

1, 2, 3, 4, 5, 6: BASE STATIONS OF CALIBRATION LINE IN PARNITHA
HMGS: NATIONAL FUNDAMENTAL GRAVITY BASE IN IGSN' 71
LAMIA ETC: GRAVITY BASES OF NATIONAL GRAVITY BASE NETWORK

Charts 3

Charts 3 Cont'd
TEMPORAL VARIANCES OF GRAVITY BETWEEN 1999-1998
IN REGION OF ATTICA AFTER THE EARTHQUAKE IN 7 SEP 1999.
THE MEASUREMENTS TOOK PLACE IN SEPTEMBER 1999

VALUES ARE IN $\mu$gals

1,2,3,4,5,6: THE GRAVITY STATIONS OF CALIBRATION LINE IN PARNITHA
HMGS: NATIONAL FUNDAMENTAL GRAVITY BASE IN IGSN'971
MEGARA ETC: GRAVITY BASES OF NATIONAL GRAVITY BASE NETWORK

Charts 4 Cont’d
TEMPORAL VARIANCES BETWEEN 1999-1998
IN ATTICA AFTER EARTHQUAKE IN PARNITIA
FROM SOUTH-WEST IN THIRD VIEW.

Charts 4 Cont’d
TEMPORAL VARIANCES OF GRAVITY BETWEEN 1999-1999,
THE MEASUREMENTS HAVE TAKEN PLACE
AFTER THE EARTHQUAKE OF ATHENS
FROM 14 SEP 1999 TO 1 OCT 1999.

THE ISOLINES ARE IN μgal

Charts 4 Cont’d
Charts 3 Cont’d
Charts 4
1.2 Topographic Service of the Ministry of Agriculture

During the reporting period, the activities of the Topographic Service of the Ministry of Agriculture in the field of Geodesy were the following:

a) Except for a few areas near the northern boundaries of the country, full map coverage was achieved with the production of Orthophoto maps in a scale of 1:5000, blocks and codes. The above products were created as part of the I.A.C.S. (Integrated Administrative and Control System for arable and grazing lands) programme, and the GIS-OLI and GIS-VITI software programs (Geographic Information Systems for Olive Trees and Vineyards respectively).

b) The completion and delivery of 264,587 km$^2$ of willing and compulsory Land Consolidation, to the beneficiary farmers, in seventy (70) agricultural and land field in several regions of Greece.

c) Annual inspections of arable and grazing fields with the assistance of Remote Sensing, in certain areas of the country in the context of the I.A.C.S programme.

Sample orthophoto map 1:5000 (code number 408-197) of Corinthia Prefecture
1.3 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA)

During the reporting period, The Laboratory of General Geodesy (Division of Topography) of the National Technical University of Athens was mainly involved in the following areas of research:

- Deformation monitoring of small and medium scale (ground and structures)
- Metrology (quality aspects of conventional surveying and satellite positioning systems)
- Industrial surveying
- Geometric documentation of structures and monuments

Respectively, the Higher Geodesy Lab and the Dionysos Satellite Observatory were involved in the following main scientific areas:

- **Geodesy and Geodynamics using GPS and INSAR technologies**
- **Road mapping and navigation using GPS**
- **Gravity**

**Publications**


• The use of geodetic techniques for the determination of tolerances in pre-fabricated structures (Georgopoulos G., S. Tsoukantas). In: Proc. Of the 13th Hellenic Symposium in Concrete, October, 1999, Rethymnon, Greece (in greek).


• “Speed and maneuverability trials of a 120 m ship” (D. Paradisssis), Pyrforos (3), 2000, in Greek.


• The use of Geodesy and Photogrammetry in documentation and preservation of cultural heritage monuments (Balodimos D.) In: Proc. Of the 3rd Scientific Symposium of the National Technical University of Athens, 7-10 June, 2001, Metsovo, Greece (in greek).


A low cost geodetic engineering method based on observations of the height reference datum to locate suspected tectonic faults in a region (M. Doufexopoulou and V.M. Pagounis). *European Geophysical Society Assembly, EGS XXVI, Nice, 2001* [ poster ].


Geometric documentation and three-dimensional photo-realistic presentation of the stone arc bridge of Kokkorou (Kritharas N., X. Kritsiotaki, E. Bakali, M. Papakosta, A. Georgopoulos, D. Balodimos). In: *Proc. Of the 3rd Scientific Symposium of the National Technical University of Athens, 7-10 June, Metsovo, Greece, 2001* (in greek).


“Demonstrating the utility of SAR differential interferometry for the assessment of earthquake risk” (D. Paradissis, and al.), *CD-ROM, 2001.*


*The use of robotic total station in testing the trajectory of a moving target* (Stathas D., J. Karabelas). *Geomatics Research Australasia, 2001.*


• Tracing signals from the Earth’s crust by using only geodetic observations without inversion (M. Doufexopoulou). Proceedings of Hispanoportuguese Assembly of Geodesy and Geophysics - February 2002

• The lateral variations within the Earth’s crust revealed by an observed geoid (M. Doufexopoulou). IAG Section III, Determination of the Gravity Field, 3rd Meeting of the International Gravity and Geoid Service (Διεθνής Γεωδαιτική Ένωση, Περιοχή ΙΙΙ Προσδιορισμός του πεδίου βαρύτητας, 3η Συνάντηση της Διεθνούς Επιτροπής Βαρύτητας και Γεωειδούς), Thessaloniki, August 2002.


1.4 The Department of Geodesy and Surveying, Aristotle University of Thessaloniki

I. Field Work

GPS measurements in the geodynamically unstable area of Lakes Volvi and Lagada, in order to detect crustal deformations.

Gravity field network measurements and shallow underground water, temperature and other meteorological parameter measurements in different areas of Greece, in the frame of an earthquake prediction program.

II. Contribution to International Associations

- Professor A. Dermanis was individual member of the Special commission SC1 “Mathematical and Physical Foundations of Geodesy”.
- Professor Michael E. Contadakis was member of the Hellenic National Astronomical Committee: 1999-2001, and he is Vice-Chairman (Responsible for Earthquakes Hazard) of the International Working Group on Natural Hazards of European Geophysical Society (2000-now) and member of the Editorial Board of the EGS International Scientific Journal “Natural Hazard and Earth System Sciences” (2002-now).
- Professor D. Rossikopoulos was member of the IAG Special Study Group 4.190 “Non-probabilistic assessment in geodetic analysis”.
- Professor I. N. Tziavos was chairman of the IAG Special Study Group 3.167 “Regional Land and Marine Geoid Modelling”, member of the editorial board of “Journal of Geodesy”, and secretary of section “Geodetic Methodology” of the European Geophysical Society (EGS).

III. Involvement in Research Projects


2. Estimation of crustal deformation parameters in the area of Volvi Lake. Using existing classical observations and since 1995 GPS measurements a geodetic network is rigorously studied. Possible displacements and deformation parameters are estimated applying prediction methods and simultaneous adjustment of all
epochs including extended models as it is the velocity model. Professors A. Fotiou, D. Rossikopoulos and Dr. C. Pikridas contributed to this project.

