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Geodetic activities in Sweden 2014–2018

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Preface

This report covers the geodetic activities at Lantmäteriet (the Swedish mapping, cadastral and land registration authority) and at universities in Sweden for the years 2014–2018. The report was presented at the 18th General Assembly of the Nordic Geodetic Commission (NKG) and it is planned to be included in the proceedings from this meeting. The location for the assembly was Helsinki in Finland, where it was held 3–6 September 2018. The universities which have contributed to and participated in the compilation of the report are:

- KTH Royal Institute of Technology (*Kungliga Tekniska högskolan*) in Stockholm.
- University of Gävle (*Högskolan i Gävle*).
- University West (*Högskolan Väst*) in Trollhättan.

Onsala Space Observatory at Chalmers University of Technology (*Onsala Rymdobservatorium vid Chalmers tekniska högskola*) in Göteborg has unfortunately not been able to contribute with their geodetic activities 2014–2018 in the same way that they have done in connection with former NKG General Assemblies, for example to the previous one in 2014 (Norin et al., 2016). Onsala Space Observatory is the Swedish national facility for radio astronomy. It is hosted by the university´s Department of Earth and Space Sciences, where the Space Geodesy and Geodynamics research group is focused on three techniques for geodetic, geophysical and other earth oriented applications for studying among others geodynamic phenomena and atmospheric processes:

- Geodetic VLBI.
- Gravimetry.
- GNSS.

It should also be mentioned that the former Associate Professor at KTH Arne Håkansson peacefully passed away on 26 May 2015 at the age of 86 and that the former geodesist at Lantmäteriet as well as national boundary inspector Åke Gustafsson peacefully passed away on 17 May 2017 at the age of 91.

Geodetic activities in Sweden 2014–2018

Geodetic activities in Sweden 2014–2018

1 Geodetic activities at Lantmäteriet

1.1 Introduction

At Lantmäteriet (the Swedish mapping, cadastral and land registration authority) the geodetic activities since the previous NKG General Assembly in 2014 (Norin et al., 2016) have been focused on:

- The operation, expansion and services of SWEPOS™, the Swedish national network of permanent reference stations for GNSS[1].
- The implementation and sustainability of the Swedish national geodetic reference frame SWEREF 99 and the national height system RH 2000 (ETRS89[2] and EVRS[3] realisations, respectively).
- The improvement of Swedish geoid models and renovation of the gravity network.

Some of the activities are performed within the framework of NKG[4].

The geodetic work within Lantmäteriet has been based on a 10-year strategic plan for the years 2011–2020 called Geodesy 2010, which was released in 2011 and updated in 2015 (Lantmäteriet, 2011, 2015). A new strategic plan will be released during 2018 (Lantmäteriet, 2018), initiated by a new national geodata strategy from 2016.

To ensure a long-term stable national geodetic infrastructure, Onsala Space Observatory at Chalmers University of Technology in 2017 initiated discussions concerning funding from Lantmäteriet of the geodetic activities at the observatory. This will start from 2019 and is an important step in implementing the UN[5] resolution on "A Global Geodetic Reference Frame for Sustainable Development" in Sweden.

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[1] GNSS = Global Navigation Satellite Systems

[2] ETRS = European Terrestrial Reference System

[3] EVRS = European Vertical Reference System

[4] NKG = Nordiska Kommissionen för Geodesi (Nordic Geodetic Commission)

[5] UN = United Nations

1.2 Satellite positioning (GNSS)

Lantmäteriet operates the NKG AC[6] for EPN[7] in cooperation with Onsala Space Observatory. The NKG AC contributes with weekly and daily solutions using the Bernese GNSS Software version 5.2. The EPN sub-network processed by the NKG AC consists of 90 reference stations concentrated to northern Europe, see Figure 1.1. This means that 31 stations have been added to and 2 stations have been redrawn from the NKG AC sub-network since the previous NKG General Assembly four years ago. NKG has through Lantmäteriet been represented at the ninth and tenth EUREF[8] AC Workshops held in 2015 and 2017.

Figure 1.1: *The NKG EPN AC sub-network of 88 permanent reference stations for GNSS. Source: www.epncb.oma.be.*

The NKG GNSS analysis centre project was declared fully operational in April 2017 and it is chaired by Lantmäteriet (Lahtinen et al., 2018). The project aims at a dense and consistent velocity field in the Nordic and Baltic area. Consistent and combined solutions are produced based on national processing following the EPN analysis guidelines. A reprocessing of the full NKG network of reference stations including all Nordic and Baltic countries for the years 1997–2016 has been completed and the time series analysis has been finalised during 2018.

In June 2016, Lantmäteriet became one of the analysis centres in E-GVAP[9], where Lantmäteriet manages the data processing to provide near-real-time zenith total delay of GNSS signals in the troposphere

[6] AC = Analysis Centre

[7] EPN = EUREF Permanent Network

[8] EUREF = the IAG Reference Frame Subcommission for Europe

[9] E-GVAP = the EUMETNET EIG GNSS water vapour programme

(Lindskog et al., 2017 and Ning et al., 2016). Both the Bernese GNSS Software version 5.2 and GIPSY/OASIS II version 6.2 are used for the processing. The latter software uses the PPP[10] strategy and approximately 700 reference stations in total situated mainly in Sweden, Finland, Norway and Denmark are processed.

The EGNOS[11] RIMS[12] that was inaugurated at Lantmäteriet in Gävle already during 2003 has been successfully supported by Lantmäteriet since then.

1.3 Network of permanent reference stations for GNSS (SWEPOS)

SWEPOS™ is the Swedish national network of permanent GNSS stations operated by Lantmäteriet, see Figure 1.2 (Lilje et al., 2014). The SWEPOS website is available on www.swepos.se (www.lantmateriet.se/swepos).

Figure 1.2: *The SWEPOS control centre at the headquarters of Lantmäteriet in Gävle during a study visit in 2016 by Mr Peter Eriksson, the Swedish Minister for Housing and Digital Development. Photo: Britt-Louise Malm.*

The purposes of SWEPOS are:

- Providing single- and dual-frequency data for relative GNSS measurements.
- Providing DGNSS[13] corrections and RTK[14] data for distribution to real-time users.
- Acting as the continuously monitored foundation of SWEREF 99.

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[10] PPP = Precise Point Positioning

[11] EGNOS = European Geostationary Navigation Overlay System

[12] RIMS = Ranging and Integrity Monitoring Station

[13] DGNSS = Differential GNSS

[14] RTK = Real Time Kinematic

- Providing data for geophysical research and for meteorological applications.
- Monitoring the integrity of the GNSS systems.

SWEPOS uses a classification system of permanent reference stations developed within the NKG (Engfeldt et al., 2006). The SWEPOS stations belong either to class A or class B, where class A meets the highest demands.

Figure 1.3: *Sveg is a SWEPOS class A station. It has both a new monument (established in 2011) and an old monument (from 1993).*

By the time for the 18th NKG General Assembly in September 2018 SWEPOS consisted of totally 401 stations (41 class A stations and 360 class B ones), see Figures 1.3 and 1.4.

Figure 1.4: *Gustavsberg is a SWEPOS class B station with a roof-mounted GNSS antenna mainly established for network RTK purposes.*

This means that the total number of SWEPOS stations has increased with 96 stations since the previous NKG General Assembly, see Figure 1.5.

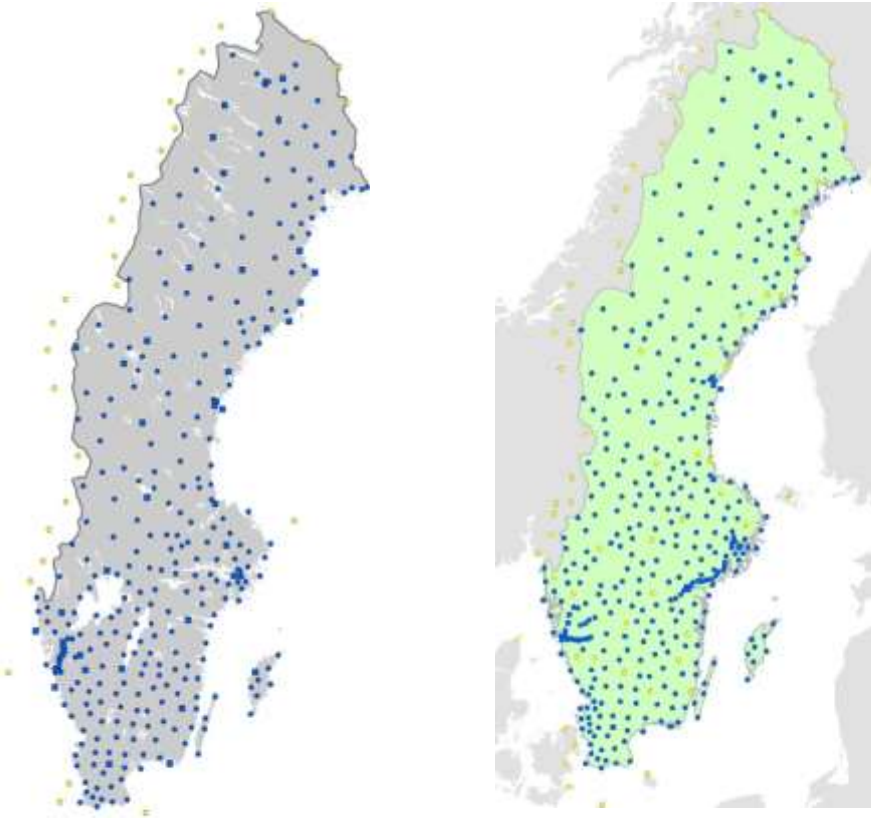

Figure 1.5: *The SWEPOS network by the time for the previous NKG General Assembly in 2014 to the left and by the time for the 18th NKG General Assembly in September 2018 to the right. Squares indicate class A stations and dots indicate class B ones. Stations in neighbouring countries and from other service providers used in the SWEPOS Network RTK Service are also marked.*

The class A stations are built on bedrock and have redundant equipment for GNSS observations, communications, power supply, etc. Class B stations are mainly established on top of buildings for network RTK purposes. They have the same instrumentation as class A stations (dual-frequency multi-GNSS receivers with antennas of Dorne Margolin choke ring design), but with somewhat less redundancy. All SWEPOS stations have in recent years been upgraded to track the modernised GPS signals and the signals from the new GNSS systems Galileo and BeiDou.

The 21 original class A stations have two kinds of monuments; the original concrete pillar as well as a newer steel grid mast, see Figure 1.3. The new monument is equipped with individually calibrated GNSS antennas and radomes of the type LEIAR25.R3 LEIT.

The seven SWEPOS stations Onsala, Mårtsbo, Visby, Borås, Skellefteå, Vilhelmina and Kiruna (ONSA, MAR6, VIS0, SPT0, SKE0, VIL0 and KIR0), which all are original class A stations, have since the very beginning been included in EPN. The new monuments on 20 of the 21 original class A stations mentioned above have also become EPN stations during 2014–2016. Daily and hourly data are delivered from all 27 stations and real-time (EUREF-IP) data (1 Hz) are delivered from seven stations. The new monument for the last original SWEPOS station is expected to be included in EPN later.

Onsala, Mårtsbo, Visby, Borås and Kiruna are also included in the IGS[15] network, as well as three of the new monuments (ONS1, MAR7 and KIR8). These three stations also contribute to the IGS-MGEX[16] pilot project, which has been set-up to track, collate and analyse all available GNSS signals.

1.4 SWEPOS services

SWEPOS provides real-time services on both metre level (DGNSS) and centimetre level (network RTK), as well as data for post-processing in RINEX[17] format. A transition from RINEX 2 to RINEX 3 is ongoing and the plan is to have RINEX 3 fully implemented for all SWEPOS stations during 2018. An automated post-processing service which utilises the Bernese GNSS Software is also available. Version 5.2 of the software has been used since 2015 and from 2016 the service takes advantage of both GPS and GLONASS. A SWEPOS user group consisting of representatives from governmental and non-governmental organisations as well as from the private sector supports the development of SWEPOS and its services.

The SWEPOS Network RTK Service reached national coverage in 2010 and it has supplied RTK data for both GPS and GLONASS since April 2006. Galileo as well as GPS L5 and L2C signals were implemented in the service on 1 February 2018. The implementation of Galileo was preceded by extensive and successful test measurements. Studies of the impact from hardware biases from code and phase biases in multi-GNSS positioning are also going on (Håkansson, 2017 and Håkansson et al., 2017)

Since data from permanent GNSS stations are exchanged between the Nordic countries, good coverage of SWEPOS network RTK service has been obtained also in border areas and along the coasts. Several stations from SATREF in Norway and Styrelsen for Data-forsyning of Effektivisering (Agency for Data Supply and Efficiency) in Denmark are included together with stations from private operators in Norway, Denmark, Finland, Germany as well as Sweden.

By the time for the 18th NKG General Assembly in September 2018, the service had approximately 3,900 subscriptions, which means some 1,500 additional users since the previous NKG General Assembly four years ago.

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15 IGS = International GNSS Service

16 IGS-MGEX = IGS Multi-GNSS Experiment

17 RINEX = Receiver Independent EXchange format

Lantmäteriet has also signed cooperation agreements with four international GNSS service providers, using GNSS data from SWEPOS stations for their own services. This is done to increase the use of SWEPOS data as well as optimising the benefits of the geodetic infrastructure.

A general densification of the SWEPOS network started 2010 with the main purpose to improve the performance of the network RTK service. The establishment of new stations is since 2017 on a little lower level. More comprehensive densifications have also been performed in some areas to meet the demands for machine guidance in large-scale infrastructure projects as well as in collaboration with some municipalities.

SWEPOS also offers a single frequency DGNSS Service as a supplement to the network RTK service. The service is since 2016, in line with some other national geographical data from Lantmäteriet, available as open data. Both services are utilising Trimble Pivot Platform GNSS Infrastructure Software and are operating in virtual reference station mode.

1.5 Reference system management – SWEREF 99

SWEREF 99 has been used as the national geodetic reference frame in Sweden since 2007 and it was adopted by EUREF as the Swedish realisation of ETRS89 at the EUREF 2000 symposium in Tromsö (Jivall & Lidberg, 2000). It is defined by an active approach through the 21 original SWEPOS stations, hence relying on positioning services like the network RTK service. All alterations of equipment and software as well as movements at the reference stations will in the end affect the coordinates.

