



Paper No: 13 **Agenda item: 8.1**

SCAR SG **Geosciences**

Person Jesús Galindo-
Responsible: Zaldívar

SCAR Delegates Report 2020

Geosciences Group (GSG) **2018-2020 Report**

Summary

Report Author(s)

Jesús Galindo-Zaldívar (Chief Officer, Spain),
Naresh C. Pant (Deputy Chief Officer, India),
Marcelo Leppe (Secretary, Chile)

Contributions of Chief Officers of Expert Groups and Action Groups.

Summary of activities from 2018-20

This report includes the activities of Geosciences Group in a setting where the global COVID19 pandemic prevents in person meeting to advance in the programmed 2020 activities. Most of these proposed meetings have been delayed at least for the next year. The internal discussions of most of the groups are postponed, including GSG, waiting for a new virtual or in person setting for meetings. In this framework, it is not possible to adequately develop the activities, including elections and budget allocation, and in consequence planning is mostly extrapolated from previous years.

Geosciences Group include 7 expert groups and 4 action groups, three of them cross- disciplinary. The action group GeoMAP has successfully completed their tasks for which they were established and is proposed to end. GeoMAP Action Group has constructed a GIS dataset describing exposed bedrock and surficial geology of Antarctica. The recommendation is that the produced map becomes a SCAR product. Action Group on Geological Heritage and Geoconservation has provided valuable results in response to the request from SCAR for advice on the protection of geological heritage sites from the CEP. SCAR should consider the best way to advance in the identification of Antarctic Geological Heritage and proposals of Geosites that will require the close interaction of the Geosciences Group and the SCATS. This group aimed to become an expert group during the cancelled Hobart SCAR 2020 meeting and will continue as an action group up to the next GSG meeting. Recommendations to Delegates are included in the Group report. Other EG / AG continue their scheduled activities and do not have any major issue. Please peruse details of their activities in Progress reports submitted by each EG/AG.

The main activity in this period have been the ISAES XIII, in Incheon, Republic of Korea, July 22-26, 2019, hosted by the KOPRI, with 443 submitted abstracts, about 300 international participants and 100 to 150 Korean attenders (<https://www.isaes2019.org:12090/home/>).

Summary Budget 2019 to 2022

	2019	2020	2021	2022
	Spent	Allocated	Request	Request
(US\$)	12114	42310	24500	24500

Progress to date

Sub-group Outcomes to date

REPORTS of ANTOS, GRAPE and AntArchitecture cross-disciplinary groups are already included in LSG and PSG. They are not duplicated in this GSG report.

Sub-group	Activity/Outcome
ADMAP	<ul style="list-style-type: none"> +ISAES side meeting. +Ongoing data acquisition in Antarctica. +Diverse publications using and/or building on ADMAP2 data compilation.
ANTPAS	<ul style="list-style-type: none"> + ANTPAS has participated at the XIII International Symposium on Antarctic Earth Science (ISAES 2019), the 1st Southern Hemisphere Conference on Permafrost (SouthCOP) and other conferences. +Coordination and joint proposal Nunantar.
ANTVOLC	<ul style="list-style-type: none"> +Volume titled 'Volcanism in Antarctica: 200 million years of subduction, rifting & continental break-up', editors John Smellie, Kurt Panter and Adelina Geyer, to be published as a Geological Society of London -GSL- Memoir. + AntVolc "White Paper" Workshop and working groups.
CGG	<ul style="list-style-type: none"> +Isotopic profiling along the Dronning Maud Land Mts. +Comprehensive Ar/Ar dataset of eastern DML. +High-resolution aeromagnetic survey over the western margin of the Mariner Glacier, combined with extensive geological field work in Victoria Land. +Geological and geophysical contributions to new SCAR-SERCE international and interdisciplinary Geothermal Heat Flow Sub-Group.
Geological Heritage and GeoConservation	<ul style="list-style-type: none"> +SCAR Working Paper for ATCM detailing a new methodology for the identification of Geological Heritage within Antarctica. (submission postponed to 2021). +SCAR Environmental Code of Conduct (CoC) for Geosciences Field Research Activities in Antarctica (submission postponed to 2021). An advance draft of this CoC was presented by SCAR as an Information Paper to the ATCM XLII (Prague, 2019). +List of national repositories (museums, universities, institutes, etc.) housing Antarctic geological and palaeontological specimens (submission postponed to 2021). +Identification of 9 Geological Frameworks for Antarctica that allow the systematic identification of individual Geosites. +First SCAR-led identification of a Geosite in Antarctica on Seymour (Marambio) Island for the Geological Framework 'K-Pg Transition'.