3. Monitory and study of the sea tides in the Hellenic area. Professors D. Arabelos and S. Spatalas contributed to this project.

4. Professor D. N. Arabelos contributed to the projects:
   - Refinement of observation requirements for GOCE. ESA Sponsored GOCE Study.
   - Eötvös to mGal.
   - European GOCE Gravity Consortium.
   - SAGRADA Satellite Gravity Data Analysis Project.
   - Geophysical investigations of sea, land and ice from a synergy of ENVISAT data. AO-ID 392.

5. Study of the variations of ground waters level and temperature as earthquake precursory phenomena. Professors G. Asteriadis and M. Contadakis contributed to this project.

IV. References


• Arabelos, D., C.C. Tscherning, Improvements in vertical datum control to be expected from the GOCE mission, Presented at the XXIV General Assembly of the EGS, The Hague, 19-23 April, 1999.


• Dermanis, A., *Space Geodesy and Geodynamics - GPS*. Editions Ziti, Thessaloniki, 450 pp., 1999 (in Greek)


• Katsambalos, K. Conclusions from the 1st National Cadastre Pilot Project. Invited speaker in the Conference organized by the Northern Greece Lawyer's Association, Thessaloniki, 2-3 April, 1999 (in Greek).


• Theodoridou, S., K. Tokmakidis, D. Skarlatos, Use of Radio-Controlled Model Helicopters in Archaeology Surveying and in Building construction industry, XIXth ISPRS Congress: Geoinformation for all, Amsterdam 16-23 July 2000.


• Tscherning, C.C., D. Arabelos, A study of the correlations between spherical harmonic coefficients and point related quantities, XXV General Assembly of the EGS, Nice, France April 2000.
- Arabelos, D, G. Asteriadis, M. Contadakis, G. Zioutas, Daoyi Xu, Cunde Zhang and Binghua Zheng, The use of an outlier detecting method in time series of


- Mintsis, G., S. Basbas, P. Papaioannou, C. Taxiltaris and I.N. Tziavos, Applications of GPS technology in the land transportation system, Accepted for publication in *European Journal of Operational Research*.

- Rossikopoulos, D., Modeling Alternatives in deformation measurements. Presented at the First International Symposium on Robust Statistics and Fuzzy Techniques in


Stylianidis, E., L. Sechidis, P. Patias, S. Spatalas, Generating Orthoimages for close-range objects by automatically detecting breaklines, Pres. at Turkish-German Geodetic days, Berlin, 2001.


Tsioukas, V., P. Patias, S. Spatalas, The concept of neutral geometry of digital images and its application in data fusion, Pres. at Turkish-German Geodetic days, Berlin 2001.


• Hatjidakis, N. and D. Rossikopoulos, Orthometric heights form GPS: The integrated approach, Pres. at 3rd Meeting of the International Gravity and Geoid Commission, Section III (IAG), Thessaloniki, Greece, 26 – 30 August, 2002.
• Huang, J.L., M.G. Sideris, P. Vanicek, and I.N. Tziavos, Numerical investigation of downward continuation techniques for gravity anomalies. Accepted for publication to Bollettino di Geodesia e Scienze Affini, 2002.


• Pikridas, C. and A. Fotiou, Evaluation of the ionospheric refraction on relative GPS positioning: Application in the broader area of Thessaloniki using GPS permanent station data, Technika Cronika, Scientific Journal of the Technical Chamber of Greece 2002 (accepted for publication).

• Rossikopoulos, D., GPS Networks Densification, in the Volume dedicated to prof. A. Badelas (in print) 2002 (in greek).


1.5 THE HELLENIC PETROLEUM CORPORATION

Gravimetry

Acquisition

During the period 1999-2002, 552 new measurements of earth gravity field were carried out in Etoloakarnania (332) and Egion (220) areas, with a Lacost & Romberg model G Geodetic Gravity meter along straight and crooked traverses every 300 meters and 50 meters respectively.

Processing

In the above areas the processing of these points followed and the Bouguer maps of these areas were created at a scale of 1:50000 and 1:2000 respectively. Special software was used permitting an improved Topographical Correction application, resulting in an overall reduction of the total Bouguer Anomaly values error by 20%-30%.

Publications

- Geodetic support to the special seismic program FRACARES at Portugal in cooperation with the Geological Survey of Demark and Greenland (GEUS), Instituto Geologiko e Mineiro (IGM) of Portugal and University of Liverpool (Fault Analysis Group FAG) during February –March of 1999 for predicting flow paths in fractured carbonate reservoirs. (Project No : OG/00173/97/GR/DK/PT/UK) (1999).

- Geodetic support for the navigation of special survey ships at a geophysical survey which included measurements of Environmental parameters, of water quality and monitoring of the Marine flora and fauna for the Agios Kosmas Olympic Sailing Center. This project was done in cooperation with NCMR (National Center For Marine Research) (1999).

- Geodetic control of the verticality of the oil tanks at the Aspropyrgos refineries after the earthquake of Athens of 1999 (1999).
• Final geodetic study at scale 1:1000 of the oil pipe from Aspropyrgos oil refineries to the new International Airport of Athens “Eleftherios Venizelos” (2000).

• Geodetic support to mainland seismic research for the discovery of deposits of hydrocarbons in the areas of Pirgos-Pilos (Southeast Peloponnisos-West Greece), Epirus (Northwest Greece) and Epanomi (North Greece) (2000). Total length of seismic lines: 195 km. Equipment used: Two GTS700 total stations of TOPCON.

• Geodetic study at scale 1:50000 of the oil pipe from Burgas (Boulgaria) to Alexandroupolis (Northeast Greece) for the oil transportation from Russia through Burgas to Alexandroupolis and from there to Europe (2001).

• Processing of geodetic data of the seismic research in Albania in a common seismic project with OMV (Austria) for the discovery of oil deposits (2001).

• Geodetic processing of the earthquake’s positions at the Northwest Peloponissos for seismic a survey project of the area (2001).

• Fixing the location of two new sea wells (E1 and E1A) to discover deposits of hydrocarbons at Kavala bay (North Greece) using Differential GPS System 4000SE LandSurveyor II of Trimble as well as DDMU 542 system of DEL NORTE as secondary system (2000-2002).

• Continuous participation at the EPSG (European Petroleum Survey Group) meetings (1999-2002).

• Topographical survey of all Hellenic Petroleum S.A installations (Refineries, oil tanks, ports etc.) all over Greece on land as well as at sea (2000-2002).

• Final geodetic study at scale 1:1000 of the gas pipe of Natural Gas from Kipi village (Evros county-North Greece) to Alexandroupolis for the transportation of Natural gas from Iran to Europe (2002).

• Processing of all the geodetic data of the seismic research of Greece on land and at sea for the period 1976 up to nowadays in a common database under a common format (2001-2002).
1.6 KTIMITATOLOGIO S.A. AND HELLENIC MAPPING AND CADASTRE ORGANIZATION

KTIMITATOLOGIO S.A. is responsible for the design, development and operation of the Hellenic Cadastre. The company is managing this project in common with the Hellenic Mapping and Cadastre Organization (HEMCO). The main geodetic activities of HEMCO and KTIMITATOLOGIO S.A. concern the supervision of the geodetic works performed for the Hellenic Cadastre.

