

GeoGravGOCE

***Geoid and Gravity Field Modelling by
GOCE Satellite Gradients
and Terrestrial Data***

WP 6: Dissemination and feasibility
TSK6200: Project website and server

DELIVERABLE
DL6210: Project website

Distribution List			
HFRI		AUTH Research Committee	
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Abstract

This report refers to the activities focusing on the implementation of WP6, TSK6200, Action 6210 of the GeoGravGOCE project. It outlines the GeoGravGOCE project website, its overall functionality as well as the material available until the reporting day. The project website and server are a work in progress, therefore periodic updates of the DL6210 will be delivered depending on the material added.

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Acronyms

AUTH	Aristotle University of Thessaloniki
DL	Deliverable
GSRT	General Secretariat for Research and Technology
HFRI	Hellenic Foundation for Research and Innovation
TSK	Task
WP	Work Package
WPS	Work Package Structure

1.

GeoGravGOCE web-page and server

1.1 Outline of the deliverable

This report refers to the actions focusing on the implementation of WP6, TSK6200, Action 6210 of the GeoGravGOCE project. It outlines the GeoGravGOCE project website, its overall functionality as well as the material available until the reporting day. Moreover an account of the partners dedicated server is given with the necessary credentials for both the project team and HFRI administrators.

The project website is composed of the basic administrative material, i.e., the project concepts and goals, the partnership, its funding, contact information of the research team, the project WPs and its DLs along with a partner/HFRI dedicated section which are described in the sequel.

1.2 Basic structure of the GeoGravGOCE website

The GeoGravGOCE project website (<http://olimpia.topo.auth.gr/GeoGravGOCE>) resides at a dedicated server at the facilities of the research team. Upon entrance to the website a general overview of the project is given following its main layout, where the logos from GravLab and HFRI reside on the header and those of the project, AUTH, GOCE and GSRT at the footer (see 0). On top of the logos reside the basic contact information as well as the funding details of the project, which when accessed re-direct the user to the relevant url pages (see Figure 2 and Figure 3 below). Finally, the Home link directs to the root url of the GeoGravGOCE webpage.

As seen in Figure 1, the home page of the project contains also the basic concepts of the project along with its main goals. Then immediately before the footer, there is a news section available (left pane) and another one (right pane) where the project Newsletters will be published.

1.3 The GeoGravGOCE project description

From the main navigation menu, the first link provides more detailed information about the project and directs to a URL page entitled “GeoGravGOCE at a glance” (see Figure 4). There, the basic idea behind the project is outlined, along with a detailed account of its major goals and objectives.

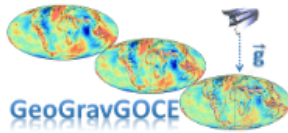
GeoGravGOCE

Geoid and Gravity Field Modelling by
GOCE Satellite Gradients and Terrestrial
Data



THE PROJECT WORK PACKAGES DELIVERABLES NEWS PARTNERS CORNER

GeoGravGOCE Project



Monitoring the Earth's gravity field both over marine and continental regions has been the focus of extensive geodetic research for the past decades, but has gained increased importance during the last years due to the recent gravity-field dedicated satellite missions. With the missions of CHAMP and GRACE setting the path, ESA's GOCE mission has offered breakthrough opportunities for improved insights into the Earth's gravity field and geoid. Additionally, the synergistic use of geodetic, oceanographic and earth observation data contributed to other geo-scientific areas as well. The key contribution of the GOCE mission has been in its unprecedented representation of the Earth's geoid, hence contributing significantly to the synergy of geodesy with the rest of the Earth sciences, like geology, geodynamics, hydrology and oceanography. All related studies thus far rely either on the exploitation of GOCE SGG data in their original Gradiometric Reference Frame at satellite altitude, which after proper processing are provided in the form of spherical harmonics expansions of the Earth's potential. This is known in geodesy as spherical harmonic analysis (SHA) and provides to the scientific community harmonic coefficients derived from GOCE and other satellite and terrestrial data, up to some specific degree of model expansion. The power of GOCE-based GGMs stems from the fact that the entire processing of GOCE SGG data and the respective filtering is done through the SHA, hence the provided field and gravity functionals are already processed. The user in that case can apply spherical harmonic synthesis (SHS) of the coefficients, which is trivial to the geodetic community, to get GOCE-only functionals of the Earth's potential.