To be able to check all alterations mentioned above, approximately 300 nationally distributed passive so-called consolidation points are used. They are remeasured with static GNSS in a yearly programme with 50 points each year. The main part of the consolidation points is still existing so-called SWEREF points established already with the beginning in 1998. In 2017, a reprocessing of all measurements was performed. All measurements have been done for 2x24 hours using choke ring antennas, where the original processing was done in the Bernese GNSS software and the reprocessing 2017 was done in both the Bernese GNSS software and in the GAMIT software. The outcome will be used to analyse the stability of SWEREF 99 and has been used to define the SWEREF 99 component in the fit of the NKG2015 geoid model to SWEREF 99 and RH 2000 (see Section 1.7).

Station dependent errors at the SWEPOS stations are limiting factors for height estimation in SWEREF 99. In order to investigate this, station calibration campaigns – in situ calibrations – have been carried out on a selection of the original SWEPOS stations (Lidberg et al., 2016).

The work regarding the implementation of SWEREF 99 among different authorities in Sweden, such as local ones, is still not finalised. By the time for the previous NKG General Assembly four years ago, 264 of the 290 Swedish municipalities had finalised the process to replace their old reference frames with SWEREF 99, while four municipalities still remain to date.

1.6 Reference system management – RH 2000

The third precise levelling of the mainland of Sweden lasted 1978–2003, resulting in the new national height system RH 2000 in 2005. The network consists of about 50,000 benchmarks, representing roughly 50,000 km double run precise levelling measured by motorised levelling technique.

Since the beginning of the 1990s, a systematic inventory/updating of the network is continuously performed. When an update is required, the required precise levelling is done through procurement procedures, which is also the situation for the remeasurements of the 300 consolidation points described in Section 1.5. Precise levelling work has also been carried out to connect tide gauges to the national levelling network and for height determination of surface levels of the large lakes in Sweden.

The implementation of RH 2000 among different authorities in Sweden is in progress (Kempe et al., 2014). About 93% of the 290 Swedish municipalities have, mainly in cooperation with Lantmäteriet, started the replacement of their local height systems with RH 2000. So far 247 municipalities have finalised the replacement for all activities, which is 88 more than by the time for the previous NKG General Assembly four years ago.

1.7 Geoid models

According to Geodesy 2010, the ultimate goal is to compute a 5-mm geoid model (68%) by 2020. To reach this goal – to the extent that it is realistic – the following activities have been carried out and are still ongoing:

- Work with the new national gravity reference frame RG 2000 finalised in the beginning of 2018 (see Section 1.8).
- New detail gravity observations collected with relative gravimeters of the brand Scintrex CG5 with the purpose to fill gaps or replace old data of bad quality (e.g. on Lake Vänern and in the rough Swedish mountains in the north-west part of the country, see Figure 1.6).

- Improvement of the national GNSS/levelling dataset, where the core of the new updated dataset is the SWEREF and consolidation points (see Section 1.5) for which accurate levelled heights are available in RH 2000.
- Computation of NKG2015, which is the new common gravimetric quasigeoid model over the Nordic and Baltic countries released in October 2016 (Ågren et al., 2016).

Figure 1.6: *More than 3,400 new relative gravity measurements have been performed in Sweden since 2010. The heights of the locations are determined by network RTK measurements. Photo: Örjan Josefsson.*

The work with NKG2015 was performed in the geoid model project of the NKG Working Group of Geoid and Height Systems. An update of the NKG gravity database for the whole Nordic-Baltic area and a creation of a new NKG GNSS/levelling database and a common DEM[18] were also included in the project. Independent computations for NKG2015 were first made by five computation centres – from Sweden, Denmark, Finland, Norway and Estonia – using different regional geoid computation methods, software and set-ups. The modelling method utilised for the final model, the Least Squares Modification of Stokes' formula with additive corrections, was chosen based mainly on the agreement to GNSS/levelling. GNSS/levelling evaluations show that NKG2015 is a significant step forward, not only compared to previous NKG geoid models, but also with respect to other state-of-the-art ones covering the whole Nordic-Baltic area, e.g. EGM2008, EGG2015 and EIGEN-6C4.

The new Swedish national geoid model SWEN17_RH2000 was released in October 2017. It was computed by adapting the gravimetric NKG2015 geoid model (slightly corrected over Sweden with some new Swedish data) to the GNSS/levelling dataset by

[18] DEM = Digital Elevation Model

adding a smooth residual surface computed by Least Squares Collocation. The standard uncertainty of SWEN17_RH2000 is estimated by cross validation to 8–10 mm on the Swedish mainland and on the islands of Öland and Gotland. This is a significant step forward compared to the old model SWEN08_RH2000, but still more work is required to reach the ultimate 5-mm goal.

1.8 Gravimetry

Absolute gravity observations have been carried out at 14 Swedish sites since the beginning of the 1990s, see Figure 1.7.

All sites, except for Göteborg (Gtbg) which no longer is in use, have been observed by Lantmäteriet since 2007. The observations have been carried out with Lantmäteriet's absolute gravimeter (Micro-g LaCoste FG5X – 233), where the upgrade from FG5 to FG5X was done in autumn 2016. The objective behind the investment was to ensure and strengthen the observing capability for long-term monitoring of the changes in the gravity field due to the Fennoscandian GIA[19].

All Swedish sites are co-located with SWEPOS stations with the exception for Göteborg (Gtbg). Ratan, Skellefteå, Smögen, Visby and Onsala are co-located with tide gauges. Onsala is also co-located with VLBI[20].

Figure 1.7: *There are 14 absolute gravity sites (for FG5/FG5X) in Sweden marked with red squares in the map. Absolute gravity sites in neighbouring countries are marked with grey circles. The four sites with time series more than 15 years long have a green circle as background to the red square.*

Absolute gravity observations are also performed abroad, mainly in the Nordic countries. They have however during the last four-year-period been limited to gravimeter intercomparisons (one in Belval and one in Wettzell), which now means that totally eight such comparisons have been carried out.

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[19] GIA = Glacial Isostatic Adjustment

[20] VLBI= Very Long Baseline Interferometry

In the beginning of 2018, the new Swedish gravity reference frame RG 2000 became official (Engfeldt et al., 2018). The reference level is as obtained by absolute gravity observations according to international standards and conventions. It is a zero-permanent tide system in post-glacial rebound epoch 2000. RG 2000 is realised by the 14 Swedish absolute gravity sites, 96 A10 stations (measured by IGiK[21]) and some 200 stations observed with relative gravimeters.

The superconducting gravimeter at Onsala Space Observatory installed during 2009 is regularly calibrated by Lantmäteriet's FG5/FG5X, latest in June 2018, which was the seventh performed calibration.

1.9 Geodynamics

The main purpose of the repeated absolute gravity observations of Lantmäteriet is to support the understanding of the physical mechanisms behind the Fennoscandian GIA process. One key parameter here is the relation between gravity change and geometric deformation (Olsson, 2015).

Research regarding the 3D geometric deformation in Fennoscandia and adjacent areas is foremost done within the BIFROST[22] effort. Reprocessing of all observations from permanent GPS stations is a continuous activity and velocity fields are produced based on the GAMIT/GLOBK, GIPSY and the Bernese GNSS software.

A new land uplift model called NKG2016LU substituted the older model NKG2005LU on 30 June 2016. The new model is developed as a combination and modification of a mathematical (empirical) model of Olav Vestøl and a geophysical model developed within NKG called NKG2016GIA_prel0306. It delivers both vertical and horizontal motions, as well as gravity-rates-of-change and geoid change. Current efforts aim at providing reliable uncertainty estimates and a submission of a final publication for peer review. The uncertainty of the geophysical model NKG2016GIA_prel0306 is calculated based on the spread of well-fitting GIA models to the observations within the 1-sigma range of the best-fitting GIA model, see Figure 1.8.

A new 3D velocity model for northern Europe called NKG_RF17vel is currently in preparation. The vertical part is based on NKG2016LU, while the horizontal motions are generated from an updated geophysical model preliminary named NKG2016GIA_prel0907.

[21] IGiK = Institute of Geodesy and Cartography, Poland

[22] BIFROST = Baseline Inferences for Fennoscandian Rebound Observations Sea level and Tectonics

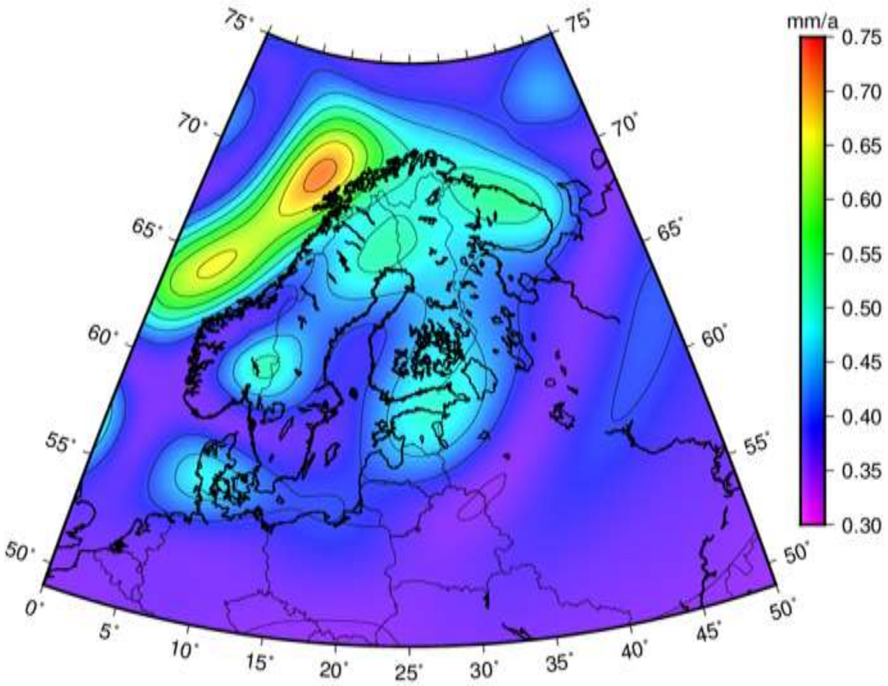

Figure 1.8: *Uncertainty of the geophysical model NKG2016GIA_prel0306.*

Lantmäteriet has also been involved in other activities related to geodynamics:

- Participation in the EUREF working group on Deformation models, which aims at obtaining a high-resolution velocity model for Europe and adjacent areas and significantly improving the prediction of the time evolution of coordinates.
- Contribution during 2015–2017 with global GIA corrections for gravity missions such as GRACE, via a Service Level Agreement to the EU[23]-financed Horizon 2020 project EGSIEM[24].
- Contribution to geodynamic studies regarding the reactivation of faults due to GIA (Brandes et al., 2015, 2018).

1.10 Further activities

1.10.1 Diploma works

During the period 2014–2018 totally 11 diploma works have been performed at Lantmäteriet by students from KTH[25], Stockholm University, the University of Gävle and University West (not all published). They have mainly been focused on GNSS and to a large extent the SWEPOS services.

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[23] EU = European Union

[24] EGSIEM = European Gravity Service for Improved Emergency Management

[25] KTH = Kungliga Tekniska högskolan (Royal Institute of Technology)

1.10.2 Arranged workshops and seminars

In cooperation with Chalmers University of Technology, the 17th NKG General Assembly was arranged in Göteborg 1–4 September 2014, see Figure 1.9. It gathered 100 participants with additional 20 participating in the seminar co-arranged one of the days with the Nordic Institute of Navigation and the Swedish Board of Radio Navigation.

Figure 1.9: *At the 17th NKG General Assembly, which was held in Göteborg in 2014, the former and the new professor in Geodesy at KTH Lars E. Sjöberg (left) and Anna Jenson (right) were honoured by Jan Johansson of Chalmers University of Technology. Photo: Holger Steffen.*

The NKG Summer School gathering 80 participants was arranged in Båstad 29 August–1 September 2016 and an NKG land uplift workshop was arranged in December 2016. The NKG2016LU land uplift model was introduced during the land uplift workshop and further steps in NKG model developments were also discussed.

Chalmers University of Technology arranged the European Navigation Conference 2018 (ENC 2018) in Göteborg 14–17 May 2018 in cooperation with Lantmäteriet and RISE Research Institutes of Sweden.

For Swedish GNSS users, seminars were arranged in Gävle in October 2015 and October 2017. The aim of these seminars held every second year is to highlight the development of GNSS techniques, applications of GNSS and experiences from the use of GNSS. Many locally organised seminars have also had key speakers from Lantmäteriet, who have informed about e.g. SWEPOS, SWEPOS services and the implementation of SWEREF 99 and RH 2000. Lantmäteriet is also giving courses in e.g. geodetic reference frames and GNSS positioning.

Among meetings which have taken place in Gävle, a meeting with the EUREF Technical Working group in March 2014 can be mentioned.

1.10.3 Participation in projects overseas

Lantmäteriet are involved in several projects abroad. Some projects have been organised through the state-owned company Swedesurvey, but since 2017 all activities are operated by Lantmäteriet. Many projects have a geodetic part and typical components are development of the geodetic infrastructure and implementation of modern surveying techniques based on GNSS.

Countries which geodetic personnel have visited for assignments over the last four years are Albania, Belarus, Bosnia and Herzegovina, Georgia, Ghana, Jordan (see Figure 1.10), Kosovo, Republic of Macedonia, Rwanda and Serbia.

Figure 1.10: *The mission in the EU Twinning project in Jordan was to enhance the technical and administrative capacities of the Department of Lands and Survey with the main purpose to reduce the discrepancies between the physical reality and the graphical cadastral information. Photo: Dan Norin.*

Besides the projects overseas, Lantmäteriet has also been represented and involved in different international seminars and working groups. Mikael Lilje is since 2017 one of the vice presidents of FIG[26] and Martin Lidberg is since 2012 a member of EUREF Governing Board. Lantmäteriet has contributed to the UN resolution on "A Global Geodetic Reference Frame for Sustainable Development" being adopted by the General Assembly in February 2015 and the

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[26] FIG = Fédération Internationale des Géomètres (International Federation of Surveyors)

UN Subcommittee on Geodesy Focus Group on Education, Training and Capacity Building is headed by Sweden (Mikael Lilje). Lantmäteriet supports the management of the geodetic UNESCO[27] World Heritage Struve Geodetic Arc, both nationally and internationally, and Dan Norin is since 2008 the Swedish representative in Struve Geodetic Arc Coordinating Committee.