The geodetic data delivered by the contractors of the Hellenic Cadastre are subject to quality control, in order to ensure the required accuracy and reliability. The quality control is based on both reprocessing of the submitted data and control measurements in the field.

Field measurements have been conducted in 15 areas of the first pilot project of the Hellenic Cadastre. Established trigonometric points, photo control points and parcel boundaries have been measured using GPS receivers and optical total stations.

Submitted data from 21 areas of the second pilot and first main project of the Hellenic Cadastre have been reprocessed. Particularly, 4965 GPS-baselines have been processed using Rinex-data delivered by the contractors. These baseline vectors form 48 GPS-networks (21 trigonometric networks, 11 urban networks and 16 photo control point networks) that have been adjusted.

As a part of the project for the revision of the Technical Specifications of the Hellenic Cadastre, new specifications for the geodetic works (satellite measurements, control point networks etc.) have been compiled. The new specifications take into account recent technology advances. Furthermore, the experience gained during the quality control of the submitted geodetic data has been taken into consideration. This is expected to enhance the effectiveness of the specifications.

A digital database has been developed for the trigonometric and urban networks established for the Hellenic Cadastre. Data that have been checked for compliance with the specifications are loaded into the database. The database contains the coordinates and their precision, as well as documentation material (photos, sketches etc.). The database material will be available to surveyors in order to facilitate the maintenance of cadastral data.

Publications


2. GEOMAGNETISM AND AERONOMY

2.1 THE INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION (IGME)

Magnetic Observatory of Pendeli (GOP) has been running since 1958 under the auspices of the Institute of Geology and Mineral Exploration. The main activity of GOP during the period 1999-2002 was the recording and study of the geomagnetic field’s variations, as follows:

1. Absolute measurements (twice a week) of declination (D), horizontal and vertical components (H, Z).
2. Permanent recording (per 1 sec.) of the declination, horizontal, vertical components and the total field as well.
3. Mean hourly and monthly values of H, D, Z.
5. Determination and study of rapid and special events (ssc, si, b, solar flares e.t.c.).

During 2002 a magnetic research of declination was carried out in the airport “Eleftherios Venizelos”. The purpose of the research was the determination, in a magnetic “clean” location, of D value, for the monitoring of the airplane magnetic compasses.

Publications-Bibliography


3. HYDROLOGICAL SCIENCES

3.1 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA)

The Laboratory of Reclamation Works and Water Resources Management (Division of Infrastructure Works and Rural Development) of the School of Rural and Surveying Engineering, National Technical University of Athens, during the reporting period were engaged with research projects in the following areas:

- Water Resources Management
- Hydrologic modeling
- Groundwater modeling and assessment

Publications:


4. ATMOSPHERIC SCIENCES

4.1 HELLENIC NATIONAL METEOROLOGICAL SERVICE

The mission of Hellenic National Meteorological Service (HNMS) is to provide meteorological support for protection of properties and lives of the society from atmospheric disaster, as well as to provide meteorological support to national economy and defense (Low No 161/97).

The HNMS in the frame of its activities:

1. Takes care of the improvement of the meteorological support to users by implementing the development projects.
2. Maintains and operates a network of meteorological stations (map 1), of offices of meteorological briefing, of peripheral meteorological centres and of weather offices.
3. Studies, develops and implements methods and systems for the weather forecast improvement and at proper time issuing warnings for dangerous weather conditions.
4. Receives a broad spectrum of information from the meteorological satellites METEOSAT and NOOA IPT using the system PROTEAS.
5. Maintains an archive of meteorological observations.
6. Studies all the atmospheric phenomena and data which are related to the weather and climate of Greece.
7. Issues weather forecasts.
8. Provides meteorological support to national defense and national economy support.
9. Is a member of the WMO, ECMWF, EUMETSAT, ECSN, EUMETNET project, COSMO and represents the country in all forum concerning meteorological aspects.
10. Takes part in committees responsible for the coordination and cooperation of Greek services dealing with weather aspects.
Hellenic National Meteorological Service - Map 1
Hellenic National Meteorological Service - Map 2

TOTAL PRECIPITATION [mm/3hr] 2003/27/05 15 UTC

Hellenic National Meteorological Service - Map 3
PRESENT STATUS AND FUTURE PLANS

The HNMS has been involved in a number of development activities in order to achieve its goal, through national and international cooperation.

A. PRESENT STATUS

Within these activities the following operational projects have been implemented.

(1) SATELITE STATION PROJECTS

The Primary Research Operational Tele-detection Environmental Archiving System (PROTEAS) operates in the HNMS. This system receives data from the NOAA and EUMETSAT satellites. It has been implemented as a project funded by the European Union.

(2) LIMITED AREA ATMOSPHERIC MODEL SKIRON

This is a limited area hydrostatic model and it has been implemented as a result of a European Union project in collaboration with the numerical weather prediction group.
of the University of Athens. This model is used operational and one output is shown in map 2.

(3) **FORECASTING SYSTEM NHREAS**

In collaboration with the University of Athens and through a European Union project it has been implemented the forecasting system NHREAS. The system NHREAS consist of the non-hydrostatic atmospheric model RAMS (map 3) which run operational in three way nesting (40 km, 12 km and 4 km) the data assimilation system LAPS and the wave model WAM (map 4).

(4) **FORECASTING MODEL COSMO**

This model is the result of Research cooperation between the Meteorological Services of Germany, Italy, Switzerland, Greece and Poland. Through this cooperation the non-hydrostatic model COSMO (map 5) has been developed. The development is on a continuous base and new versions of this model are produced. The model is running daily at the computers of ECMWF on a resolution of 7X7 km.

As it has been mentioned in paragraphs 3 and 4, the models RAMS and COSMO are non-hydrostatic models and both are capable of predicting small-scale features, such as sea breeze, convective clouds etc.

(5) **CORRECTION OF MODELS RESULTS TOWARDS OBSERVATIONS**

Due to the fact that, even if the model is integrated in small resolutions, still there are unresolved sub-grid scale processes, there is a need for correction of models output towards the observations. One method which is used of HNMS is the Kalman filtering (map 6).

(6) **OIL SPELL MODEL MOTHY AND A TRAJECTORY MODEL**

In cooperation with Meteo-France an oil spell model has been modified to run on a PC and it is used operationally (map 7). As well as a trajectory model it has been developed.

**B. FUTURE PLANS WHICH WILL BE IMPLEMENTED SOON**

In a continuous effort to update the HNMS the following project will be funded either the HNMS budget or under the C Frame Work Program of European Union.

(1) Acquisition of a super computer system for running operational the models SKIRON, NHREAS and COSMO. This computer system will give the capability of HNMS to simulate well the small scale weather features (local winds, thunderstorms etc).