The other possibility attempted in the literature so far, refers to the preparation of GOCE SGG grids at some very high altitude (around 250 km), where the respective processing is done by Least Squares Collocation (LSC). In this latter case, the filtering performed to the inherently noisy SGG data is performed with classic spatial and digital filters. In both of the aforementioned approaches, only the vertical gradients V_{zz} of the potential measured by the satellite are used, while their final product is over-smoothed without attention to local details depicted in the raw satellite data. This is normal, as both GGMs and grids at a specific altitude are dedicated for global use, i.e., they provide an optimal, in terms of gravity field representation, picture of the Earth's potential for the entire globe. [read more](#)

GeoGravGOCE is funded by (H.F.R.I.) within its Call for Research Projects for Research and Academic Staff (H.F.R.I./Staff) following a successful application to the General Secretariat for Research & Technology (GSRT).

For more information on GeoGravGOCE, its objectives, workflow, and main findings please browse through the rest of the site. Please note that the [Partners Corner](#) is only accessible for registered users, i.e., the project team and ESA PRODEX representatives.

GeoGravGOCE Latest news

- 24.01.2020: The GeoGravGOCE [Project Brochure](#).
 - 24.01.2020: The GeoGravGOCE web-page has been launched.
- [More](#) (News, Conference Presentations and Papers)

GeoGravGOCE Newsletter

The GeoGravGOCE semi-annual newsletters will be shortly available here.
[GeoGravGOCE Newsletter #1 \(31.01.2020\)](#)

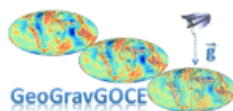


Figure 1: Screen capture from the root page of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/>).

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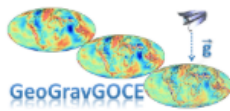
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Figure 2: Screen capture from the contact page of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/contact.html>).

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GeoGravGOCE Funding

GeoGravGOCE is funded by (HFRI) within its Call for Research Projects for Research and Academic Staff (HFRI/Staff) following a successful application to the General Secretariat for Research & Technology (GSRT).

The duration of the project is 24 months between **December 23, 2020 and December 22, 2020**. Its total funding by the EFRI/GSRT office is set to **186,895.50 €**.

The project team is composed by:

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- [Dr. George S. Vergos](#), Co-Investigator
- [Dr. Vassilios N. Grigoriadis](#), senior researcher
- [Dipl. Eng., MSc, Dimitrios A. Natsiopoulos](#), junior researcher
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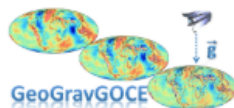
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Figure 3: Screen capture from the funding page of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/funding.html>).

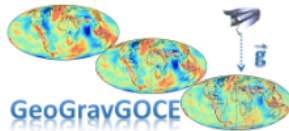
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GeoGravGOCE at a glance



Monitoring the Earth's gravity field both over marine and continental regions has been the focus of extensive geodetic research for the past decades, but has gained increased importance during the last years due to the recent gravity-field dedicated satellite missions. With the missions of CHAMP and GRACE setting the path, ESA's GOCE mission has offered breakthrough opportunities for improved insights into the Earth's gravity field and geoid. Additionally, the synergistic use of geodetic, oceanographic and earth observation data contributed to other geo-scientific areas as well. The key contribution of the GOCE mission has been in its unprecedented representation of the Earth's geoid, hence contributing significantly to the synergy of geodesy with the rest of the Earth sciences, like geology, geodynamics, hydrology and oceanography. All related studies thus far rely either on the exploitation of GOCE SGG data in their original Gradiometric Reference Frame at satellite altitude, which after proper processing are provided in the form of spherical harmonics expansions of the Earth's potential. This is known in geodesy as spherical harmonic analysis (SHA) and provides to the scientific community harmonic coefficients derived from GOCE and other satellite and terrestrial data, up to some specific degree of model expansion. The power of GOCE-based GGMs stems from the fact that the entire processing of GOCE SGG data and the respective filtering is done through the SHA, hence the provided field and gravity functionals are already processed. The user in that case can apply spherical harmonic synthesis (SHS) of the coefficients, which is trivial to the geodetic community, to get GOCE-only functionals of the Earth's potential.

The other possibility attempted in the literature so far, refers to the preparation of GOCE SGG grids at some very high altitude (around 250 km), where the respective processing is done by Least Squares Collocation (LSC). In this latter case, the filtering performed to the inherently noisy SGG data is performed with classic spatial and digital filters. In both of the aforementioned approaches, only the vertical gradients V_{zz} of the potential measured by the satellite are used, while their final product is over-smoothed without attention to local details depicted in the raw satellite data. This is normal, as both GGMs and grids at a specific altitude are dedicated for global use, i.e., they provide an optimal, in terms of gravity field representation, picture of the Earth's potential for the entire globe.