1.10.4 Website and digital geodetic archive

The Lantmäteriet website (www.lantmateriet.se/geodesi) contains extensive geodetic information. Here also transformation parameters and geoid models are easily and freely accessible.

Lantmäteriet has a digital geodetic archive with descriptions of national control points and their coordinates and heights etc., which has been accessible through a website since October 2007. The users are several hundreds and can since 2018 get the information without any fee. Large efforts have also been made to make the old analogue archive and the geodetic library organised and secure for the future.

1.10.5 Handbooks for mapping and surveying

Lantmäteriet has published a series of handbooks for mapping and surveying called HMK ("Handbok i mät- och kartfrågor"), with the aim to contribute to an efficient and standardised handling of surveying and mapping issues in Sweden. The handbooks are divided into two main parts, geodesy and geodata capture. Geodetic applications are covered in five documents with the most recent versions published in 2017:

- Geodetic infrastructure.
- Control surveying.
- Terrestrial detail surveying.
- GNSS-based detail surveying.
- Support for tendering and choice of surveying methods.

1.10.6 FAMOS and the Baltic Sea Chart Datum 2000

Lantmäteriet has since 2014 been engaged in parts of the ongoing EU project FAMOS[28], which has the main purpose to increase the safety of navigation in the Baltic Sea:

- Improvement of navigation and hydrographic surveying with GNSS-based methods.
- Support to the introduction of the common Baltic Sea Chart Datum 2000 (EVRS with land uplift epoch 2000.0) in the Baltic Sea by 2020.

[27] UNESCO = United Nations Educational, Scientific and Cultural Organisation
[28] FAMOS = Finalising Surveys for the Baltic Motorways of the Sea

- Improvement of the geoid model in the Baltic Sea area, which will provide an important basis for future offshore navigation.

To reach the goal of an improved Baltic Sea geoid model, new marine gravity data are collected. In support to this activity, Lantmäteriet has procured a ZLS marine gravimeter delivered in April 2017.

1.10.7 National elevation model

Lantmäteriet is responsible for the production of a new Swedish national elevation model. The mainly used method for the data capture is airborne laser scanning and the production started in July 2009. The project is almost finalised, leaving a few small spots of the Swedish territory in the mountainous part unscanned.

2 Geodetic activities at KTH

2.1 Organisation and staff

At KTH – Kungliga Tekniska högskolan – a number of changes have happened with "KTH-Geodesy" during the four past years.

By 1 January 2015, KTH-Geodesy became an independent organisational and economic unit called Division of Geodesy and Satellite Positioning. The new division belonged to the Department of Urban Planning and Development, but was moved to the Department of Real Estate and Construction Management by 1 January 2018. In connection with the re-organisation, KTH-Geodesy also moved physically to a brand-new building, Teknikringen 10B, still at the main KTH campus in Stockholm.

Head of the new Division of Geodesy and Satellite Positioning in January 2015 was Anna Jensen, who was appointed as professor in September 2014 following the retirement of Lars Sjöberg. Further, two associate professors; Milan Horemuz and Huaan Fan, as well as one researcher Mohammad Bagherbandi hold permanent positions in the division. Jonas Ågren, who is employed at Lantmäteriet in Sweden, was appointed docent at KTH in 2016. The number of Ph.D. students has varied between four and six during the period. The division also employs ad hoc (teaching) assistants, has hosted an intern from Greece as well as a Syrian refugee who worked as trainee, both for three months in 2017. For shorter time periods the division also hosted two Ph.D. students from Kazakhstan funded by EU Erasmus+ as well as a visiting professor.

During 2014–2018 the division has been going through an economical revision to reduce costs. This induced e.g. a reduction of travels and conference participations, a reduction of the geodetic library, a reduction of the instrument storage room from 80 to 40 square metres, and a gradual transition towards more rental than ownership of geodetic instruments for teaching. Also, all Ph.D. students must now be fully funded to be admitted.

2.2 Education

2.2.1 Bachelor

KTH-Geodesy mainly contributes with teaching in geodetic surveying techniques, map projections and reference systems in year 1 and 3 of Degree Programme in Civil Engineering and Urban Management (Swedish: Civilingenjörsutbildning i samhällsbyggnad). A total of around 150 students are enrolled in this programme and 5–10 of these choose to specialise in Geodesy and Geoinformatics in year 3.

To a smaller degree, KTH-Geodesy also contributes to the bachelor in Constructional Engineering and Design with courses in geodetic surveying techniques, laser scanning and 3D building modelling.

2.2.2 Master

At the master level, KTH-Geodesy contributes to the master programme Transport and Geoinformation Technology with courses in GNSS, laser scanning, geodata quality and adjustment theory. The master programme has a total of around 40 students and 2–5 of these do their master thesis in geodesy. During 2014–2018 the most popular topics for master theses have been laser scanning in various applications, sensor integration, geodetic aspects of BIM[29] and geodata quality issues. All master theses are carried out in cooperation with private companies or governmental organisations.

To a smaller degree, KTH-Geodesy contributes to the master in Aerospace Engineering with a GNSS course and co-supervision of master theses.

2.2.3 Ph.D.

Ph.D. students at KTH-Geodesy are enrolled in the Ph.D. programme in Geodesy and Geoinformatics with specialisation in Geodesy. During 2014–2018, the specialisation in geodesy has been significantly revised to meet new administrative requirements, but also to modernise the curriculum and broaden the scope of the Ph.D. courses as a whole. The new programme was approved by KTH in May 2017. A total of eight Ph.D. students have been enrolled during 2014–2018, where four have completed their studies (Ssengendo, 2015, Abrehdary, 2016, Alizadeh-Khameneh, 2017 and Shafiei Joud, 2018). Four Ph.D. students are presently enrolled (June 2018).

[29] BIM = Building Information Modelling

2.3 Research

Research at KTH-Geodesy is done partly by the staff being permanently employed without external funding, and partly within the frame of externally funded research projects where most of the funding is used for salaries for Ph.D. students.

Research topics are physical geodesy, satellite gravimetry, GNSS-based positioning and navigation, atmospheric effects on GNSS satellite signals, geodetic reference systems and applications, geodetic surveying and theory of errors, integration of GNSS and terrestrial surveying techniques, geodynamics, laser scanning, and geodata quality.

External funding for research projects at KTH-Geodesy during 2014–2018:

- A New Vertical Geodetic Datum for Uganda, funded by SIDA[30], 2010–2015.
- Optimisation of Geodetic Deformation Networks, funded by Formas, led by KTH-Geodesy, 2012–2015.
- Modelling the Earth's Crust by Combining GOCE, Terrestrial Gravity and Seismic Data, funded by Swedish National Space Board, led by KTH-Geodesy, 2013–2016.
- Development of Geodetic Surveying Methods for Archaeological Studies in the Arctic. Funded by the Tryggve Rubin Foundation, led by KTH-Geodesy, 2016–2017.
- Climate Change Detection by Taking Advantage of a Future Satellite Mission: GRACE Follow-On, funded by Proficio Foundation, led by KTH-Geodesy, 2016–2017.
- Industrial Thinking through the Full Value Chain in Coupling Geodesy, Geodata Quality and BIM, funded by the Swedish Transport Administration, led by KTH-Geodesy, 2017–2021.
- Data Quality and Data Responsibility in the Built Environment, funded by Smart Built Environment and Formas, led by KTH-Geodesy, 2017–2019.

Also during 2014–2018 KTH-Geodesy has participated in the following projects funded by the EU Tempus and Erasmus+ programmes:

- Modernising Geodesy Education in Western Balkan with Focus on Competences and Learning Outcomes, led by KTH-Geodesy, 2015–2018.
- Development of a New Geodesy Master Programme in Kosovo, led by KTH-Geodesy, 2013–2016.
- Geodesy and Geoinformatics for Sustainable Development in Jordan, led by KTH-Geodesy, 2017–2020.

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[30] SIDA = Swedish International Development Cooperation Agency

- Innovation and Entrepreneurship in Engineering Education, led by KTH-Geodesy, 2016–2019.
- Interdisciplinary Reform in Tourism Management and Applied Geoinformation, led by Polytechnical University of Valencia, Spain, with KTH-Geodesy as project partner, 2016–2019.
- Doctoral studies in GeoInformation Science, led by Obuda University, Hungary, with KTH-Geodesy as project partner, 2017–2020.

All staff members of KTH-Geodesy also contribute to review of scientific papers, participate in editorial boards of international scientific journals, act as opponent and committee members at Ph.D. defences, perform review of research proposals etc.

2.4 Outreach and dissemination

Outreach and dissemination has been important for KTH-Geodesy during 2014–2018 and this involved a large number of external activities with the Swedish geodetic community as well as internal obligations in committees and boards within the university.

Examples of external activities by KTH-Geodesy:

- Cooperation with the Vasa museum; deformation monitoring of the Vasa-ship twice yearly.
- Cooperation with the company Trimtec on continued education in measurement uncertainty and GNSS for professionals in Sweden, several one-day courses have been held every year since 2012.
- Summer schools in physical geodesy for international students.
- A seminar series on geodesy and BIM arranged in cooperation with the Swedish Transport Administration with two seminars per year since 2016.
- Presentations at national conferences, seminars and workshops, for instance Kartdagarna (the Swedish Mapping days) and Geodesidagarna (the Surveying Days).
- Distribution of a newsletter in Swedish three times per year to Swedish geodesists, land surveyors and survey technicians.
- Consulting for private and public organisations.

Also, during 2014–2018, KTH-Geodesy has contributed with members to working groups within NKG, a member of the board of the Nordic Institute of Navigation and a Swedish representative in the European Commission working group on the Galileo Commercial Service.

Examples of internal tasks at KTH undertaken by staff of KTH-Geodesy:

- Programme responsible for the master in Transport and Geoinformation Technology.
- Director of studies of the Geo-IT specialisation of education at the School of Architecture and Built Environment.
- Member of the KTH Scholarship council.
- Vice-chair of the Recruitment Committee of the School of Architecture and Built Environment.
- Deputy director of the KTH Space Centre.
- Member of the KTH Employment Committee.
- Member of the Strategic Council of the ABE school.
- Programme responsible for the research education (Ph.D.) in Geodesy and Geoinformatics.
- Member of the Docent committee of the ABE school.

Also on 15 September 2017 we celebrated the **100-year birthday of late Prof. Arne Bjerhammar** at KTH. His contributions to geodesy in Sweden, and internationally, are significant, so the day was celebrated with lectures and a reception for around 50 invited people; mainly former colleagues and Ph.D. students of Bjerhammar as well as his daughters and their families.

3 Geodetic activities at the University of Gävle

3.1 Introduction

The Department of Industrial Development, IT and Land Management at the University of Gävle (HiG, www.hig.se) offers graduate and postgraduate education as well as performs research in geodesy, engineering surveying, geomatics, GIS[31] and built environment processes.

3.2 The graduate programme in Land Management and Land Surveying

In 2009 the existing graduate programme in Geomatics was comprehensively revised and at the same time renamed to the more appropriate Land Management/Land Surveying (LM/LS) programme. The two specialisations, LM and LS, share several courses which are of importance for both of them – such as surveying courses which are related to geodata capturing in 3D using terrestrial, aerial and satellite-based geodetic sensors. The LM/LS programme contributes with new knowledge/methods utilising geospatial information.

The LM/LS graduate programme was reviewed during 2013 by UKÄ[32] and received, as the only Swedish programme within the area, the highest rank "Very high quality".

We have also developed a new two-year master programme in Geospatial Information Science since 2016. The idea of the new master programme is to create opportunities for our existing bachelor programmes (IT/GIS, land surveying, land management, urban planning and existing one-year master programme in Geomatics) to proceed to postgraduate studies in Geospatial Information Science. By developing and deepening existing knowledge and also providing new knowledge in related fields, the student can acquire knowledge and skills that can be used directly in the Swedish and international labour market, as well as qualifying

[31] GIS = Geographic Information Systems

[32] UKÄ = Universitetskanslersämbetet (Swedish Higher Education Authority)

for further research studies. In the programme, new courses have been developed in GIS application and applied geodesy.

HiG has during 2018 applied at UKÄ for a permission to also establish a five-year "Master of Science (Civilingenjörsexamen)" programme in geospatial science. "Master of Science (Civilingenjörsexamen)" programmes in Sweden are still very prestigious and corresponds to the German (and others) "diplom-ingenieur". Further, "Master of Science (Civilingenjörsexamen)" in Sweden is (was) the contrary to military engineering. This particular programme, with respect to the above-mentioned master programme, is more engineering-oriented. If the programme is accepted, it will have two specialisations – one in geodesy and one in GIScience.

3.3 Staff, research and quality in geodesy and engineering surveying

The increasing number of applicants to the LM/LS programme has involved an increasing number of enrolled students. Consequently, the number of staff has increased. By the time for the 18th NKG General Assembly in September 2018, there are five highly qualified (Ph.D.) lecturers/researchers in geodesy and two instructors employed. Among of them there are one full professor and two associate professors. Their main task is lecturing, with research up to approximately 20–30%. An increase in research is expected, particularly since an application for the entitlement of awarding postgraduate and Ph.D. qualifications has been approved with effect from 1 January 2015. The research area has been defined as "Geospatial Information Science" and comprises besides land management, land surveying, applied geodesy also spatial planning and computer science. There are seven active Ph.D. students in the Geospatial Information Science programme (three of them are in applied geodesy). Since 2017, two guest researchers visited our division and one guest professor joined to our research programme at HiG.

Our research has primarily been focused on applied geodesy and land surveying engineering such as:

- Geodata capturing using different terrestrial, aerial (including drones) and satellite-based geodetic sensors for 3D mapping.
- Using drones (Unmanned Aircraft Systems) and different sensors for environmental surveillance.
- Change detection of engineering structures (e.g. dams and bridges monitoring) and hazard monitoring using geodetic approaches.

- Measurement and analysis of anthropogenic and natural ground/structural deformation using GNSS and InSAR[33].
- Studying Earth's gravity field and its applications (physical geodesy).
- Earth reference system and datum unification.
- Climate change studies using satellite gravimetry and altimetry (sea level rise, glacier melting, groundwater depletion and subsidence).
- Earth's crust modelling.