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GEOMAP	<ul style="list-style-type: none"> + Collaboration: GeoMAP has involved at least 12 nations. + Capacity Building: Much of the manual work has been completed by 11 student volunteers that contributed to the professional development of the students. +Adoption of Methodological Framework. +A dataset of Antarctic geology provides continent-wide perspectives for cross-discipline use that never before existed optimized for use at 1:250,000 scale, with higher spatial precision locally.
GIANT	<ul style="list-style-type: none"> + GIA Training School in Gävle, Sweden, in September 2019. + Project GIANT-REGAIN (Geodynamics In ANTArctica based on REprocessing GNSS dAta Initiative).
IBCSO	<ul style="list-style-type: none"> +IBCSO coordination/IBCSO v2.0/ IBCSO v2.0. +Identification of data sets and data gaps/improved data collection/up-to-date data coverages available. +Optimising of workflows/improved product generation/optimisation is finalised.

Sub-group Cash Flow

(From previous Delegates meeting to date)

Most of the groups have unexpended, waiting the meetings during Hobart SCAR-OSC 2020. Because meeting was cancelled due to the pandemic setting, it is requested that these amounts may be reallocated to the next year, when there is a more clear panorama to develop activities.

Sub-group	Allocation	Amount spent		
		2018	2019	2020
ADMAP	6500		0	0
AntArchitecture	2000		0	0
ANTOS	2000		0	0
ANTPAS	7500		4354	0
ANTVOLC	5000		0	0
CGG	5000		0	0
Geological Heritage and GeoConservation	6924	0	2800	3438
GEOMAP	4500		2353	0
GIANT	6000		0	0
GRAPE	4000		1746	0
IBCSO	5000		860	0

Future plans

Sub-group future plans

ANTOS, GRAPE and AntArchitecture cross-disciplinary groups are already included in LSG and PSG. They are not duplicated in this GSG report. The Action Group Geological Heritage and Geoconservation has been a very active group and developed important and relevant activities in the framework of Geosciences (see their report). It aims to become an Expert Group, but in the present-day pandemic setting it will continue as an Action Group up to the next GSG meeting.

Sub-group	Planned activity
ADMAP	+EGU splinter meeting 2021. +EGU splinter meeting 2022. +SCAR-OSC 2022 business meeting.
ANTPAS	+12 International Conference Permafrost Lanzhou 2022 +SCAR OPEN Science conference 2022. +Arctic Science Summit Week session on comparison Antarctic and arctic permafrost 20/26 March 2021. +Regional Permafrost Conference Boulder July 2021. +Meeting for Research Program 2021.
ANTVOLC	+White Paper' for SCAR summarizing the state of research into Antarctic volcanism and providing a roadmap for future volcanic research. +Completion of an online database of tephra analyses. +Encourage the compilation and completion of a volume titled 'The Antarctic mantle'.
CGG	+SRP planning meeting in Bergen, Norway, in early 2021 +EGU/AGU, conference sessions +Contributions to new International Lithosphere Programme on East Antarctica (2020-2025). +4D Antarctica modelling efforts to help constrain crustal and lithosphere structure and its influence on Antarctic geothermal heat flux heterogeneity (2020-2022).
Geological Heritage and GeoConservation	+ Implementation of the methodology developed by the Action Group to identify Antarctic Geological Heritage. SCAR would be well placed to undertake this work for the ATCM. + Establishment of an expert group, under SCAR Geosciences, to identify Antarctic Geosites for the remaining Geological Frameworks.
GIANT	+ Next phase of project GIANT-REGAIN (Geodynamics In ANTArctica based on REprocessing GNSS dAta Initiative). + Improve the visibility of GIANT. Geodesy provides key data to maintain the terrestrial reference frame in Antarctica and to determine the regional gravity field at high resolution. + Involving early career scientists.