Within **GeoGravGOCE**, we propose a completely new approach, where the irregular GOCE gradients are used and referred to some mean earth sphere for further processing. This first step will be done employing the original Level1b products, hence the raw scatter observations without any gridding. The latter is to be avoided in order to reduce the impact of correlated errors in the GOCE observations. All SGG derivatives will be used exploiting the full spectrum of the GOCE measurements, hence not limiting ourselves to the vertical potential gradients only. This is crucial in terms of the novelty of our approach, as the derivatives along the xx and yy axes are of the same accuracy as the vertical ones and can show variations of the Earth's potential due to lateral density variations.

Moreover, within **GeoGravGOCE**, the filtering of the gradients will not be carried out only with classical spatial and digital filters, but employing wavelet multi-resolution analysis (WL MRA). While classical filters cannot distinguish between space and time features, as well as specific details with geophysical meaning in the three-dimensional space, WL MRA allows for selective filtering in both space and time and of some and not all coefficients. Another novel aspect is that GeoGravGOCE will attempt for the first time the downward continuation of GOCE filtered SGG data to the Earth's surface and the geoid, while their combination with in-situ data will be performed at that space and not at some high altitude. Hence, attenuation of the GOCE contribution with height will be kept to a minimum, while full exploitation of the satellite signal will be achieved. Finally, within the proposed project, we will attempt for the first time the combination of GOCE SGG data with terrestrial ones, without any need to make assumptions for the upward continuation to satellite altitude, so as to exploit the full signal power of GOCE observables. To carry this operation out, we will rely on the power spectrum of the existing local gravity data, so as to replicate the expected covariance structure of the gradiometric observations.

Figure 4: Screen capture from section on details of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/project.html>).

The next link in the navigation menu directs to the WPs of the project, where the work breakdown structure of GeoGravGOCE is given in the form its WPs (see Figure 5). The same logic is followed in the Deliverables section, where the deliverables of the project are presented in a dedicated table (see Figure 6).

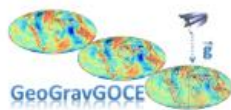
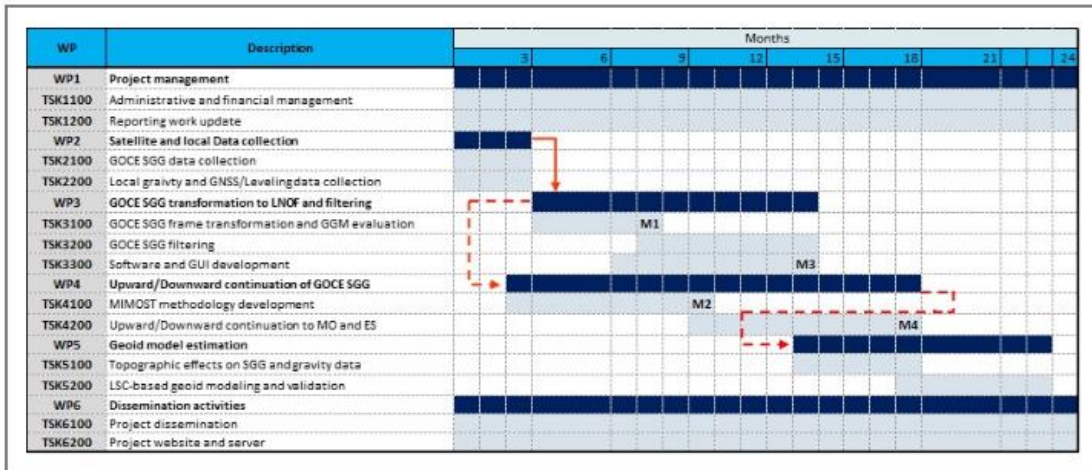
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GOCESeaComb WorkPackages

For the successful completion of the GeoGravGOCE project, six (6) Work Packages (WPs) have been identified, which are further analyzed in Tasks (TSK) as given in the flowchart below (see Figure 1). The latter outlines the Work Breakdown Structure (WBS) for the entire activity.



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Figure 5: Screen capture from Workpackages section of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/WPs.html>).

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GeoGravGOCE Deliverables

The GeoGravGOCE project comprises of several deliverables (DLs) throughout its six WPs. The Table below summarizes the deliverables of the project as well as the planned delivery data. Note that the delivery dates specified below refer to months after project start.