HiG and Lantmäteriet decided to collaborate more in different research platforms in 2016. In April 2016, the first deliberation took place between HiG and Lantmäteriet to determine the areas of common interest in which research project could and should be developed. The authorities were represented by vice president of research at HiG and the Director General of Lantmäteriet. As a result of this initial deliberation, it was decided to work on the strategies and relevant research areas. Within both authorities, there is research of common interest in the areas of geodata (including property information) and geodesy. After two initial deliberations (April and May 2016) and a workshop (June 2016), three areas of strategic research have been crystallised:

1. Automated decision making.
2. Information supply in Geodata area (change detection, image analysis, 3D modelling, BIM and crowd-sourcing).
3. Information presentation and visualisation.

The collaboration plan will be realised through the elaboration of doctoral student position within each area through joint research funding applications.

[33] InSAR = Interferometric Synthetic Aperture Radar

4 Geodetic activities at University West

4.1 Introduction

The surveying engineering programme at University West (UW) is one of the divisions of the Department of Engineering Science at this university. This programme offers graduate education and the division performs research in geodesy and geodetic surveying.

4.2 Surveying engineering programme

The current surveying engineering education of UW is one of the most popular engineering programmes. It does not have different directions like other Swedish universities yet and the degree that the students will receive is not specified whether it is in the Land Management (LM) or the Land Surveying (LS). During the first 2.5 years of studies, all courses are compulsory for the students. In the second half of the third year, before students select the subject of their thesis works, they have some voluntary courses in either LM or LS. The programme offers six geodetic courses, amongst which, Basic Surveying, Applied Geodesy and Photogrammetry, and Global Navigation Satellite Systems as obligatory courses and Estimation theory and hypothesis testing in Geodesy and Photogrammetry, Reference System and Hydrographic Surveying as voluntary. During the last four years, the programme has been successful and served more than 50 students per year. The result of the review by UKÄ was "High quality" for this programme at UW.

4.3 Two directions for surveying engineering programme

The Department of Engineering Science at UW has investigated the possibility of developing the surveying engineering education programme. A project was defined for this purpose and after discussions and investigations, the head of the department, Professor Per Nylén, and the group leader Åsa Axgärde decided to divide the programme into two different directions, one towards an engineering degree and the other one to Bachelor of Science and mainly in Built Environment and planning, Cadastre and LM. The engineering side of the programme includes more courses in mathematics and statistics, and engineering courses in geodesy, photogrammetry, laser scanning and hydrographic surveying. Both programmes will have some common obligatory courses that the students must study together, including GIS, cartography, cadastre and LM. After different meetings with private and governmental sectors, which are active in these fields, it was revealed that both subjects are important and necessary for the society. The proposal for splitting the programme was submitted to the Education Board of the university and according to their positive recommendation the university president, Professor Martin Hellström, took a formal decision to divide the programme into Surveying Engineering in direction of measuring and mapping; and Surveying in direction of built environment and planning. UW will officially close the current education programme and start the new ones from 2019. The engineering platform opens new doors for developing Geodesy further in the society.

4.4 Staff and research in geodesy

Being the only university in the western part of Sweden, which has this programme and having capacity of training more than 50 students per year, has increased the capability of the university to hire more experts. So far, the university succeeded to employ a professor and a senior lecturer in Geodesy.

Further, the university has hosted:

- A guest researcher from Czech Republic (June 2014).
- A Spanish professor of Geodesy (June 2016).
- Another researcher from Czech Republic (November 2016 and June–August 2017).
- A guest researcher from Brazil doing some research in Geodesy and Geophysics (February 2018).

One Ph.D. in Geophysics has been trained in a cooperation between UW and Quaid-i-Azam University of Pakistan in 2017. The Ph.D. student was present at UW from March 2015 to June 2016. Another Ph.D. student in Geodesy at University of Addis Ababa, Ethiopia, has a supervisor at UW.

During 2014–2018, UW managed to publish 43 articles in peer-reviewed scientific journals, 2 lecture notes for education purpose, 8 papers in conference proceedings and 20 conference presentations in the following fields:

- Optimisation and design of geodetic monitoring networks.
- Recovery of gravity field and its changes.
- Geophysical studies using satellite data, like Moho and sub-crustal stress determination.

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[34] IAG = International Association of Geodesy

[35] IASPEI = International Association of Seismology and Physics of the Earth's Interior

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[36] IGFS = International Gravity Field Service

Appendix 1 – Lantmäteriet: Geodetic publications 2014–2018

Appendix 1.1 – Lantmäteriet: International journals

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Xiang L., Wang H., **Steffen H.**, Wu P., Jia L., Jiang L., Shen Q. (2016): Corrigendum to "Groundwater storage changes in the Tibetan Plateau and adjacent areas revealed from GRACE satellite gravity data" [Earth Planet. Sci. Lett. 449 (2016) 228–239]. Earth and Planetary Science Letters, 452, p. 309.

Yazdanfar C., Nemati M., Agh Ataby M., Roustaei M., **Nilfouroushan F.** (2018): Stress transfer, aftershocks distribution and InSAR analysis of the 2005 Dahuieh earthquake, SE Iran. Journal of African Earth Sciences, 147, pp. 211–219.

Appendix 1.2 – Lantmäteriet: Swedish journals

Alfredsson A. (2016): HMK Geodesi är nu publicerad. SKMF[37], Sinus, nr 1 2016, p. 12.

Alfredsson A. (2016): Reserapport från CGSIC:s 56:e möte vid ION GNSS+ 2016, Portland, Oregon, USA, 12–16 september 2016. RNN[38], RNN-bulletinen, nr 1 2016, bilaga, pp. 1–19.

Engberg L. E. (2015): Minnesord över Arne Håkansson. SKMF, Sinus, nr 3 2015, p. 24. Also in KS[39], Kart & Bildteknik, 2015:3, p. 13 (slightly updated and with the title "En legendarisk personlighet i geodesivärlden har gått ur tiden").

Hedling G. (2016): Reserapport från RTCM SC-104-mötet i Portland, Oregon, USA, 12–13 september 2016. RNN, RNN-bulletinen, nr 1 2016, pp. 21–23.

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[37] SKMF = Sveriges Kart- och Mätningstekniska Förening (Swedish Mapping and Surveying Association)

[38] RNN = Radionavigeringsnämnden (Swedish Board of Radio Navigation)

[39] KS = Kartografiska Sällskapet (Swedish Cartographic Society)

Hofvenstam M. (2015): Galileo utmanar GPS. Lantmäteriet, Gränssnittet, 2015 #4, p. 8.

Håkansson M. (2016): Noggrann positionering med mobiltelefoner – snart en realitet. RNN, RNN-bulletinen, nr 1 2016, pp. 19–21.

Jansson J. (2014): Tyngdkraftsmätning i fjällen. SKMF, Sinus, nr 4 2014, pp. 24–25.

Jonilson M. (2015): GPS ett måste för husbilsåkarna – men man kan ändå hamna fel. Lantmäteriet, Gränssnittet, 2015 #2, pp. 19–21.

Jonsson B. & **Wiklund P.** (2014): SWEPOS® – 20 års utveckling av GNSS-tekniken. SKMF, Sinus, nr 1 2014, pp. 18–22.

Jämtnäs L. (2017): HMK – en handbok för framtiden? SKMF, Sinus, nr 4 2017, pp. 26–27.

Kempe T & **Ågren J.** (2018): Om SWEN17_RH2000 – den nya nationella geoidmodellen. SKMF, Sinus, nr 1 2018, pp. 12–13.

Kempe T & **Ågren J.** (2018): Nya geoidmodellen SWEN17_RH2000 – ger bättre höjdbestämning med GNSS. KS, Kart & Bildteknik, 2018:2, pp. 16–19.

Lilje M. (2015): FN och geodetisk infrastruktur – kopplingen stärks för varje år! KS, Kart & Bildteknik, 2015:1, pp. 8–10. Also in SKMF, Sinus, nr 1 2015, pp. 8–9 and Samhällsbyggarna, Samhällsbyggaren, 03/15, pp. 38–40.

Malm B.-L. (2015): Målgång för temauppdrag stompunkter. KS, Kart & Bildteknik, 2015:4, pp. 22–23.

Malm B.-L. (2015): Kunskaper om landhöjningen viktiga i klimatforskning. Lantmäteriet, Gränssnittet, 2015 #2, pp. 16–18.

Malm B.-L. (2015): Satellitmätning – ger tidsvinster i stora VA-projekt. Lantmäteriet, Gränssnittet, 2015 #4, pp. 9–11.

Malm B.-L. (2016): Sjömätning för säkrare trafik på Östersjön. KS, Kart & Bildteknik, 2016:4, pp. 14–15. Also in Lantmäteriet, Gränssnittet, 2016 #1, pp. 14–16.

Malm B.-L. (2016): Förbättrad navigering i framtiden. KS, Kart & Bildteknik, 2016:4, p. 16. Also in Lantmäteriet, Gränssnittet, 2016 #1, pp. 17–18.

Malm B.-L. (2016): Noggrannare GNSS-mätningar är målet för Martins studier. Lantmäteriet, Gränssnittet, 2016 #3, pp. 6–7.

Norin D. (2014): Wilhelm Struve mer aktuell än någonsin. Samhällsbyggarna, Samhällsbyggaren, nr 2-2014, pp. 34–35.

Norin D. (2017): Galileo – europeisk satellitnavigering redo för praktisk användning. SKMF, Sinus, nr 1 2017, pp. 10–12.

Norin D. (2017): Bättre mätkvalitet med Galileo och andra moderniserade GNSS. KS, Kart & Bildteknik, 2017:4, pp. 8–11.

Norin D. (2018): Galileos utveckling till att bli en del av praktisk GNSS-användning. SKMF, Sinus, nr 1 2018, pp. 26–28.

Ohlsson K. (2015): Studie av mätosäkerhet och tidskorrelationer vid mätning med nätverks-RTK i SWEPOS 35 km-nät. SKMF, Sinus, nr 2 2015, p. 22.

Tähtikivi A. (2014): Svensk geoprocess – enhetliga referenssystem. KS, Kart & Bildteknik, 2014:2, pp. 26–27.

Tähtikivi A. (2015): Enhetliga referenssystem. KS, Kart & Bildteknik, 2015:4, p. 26.

Wiklund P. (2016): SWEPOS® förbereds för Galileo och nya satellitsignaler. RNN, RNN-bulletinen, nr 1 2016, pp. 12–15.

Appendix 1.3 – Lantmäteriet: Conference proceedings and compilation works

Alfredsson A., **Engberg L. E.**, **Engfeldt A.**, **Jivall L.**, **Kempe C.**, **Lidberg M.**, **Lilje C.**, **Lilje M.**, **Norin D.**, **Steffen H.**, **Wiklund P.**, **Ågren J.** (2014): National report of Sweden to the EUREF 2014 Symposium – geodetic activities at Lantmäteriet. EUREF, 2014 Symposium, 4–6 June 2014, 8 pp., Vilnius, Lithuania.

Alfredsson A., **Sunna J.**, **Persson C.-G.**, **Jämtnäs L**. (2014): HMK – Swedish handbook in surveying and mapping. FIG, XXV International Congress, 16–21 June 2014, 8 pp., Kuala Lumpur, Malaysia. Also in Kempe (ed.) (2016): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 104–106, Göteborg, Sweden (slightly updated).

Bilker-Koivula M., Mononen J., Saari T., Förste C., Barthelmes F., Lu B., **Ågren J.** (2017): Improving the geoid model for future GNSS-based navigation in the Baltic Sea. FIG, Working Week 2017, 29 May–2 June 2017, 11 pp., Helsinki, Finland.

Engberg L. E. (2018): Geodetisk verksamhet vid Lantmäteriet. In KS: Sveriges kartläggning – tillägg 2008–2017. KS, pp. 26–37, Gävle, Sweden (in Swedish).

Engfeldt A., **Lidberg M.**, Sekowski M., Dykowski P., Krynski J., **Ågren J.**, **Olsson P.-A.**, **Bryskhe H.**, **Steffen H.**, Nielsen J. E. (2018): RG 2000 – the new gravity reference frame of Sweden. FIG, XXVI International Congress, 6–11 May 2018, 20 pp., Istanbul, Turkey. Also at EUREF 2018 Symposium, 30 May–1 June 2018, Amsterdam, the Netherlands.

Gabrielsson B., Eliardsson P., Alexandersson M., Wiklundh K., Stenumgaard P., **Hedling G.**, **Frisk A.**, **Wiklund P.** (2016): Autonomous detection of electromagnetic interference in the GPS band. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, p. 97, Göteborg, Sweden.

Håkansson M. (2018): Precise positioning with Android. In Johansson & Elgered (eds): Proceedings of the European Navigation Conference 2018 (ENC 2018). EUGIN[40], ENC 2018, 14–17 May 2018, pp. 143–144, Göteborg, Sweden.

Häkli P., **Lidberg M.**, **Jivall L.**, Nørbech T., Tangen O., Weber M., Pihlak P., Liepiņš I., Paršeliūnas E. (2017): A new transformation including deformation model for the Nordic and Baltic countries. FIG, Working Week 2017, 29 May–2 June 2017, 12 pp., Helsinki, Finland.

Ihde J., Habrich H., Sacher M., Söhne W., Altamimi Z., Brockmann E., Bruyninx C., Caporali A., Dousa J., Fernandes R., Hornik H., Kenyeres A., **Lidberg M.**, Mäkinen J., Poutanen M., Stangl G., Torres J. A., Völksen C. (2014): EUREF´s contribution to national, European and global geodetic infrastructures. In Rizos & Willis (eds): Earth on the edge: science for a sustainable planet. IAG, General Assembly, 28 June–2 July 2011, 139, pp. 189–196, Melbourne, Australia.

Jivall L. (2016): Comparison of Vienna Mapping Function (VMF1) and Global Mapping Function (GMF) for NKG GNSS AC. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 132–136, Göteborg, Sweden.

Jivall L., **Kempe T.**, **Lilje C.**, Nyberg S., Häkli P., Kollo K., Pihlak P., Weber M., Kosenko K., Sigurðsson Þ., Valsson G., Prizginiene D., Paršeliūnas E., Tangen O. (2016): Report from the project NKG GNSS AC. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 98–102, Göteborg, Sweden.