IBCSO	<ul style="list-style-type: none"> +IBCSO coordination. +Identification of data sets and data gaps. +Publication of IBCSO v2.0. +Promotion of IBCSO v2.0.
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Sub-groups recommended for closure

Sub-group	Leaders	Reasons for closure
GEOMAP	Simon Cox Paul Morin	Group has successfully completed their tasks.

New sub-groups being proposed

The new action group proposal (Antarctic RING) has been presented, but the global pandemic has prevented in-person meeting and opportunity to discuss and approve any new sub-group in the frame of GSG. We wait for the new rules to be approved for online meetings or alternatively we return to in-person meeting.

Scientific Research Programme Planning Groups

There is an initiative led by Joachim Jacobs, chair of the CGG group, that prepares a full SRP proposal by the end of next year in the frame of Geosciences Group.

Budget

Planned use of funds for 2020 to 2022

The global pandemic prevents in person meetings and avoid to discuss and approve the budget in the frame of Geosciences. The amounts available in 2020 may be partially expended, according to the evolution of pandemia and scheduled activities. A clearer setting will be possible to be established in September-October 2020. The tasks that cannot be done in 2020 may be delayed for the next year.

In this framework, the planed use of funds is flexible and the amounts may be reallocated. A Geosciences Miscellaneous item will be taken into account to reallocate in an efficient way the amounts that needs the different Geosciences groups.

Year (YYYY)	Purpose / Activity	Amount (in USD)	Contact Name	Contact Email
2021-21	ADMAP	7000	Graeme Eagles	graeme.eagles@awi.de
2021-22	AntArchitecture	2000	Robert Bingham	r.bingham@ed.ac.uk
2021-22	ANTOS	2000	Craig Cary	caryc@waikato.ac.nz
2021-22	ANTPAS	5000	Mauro Guglielmin	mauro.guglielmin@uninsubria.it
2021-22	ANTVOLC	5000	Adelina Geyer	ageyer@ictja.csic.es
2021-22	CGG	7500	Joachim Jacobs	joachim.jacobs@uib.no
2021-22	Geological Heritage and GeoConservation	3000	Kevin A. Hughes	kehu@bas.ac.uk
2021-22	GIANT	6000	Mirko Scheinert	mirko.scheinert@tu-dresden.de
2021-22	GRAPE	4500	Giorgiana De Franceschi	giorgiana.defranceschi@ingv.it

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2021-22	IBCSO	5000	Boris Dorschel	boris.dorschel@awi.de
2021-22	Miscellaneous Geosciences	2000	Jesus Galindo Naresh Pant Marcelo Leppe	jgalindo@ugr.es pantnc@gmail.com mleppe@inach.cl
TOTAL		49000		

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
Chief officer	Jesús	Galindo-Zaldívar	Universidad de Granada	Spain	jgalindo@ugr.es	sept, 2016	aug, 2020
Deputy chief officer	Naresh	Pant	University of Delhi	India	pantnc@gmail.com	sept, 2016	aug, 2020
Secretary	Marcelo	Leppe	Instituto Antártico Chileno	Chile	mleppe@inach.cl	sept, 2016	aug, 2020

Other members

First Name	Last Name	Affiliation	Country	Email
Fernando	Bohoyo	Instituto Geológico y Minero	Spain	f.bohoyo@igme.es
Nicolas	Bergeot	Royal Observatory of Belgium	Belgium	Nicolas.bergeot@oma.be
Francisco	Fernandoy	Universidad Nacional Andrés Bello	Chile	Francisco.fernandoy@unab.cl
Fausto	Ferraccioli	BAS	UK	ffe@bas.ac.uk
Jane	Francis	BAS	UK	j.francis@bas.ac.uk
Karsten	Gohl	Alfred Wegener Institut	Germany	Karsten.gohl@awi.de
Mauro	Guglielmin	Università degli studi dell'Insubria	Italy	Mauro.guglielmin@uninsubria.it
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Yue	Zhao	Academy of Science	China	Yue_zhao@cags.ac.cn

Additional information (optional)

Notable Papers

1.- Carson, C. J., Atkins, C. B., Hughes, K. A., and Reguero, M. A. (2018). Protecting Antarctica's geological heritage. *Antarctic Science* 30: 1.