(2) Update the whole structure of the operational data base which will give the capability to HNMS to do a better organized archiving, to improve the models high resolution experiments and to investigate climatic changes.

(3) Enhancement of the existing network of the radar system (map 8).
(4) Installment of lightening detection system.
(5) Installment of wind profiler.
(6) Installment of a now-casting system.
(7) Research for the improvement of now-casting system using combine results of Radar, Satellite, Model output and research.

Publications

4.2 NATIONAL OBSERVATORY OF ATHENS

4.2.1 Institute for Environmental Research & Sustainable Development

General Description

The Institute for Environmental Research & Sustainable Development is active over the whole area of the Sciences for the Environment with emphasis in the following fields:

- Development of reliable data bases related to the atmospheric environment, to enable the study of meteorological parameters and especially solar radiation, maintaining two meteorological stations, an Atmospheric Electricity Station and a Calibration Laboratory. The data, both raw and processed, are available for use by the scientific and the technical community.

- Experimental research on air quality, utilizing a mobile pollution measuring station, a DOAS and an Atmospheric Chemistry Laboratory equipped to measure particulate matter pollution, dioxins and other volatile organic compounds.

- Experimental and theoretical research of the Atmospheric Boundary Layer, wind power, and intense weather phenomena (storms) using both conventional and state of the art equipment, such as the mobile meteorological radar and the accompanying instrumentation, tethered balloons and radiosondes.

- Synoptic and mesoscale atmospheric modeling for research purposes as well as for providing weather forecast services to the public.
• Improvement of meteorological, hydro-meteorological and climatic events forecasting, especially intense ones.

• Application of global climatic and atmospheric chemistry models, to study, among others, the large-scale mechanisms of pollution buildup and the effect of anthropogenic warming on extreme climatic events.

• Initiatives, measures, actions and plans such as the annual Greek submissions of the national emission inventory in the scope of the European Union Monitoring Directive for the reduction of greenhouse gases emissions in Greece through the Greek Action Plan for the Reduction of Greenhouse Gas Emissions as specified in the Framework Convention on Climate Change (FCCC).

• Building physics and energy conservation applied research, investigating ventilation, building materials, indoor air quality etc. Supporting the technical community through specialized publications, software, and consultant services.

• Development of data bases for the estimation of greenhouse gases’ emissions, along with methodological tools aiming to a better planning of energy and environmental policies against climatic change.

• Addressing environmental management, planning and sustainable development issues, by introducing and using methodologies for the identification and assessment of possible environmental impact, as well as risk management, prevention and treatment.

• Study of surface and underground hydrology, and the physicochemical processes affecting the fate of pollutants in an aqueous environment. Development of water resources management and protection methodologies, accounting for social, economical and legal/constitutional aspects.

• Air quality research, with specific attention to compounds suspect for toxic, carcinogenic or mutagenic activity, such a dioxins, VOCs and PAHs.

Research Activities – Funded Projects 1999-2002

• Environmental Monitoring, Warning and Emergency System
• Impact Assessment Study CEO Programme 1999.
• European Large Scale Solar Heating Network (SOLAR NET) 1997-1999.
- Surface Boundary Layer Refractive Index Measurements in Greece, Turkey and UK Relevant to Optical and Microwave Frequencies in Aerospace Operations (NATO/AGARD) 1997-1999.
- Integrated pollution control, compliance and enforcement of EU Environmental legislation to Industries (IPPC and non IPPC) of the food production/processing sector, DGENV 2000-2001.
- MEDEX MEDiterranean EXperiment on "Cyclones that produce high impact weather in the Mediterranean" 2000-2004.

• Relationship between Ultrafine and fine Particulate matter in Indoor and Outdoor air and respiratory Health (RUPIOH), DG Research, 2001-2004.

• Environmental Inspectorated in Cyprus (INSPECT), 2002-2004.

• IMPEL OLIVE OIL PROJECT, 2002-2003.

• European network for the assessment of air quality by the use of bio-indicator plants (EuroBionet), LIFE-ENV, European Union, 2000-2002.


• MINOS “Mediterranean Intensive Oxidant Study” (International collaboration program funded by Max Planck Institute of Chemistry, Germany), 2002-2003.

**Refereed Publications**


• Kambezidis, H.D., Adamopoulos, A.D., Zevgolis, D., Determination of Ångström and Schüepp parameters from ground-based spectral measurements of beam


### 4.2.2 Institute for Space Applications & Remote Sensing

**Space Physics Research Group**

**General Description**

The activities of the Space Physics Research Group focus on solar and heliospheric physics, interplanetary disturbances, magnetospheric dynamic processes and impacts on the terrestrial atmosphere. The Group is particularly active in investigations of:

- Solar atmosphere dynamics
- Charged particle acceleration mechanisms
- Space magnetic storms and space weather
- Magnetosphere-ionosphere coupling
- Storm-time ring current dynamics
- Particle propagation in Coronal Mass Ejections

Such investigations are achieved by means of:

- Data processing, analysis and interpretation of spacecraft data.
- Development of modeling software for the implementation of mission objectives.
- Computer simulations of basic physical processes.
Researchers of ISARS have been participating in several space missions under the Co-Investigator or Group Member status. Active co-operation exists with a number of research institutes in Europe and USA.

Detailed information on the activities of the Space Physics Research Group of ISARS can be found at the following URL address

http://www.space.noa.gr/space_physics/isars_space_physics_main.htm

Research Activities 1999 – 2002

For the period 1999 – 2002 the Group’s research activities were the following:

- Theoretical work on the energy release process during solar flares by constructing MHD consistent Cellular Automata models.
- Interpretation of the statistical properties of the observed radiation signatures from solar energetic events.
- Study of magnetic flux emergence in active regions using observations from SOHO, TRACE and ground based instruments.
- Study of sunspot oscillations from observations obtained with THEMIS.
- Study of the fine structure of the solar chromosphere.
- Study of the development and decay of geospace storms through ground magnetic disturbances.
- Study of intense geospace storms by solar/interplanetary drivers and internal magnetospheric properties.
- Study of particle acceleration by substorm-induced electric fields and interaction of Mercury’s magnetosphere with the solar wind.

Organization of International Meetings

The Institute for Space Applications and Remote Sensing of the National Observatory of Athens (NOA) organized, during the period 1999 – 2002, the following International Meetings:

1. 6th Workshop on Magnetic Storm Dynamics, Athens, Greece April 1999.
2. NATO Advanced Study Institute on Space Storms and Space Weather Hazards, Crete, Greece, June 2000.
**Externally Funded Projects**

The members of the Space Physics Research Group were/are the principal investigators of the following externally funded projects:

- The role of Solar wind and Earth's ionosphere in the development of Magnetic Storms in Geospace, Greek General Secretariat of Research and Technology, French-Greek bilateral research project, 2002 - 2004.

- Dynamics of the Solar Atmosphere using ground based and space borne observations, Greek General Secretariat of Research and Development, French-Greek bilateral research project, 2001-2002.