Jivall L., **Norin D.**, **Lilje M.**, **Lidberg M.**, **Wiklund P.**, **Engberg L. E.**, **Kempe C.**, **Ågren J.**, **Engfeldt A.**, **Steffen H.** (2016): National report of Sweden to the EUREF 2016 Symposium – geodetic activities at Lantmäteriet. EUREF, 2016 Symposium, 25–27 May 2016, 11 pp., San Sebastian, Spain.

Kempe C., **Alm L.**, **Dahlström F.**, **Engberg L. E.**, **Jansson J.** (2014): On the transition to the new Swedish height system RH 2000. FIG, XXV International Congress, 16–21 June 2014, 9 pp., Kuala Lumpur, Malaysia. Also in Kempe (ed.) (2016): Proceedings of the NKG

[40] EUGIN = European Group of Institutes of Navigation

General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 118–121, Göteborg, Sweden (slightly updated and with the title "Swedish municipalities implementing the new national height system RH 2000").

Kempe C., **Jivall L.**, **Lidberg M.**, **Lilje M.** (2016): On the management of reference frames in Sweden. FIG, Working Week 2016, 2–6 May 2016, 16 pp., Christchurch, New Zeeland.

Kempe C., **Jivall L.**, **Norin D.**, **Engfeldt A.**, **Steffen H.**, **Ågren J.**, **Wiklund P.**, **Lidberg M.**, **Engberg L. E.**, **Lilje M.**, **Alm L.**, **Jämtnäs L.**, **Ning T.** (2017): National report of Sweden to the EUREF 2017 Symposium – geodetic activities at Lantmäteriet. EUREF, 2017 Symposium, 17–19 May 2017, 10 pp., Wroclaw, Poland.

Kierulf H. P., **Steffen H.**, Simpson M. J. R., **Lidberg M.** (2016): A GNSS velocity field for Fennoscandia and a consistent comparison to Glacial Isostatic Adjustment models. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, p. 89, Göteborg, Sweden.

Lidberg M., Jarlemark P., **Ohlsson K.**, Johansson J. (2016): Station calibration of the SWEPOS GNSS network. FIG, Working Week 2016, 2–6 May 2016, 17 pp., Christchurch, New Zeeland. Also at EUREF 2016 Symposium, May 25–27 2016, San Sebastian, Spain and submitted to IAG/IASPEI Scientific Assembly 2017, 30 July–4 August 2017, Kobe, Japan.

Lidberg M., **Ågren J.**, **Steffen H.** (2017): On the use of crustal deformation models in the management of ETRS89 realisations in Fennoscandia. FIG, Working Week 2017, 29 May–2 June 2017, 15 pp., Helsinki, Finland.

Lidberg M., Bruyninx C., Kenyeres A., Poutanen M., Söhne W. (2018): EUREF and the infrastructure for high performance GNSS applications in Europe. In Johansson & Elgered (eds): Proceedings of the European Navigation Conference 2018 (ENC 2018). EUGIN, ENC 2018, 14–17 May 2018, pp. 85–86, Göteborg, Sweden.

Lilje C., **Alm L.**, **Jivall L.**, **Kempe C.**, **Lidberg M.**, **Lilje M.**, **Ning T.**, **Olsson P.-A.**, **Steffen H.**, **Wiklund P.**, **Ågren J**. (2018): National report of Sweden to the EUREF, 2018 Symposium – geodetic activities at Lantmäteriet. EUREF, 2018 Symposium, 30 May–1 June 2018, 9 pp., Amsterdam, the Netherlands.

Lilje M., **Wiklund P.**, **Hedling G.** (2014): The use of GNSS in Sweden and the national CORS network SWEPOS. FIG, XXV International Congress, 16–21 June 2014, 11 pp., Kuala Lumpur, Malaysia.

Ning T. & Elgered G. (2015): A 17 year time series of ground-based GNSS for sensing of atmospheric water vapour. ESA[41], 5th International Colloquium – scientific and fundamental aspects of the Galileo programme, 27–29 October 2015, Braunschweig, Germany.

Ning T., Elgered G., Heise S. (2017): Trends in the atmospheric water vapour estimated from two decades of ground-based GPS data: sensitivity to the elevation cutoff angle. ESA, 6th International Colloquium on scientific and fundamental aspects of GNSS/Galileo, 25–27 October 2017, 6 pp., Valencia, Spain.

Norin D. (2014): Struve Geodetic Arc activities in Sweden. In Kollo et al. (eds): Friedrich Georg Wilhelm von Struve. Association of Estonian Surveyors, pp. 3–6, Tallinn, Estonia.

Norin D., Lilje M., Lidberg M., Wiklund P., Engberg L. E., Jivall L., Kempe C., Ågren J., Engfeldt A., Steffen H. (2015): National report of Sweden to the EUREF 2015 Symposium – geodetic activities at Lantmäteriet. EUREF, 2015 Symposium, 3–5 June 2015, 8 pp., Leipzig, Germany.

Norin D. & Aaro S. (2015): Network of Struve Geodetic Arc in Sweden – the past and the present. LGIA[42], International conference "Struve Geodetic Arc – 10 years in UNESCO World Heritage list", 17–18 September 2015, 5 pp., Jelgava and Jekabpils, Latvia.

Norin D., Salo T., Barsk H., Rönnbäck L., Lantto L., Aaro S. (2015): Swedish work with Struve Geodetic Arc. LGIA, International conference "Struve Geodetic Arc – 10 years in UNESCO World Heritage list", 17–18 September 2015, 5 pp., Jelgava and Jekabpils, Latvia.

Norin D., Johansson J. M., Mårtensson S.-G., Eshagh M. (2016): National report of Sweden to the NKG General Assembly 2014 – geodetic activities in Sweden 2010–2014. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 52–77, Göteborg, Sweden. Also as Lantmäteriet, Lantmäterirapport 2015:2, 62 pp., Gävle, Sweden (slightly different and with the title "Geodetic activities in Sweden 2010–2014").

Olsson P.-A., **Engfeldt A.**, **Ågren J.** (2018): Investigations of a suspected jump in Swedish repeated absolute gravity time series. In Freymüller & Sanchez (eds): International symposium on earth and environmental sciences for future generations. IAG, General Assembly, 22 June–2 July 2015, 147, pp. 137–143, Prague, Czech Republic.

[41] ESA = European Space Agency

[42] LGIA = Latvian Geospatial Information Agency

Olsson P.-A., Milne G., Scherneck H.-G., **Ågren J.** (2016): Investigations of the relation between gravity and vertical displacement change rates in formerly glaciated areas. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 87–88, Göteborg, Sweden.

Rieck C., Jarlemark P., Jaldehag K., **Hedling G.**, **Frisk A.** (2018): UTC(k) time distribution using network RTK. In Johansson & Elgered (eds): Proceedings of the European Navigation Conference 2018 (ENC 2018). EUGIN, ENC 2018, 14–17 May 2018, pp. 151–152, Göteborg, Sweden.

Sarib R. & **Lilje M.** (2014): GNSS CORS networks and linking to ITRF. In Blick (ed.): Reference frames in practice manual. FIG, 64, pp. 47–49, Copenhagen, Denmark.

Scherneck H.-G., **Engfeldt A.**, **Olsson P.-A.**, Timmen L. (2016): Five years of gravity measurement at Onsala Space Observatory: the absolute scale. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 82–84, Göteborg, Sweden.

Simpson M. J. R., Nilsen E. Ø., Breili K., Kierulf H. P., **Steffen H.**, Roaldsdotter Ravndal O. (2016): Regional 21st century sea-level projections for Norway based on IPCC AR5 science. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 129–130, Göteborg, Sweden.

Steffen H., Barletta V. R., Kollo K., Milne G. A., Nordman M., **Olsson P.-A.**, Simpson M. J. R., Tarasov L., **Ågren J.** (2016): NKG201xGIA – a model of Glacial Isostatic Adjustment for Fennoscandia. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 85–86, Göteborg, Sweden.

Vestøl O., **Ågren J.**, Oja T., Kall T., Aleksejenko I., Paršeliūnas E., Rüdja A. (2016): NKG2014LU_test – a new empirical land uplift model over Fennoscandia. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 78–79, Göteborg, Sweden.

Ågren J. & Sjöberg L. E. (2014): Investigation of gravity data requirements for a 5 mm-quasigeoid model over Sweden: In Marti (ed.): Gravity, geoid and height systems. IAG, GGHS 2012, 9–12 October 2012, 141, pp. 143–150, Venice, Italy.

Ågren J., **Engberg L. E.**, **Alm L.**, **Dahlström F.**, **Engfeldt A.**, **Lidberg M.** (2014): Improving the Swedish quasigeoid by gravity observations on the ice of Lake Vänern. In Marti (ed.): Gravity, geoid and height systems. IAG, GGHS 2012, 9–12 October 2012, 141, pp. 171–178, Venice, Italy.

Ågren J. (2016): NKG Working Group of Geoid and height systems – report 2010–2014. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 24–26, Göteborg, Sweden.

Appendix 1.4 – Lantmäteriet: Other geodetic publications

Ekman M. & **Olsson P.-A.** (2017): Gravity determinations at the observatories of Uppsala and Stockholm during three centuries. Summer Institute for Historical Geophysics, Small Publications in Historical Geophysics, 30, 15 pp., Åland Islands.

HMK (2014): HMK – Referenssystem och geodetisk mätning 2014. HMK, 82 pp., Gävle, Sweden (in Swedish).

HMK (2017): HMK – Geodatakvalitet 2017. HMK, 61 pp., Gävle, Sweden (also as versions 2014 and 2015, in Swedish).

HMK (2017): HMK – Ordlista och förkortningar december 2017. HMK, 36 pp., Gävle, Sweden (also as versions juli 2014, december 2014 and juni 2015, in Swedish).

HMK (2017): HMK – Geodetisk infrastruktur 2017. HMK, 64 pp., Gävle, Sweden (also as version 2015, in Swedish).

HMK (2017): HMK – Stommätning 2017. HMK, 98 pp., Gävle, Sweden (also as version 2015, in Swedish).

HMK (2017): HMK – Terrester detaljmätning 2017. HMK, 45 pp., Gävle, Sweden (also as version 2015, in Swedish).

HMK (2017): HMK – GNSS-baserad detaljmätning 2017. HMK, 52 pp., Gävle, Sweden (also as version 2015, in Swedish).

HMK (2017): HMK – Kravställning vid geodetisk mätning 2017. HMK, 44 pp., Gävle, Sweden (in Swedish).

Håkansson M. (2017): Hardware biases and their impact on GNSS positioning. KTH, licentiate thesis, TRITA-SOM 2017-08, 66 pp. Stockholm, Sweden.

Jansson P. & **Persson C.-G.** (2014): Uncertainty in area determination. KTH, report, TRITA SoM 2014-14, Stockholm, Sweden.

Lantmäteriet (2018): Geodesi 2018 – Lantmäteriets geodesistrategi. Lantmäteriet, 12 pp., Gävle, Sweden (in Swedish).

Lithén T. & **Persson C.-G.** (2016): Lägesosäkerheten i geodata – likheter och olikheter. HMK, Teknisk rapport 2016:3, 40 pp., Gävle, Sweden (in Swedish).

Persson C.-G., **Lithén T.**, **Lönnberg G.**, **Svärd T.** (2015): Terminologi, principer och trender inom geodatakvalitet. HMK, Teknisk rapport 2015:1, 48 pp., Gävle, Sweden (in Swedish).

Persson C.-G. (2016): Standardosäkerheter, konfidensintervall m.m. vid positionsbestämning i 1D, 2D och 3D. HMK, Teknisk rapport 2016:2, 27 pp., Gävle, Sweden (in Swedish).

Persson C.-G. & **Lithén T.** (2016): Hantering av lägesosäkerheten i geodata – igår och idag. HMK, Teknisk rapport 2016:1, 29 pp., Gävle, Sweden (in Swedish).

Persson C.-G. & **Lithén T.** (2016): I gränslandet BIM – GIS – Geodesi. HMK, Teknisk rapport 2016:4, 39 pp., Gävle, Sweden. Also at KTH/ULI, Seminar 2015, Stockholm, Sweden (in Swedish)

Persson C.-G. (2018): Mät- och lägesosäkerhet vid geodatainsamling – en lathund. HMK, Teknisk rapport 2018:1, 9 pp., Gävle, Sweden (in Swedish).

Simpson M. J. R., Nilsen J. E. Ø., Ravndal O. R., Breili K., Sande H., Kierulf H. P., **Steffen H.**, Jansen E., Carson M., Vestøl O. (2015): Sea level change for Norway: past and present observations and projections to 2100. Norwegian Centre for Climate Services, Report 1/2015, Oslo, Norway.

Appendix 1.5 – Lantmäteriet: Reports in Geodesy and Geographical Information Systems

2014:2: Vestøl O., **Eriksson P.-O.**, Jepsen C., Keller K., Mäkinen J., Saaranen V., Valsson G., Hoftuft O.: Review of current and near-future levelling technology – a study project within the NKG working group of Geoid and Height Systems.

2014:5: **Ohlsson K.**: Studie av mätosäkerhet och tidskorrelationer vid mätning med nätverks-RTK i SWEPOS 35 km-nät (diploma work, in Swedish).

2015:1: **Fredriksson A.** & **Olsson M.**: Jämförelse av höjdmätning med olika GNSS-mottagare i SWEPOS Nätverks-RTK-tjänst (diploma work, in Swedish).

2015:2: **Norin D.**, Johansson J. M., Mårtensson S.-G., Eshagh M.: Geodetic activities in Sweden 2010–2014.

2015:4: **Andersson B.**, **Alfredsson A.**, Nordqvist A., Kilström R.: RIX 95-projektet – slutrapport (in Swedish).

2016:1: **Engfeldt A.**: RG 2000 – status March 2016.

2016:2: **Engfeldt A.**: Preparations and plans for the new national gravity system, RG 2000.

2016:4: **Kempe C.** (ed.): Proceedings of the NKG General Assembly – Göteborg, Sweden, 1–4 September 2014.

2016:5: **Berggren A.**: Inledande försök till mätning med Europas navigeringssystem Galileo (diploma work, in Swedish).

2018:3: **Svensson V.** & **Tobler F.**: Utvärdering av olika metoder för fri stationsetablering med nätverks-RTK (diploma work, in Swedish).