This paper analyses geoconservation in Antarctica.

2.- Antoniades, D., Giralt, S., Geyer, A., Álvarez-Valero, A.M., Pla-Rabes, S., Granados, I., Liu, E.J., Toro, M., Smellie, J.L. and Oliva, M. 2018. The timing and widespread effects of the largest Holocene volcanic eruption in Antarctica. *Nature Scientific Reports*, 8: 17279; doi:10.1038/s41598-018-35460-x

This paper provides, for the first time, a precise age for the Deception Island paroxysmal eruption, which enables its presence as tephra to be tracked right across Antarctica (> 4000 km) and raises the possibility that the event may have had pan-continental environmental effects.

3.- Reguero, MA. (2019). Antarctic Paleontological Heritage: Late Cretaceous– Paleogene vertebrates from Seymour (Marambio) Island, Antarctic Peninsula. In: C. Acosta Hospitaleche, J. Gelfo, J. Alistair Crame (Eds.), *Geology and paleontology of the James Ross Basin, Antarctic Peninsula. Advances in Polar Science*, 30(3), 328-355. <https://doi:10.13679/j.advps.2019.0015>

This paper provides a review of the vertebrate fossil occurrences and outcrops on Seymour Island, Antarctic Peninsula and discusses the geological heritage value of these fossils and some threats to the fossil sites.

<https://www.scar.org/science/geoconservation/geological-heritage-and-geo-conservation-news/>

4.- Hughes, K.A., Carcavilla, L., Crame, A., Díaz-Martínez, E., Elliot, D., Francis, J., López-Martínez, J., Reguero, M. (2020). Seymour (Marambio) Island: an outstanding example of Antarctic geological heritage. *Antarctic Science* 32, 167.

This editorial provides brief details of the new methodology for identification of Antarctic Geological Heritage developed by the Action Group. It describes the application of the methodology to identify the first Geosite in Antarctic using the methodology adopted by SCAR.

5.- Geyer, A., A. M. Álvarez-Valero, G. Gisbert, M. Aulinas, D. Hernández-Barreña, A. Lobo and J. Marti, 2019. Deciphering the evolution of Deception Island's magmatic system. *Scientific Reports* 9(1): 373. <https://doi.org/10.1038/s41598-018-36188-4>

Results presented in this paper provide a complete picture of Deception Island's plumbing system, one of Antarctica's most active volcanoes. Understanding the current state of the island's magmatic system, and its potential evolution in the future, is fundamental to increase the effectiveness of interpreting monitoring data during volcanic unrest periods and hence, for future eruption forecasting.

6.- Ebbing, J., Haas, P., Ferraccioli, F., Pappa, F., Szwilius, W., & Bouman, J. (2018). Earth tectonics as seen by GOCE-Enhanced satellite gravity gradient imaging. *Scientific reports*, 8(1), 1-9.

A pioneering study introducing the use of satellite gravity gradient data for interpretations of global tectonics, with a discussion on its particular utility for remote regions like Antarctica when combined with the ADMAP2 compilation.

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7.- Jordan, T. A., Riley, T. R., & Siddoway, C. S. (2020). The geological history and evolution of West Antarctica. *Nature Reviews Earth & Environment*, 1-17.

A comprehensive review of geoscientific understanding of West Antarctica, relying heavily on the ADMAP2 compilation for context and some new interpretations.

8.- Daczko, N. R., Halpin, J. A., Fitzsimons, I. C. W., Whittaker, J. M., 2018. A cryptic Gondwana-forming orogen located in Antarctica. *Scientific Reports*, 8, 8371.

This work proposes that the cryptic Kuunga suture, where Indo-Antarctica and Australo-Antarctica collided during Gondwana assembly lies close to Mirny Glacier. A follow-up paper published in *Geology* in 2019 further hypothesizes that it also links to the major Gamburtsev Suture in interior East Antarctica.