**Refereed Publications**


Ionospheric Group

General Description

The Ionospheric Group activities during the last four years 1999-2002 concern the investigation of the physical processes characterizing the dynamics of the Earth’s Ionosphere for scientific purposes and operational applications. More precisely the activities are focused on:

- Monitoring the state of the ionosphere over Greece operating a DPS4 station, providing real-time information through the web page http://www.iono.noa.gr
- Providing ionospheric data in real-time to the World Data Centers in Europe (RAL), USA (Boulder) and Australia (IPS)
- Ionospheric mapping over Europe in real-time
- Ionospheric storm forecasting models driven by solar wind parameters
- Modeling of the topside ionosphere and plasmasphere
- Modeling of ionospheric storm effects at middle latitudes

Participation in the Space Missions as Co-Investigator

CHAMP Space Mission, Co-Investigators in the GPS Receiver TRSR-2 experiment onboard CHAMP on “Comparative studies between Athens digisonde and CHAMP ionospheric data”.

SWARM “A constellation to study the dynamics of the Earth’s magnetic field and its interactions with the Earth system”, Earth Explorer Opportunity Missions, ESA.

Participation in International Research Programs

Cooperation with the Australian Forecast Center (IPS) to support HF radio in Europe (http://www.iono.noa.gr)

Cooperation with Northwest Research Associates for the derivation of Ionospheric Indices to support space weather applications (http://www.nwra-az.com)

Externally funded projects

- Installation and Operation of the Ionospheric Station in NOA, Greek General Secretariat for Research and Technology, 1998-2001
- COST271, Effects of the upper atmosphere on terrestrial and Earth-space communications, European Commission, 2000-2004
• COST724, Developing the scientific basis for monitoring, modeling and predicting space weather, European Commission, 2002-2007

• Modeling of the topside ionosphere for operational applications, NATO Collaborative Linkage Grant, 2002-2005

• Geomagnetic Indices Forecasting and Nowcasting Ionospheric Tools, ESA Space Weather Pilot Project, 2002-2004

• Earth to space communication and positioning systems: maps and models of ionospheric and plasmaspheric variability, Greek General Secretariat for Research and Technology, Italian-Greek Bilateral Agreement, 2002-2004.

Publications


• Belehaki, A., D. Lalas and G. Moraitis, Operation of a new fully automated digisonde by the National Observatory of Athens, Space Storms and Space Weather Hazards, NATO Advanced Study Institute, Crete, 2000.


Tsagouri I., and A. Belehaki, On the nature of night-time ionization enhancements observed with the Athens Digisonde, Annales Geophysicae, 20, 1225-1238, 2002.


Tsagouri I. and A. Belehaki, Nighttime ionisation enhancements observed with the Athens Digisonde, URSI, XXVIth General Assembly, CD-proceedings, Maastricht, The Netherlands, August 2002.


5. PHYSICAL SCIENCES OF THE OCEAN

5.1 HELLENIC NAVY HYDROGRAPHIC SERVICE

I. Hydrographic Topographic Surveys

For the period 1999-2002 an extensive program of hydrographic surveys was conducted by Hellenic Navy Hydrographic Service. The three hydrographic vessels were employed for 1637 working days in site around Hellenic seas while the topographic teams were employed for 692 working days. The purpose of all the hydrographic topographic projects, was the publishing of fair sheets at different scales, due to the necessity of publishing new charts as well as to cover the operational needs of Hellenic Navy General Staff, the support of Ministry of Maritime Marine and the support of Olympic Games of ATHENS. In detail the hydrographic and topographic teams conducted 228 missions (101 for hydrography) in Aegean and Ionian Sea and especially in 38 port areas, at scales 1 : 500-1 : 1.000, 34 coastal areas, at scales 1 : 2.000-1 : 5.000 29 off shore areas at scales 1 : 5.000-1 : 25.000 and 127 topographic surveys at scales 1 : 200÷1 : 2.000. The main hydrographic activities are shown on the attached chart.

Also HNHS participated in the following projects:

- GAVDOS Project
- ESEAS Project

II. Physical Oceanography

During the period 1999-2002 the activities in Physical Oceanography were concentrated on the areas of understanding the physical phenomena in Hellenic Seas. The collection, analysis and study of various kinds oceanographic data like temperature, salinity, oxygen, current etc form the basics of our data bases.

Specially 15 oceanographic cruises were carried out covering areas of Navy’s interest in order to provide environment support for naval operations.

There is also in operation a permanent network of stations for a systematic measurement of Sea-surface temperature and Sea-state.
III. Sea Level Measurements

For the measurement of Sea level variations, Hellenic Navy Hydrographic Service has established a permanent network of 19 Tide Gauges. Data and statistical results are published as technical reports providing the basis for scientific presentations and studies.

IV. Geological Oceanography

Selected areas of the Aegean and Ionian Seas were examined by bottom sampling and coring, while the bottom structure has been examined using Side Scan Sonar and Sub Bottom Profilers.
5.2 NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA)

Publications


- **The impact of islets and rocks on Greek territorial waters** (E. Doukakis), International Symposium on “Oceanographic Aspects for a sustainable Mediterranean” Athens, 27-29/9/2002


Publications in Greek

- **Κυκλικό Δικαιώματα Διαχείρισης και Εκμετάλλευσης Θαλάσσιων Ζωνών στην Κρήτη (Ε. Δουκάκης), 10ο Πανελλήνιο Συνέδριο Ιχθυολόγων για την Διαχείριση και Αειφορική Ανάπτυξη Υδάτινων και Παραδάτων Περιοχών, Χανιά, 18-20 Οκτωβρίου 2001.**

- **Η Επίδραση του Φαινομένου του Θερμοκηπίου σε Περιβαλλοντικά Ευαισθητικές Παραλιακές Περιοχές (Ε. Δουκάκης, Π. Αντωνίου), 10ο Πανελλήνιο Συνέδριο Ιχθυολόγων για την Διαχείριση και Αειφορική Ανάπτυξη Υδάτινων και Παραδάτων Περιοχών, Χανιά, 18-20 Οκτωβρίου 2001.**

- **Ένα Ολοκληρωμένο Σύστημα Παρακολούθησης και Διαχείρισης της Θαλάσσιας Κυκλοφορίας (Ε. Δουκάκης), 10ο Πανελλήνιο Συνέδριο Ιχθυολόγων για την Διαχείριση και Αειφορική Ανάπτυξη Υδάτινων και Παραδάτων Περιοχών, Χανιά, 18-20 Οκτωβρίου 2001.**

- **Ακουστικά Δίκτυα και Ναυπαλιοκοτά Κίνδυνοι στο Λιγαρίο, Πανελλήνιο Συνέδριο (Ε. Δουκάκης), «Acoustics 2002», Πάτρα 30/9-1/10/2002.**

- **Εκτίμηση Παράκτιων Διαβρώσεων με συνδυασμό Στατικού και Δυναμικού Μοντέλου (Ε. Δουκάκης), Β’ Πανελλήνιο Συνέδριο για τη Διαχείριση και Προστασία των ακτών, Αθήνα, 25-28/11/2002.**
6. SEISMOLOGY AND PHYSICS OF THE EARTH’S INTERIOR

6.1 NATIONAL OBSERVATORY OF ATHENS - INSTITUTE OF GEODYNAMICS

1. Introduction

The Institute of Geodynamics (I.G) is one of the four Institutes comprising the National Observatory of Athens (N.O.A.), which is a National Research Center supervised by the General Secretariat of Research and Technology, Ministry of Development. I.G is one of the oldest Institutes in Greece operating continuously since 1893. In 1897 the first seismograph was installed in Athens and in 1899 the first seismic network started to operate. Since then, systematic and detailed seismic observations started for the region extending from 34°N to 42°N and 19°E to 30°E. The location of the Head Office of I.G is on the hill of Nymphs, opposite to Acropolis, at the center of Athens.