2018:4: **Norin D.**, Jensen A. B. O., Bagherbandi M., Eshagh M.: Geodetic activities in Sweden 2014–2018.

2018:X: **Jivall L.** & **Nilfouroushan F.**: Comparison between mast-based and pillar-based networks for SWEREF-point determination using BERNESE and GAMIT-GLOBK (in press).

Appendix 2 – KTH: Geodetic publications 2014–2018

Appendix 2.1 – KTH: International journals

Abrehdary M., Sjöberg L. E., Bagherbandi M. (2015): Combined Moho parameters determination using CRUST1.0 and Vening Meinez-Moritz Model. Journal of Earth Science, 26(4), pp. 607–616.

Abrehdary M., Sjöberg L. E., Bagherbandi M. (2016): Modelling Moho depth in ocean areas based on satellite altimetry using Vening Meinez-Moritz method. Acta Geodaetica et Geophysica, 51(137), pp. 137–149.

Abrehdary M., Sjöberg L. E., Bagherbandi M. (2016): The spherical terrain correction and its effect on the gravimetric-isostatic Moho determination. Geophysical Journal International, 204(1), pp. 262–273.

Abrehdary M., Sjöberg L. E., Bagherbandi M., Sampietro D. (2017): Towards the Moho depth and Moho density contrast along with their uncertainties from seismic and satellite gravity observations. Journal of Applied Geodesy, 11(4), pp. 231–247.

Alizadeh-Khameneh M. A., Eshagh M., Sjöberg L. E. (2015): Optimisation of Lilla Edet landslide GPS monitoring network. Journal of Geodetic Science, 5, pp. 57–66.

Alizadeh-Khameneh M. A., Eshagh M., Sjöberg L. E. (2016): The effect of instrumental precision on optimisation of displacement monitoring networks. Acta Geodaeitica et Geophysica, 51(4), pp. 761–772.

Alizadeh-Khameneh M. A., Eshagh M., Jensen A. B. O. (2018): Optimization of deformation monitoring networks using finite element strain analysis. Journal of Applied Geodesy, 12(2), pp. 187–197.

Alizadeh-Khameneh M. A., Sjöberg, L. E., Jensen A. B. O. (2017): Optimisation of GNSS networks – considering baseline correlations. Survey Review (online 26 June 2017).

Alizadeh-Khameneh M. A., Horemuz M., Jensen A. B. O., Andersson J. V. (2018): Optimal vertical placement of total station. Journal of Surveying Engineering, 144(3).

Bagherbandi M., Tenzer R., Sjöberg L. E. (2014): Moho depth uncertainties in the Vening-Meinesz Moritz inverse problem of isostasy. Studia Geophysica et Geodaetica, 58(2), pp. 227–248.

Bagherbandi M., Tenzer R., Sjöberg L. E. Abrehdary M. (2014): On the residual isostatic topography effect in the gravimetric Moho determination. Journal of Geodynamics, 83, pp. 28–36.

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Eshagh M. (2014): Integral development of Vening Meinesz-Moritz formula for local determination of Moho discontinuity with applications in Iran. Geodynamics Research International Bulletin, 2(3), pp. I–IX.

Eshagh M. (2014): From tensor to vector of gravitation. Artificial Satellites, 49(2), pp. 63–80.

Eshagh M. (2014): A theoretical study on terrestrial gravimetric data refinement by Earth gravity models. Geophys. Prosp., 62, pp. 158–171.

Eshagh M. (2014): From satellite gradiometry data to the sub-crustal stress due to the mantle convection. Pure and Applied Geophysics, 171, pp. 2391–2406.

Eshagh M. (2015): On the relation between Moho and sub-crustal stress induced by mantle convection. Journal of Geophysics and Engineering, 12, pp. 1–11.

Eshagh M. & Bagherbandi M. (2014): Combined Moho estimators. Geodynamics Research International Bulletin, 1(3), pp. 1–11.

Eshagh M. & Ebadi S. (2014): A strategy to calibrate errors of Earth gravity models. J. Appl. Geophys., 103, pp. 215–220.

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Eshagh M. & Alizadeh-Khameneh M. A. (2015): Two-epoch optimal design of displacement monitoring networks. Boletim de Ciências Geodésicas, 21(3), pp. 484–497.

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Eshagh M. & Zoghi S. (2016): Local error calibration of EGM08 geoid using GNSS/levelling data. Journal of Applied Geophysics, 130, pp. 209–217.

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Horemuž M. & Zhao Y. (2014): Motion of moving camera from point matches: comparison of two robust estimation methods. IET Computer Vision, 8(6), pp. 682–689.

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Ouassou M., Jensen A. B. O., Gjevestad J. G. O., Kristiansen O. (2015): Next generation network real-time kinematic interpolation segment to improve the user accuracy. International Journal of Navigation and Observation, article ID 346498, 15 pp.

Ouassou M., Natvig B., Jensen A. B. O., Gåsemyr J. I. (2018): Reliability analysis of network real-time kinematic. Journal of Electrical and Computer Engineering, article ID 8260479, 16 pp.

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Sjöberg L. E. (2015): On the gravity and geoid effects of glacial isostatic adjustment in Fennoscandia – a short note. Journal of Geodetic Science. 5, pp. 189–191.

Sjöberg L. E. (2018): On the topographic bias and density distribution in modelling the geoid and orthometric heights. Journal of Geodetic Science, 8(1), pp. 30–33.

Sjöberg L. E. (2018): Topographic effects in geoid determinations. Geosciences, 8(4), 143, 8 pp.

Sjöberg L. E., Abrehdary M., Bagherbandi M. (2014): The observed geoid height versus Airy's and Pratt's isostatic models using matched asymptotic expansions. Acta Geod Geophys 49, pp. 473–490.

Sjöberg L. E., Bagherbandi M., Tenzer R. (2015): On Gravity inversion by no-topography and rigorous isostatic gravity anomalies. Pure and Applied Geophysics, 172(10), pp. 2669–2680.

Sjöberg L. E., Grafarend E. W., Shafiei Joud M. S. (2017): The zero gravity curve and surface and radii for geostationary and geosynchronous satellite orbits. Journal of Geodetic Science, 7(1), pp. 43–50.

Sjöberg, L. E. & Shafiei Joud M. S. (2018): A numerical test of the topographic bias. Journal of Geodetic Science, 8(1), pp. 14–17.

Tenzer R., Bagherbandi M., Sjöberg L. E. (2015): Comparison of various isostatic marine gravity disturbances. Journal of Earth System Science, 124(6), pp. 1235–1245.

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Tenzer R., Chen W., Tsoulis D., Bagherbandi M., Sjöberg L. E., Novák P., Jin S. (2015): Analysis of the refined CRUST1.0 crustal model and its gravity field. Surveys in Geophysics, 36(1), pp. 139–165.

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Tenzer R. & Bagherbandi M. (2016): Theoretical deficiencies of the isostatic models for modelling the Moho geometry along the convergent continental tectonic plate boundaries. Journal of Earth Science, 27(6), pp. 1045–1053.

Tenzer R., Bagherbandi M., Chen W., Sjöberg L. E. (2017): Global isostatic gravity maps from satellite missions and their applications in the lithospheric structure studies. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 10(2), pp. 549–561.

Tenzer R., Foroughi I., Sjöberg L. E., Bagherbandi M., Hirt C., Pitoňák M. (2018): Definition of height systems for telluric planets and moons. Surveys in Geophysics, 39(3), pp. 313–335.

Appendix 2.2 – KTH: Swedish journals

Horemuz M. & Jansson P. (2016): Optimal placering av en totalstation. SKMF, Sinus, nr 3 2016, pp. 18–20.

Lundgren Nilsson L. & **Jansson P.** (2015): Stomnätsstrategi – inför en framtida kommunal stomnätsstrategi i plan. SKMF, Sinus, nr 3 2015, pp. 21–23.

Appendix 2.3 – KTH: Conference proceedings and compilation works

Alizadeh-Khameneh M. A., Sjöberg L. E. & Jensen A. B. O. (2016): Optimisation of GNSS deformation monitoring networks by considering baseline correlations. FIG, Working Week 2016, 2–6 May 2016, 14 pp., Christchurch, New Zeeland.

Alizadeh-Khameneh M. A., Horemuz M., Jensen A. B. O., Andersson J. V. (2017): Investigation of the RUFRIS method with GNSS and total station for levelling. 2017 International Conference on Localization and GNSS, 27–29 June 2017, 6 pp., Nottingham, Great Britain.

Ebadi S. & Eshagh M. (2014): A method for calibrating errors of the Earth gravity models. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ebadi S. & Eshagh M. (2014): Investigations into the recent Earth's gravity models of GOCE in comparison with EGM08. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ebadi S. & Eshagh M. (2014): Precise geoid determination based on the recent developments in the gravimetric data. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ghorbannia M. & Eshagh M. (2014): Evaluation of Gaussian equations of motion of a satellite for local Earth's gravity field recovery over Iran. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Harrie L., Larsson K., Tenenbaum D., Horemuz M., Ridefelt H., Lysell G., Brandt S. A., Sahlin E. A. U., Adelsköld G., Högström M., Lagerstedt J. (2014): Some strategic national initiatives for the Swedish education in the geodata field. AGILE[43], 17th Conference on Geographic Information Science (AGILE 2014), 3–16 June 2014, 5 pp., Castellon, Spain.

Jensen A. B. O. & Almholt A. (2015): Geodetic infrastructure and positioning for the Fehmarnbelt Fixed Link. FIG, Working Week 2015, 17–21 May 2015, 13 pp., Sofia, Bulgaria.

Sjöberg L. E. & Shafiei Joud M. S. (2017): New modifications of Stokes' integral. In IAG: International Association of Geodesy Symposia, pp. 1–8 (online 27 August 2017).

Sjöberg L. E. & Bagherbandi M. (2019): Isostasy. In Grafarend (ed.): Encyclopedia of Geodesy. Springer, pp. X–X (in press).

[43] AGILE = Association of Geographic Information Laboratories in Europe

Tenzer R. & Bagherbandi M. (2016): Comparative study of the uniform and variable Moho density contrast in the Vening Meinesz-Moritz’s isostatic scheme for the gravimetric Moho recovery. In: Jin & Barzaghi (eds): IGFS 2014. IAG/IGFS, 3rd General Assembly, 30 June–6 July 2014, 144, pp. 199–207, Shanghai, China.

Uggla G. & Horemuz, M. (2018): Georeferencing methods for IFC. University of Warmia and Mazury et al., Baltic Geodetic Congress 2018, 21–23 June 2018, Olsztyn, Poland (in press).

Appendix 2.4 – KTH: Other geodetic publications

Abrehdary M. (2016): Recovering Moho parameters using gravimetric and seismic data. KTH, Ph.D. thesis, TRITA SoM 2016-02, 56 pp., Stockholm, Sweden.

Alizadeh-Khameneh M. A. (2015). On optimisation and design of geodetic networks. KTH, licentiate thesis, TRITA-SoM 2015-05, 40 pp., Stockholm, Sweden.

Alizadeh-Khameneh M. A. (2017): Optimal design in geodetic GNSS-based networks. KTH, Ph.D. thesis, TRITA-SoM 2018-01, 72 pp., Stockholm, Sweden.

Håkansson M. (2017): Hardware biases and their impact on GNSS positioning. KTH, licentiate thesis, TRITA-SoM 2017-08, 66 pp., Stockholm, Sweden.

Jansson P. & Persson C.-G. (2014): Uncertainty in area determination. KTH, report, TRITA SoM 2014-14, 29 pp., Stockholm, Sweden.

Norin D., Jensen A. B. O., Bagherbandi M., Eshagh M. (2018): Geodetic activities in Sweden 2014–2018. Lantmäteriet, Lantmäterirapport 2018:4, 78 pp., Gävle, Sweden.

Shafiei Joud M. S. (2018): Contributions of satellite geodesy to post-glacial rebound research. KTH, Ph.D. thesis, TRITA-SoM 2018-02, 180 pp., Stockholm, Sweden.

Sjöberg L. E. & Bagherbandi M. (2017): Gravity inversion and integration: theory and applications in geodesy and geophysics. Springer, 377 pp.

Ssengendo R. (2015): A height datum for Uganda based on a gravimetric quasigeoid model and GNSS/levelling. KTH, Ph.D. thesis, TRITA SoM 2015-08, 190 pp., Stockholm, Sweden.

Appendix 2.5 – KTH: Poster and oral presentations

Abrehdary M., Sjöberg L. E. Bagherbandi M. (2015): Modelling Moho depth in ocean areas based on satellite altimetry using Vening

Meinez-Moritz' method. IUGG[44], 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (poster presentation).

Alizadeh-Khameneh M. A. (2017): RUFRIS som en alternativ metod till avvägning. KS, Kartdagarna 2017, 28–30 March 2017, Örebro, Sweden (oral presentation, in Swedish).

Alizadeh-Khameneh M. A. & Eshagh M. (2014): Optimization of Lilla Edet land slide GPS monitoring network. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Bagherbandi M. & Sjöberg L. E. (2015): Viscosity of mantle inferred from land uplift rate and mantle gravity field in Fennoscandia. IUGG, 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (poster presentation).

Bagherbandi M., Hadi A., Gido N., Sjöberg L. E. (2017): A novel approach to study ice mass change using satellite data in Greenland and Antarctica. IAG/IASPEI, Scientific Assembly 2017, 30 July–4 August 2017, Kobe, Japan (oral presentation).

Bagherbandi M., Gido N., Sjöberg L. E., Tenzer R. (2018): Studying permafrost by integration of satellite and in situ data in Arctic region. IAG/ICCT[45], IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (poster presentation).

Bagherbandi M., Sjöberg L. E., Amin H. (2018): Towards a world vertical datum defined by the geoid potential and earth's ellipsoidal parameters. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (oral presentation).

Eshagh M. (2014): On the relation between Moho and sub-crustal stress induced by mantle convection. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Eshagh M. & Alizadeh-Khameneh M. A. (2014): Two-epoch optimal design of displacement monitoring networks. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Eshagh M. & Romeshkani M. (2014): Determination of sub-crustal stress due to mantle convection using GOCE gradiometric data. UNESCO, 5th GOCE users workshop, 25–28 November, Paris, France (poster presentation).

Eshagh M. & Tenzer R. (2014): Sub-crustal stress induced by mantle convection from gravity data. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (oral presentation).