9.- Mikhalsky E.V. and Leitchenkov G.L. (Eds). 2018. Geological map of Mac.Robertson Land, Princess Elizabeth Land, and Prydz Bay (East Antarctica). Scale 1:1000000. *VNIIOkeangeologia, SPb.* 1 Sheet. Explanatory notes to geological map of Mac.Robertson Land, Princess Elizabeth Land, and Prydz Bay (East Antarctica) in scale 1 : 1 000 000 (Ed. By E.V. Mikhalsky and G.L. Leitchenkov. *VNIIOkeangeologia, SPb.* 82 p. ISBN 978-5-88994-121-7.

Detailed work integrating geology and geophysics, outlining the contrast between stable and mobile crustal domains. The authors suggest key geological transects across major crustal domains.

10.- Arora, D., Pant, Naresh, Pandey, M., Chattopadhyay, A., Greenbaum, J., Siegert, M., Bo, Sun, Benkinship, D., Rao, Chalapathi and Bhandari, A. (2020) Insights into geological evolution of Princess Elizabeth Land, East Antarctica-clues for continental suturing and breakup since Rodinian time, *Gondwana Research*, 84, 260-283, doi.org/10.1016/j.gr.2020.05.002

This work suggests presence of two orogenies in the Prydz Bay sector of east Antarctica with an ~800Ma orogeny overprinted by a ~500Ma orogeny. Analog structural experimental approach also indicates influence of orogeny related fabric in development of major extensional structures at the time of later rifting.

Direct support from outside organisations received for your activities

AntVolc: ICTJA- CSIC – in kind support

Geoheritage: Provision of workshop facilities at: the Instituto Geológico y Minero de España (Madrid, Nov 2018) and the British Antarctic Survey (Cambridge, March 2019, March 2020). Partial travel support to attend AG workshops provided by the British Antarctic Survey (UK) and the Universidad Autónoma de Madrid (Spain).

GeoMAP:

+\$50k In kind support: GeoMAP has relied heavily on voluntary efforts of students, funded to varying degrees by their home institutions or federal grants. We estimate their co-funding value, in wage-equivalent, to total ~US\$50k for 2018-2020.

+US\$162k Co-funding: GeoMAP has been primarily led by GNS Science in New Zealand. This contribution is based on US\$70k/yr from Direct Core Funding, US \$20k from a Ross Sea Region (RSR) Terrestrial Data Analysis project (Landcare MBIE CO9X1413); \$2k from NZARI.

Major collaborations your Science Group has with other SCAR groups and with organisations/groups beyond SCAR

(Numbered list of substantive collaborations)

Within SCAR

1. Links crossing geosciences groups.
2. SERCE
3. PAIS
4. SCATS
5. INSTANT
6. Geothermal Heat Flux
7. Quantarctica 3
5. Antera
6. Anteco
7. Antos
8. Standing Committee on Antarctic Geographic Information (SCAGI)
9. Standing Committee on Antarctic Data Management (SCADM)

Outside SCAR

1. IAVCEI
2. IGCP-628: Geological map of Gondwana
3. IGCP 648: Supercontinent cycles & global geodynamics
4. ESA & 3D Earth
5. 4D Antarctica
6. IUGG
7. International Lithosphere Programme (upcoming focus on East Antarctica)
8. Antarctic Resolution
9. One Geology
10. PGC: Polar Geospatial Centre webserverd imagery, photos and data (eg. REMA)
11. IPA (International Permafrost Association)
12. LTER Long Term Ecological Research
13. ITEX (international Tundra Experiment)
14. IAG (International Geomorphology Association)
15. International Association of Geodesy (IAG) Subcommittee 1.3f: Regional reference frame in Antarctica
16. International Association of Geodesy (IAG) Subcommittee 2.4: Gravity and Geoid in Antarctica

Outreach, communication and capacity-building activities

AntVolc

AntVolc now has a new priority line to promote Education and Outreach. Our first step here has been setting up active social media accounts for our group. These are now online and can be found on twitter and facebook by searching @antvolc (or here: <https://twitter.com/antvolc> ; <https://www.facebook.com/AntVolc>). The coordinator is an Early-Career Scientist, Max Van Wyk de Vries (vanwy048@umn.edu).