Deliverable Number	Deliverable Name	Related WP	Dissemination Level	Delivery Date
DL1110.1	Minutes of the kick-off	1	Public	1
DL1110.2	Minutes of the final meeting	1	Public	24
DL1120.1	Financial reporting of the	1	Public	24
DL1210.1	1 st Semi-annual progress	1	Public	7
DL1210.2	2 nd Semi-annual progress	1	Public	13
DL1210.3	3 rd Semi-annual progress	1	Public	19
DL1220	Final progress report	1	Public	24
DL1230	Project action list	1	Public	24
DL1240	Project bar-chart	1	Public	24
DL2110	Report on the data collected for GeoGravGOCE realization	2	Public	3
DL2210	Report on the performed GNSS campaigns and data	2	Public	3
DL3110	Report on the GOCE SGG data	3	Public	14
DL3210	Report on the filtering	3	Public	12
DL3310	Report on the GOCE SGG	3	Public	14
DL4110	Methodology for GOCE SGG upward/downward	4	Public	12
DL4210	Report on the GOCE SGG data	4	Public	18
DL5110	Report on the evaluation of topographic effects for GOCE	5	Public	18
DL5210	Report on the developed geoid models and their	5	Public	23
DL6110	Project brochures	6	Public	3
DL6120.1	1 st Project semi-annual	6	Public	1
DL6120.2	2 nd Project semi-annual	6	Public	12
DL6120.3	3 rd Project semi-annual	6	Public	18
DL6120.4	4 th Project semi-annual	6	Public	24
DL6130	Participation and promotion to conferences and workshops	6	Public	24
DL6140	Three journal papers	6	Public	24
DL6210	Project web-site	6	Public	2



Figure 6: Screen capture from Deliverables section of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/DLs.html>).

1.4 The GeoGravGOCE news section

The next link on the main navigation menu directs to the GeoGravGOCE news section, where all the updated information corresponding to the activities and progress of the project will be posted (see Figure 7). Whenever a report and a newsletter should be published, this will be available in PDF format.

GeoGravGOCE

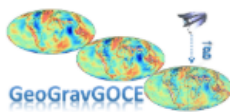
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GeoGravGOCE Project News

- 24/01/2020: The first GeoGravGOCE brochure has been prepared for the dissemination of the project main objectives. [Project Brochure](#).
- 24/01/2020: The GeoGravGOCE web-page has been launched. For comments please contact the site [webmaster](#).
- 08/01/2020: The GeoGravGOCE kick-off meeting has been carried out. Work is under way.
- 23/12/2019: GeoGravGOCE contract signed with GRST/HFRI (**Contract No: 3488**)



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Figure 7: Screen capture from news section of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/news.html>).

1.5 The GeoGravGOCE protected site

The next link on the main navigation menu directs to the GeoGravGOCE “PARTNERS CORNER”. In this section, all project deliverables will be uploaded, so that they can be accessed at all times. Note that the DLs which are ready and delivered to HFRI provide the necessary link to the report/data (see Figure 8).

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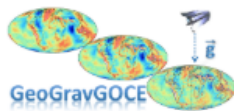
GeoGravGOCE Partners' Corner

This portion of the GeoGravGOCE Project Website is dedicated to act as an access point for the GeoGravGOCE team personnel and the ELKE/AUTH, HFRI/GSRT representatives. Here, the various deliverables of the project will be available in PDF format, so that they can be downloaded by the team personnel and checked by the respective ELKE/AUTH and HFRI/GSRT offices.

The Deliverables below, are listed as per WP and TSK, so that they conform with the approved Project proposal and be retrieved easily. The list will be populated with the progress of the project. A dedicated DL Template has been generated so that all DLs will be reported on the same format ([DL Template](#)).

WP1	WP2	WP4
TSK1100 <ul style="list-style-type: none"> ◦ DL1110.1 Minutes of the kick-off meeting. 	TSK2100 TSK2200	TSK4100 TSK4200
TSK1200	WP3	WP5
	TSK3100 TSK3200	TSK5100 TSK5200
		WP6
		TSK6100 <ul style="list-style-type: none"> ◦ DL6110 GeoGravGOCE Project Brochure. ◦ DL6120.1 1st GeoGravGOCE Project Newsletter.
		TSK6200

Last update (24.02.2020)



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Figure 8: Screen capture from **Partners Corner** section of the GeoGravGOCE project (<http://olimpia.topo.auth.gr/GeoGravGOCE/partners/partners.html>).

1.6 Concluding remarks

The GeoGravGOCE project website as it is available in its present form has been described. All necessary information and functionalities are available, along with the dedicated project server to upload the project DLs.