[44] IUGG = International Union of Geodesy and Geophysics

[45] ICCT = Inter Commission Committee on Theory

Gu X., Tenzer R., Eshagh M., Hwang C. (2014): Crustal stress in Taiwan. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (oral presentation).

Horemuž M. (2014): Balanced least absolute value estimator and its applications in navigation problems. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (oral presentation).

Horemuž M. (2014): Bästa instrumentplacering vid fri stationsetablering. Trimtec, TAK2014, 26–28 November 2014, Stenungsund, Sweden (oral presentation, in Swedish).

Horemuz M. (2015): Evaluation of testing methods for positioning modules. Conference "Capturing Reality", 22–25 November 2015, Salzburg, Austria (oral presentation).

Horemuž M. & Jansson P. (2014): Precisionsutvärdering av mobila plattformar. KS, Kartdagarna 2014, 18–20 March, Jönköping, Sweden (oral presentation, in Swedish).

Håkansson M. (2017): Betydelsen av biases vid positionering med GNSS. KS, Kartdagarna 2017, 28–30 March 2017, Örebro, Sweden (oral presentation, in Swedish).

Håkansson M. (2017): Study of satellite dependency of phase biases between receivers and between signals. IGS, Workshop 2017, 3–7 July 2017, Paris, France (oral presentation).

Jansson P. (2014): Om osäkerheten i arealbestämningar. KS, Kartdagarna 2014, 18–20 March 2014, Jönköping, Sweden (oral presentation, in Swedish).

Jensen A. B. O. (2015): Geodetic infrastructure for the Fehmarnbelt Fixed Link. KS et al., Position 2015, 17–18 March 2015, Stockholm, Sweden, (oral presentation, in Swedish).

Jensen A. B. O. (2015): Examples of Galileo research at KTH. EU, European Space Expo, May 2015, Stockholm, Sweden (oral presentation).

Jensen A. B. O. (2015): Geodetic space related research at KTH. Association of Space Explorers/KTH, XXVII Planetary Congress, September 2015, Stockholm, Sweden (oral presentation).

Jensen A. B. O. (2015): Development and research in the field of GNSS at KTH. Lantmäteriet, GNSS/SWEPOS seminar, 20–21 October 2015, Gävle, Sweden (oral presentation).

Jensen A. B. O. (2016): Functionality and design of Galileo commercial service. RNN, RNN-conference, 3 February 2016, Stockholm, Sweden (oral presentation).

Jensen A. B. O. (2016): News from the world of the satellites. Danish Association of Chartered Land Surveyors, Yearly meeting, February 2016, Nyborg, Denmark (oral presentation, in Danish).

Jensen A. B. O. (2016): Static GNSS measurements. KS, Kartdagarna 2016, 26–28 March 2016, Gävle, Sweden (oral presentation, in Swedish).

Jensen A. B. O. (2016): Challenges for navigation in the Arctic. EUGIN, ENC 2016, 30 May–2 June 2016, Helsinki, Finland (oral presentation).

Jensen A. B. O. (2016): How KTH works for an increased contribution from Swedish geodesy to a more effective building and management. Geoforum 2016, October 2016, Uppsala, Sweden, (oral presentation, in Swedish).

Jensen A. B. O. (2016): The north: challenges for geodesy and geomatics. ETH Zürich, Dept. of Geodesy and Photogrammetry, December 2016, Zürich, Switzerland (oral presentation).

Jensen A. B. O. (2017): Geodetic activities at KTH. SKMF, MätKart17 in cooperation with Geodesidagarna, 8–10 February 2017, Örebro, Sweden (oral presentation, in Swedish).

Jensen A. B. O. (2017): The coupling of geodesy, GIS and BIM - activities at KTH. KS, Kartdagarna 2017, 28–30 March 2017, Örebro, Sweden (oral presentation, in Swedish).

Jensen A. B. O. (2017): Data quality in building and construction. Lund University, Seminar on Digitalisation of the Society, April 2017, Lund, Sweden, (oral presentation, in Swedish).

Jensen A. B. O. (2017): Geodesy and positioning. Swedish Space Forum, May 2017, Kiruna, Sweden (oral presentation).

Jensen A. B. O. (2017): 100 years of (space) geodetic research at KTH. Campus 100 (lecture marathon of 100 lectures as part of the celebration of the KTH campus 100-year anniversary), October 2017, Stockholm, Sweden (oral presentation).

Jensen A. B. O. (2018): From meridian arc expeditions to satellite gravimetry, KTH-Geodesy through 100 years. KS, Kartdagarna 2018, 20–22 March 2018, Linköping, Sweden (oral presentation, in Swedish).

Nilfouroushan F., Bagherbandi M., Gido, N. (2017): Ground subsidence and groundwater depletion in Iran: integrated approach using InSAR and satellite gravimetry. ESA, Fringe Workshop, 5–9 June 2017, Helsinki, Finland (poster presentation).

Novak P., Tenzer R., Bagherbandi M., Chen W., Sjöberg L. E. (2016): Isostatic global gravity fields for geodetic and geophysical applications. IAG/IGFS, GGHS 2016, 19–23 September 2016, Thessaloniki, Greece (oral presentation).

Shafiei Joud M. S., Bagherbandi M., Sjöberg L. E. (2016): A new inference of the mantle viscosity from isolating the gravity field signal related to the present land uplift in Fennoscandia. IAG/IGFS, GGHS 2016, 19–23 September 2016, Thessaloniki, Greece (oral presentation).

Shafiei Joud M. S., Sjöberg L. E., Bagherbandi M. (2017): Preliminary results of a combined land uplift model in Fennoscandia using gravimetric and geometric data. Glacial Isostatic Adjustment workshop, 5–7 September 2017, Reykjavik, Iceland (oral presentation).

Shafiei Joud M. S., Mehdi S., Bagherbandi M., Sjöberg L. E. (2018): A satellite-based gravimetric approach to GIA modelling. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (poster presentation).

Sjöberg L. E. (2014): The development of physical geodesy during 1914–2014 - a personal view. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (oral presentation).

Sjöberg L. E. (2015): The geoid-to-quasigeoid separation expressed by gravity disturbances. Kolloquium der Leibniz-Societät, "Grafarend 75", 13 February 2015, Berlin, Germany (oral presentation).

Sjöberg L. E. & Ågren J. (2014): Investigations for the requirements of a 5 mm geoid model – a project status report. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Sun J. (2018): Description of geodata quality with a focus on integration of BIM data and geodata. KS, Kartdagarna 2018, 20–22 March 2018, Linköping, Sweden (oral presentation).

Sun J., Eriksson H., Harrie L., Jensen A. B. O. (2018): Sharing building information from planning to maintenance phases. AGILE, 21st Conference on Geo-information science (AGILE 2018), 12–15 June 2018, Lund, Sweden (poster presentation).

Tenzer R. & Eshagh M. (2014): Stress field along continent-to-continent collision zones. The 5th International workshop on multi-observations and interpretations of Tibet, Xinjiang and Siberia (TibXS), 10–15 August 2014, Guiyang, China (oral presentation).

Uggla G. (2018): Georeferencing capabilities of IFC. KS, Kartdagarna 2018, 20–22 March 2018, Linköping, Sweden (oral presentation, in Swedish).

Appendix 3 – University of Gävle: Geodetic publications 2014–2018

Appendix 3.1 – University of Gävle: International journals

Bagherbandi M. (2016): Deformation monitoring using different adjustment methods: a simulated study. KSCE Journal of Civil Engineering, 20(2), pp. 855–862.

Bagherbandi M., Tenzer R., Sjöberg L. E. (2014): Moho depth uncertainties in the Vening-Meinesz Moritz inverse problem of isostasy. Studia Geophysica et Geodaetica, 58(2), pp. 227–248.

Bagherbandi M., Sjöberg L. E., Tenzer R., Abrehdary M. (2015): A new Fennoscandian crustal thickness model based on CRUST1.0 and gravimetric isostatic approach. Earth-Science Reviews, 145, pp. 132–145.

Bagherbandi M., Tenzer R., Sjöberg L. E. Abrehdary M. (2015): On the residual isostatic topography effect in the gravimetric Moho determination. Journal of Geodynamics, 83, pp. 28–36.

Bagherbandi M., Bai Y., Sjöberg L. E., Tenzer R., Abrehdary M., Miranda S., Sanchez J. M. A. (2017): Effect of the lithospheric thermal state on the Moho interface: a case study in South America. Journal of South American Earth Sciences, 76, pp. 198–207.

Baranov A., Tenzer R., **Bagherbandi M.** (2018): Combined gravimetric-seismic crustal model for Antarctica. Surveys in Geophysics, 39(1), pp. 23–56.

Carrillo E., Koyi H. A., **Nilfouroushan F.** (2017): Structural significance of an evaporite formation with lateral stratigraphic heterogeneities (southeastern Pyrenean Basin, NE Spain). Marine and Petroleum Geology, 86, pp. 1310–1326.

Deng H., Koyi H. A., **Nilfouroushan F.** (2016): Superimposed folding and thrusting by two phases of mutually orthogonal or oblique shortening in analogue models. Journal of Structural Geology, 83, pp. 28–45.

Eshagh M. & **Bagherbandi M.** (2014): Combined Moho estimators. Geodynamics Research International Bulletin, 1(3), pp. 1–11.

Gido N., **Bagherbandi M.,** Sjöberg L. E. (2018): A gravimetric method to determine Horizontal Stress field due to flow in mantle in Fennoscandia. Geosciences Journal (accepted).

Joudaki M., Farzipour-Saein A., **Nilfouroushan F.** (2015): Kinematics and surface fracture pattern of the Anaran basement fault zone in

NW of the Zagros fold-thrust belt. International Journal of Earth Sciences, 105(3), pp. 869–883.

Koyi H. A., **Nilfouroushan F.**, Hessami K. (2016): Modelling role of basement block rotation and strike-slip faulting on structural pattern in the cover units in fold-and-thrust belts. Geological Magazine, 153(5/6), pp. 827–844 (thematic issue: Tectonic evolution and mechanics of basement-involved fold-and-thrust belts).

Lacombe O., Ruh J., Brown D., **Nilfouroushan F.** (2016): Introduction: tectonic evolution and mechanics of basement-involved fold-and-thrust belts. Geological Magazine, 153(5/6), pp. 759–762 (thematic issue: Tectonic evolution and mechanics of basement-involved fold-and-thrust belts).

Mårtensson S.-G. & Reshetyuk Y. (2017): Height uncertainty in digital terrain modelling with Unmanned Aircraft Systems. Survey Review, 49(355), pp. 312–318.

Raeesi M., Zarifi Z., **Nilfouroushan F.**, Boroujeni S., Tiampo K. (2017): Quantitative analysis of seismicity in Iran. Pure and Applied Geophysics, 174(3), pp. 793–833.

Reshetyuk Y. & Mårtensson S.-G. (2016): Generation of highly accurate digital elevation models with unmanned aerial vehicles. The Photogrammetric Record, 31(154), pp. 143–165.

Schreurs G., Buiter S. J. H., Boutelier J., Burberry C., Callot J.-P., Cavozzi C., Cerca M., Chen J.-H., Cristallini E., Cruden A. R., Cruz L., Daniel J.-M., Da Poian G., Garcia V. H., Gomes C. J. S., Grall C., Guillot Y., Guzmán C., Hidayah T. N., Hilley G., Klinkmüller M., Koyi H. A., Lu C.-Y., Maillot B., Meriaux C., **Nilfouroushan F.**, Pan C.-C., Pillot D., Portillo R., Rosenau M., Schellart W. P., Schlische R. W., Take A., Vendeville B., Vergnaud M., Vettori M., Wang S.-H., Withjack M. O., Yagupsky D., Yamada Y. (2016): Benchmarking analogue models of brittle thrust wedges. Journal of Structural Geology, 92, pp. 116–139.

Shafiei Joud M. S., Sjöberg L. E., **Bagherbandi M.** (2017): Use of GRACE data to detect the present land uplift rate in Fennoscandia. Geophysical Journal International, 209(2), pp. 909–922.

Shahpasand-Zadeh M., Koyi H. A., **Nilfouroushan F.** (2017): The significance of switch in convergence direction in the Alborz Mountains, northern Iran: insights from scaled analogue modelling. Interpretation, 5(1), pp. SD81–SD98.

Sjöberg L. E., **Bagherbandi M.**, Tenzer R. (2015): On gravity inversion by no-topography and rigorous isostatic gravity anomalies. Pure and Applied Geophysics, 172(10), pp. 2669–2680.

Tenzer R., **Bagherbandi M.,** Sjöberg L. E. (2015): Comparison of various isostatic marine gravity disturbances. Journal of Earth System Science, 124(6), pp. 1235–1245.

Tenzer R., **Bagherbandi M.**, Sjöberg L. E., Novak P. (2015): Isostatic crustal thickness under the Tibetan Plateau and Himalayas from satellite gravity gradiometry data. Earth Sciences Research Journal, 19(2), pp. 97–106.

Tenzer R., Chen W., Tsoulis D., **Bagherbandi M.**, Sjöberg L. E., Novák P., Jin S. (2015): Analysis of the refined CRUST1.0 crustal model and its gravity field. Surveys in Geophysics, 36(1), pp. 139–165.

Tenzer R. & **Bagherbandi M.** (2016): Theoretical deficiencies of the isostatic models for modelling the Moho geometry along the convergent continental tectonic plate boundaries. Journal of Earth Science, 27(6), pp. 1045–1053.

Tenzer R., **Bagherbandi M.**, Chen W., Sjöberg L. E. (2017): Global isostatic gravity maps from satellite missions and their applications in the lithospheric structure studies. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 10(2), pp. 549–561.

Tenzer R., Chen W**., Bagherbandi M.**, Vajda P. (2018): Evidence of the ocean-floor spreading in marine gravity data. International Geology Review (submitted).

Tenzer R., Chen W., Baranov A., **Bagherbandi M.** (2018): Gravity maps of Antarctic lithospheric structure from remote-sensing and seismic data. Pure and Applied Geophysics, 175(6), pp. 2181–2203.

Tenzer R., Foroughi I., Sjöberg L. E., **Bagherbandi M.**, Hirt C., Pitoňák M. (2018): Definition of height systems for telluric planets and moons. Surveys in Geophysics, 39(3), pp. 313–335.