The mission of the G.I is the study and the promotion of research in the fields of: Seismology, Physics of the Earth’s Interior, Geophysics, Volcanology and Geothermy, and Neotectonics. The main tasks of I.G are collection and processing of various seismological - geophysical parameters, the elaboration of research projects and relevant studies, and the training and services provided to third bodies. The G.I operates around the clock, 365 days a year. For the service and the maintenance of the various instruments, the I.G employs experienced technical staff.

The infrastructure and daily operations of the Institute are the following.

a. The I.G operates the National Seismic Network (Figure 1), consisting of twenty five (25) telemetric, digital seismic stations (6 of these stations are permanently staffed). These use leased telephone lines. All stations are equipped with broadband, 3D component seismometers. Two stations are linked with international networks (Athens is a WWSSN station and Anogeia of Crete a MEDNET station – code name IDI). IDI serves as an auxiliary station for CTBTO. The Athens station is equipped with a prototype, Wood-Anderson seismometer for the calculation of local earthquake magnitude. Since 1999, 7 radio-telemetric stations from E.P.P.O (Earthquake Planning and Protection Organisation) seismic network are linked to the base station at I.G. The National seismic network monitors regional and local seismicity with magnitude threshold smaller than 3 M$_{L}$. Teleseismic events are also recorded.
Figure 1. The National Seismic Network. Solid triangles denote locations of the seismological stations of the Institute of Geodynamics. ATH indicates location of I.G and IDI the MEDNET station.

Since 2001, I.G contributes data from four (4) stations to the European Network (ODC) at ORFEUS, under the project MEREDIAN. These stations operate in real-time and are connected to main server in Holland via Internet. Further collaboration with GEOFON and MEDNET has established an Internet-based network for the Eastern Mediterranean comprising all very broadband stations with I.G serving as a node.

Data collected from all stations, corresponding to earthquakes occurring in the territory of Greece and the bordering areas, are analysed routinely in detail. In-house software is used for processing the digital records. The results are listed in the monthly seismological bulletins of the Institute. These bulletins are distributed regularly all over the world, to several Seismological Centres and Universities, as well as to different National Centres, Universities, Organizations and Libraries.
b. Attention is also paid to record microseismicity, which gives useful information about the local seismicity within a short period of time. From this point of view I.G possesses a mobile network of seven radio link seismic stations. Furthermore there are ten units of portable seismographs. All the above set of mobile and portable seismographs largely help to better monitor the aftershock activity, for regional seismotectonic studies etc.

c. The I.G operates a permanent strong motion network consisting of 32 analog and 11 digital accelerographs (Figure 2). These instruments are installed at major cities of Greece. Moreover, 13 digital accelerographs are used for monitoring aftershock activity or in the frame of research projects. The records of accelerographs are the input information for earthquake resistant design. I.G has developed a strong motion record database covering the period 1973 - 1996.

The data collected by the networks of I.G are registered into archives. For this purpose the appropriate computer facilities as well as sophisticated software are available. All Greek earthquakes recorded by NOA are available at www.gein.noa.gr. Monthly seismicity maps are also available. A seismicity alert web page also exists with seismic phases, epicentre and magnitude information.

Preliminary readings and final products are sent to the neighboring countries and to International Centers on a weekly basis. Moreover, raw data (seismograms) are supplied to several Observatories and Institutes abroad. Many other miscellaneous seismological information is provided mostly for engineering purposes, to insurance companies, as well as to the public.

The contribution of I.G. to the education is considerable. A large number of undergraduate, postgraduate and PhD theses have or are being carried out at the Institute.
Figure 2. The configuration of the strong motion network of the Institute of Geodynamics. Locations of accelerographs are denoted by triangles.

2. Research

The research activities of the Institute of Geodynamics during the period 1999-2002 cover a broad spectrum of Seismology, Physics of the Earth's Interior and Geophysics. Results published so far, appear in the next sections. In particular, the I.G scientists were active in the following fields:

Seismicity

- Preshock, mainshock, aftershock sequences
- Seismotectonics of various regions
- Microseismic activities along selected seismic zones
- Seismic potential of active faults
- Seismic quiescence of regions of Greece and surrounding areas
- Induced seismic activity
Interaction of active faults
Recognition of characteristics of seismic activity
Focal mechanisms of earthquakes - Properties of the seismic source
Spectral characteristics of preshocks, mainshocks and aftershocks
Rupture mode of strong earthquakes
Dynamic parameters of ruptures

**Propagation of seismic waves - Strong Ground Motion**

Attenuation of strong ground motion
Directivity of propagation of seismic energy
Synthetic strong ground motions (stochastic procedures)
Synthetic strong ground motions using Green functions
Seismic hazard - Microzonation studies
Improvement of algorithms for calculation of expected seismic accelerations, velocities and displacements
Improvement of algorithms for calculation of statistical parameters
Improvement of microzonation methods

**Structure**

Structure of Earth's crust and mantle
Seismic wave attenuation
Distribution of seismic velocities
Seismic tomography and determination of seismic parameters

**Earthquake prediction**

Seismic quiescence of regions of Greece and surrounding areas
Recognition of characteristics of seismic activity
Magnetotelluric methods

**Multidisciplinary, parametric investigation of geophysical-seismological parameters**

Recognition of characteristic patterns of seismicity
Geophysical methods
Statistical methods
Algorithms of amalgamation of the different characteristics of seismic activity
Seismotectonics - Paleoseismology
Correlation of microseismic activity with active faults
Historical seismicity and association with known faults

**Seismic Sea Waves (Tsunamis)**

Catalogue compilation
Generation mechanisms and propagation
Wave simulation
Palaeotsunami investigation
Hazard assessment and applications
Awareness and Education

**Geological Remote Sensing**

Remote sensing of active faults
Remote sensing of landslides
Fault segmentation - Neotectonics
Thermal remote sensing of volcanic arcs and known faults
Hyperspectral remote sensing of hydrothermal mineralisations
Digital Geomorphometry
SAR Interferometry

**Applied Geophysics**

Reflection and Refraction Seismics
Seismic tomography
Geoelectrical imaging
Ground Penetrating Radar
Magnetic and Gravity methods
Electromagnetic methods
Archaeological surveys

3. International Research Programs

The G.I participated as Coordinator or Contractor to the following international projects:

1. "Earthquake Seismological Information" (EPSI)
2. "Geo-spatial warning systems Nissyros volcano (Greece). An emergency case study" (GEOWARN)
3. "Developing existing earthquake data infrastructures towards a Mediterranean European rapid earthquake data information and archiving network" (MEREDIAN)
5. «Landslide Early Warning Integrated System»
6. “Geological Identification of Historical Tsunamis: Application in the Corinth Gulf, Greece»
7. “3F KORINTH”
8. “SEISCANEX”
9. "Making Seismic Reflection Profiles Available to the Wide Scientific Community" (SEISCAN)
10. "Overall GPS Strain Determination and Assessment of Seismic Hazard in Greece" (GPS-HAZARD)
11. "Faults as a Tool of Seismological Studies" (FAUST)
4. National Research Programs

The G.I participated as Coordinator or Contractor to the following national projects:

1. "Μελέτης του Σεισμικού Κόσμου" (Greek Seismological Station)
2. "Ελληνική Σεισμολογία και Κηπολόγια" (Greek Seismology and Saturdays)
3. "Σύντομη, ισχυρή και ανάλυση σεισμολογικών δεδομένων του Ελληνικού Χώρου" (Short, Powerful and Analysis of Seismological Data of the Greek Territory)
4. "Αμιγώνυμη Χρηματοοικονομική Περιβάλλοντος" (Unconditional Environmental Financing)
5. "Αναπτύξεις της Σεισμικής Επιστήμης στις περιοχές των μεγάλων υδροπελαγικών έργων "ΔΕΗ" (Research in Seismology in Areas of Great Hydroelectric Works)
6. "Επεξεργασίας επιπλοκογραφημάτων Γεωδυναμικού Ινστιτούτου και δημιουργία βάσης δεδομένων) (Processing of Geodynamic Institute Data and Creation of a Database)
7. "Σύνθεση και επεξεργασία σεισμικών δεδομένων και καθοδήγηση νέου χαρτη σεισμικής επικείμενης της Ελλάδας συμβατού με τον ισχυούσο Ελληνικό Αντισεισμικό Κανονισμό και τον Ευρωπαϊκό Καθοδήγο 8) (Compilation and Processing of Seismic Data and Guidance of a New Cartography Suitable with the Existing Greek Seismic Code and the European Guide 8)
8. "Προσδιορισμός των περιοχών του Ελληνικού Χώρου με συνεχή διαδικασίας σεισμικού συμβάντος της επόμενης πενταετίας (2000-2005)" (Determination of Areas of the Greek Territory with a Permanent Seismic Process for the Next Five Years)
9. "Αξιοποίηση υπάρχοντος ενόργανου εξοπλισμού για την ανάπτυξη πολυάδυναμο γικτίου σεισμογραφικής παρακολούθησης του ευρύτερου χώρου του Νοτίου Αιγαίου" (Utilization of Existing Equipment for the Development of PolyaDynamic Seismographic Monitoring of the Wider Area of the Southern Aegean)
11. "Caucasian Seismic Information Network for Hazard Assessment (CISIN) (Caucasian Seismic Information Network for Hazard Assessment)
12. "Αναβάθμιση του σεισμολογικού σταθμού Ημαθίας, Χρήσης (Improvement of the Seismological Station of Hymettus, Athens)
13. "Numerical modeling of the crustal deformation associated with the Athens earthquake of 7 September 1999" (Numerical Modeling of the Crustal Deformation Associated with the Athens Earthquake of 7 September 1999) (Japanese Society for the Promotion of Science)
14. "Συντήρηση και λειτουργία του τηλεμετρικού δίκτυου σεισμογράφων του ΟΑΣΠ" (Maintenance and Operation of the Telemetrical Network of Seismographs of the OASPI)
15. "Ο Κίνδυνος από σεισμικά παλιρροικά κύματα (τσουνάμι) στην ακτογραμμή της πόλεως της Ρόδου και πρακτικά μέτρα για την αντιμετώπισή του" (The Risk of Seismic Seismic Waves (Tsunami) in the Coastal Line of the City of Rhodes and Practical Measures for Its Treatment)
5. Joint Research Programs with other countries

The G.I participated as Partner to the following international, bi-lateral projects:

1. «Δήμητρα και Μηχανισμός της σεισμικής ησυχίας» (ΕΛΛΑΔΑ - ΚΙΝΑ)
2. «Διερεύνηση σεισμικών παραμέτρων στην περιοχή του Κορινθιακού Κόλπου» (ΕΛΛΑΔΑ – ΠΟΛΩΝΙΑ)
3. «Dynamic maps of potential earthquakes for Greece and Caucasus based on recent physical models, methods and algorithms» (ΕΛΛΑΔΑ – ΡΩΣΙΑ)
4. «Seismic hazard assessment in south Balkans area» (ΕΛΛΑΔΑ – ΒΟΥΛΓΑΡΙΑ)
5. «Ελληνική Διακρατική Συνεργασία: Κρυσταλλική μετάβαση - Σεισμικές διακρατικές Συνεργασίες» (ΕΛΛΑΔΑ – ΙΤΑΛΙΑ)
6. «Δυναμικά χάπια και ίχνη της διάδοσης της σεισμικής δραστηριότητας από τον Καντορνίτη» (ΕΛΛΑΔΑ – ΜΕΓ. ΒΡΕΤΑΝΙΑ)
7. "Συλλογή επεξεργασία και ανταλλαγή σεισμολογικών δεδομένων" (ΕΛΛΑΔΑ – ΚΥΠΡΟΣ)
8. "Αξιοπιστία των Διαφορετικών Μεθόδων Υπολογισμού Συνθετικών Καταγραφών της Ισχυρής Σεισμικής Δόνησης στον Ελληνικό Χώρο" (ΕΛΛΑΔΑ - ΓΕΩΡΓΙΑ)
9. Εφαρμογή και Αξιοπιστία Διαφόρων Μοντέλων Σεισμικής Επικινδυνότητας - Χρήση και Εμπλουτισμός Βάσεις Δεδομένων Ισχυρών Εδαφικών Κινήσεων (ΕΛΛΑΔΑ - ΤΣΕΧΙΑ)
10. "Σεισμοτεκτονική Μελέτη του Ηφαιστείου της Σαντορίνης χρησιμοποιώντας Πρωτοποριακές Μεθόδους Υποθαλάσσιας Έρευνας" (ΕΛΛΑΔΑ - ΙΣΠΙΑΝΙΑ)
11. "Προσδιορισμός του Παράγοντα Εξασθένησης στον Ελληνικό χώρο με τη Χρήση Σεισμικών Κυμάτων Ουράς. Μελέτη της Χωρικής και Χρονικής Μεταβολής του Παράγοντα Εξασθένησης και η Συμβολή της Διασποράς και της Απόσβεσης στην Εκτίμησή του" (ΕΛΛΑΔΑ - ΙΣΠΙΑΝΙΑ)
12. "Ανάπτυξη Εργαλείου GIS για την Πρόγνωση του Κινδύνου από Τσουνάμι σε Παράκτιες Περιοχές - Εφαρμογή στην Περιοχή Ηρακλείου Κρήτης" (ΕΛΛΑΔΑ - ΙΣΠΙΑΝΙΑ)
13. "Αξιοπιστία των Διαφορετικών Μεθόδων Υπολογισμού Συνθετικών Καταγραφών της Ισχυρής Σεισμικής Δόνησης στον Ελληνικό Χώρο" (ΕΛΛΑΔΑ - ΓΕΩΡΓΙΑ)