CGG

Press release on GOCE+Antarctica on satellite gravity gradient views of the lost continents under the ice related to the Nature journal *Scientific Reports* paper of Ebbing et al., (2018) that generated over 300 news items worldwide

Press release on the first 3D model of the Antarctic lithosphere related to the *JGR* paper of Pappa et al., (2019) that generated over 20 news items.

Press release 2019 on completion and first scientific achievements of BGR geological-geophysical expedition GANOVEX XIII to Victoria Land (2018-19 season).

Contribution to public exhibition on Antarctica in Überseemuseum Bremen, Germany 2018 with article on Antarctic geology.

Contribution to publication “The Arctic and Antarctic – Extreme, Climatically Crucial and In Crisis” in *World Ocean Review* 6 (2019).

Elvevold, S., Myhre, P.I., Engvik, A., Jacobs, J., 2019: Geological mapping of Norway’s least explored mountains. *Research Notes, Fram Forum* 2019, 128-131.

GeoMAP

Communication has generally been by way of group email (~half-yearly) and small skype meetings. GeoMAP mailing list has over 60 recipients representing 15 different nations. Working meetings have been held at all major Antarctic conferences from 2015-2020.

Eleven students from USA, NZ, Australia, Italy and UK have been trained in GIS and GeoSciML. All have presented their mapping at conferences and published abstracts and posters; several are continuing with polar research.

Presentations and posters have been made for Antarctic conferences, AGU Fall meetings, GSA, Italian and NZ Antarctic conferences. All posters and presentations have been branded with the same banner and logo.



GeoMAP has been profiled in SCAR Newsletters (e.g. <https://scar.org/scar-news/geomap-news/world-first-digital-database-of-antarctic-geology/>)

GeoMAP pages on the SCAR website are well populated and informative. They have links to webmaps and data download sites, and are reasonably up to date (see <https://www.scar.org/science/geomap/home/>)

SCAR Fellowship Reviewers

As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your SG who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.

First Name	Last Name	Email	Principal Expertise
Adam	Martin	a.martin@gns.cri.nz	Mantle petrology; igneous chemistry; Erebus volcanic province
Adelina	Geyer	ageyer@ictja.csic.es	Active volcanism; Deception Island
Alessio	Di Roberto	Alessio.diroberto@ingv.it	Tephrochronology
Andreas	Läufer	andreas.laeufer@bgr.de	Tectonics, geochronology, geodynamics
Antonia	Ruppel	antonia.ruppel@bgr.de	Geophysics, geodynamics
Berry	Lyons	Lyons.142@osu.edu	Ecology Aquatic
Boris	Dorschel	Boris.Dorschel@awi.de	Geology, Habitat mapping
Detlef	Damaske	d.damaske@t-online.de	Aeromagnetism
Fausto	Ferraccioli	ffe@bas.ac.uk	Potential fields, tectonophysics, geodynamics
Graeme	Eagles	Graeme.Eagles@awi.de	Plate Kinematics
Joachim	Jacobs	joachim.jacobs@uib.no	Tectonics, geodynamics, geochronology
John L.	Smellie	jls55@leicester.ac.uk	physical volcanology, especially glaciovolcanism, eruptive palaeoenvironments
Kurt	Panter	kpanter@bgsu.edu	Igneous petrology/geochemistry/mantle geochemistry
Laura	Crispini	andreas.laeufer@bgr.de	Structural geology geodynamics
Marc	Oliva	marcoliva@ub.edu	Permafrost Quaternary Geology
Matt	King	Matt.King@utas.edu.au	Geodesy, GNSS, GIA
Mauro	Guglielmin	Mauro.guglielmin@uninsubria.it	Permafrost, Ecology
Max	Maximillian Van Wyk de Vries	vanwy048@umn.edu	Volcano-ice interactions, glaciology, volcanic hazard modelling.
Mirko	Scheinert	Mirko.Scheinert@tu-dresden.de	Geodesy, GNSS
Nicoletta	Cannone	Nicoletta.cannone@uninsubria.it	Ecology Terrestrial
René	Forsberg	rf@space.dtu.dk	Geodesy, gravity field