6. Publications

6.1 Papers in International Journals


35. Makaris, D. I., Theodulidis, N. P. and Stavvakakis G. N. Estimation of Strong Ground Motion Due to Hypothetical Fault Ruptures and Comparison with


51. Pavlides, S. B., Papadopoulos , G., and Ganas, A. The fault that caused the Athens September 1999 Ms=5.9 earthquake: field observations. *Natural Hazards*, pgs. 61-85, vol. 27(1-2), 2002


6.2 Publications in International Web Pages with peer-review


6.3 Publications in Conference Proceedings


3. Δαπόνης Ν., Κωτσάνης Ι., Καραστάθης Β. Κ., Δάλλος Γ., 2002. ΓΑΙΑ: Η μετάβαση από μία αναπαράσταση σε άλλες για τη διερευνητική μελέτη της Γης. *3ο Πανελλήνιο Συνέδριο για τη διδακτική των Φυσικών Επιστημών και την*


18. Κωτσάνης, Γ., Δασόπτες, Β., Καραστάθης, Δ. Σάμψον, & Α. Παπαγεωργίου. Η διαθεματική και διερευνητική μελέτη της Γης μέσα από τους μικρόκοσμους του λογισμικού “ΓΑΙΑ”. Πανελλήνιο Συνέδριο "Πληροφορική και Εκπαίδευση", Σύλλογος Εκπαιδευτικών Πληροφορικής Ν. Θεσσαλονίκης (ΕΠΙΔΕΘ), Θεσσαλονίκη 11 και 12 Νοεμβρίου 2000.


32. Papanastassiou, D., Sieh K., Yule D, Gaki-Papanastassiou K., Meyer B. and Vrenzou, E. Seismological and archaeological trenching to detect past earthquakes: a case study from the area of Sparta, Peloponnesus, Greece. 9th International Symposium on Natural and Man-made Hazards, Antalya, Turkey, October 3-6, 2002.


34. Papanastassiou, D. The Gulf of Corinth, central Greece, characteristic example of active extensional tectonics “Active tectonics of Western Turkey”

35. Papat Anastassiadou, Δ., Σεισμοτεκτονικές δομές του Κορινθιακού κόλπου. Ημερίδα: Έργαστήριο Βάθους Γεωδυναμικής Κορινθιακού κόλπου - Δίκτυο Ελληνικών Εργαστηρίων. Σεισμοτεκτονική του Κορινθιακού κόλπου. Οργανωτής Τομέας Γεωφυσικής-Γεωθερμίας Πανεπιστημίου Αθηνών. Αθήνα, 31 Μαΐου 2001.


6.4 Publications in Greek Journals


### 6.5 Internal Publications of the Institute of Geodynamics

1. Λατουσάκης, Ι. και Παναπόλου Γεωργία. Επιλογή καταλληλότερου μοντέλου ταχυτήτων για την καθημερινή ανάλυση του Γεωδυναμικού Ινστιτούτου, 2002.


### 6.6 Authorship of Books


6.2 Department of Geophysics, Aristotle University of Thessaloniki


• TSAPANOS, TH.: 1999. Geophysical prospecting in the Kristallopigi area (pref. of Florina) for localization of underwater deposits (Scientifically Responsible) Sponsored by Mun. of Kristallopigi.


following the August, 1999 Izmit, Turkey Earthquake. Geophysical Res. Let. 27, No.17, 2741-2744.


• KARAKAISIS, G.F.: 2001. Accelerating seismic crustal deformation prior to the IZMIT earthquake (17.8.1999, M=7.6, NW Turkey) and evolution of its seismic sequence. 2nd Congress of Earthquake Engineering and Engineering Seismology, Thessaloniki, November 28-30, pp 97-106.


PAPAZACHOS, B.C., KARACOSTAS, B.K., KIRATZI, A.A., MARGARIS, B.N., PAPAZACHOS, K.B. AND SCORDILIS, E.M.: 2001. The appropriateness of magnitude scales which are used for the determination of relations concerning parameters of strong ground motion in Greece. 2nd Congress of Earthquake Engineering and Engineering Seismology, Thessaloniki, November 28-30, pp. 55-64.


SKARLATIDIS, A., ΠΑΠΑΖΑΧΟΣ, Κ. ΚΑΙ ΜΑΡΓΑΡΗΣ Β.:2001. Καθορισμός φασματικού θορύβου από διορθωμένες καταγραφές εισχυρής κίνησης


6.3 Hellenic Petroleum S.A.

Reflection and refraction seismology was developed by Hellenic Petroleum S.A. During the period 1999-2002, Hellenic Petroleum S.A performed 240 km of reflection and refraction seismic research work in the areas of Epirus (Northwest Greece) and Western Peloponnese. Furthermore, 16 km of high resolution seismic work was performed in the area of TORRES-VEDRAS in Portugal. The work used as energy source Dynamite (Portugal) and GSI tr-4 Vibroseis. The seismic reflection recording was done by the Sercel 388 SN-SU digital ultralight system. The refraction work performed by the STRATA VIEW 60R system.

7. VOLCANOLOGY AND CHEMISTRY OF THE EARTH’S INTERIOR

7.1 National Observatory of Athens - Institute of Geodynamics

1. Introduction

The Institute of Geodynamics (I.G) is one of the four Institutes comprising the National Observatory of Athens (N.O.A.), which is a National Research Center supervised by the General Secretariat of Research and Technology, Ministry of Development. I.G is one of the oldest research Institutes in Greece operating continuously since 1893. The location of the Head Office of I.G is on the hill of Nymphs, opposite to Acropolis, at the center of Athens.

2. International Research Programs

The I.G participated as Coordinator to the following, 3-yr international project funded by the IST program of the EU:
"Geo-spatial warning systems Nisyros volcano (Greece). An emergency case study" (GEOWARN; www.geowarn.org)

The major result of the project is the development of a new planning tool that includes not only the state-of-the-art of scientific knowledge and advanced monitoring systems but also their easy use for public education to improve awareness of natural hazards. This tool contains European standards (technological norms and quality requirements and formats) and is applicable to all European regions. The new interactive medium, either on CD-ROM and/or on an Internet-platform, will enable the users to actually participate in the evaluation of volcanic and seismic hazards as well as modeling and quantification of risk. The GEOWARN project is a collaborative effort, involving organizations from four European countries. It brings together partners with specialist skills in areas including: Risk Management and Assessment, Logic Programming, Earth Observation and Satellite Image Processing, Environmental Hazard Assessment, Geology and Oceanography, Volcanology and Geochemistry, Cartography, GIS, AIS Multimedia Systems, Seismology, Geothermics.

3. Publications