Vajedian S., Motagh M., **Nilfouroushan F. (**2015): StaMPS improvement for deformation analysis in mountainous region: implications for Damavand volcano and Mosha fault in Alborz. Remote Sensing, 7(7), pp. 8323–8347.

Vajedian S., Motagh M., **Nilfouroushan F. (**2015): Response to Sowter A.; Cigna F. On the use of the ISBAS acronym in InSAR applications. Comment on Vajedian S.; Motagh M.; Nilfouroushan F. StaMPS improvement for deformation analysis in mountainous regions: implications for the Damavand volcano and Mosha fault in Alborz. Remote Sens. 2015, 7, 8323–8347. Remote Sensing, 7(9), pp. 11324–11325.

Zarifi Z., **Nilfouroushan F.**, Raeesi M. (2014): Crustal stress map of Iran: insight from seismic and geodetic computations. Pure and Applied Geophysics, 171(7), pp. 1219–1236.

Appendix 3.2 – University of Gävle: Conference proceedings and compilation works

Norin D., Johansson J. M., **Mårtensson S.-G.**, Eshagh M. (2016): National report of Sweden to the NKG General Assembly 2014 – geodetic activities in Sweden 2010–2014. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 52–77, Göteborg, Sweden. Also as Lantmäteriet, Lantmäterirapport 2015:2, 62 pp., Gävle, Sweden (slightly different and with the title "Geodetic activities in Sweden 2010–2014").

Sjöberg L. E. & **Bagherbandi M.** (2019): Isostasy. In Grafarend (ed.): Encyclopedia of Geodesy. Springer, pp. X–X (in press).

Tenzer R. & **Bagherbandi M.** (2016): Comparative study of the uniform and variable Moho density contrast in the Vening Meinesz-Moritz's isostatic scheme for the gravimetric Moho recovery. In: Jin & Barzaghi (eds): IGFS 2014. IAG/IGFS, 3rd General Assembly, 30 June–6 July 2014, 144, pp. 199–207, Shanghai, China.

Walfridsson M., **Edlund M.**, **Mårtensson S.-G.** (2017): Land surveying education in Sweden: addressing global challenges. FIG, Working Week 2017, 29 May–2 June 2017, 9 pp., Helsinki, Finland.

Appendix 3.3 – University of Gävle: Other geodetic publications

Mårtensson S.-G. & Reshetyuk, Y. (2014): Accurate and cost-effective updating of DTM by UAS for BIM. Trafikverket, FoU-rapport 2015:030, Borlänge, Sweden (in Swedish).

Norin D., Jensen A. B. O., **Bagherbandi M.**, Eshagh M. (2018): Geodetic activities in Sweden 2014–2018. Lantmäteriet, Lantmäterirapport 2018:4, 78 pp., Gävle, Sweden.

Reshetyuk Y. (2017): Terrester laserskanning. Bookboon.com, e-book, 120 pp. (in Swedish).

Reshetyuk Y. & Mårtensson, S.-G. (2016): Accurate and cost-effective updating of DTM by laser scanning for BIM – the status quo 2015. Trafikverket, FoU-rapport 2016:067, Borlänge, Sweden (in Swedish).

Sjöberg L. E. & **Bagherbandi M.** (2017): Gravity inversion and integration: theory and applications in geodesy and geophysics. Springer, 377 pp.

Appendix 3.4 – University of Gävle: Poster and oral presentations

Abrehdary M., Sjöberg L. E. **Bagherbandi M.** (2015): Modelling Moho depth in ocean areas based on satellite altimetry using Vening Meinez-Moritz' method. IUGG, 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (poster presentation).

Bagherbandi M., Sjöberg L. E., Abrehdary M., Tenzer R. (2014): Effect of the rock equivalent topography on the Moho geometry. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (poster presentation).

Bagherbandi M., Tenzer R., Sjöberg L. E., Abrehdary M. (2014): A new Fennoscandian crustal thickness model based on CRUST1.0 and gravimetric isostatic approach. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (oral presentation).

Bagherbandi M. & Sjöberg L. E. (2015): Viscosity of mantle inferred from land uplift rate and mantle gravity field in Fennoscandia. IUGG, 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (poster presentation).

Bagherbandi M., Hadi A., Gido N., Sjöberg L. E. (2017): A novel approach to study ice mass change using satellite data in Greenland and Antarctica. IAG/IASPEI, Scientific Assembly 2017, 30 July–4 August 2017, Kobe, Japan (oral presentation).

Bagherbandi M., Gido N., Sjöberg L. E., Tenzer R. (2018): Studying permafrost by integration of satellite and in situ data in Arctic region. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (poster presentation).

Bagherbandi M., Sjöberg L. E., Amin H. (2018): Towards a world vertical datum defined by the geoid potential and earth's ellipsoidal parameters. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (oral presentation).

Ganas A., Kapetanidis V., **Nilfouroushan F.**, Steffen H., Lidberg M., Deprez A., Socquet A., Walpersdorf A., d'Agostino N., Avallone A., Legrand J., Fernandes R., Nastase E. I., Bos M., Kenyeres A. (2018): Developments on the EPOS-IP pan-european strain rate product; ESC2018 - S2-749. European Seismological Commission, 36th General Assembly, 2–7 September 2018, Valletta, Malta (oral presentation).

Joudaki M., Farzipour-Saein A., **Nilfouroushan F.** (2014): Recognition of hidden faults, based on fracture orientation in Anaran Anticline (Zagros), by Remote Sensing techniques. 32nd National and the 1st International Geosciences Congress, Tehran, Iran (oral presentation).

Joudaki M., Farziour-Saein A., **Nilfouroushan F.** (2015): Kinematic history of the Pusht-e Kuh arc (Lurestan region), Zagros fold-thrust belt. Van Yüzüncü Yıl University, Symposium on Eastern Anatolian Geology, Van, Turkey (oral presentation).

Khorrami F., Masson F., **Nilfouroushan F.**, Vernant P., Saadat S. A., Nankali H. R., Hosseini S., Aghamohamadi A. (2017): An up-to-date GPS velocity field of Iran. EGU[46], General Assembly, 23–28 April 2017, Vienna, Austria (poster presentation).

Koyi H. A., **Nilfouroushan F.**, Hessami K. (2015): Modelling the role of basement block rotation and strike-slip faulting on structural pattern in the cover units of fold-and-thrust belts. EGU, General Assembly, 12–17 April 2015, Vienna, Austria (oral presentation).

Nilfouroushan F., Jivall L., Lilje C., Steffen H., Lidberg M., Johansson J., Jarlemark P. (2016): Evaluation of newly installed SWEPOS mast stations, individual vs. type PCV antenna models and comparison with pillar stations. EGU, General Assembly, 17–22 April 2016, Vienna, Austria (poster presentation).

Nilfouroushan F., **Bagherbandi M.**, Gido, N. (2017): Ground subsidence and groundwater depletion in Iran: integrated approach using InSAR and satellite gravimetry. ESA, Fringe Workshop, 5–9 June 2017, Helsinki, Finland (poster presentation).

Novak P., Tenzer R., **Bagherbandi M.**, Chen W., Sjöberg L. E. (2016): Isostatic global gravity fields for geodetic and geophysical applications. IAG/IGFS, GGHS 2016, 19–23 September 2016, Thessaloniki, Greece (oral presentation).

Pease V., Koyi H. A., **Nilfouroushan F.** (2017): Development of the Amerasia Basin: where are we now? GSA, Annual meeting, Seattle, Washington, USA (oral presentation).

Pease V., Koyi H. A., **Nilfouroushan F.** (2018): Development of the Amerasia Basin: insights from analogue modelling. International Conference on Arctic Margins ICAM VIII, 11–14 June 2018, Stockholm, Sweden (oral presentation).

Schreurs G., Buiter S., GeoModTeam (including **Nilfouroushan F.**) (2016): Benchmarking analogue models of brittle thrust wedges. GeoMod 2016 conference, Montpellier, France (oral presentation).

Shafiei Joud M. S., **Bagherbandi M.**, Sjöberg L. E. (2016): A new inference of the mantle viscosity from isolating the gravity field signal related to the present land uplift in Fennoscandia. IAG/IGFS, GGHS 2016, 19–23 September 2016, Thessaloniki, Greece (oral presentation).

[46] EGU = European Geosciences Union

Shafiei Joud M. S., Sjöberg L. E., **Bagherbandi M.** (2017): Preliminary results of a combined land uplift model in Fennoscandia using gravimetric and geometric data. Glacial Isostatic Adjustment workshop, 5–7 September 2017, Reykjavik, Iceland (oral presentation).

Shafiei Joud M. S., Mehdi S., **Bagherbandi M.**, Sjöberg L. E. (2018): A satellite-based gravimetric approach to GIA modelling. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (poster presentation).

Taymaz T., **Nilfouroushan F.**, Yolsal-Çevikbilen S., Eken T. (2018): Co-seismic crustal deformation of the 12 November 2017 Mw 7.4 Sar-Pol-Zahab (Iran) earthquake: integration of analysis based on DInSAR and seismological observations. EGU, General Assembly, 8–13 April 2018, Vienna, Austria (poster presentation).

Tenzer R., Chen W., Tsoulis D., **Bagherbandi M.**, Sjöberg L. E., Novák P., Jin S. (2014): Spectral and spatial characteristics of the refined CRUST1.0 gravity field. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (oral presentation).

Tenzer R., Foroughi I., Sjöberg L. E., **Bagherbandi M.**, Hirt C., Pitonak M. (2018): Theoretical and practical aspects of defining the heights for planets and moons. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (oral presentation).

Zarifi Z., **Nilfouroushan F.**, Raeesi M. (2014): A crustal stress map for Iran deduced from seismic and geodetic computations. EGU, General Assembly, 27 April–2 May 2014, Vienna, Austria (poster presentation).

Zarifi Z., Raeesi M., **Nilfouroushan F.**, Tiampo K. F. (2014): Quantitative interpretation of seismic deformation in Iran. AGU[47], Fall Meeting, 15–19 December 2014, San Francisco, USA (oral presentation).

[47] AGU = American Geophysical Union

Appendix 4 – University West: Geodetic publications 2014–2018

Appendix 4.1 – University West: International journals

Alizadeh-Khameneh M. A., Eshagh M., Sjöberg L. E. (2015): Optimisation of Lilla Edet landslide GPS monitoring network. Journal of Geodetic Science, 5, pp. 57–66.

Alizadeh-Khameneh M. A., Eshagh M., Sjöberg L. E. (2016): The effect of instrumental precision on optimisation of displacement monitoring networks. Acta Geodaeitica et Geophysica, 51(4), pp. 761–772.

Alizadeh-Khameneh M. A., Eshagh M., Jensen A. B. O. (2018): Optimization of deformation monitoring networks using finite element strain analysis. Journal of Applied Geodesy, 12(2), pp. 187–197.

Eshagh M. (2014): A theoretical study on terrestrial gravimetric data refinement by Earth gravity models. Geophys. Prosp., 62, pp. 158–171.

Eshagh M. (2014): Determination of Moho discontinuity from satellite gradiometry data: linear approach. Geodynamics Research International Bulletin, 1(2), pp. 1–13.

Eshagh M. (2014): Integral development of Vening Meinesz-Moritz formula for local determination of Moho discontinuity with applications in Iran. Geodynamics Research International Bulletin, 2(3), pp. I–IX.

Eshagh M. (2014): From tensor to vector of gravitation. Artificial Satellites, 49(2), pp. 63–80.

Eshagh M. (2014): From satellite gradiometry data to the sub-crustal stress due to the mantle convection. Pure and Applied Geophysics, 171, pp. 2391–2406.

Eshagh M. (2015): On the relation between Moho and sub-crustal stress induced by mantle convection. Journal of Geophysics and Engineering, 12, pp. 1–11.

Eshagh M. (2016): Integral approaches to determine sub-crustal stress from terrestrial gravimetric data. Pure and Applied Geophysics, 173, pp. 805–825.

Eshagh M. (2016): A theoretical discussion on Vening Meinesz-Moritz inverse problem of isostasy. Geophysical Journal International, 207(3), pp. 1420–1431.

Eshagh M. (2016): On Vening Meinesz-Moritz and flexural theories of isostasy and their comparison over Tibet Plateau. Journal of Geodetic Science, 6, pp. 139–151.

Eshagh M. (2017): Local recovery of lithospheric stress tensor from GOCE gravitational tensor. Geophysical Journal International, 209(1), pp. 317–333.

Eshagh M. (2017): On the approximations in formulation of the Vening Meinesz-Moritz inverse problem of isostasy. Geophysical Journal International, 210(1), pp. 500–508.

Eshagh M. (2018): Elastic thickness determination based on Vening Meinesz-Moritz and flexural theories of isostasy. Geophysical Journal International, 213(3), pp. 1682–1692.

Eshagh M. & Bagherbandi M. (2014): Combined Moho estimators. Geodynamics Research International Bulletin, 1(3), pp. 1–11.

Eshagh M. & Ebadi S. (2014): A strategy to calibrate errors of Earth gravity models. J. Appl. Geophys., 103, pp. 215–220.

Eshagh M. & Ghorbannia M. (2014): The effect of the spatial truncation error on the variance of gravity anomalies derived from inversion of satellite orbital and gradiometric data. Adv. Space Res., 54(2), pp. 261–271.

Eshagh M. & Alizadeh-Khameneh M. A (2015): The effect of constraints on bi-objective optimization of geodetic networks. Acta Geod. Geophy., 50, pp. 449–459.

Eshagh M. & Alizadeh-Khameneh M. A. (2015): Two-epoch optimal design of displacement monitoring networks. Boletim de Ciências Geodésicas, 21(3), pp. 484–497.

Eshagh M. & Hussain M. (2015): Relationship amongst gravity gradients, deflection of vertical, Moho deflection and the stresses derived by mantle convections – a case study over Indo-Pak and surroundings. Geodynamics Research International Bulletin, 3(4), pp. I–XIII.

Eshagh M. & Romeshkani M. (2015): Determination of sub-lithospheric stress due to mantle convection using GOCE gradiometric data over Iran. J. Appl. Geophysics, 122, pp. 11–17.

Eshagh M. & Tenzer R. (2015): Sub-crustal stress determined using gravity and crust structure models. Computational Geoscience, 19, pp. 115–125.

Eshagh M. & Hussain M. (2016): An approach to Moho discontinuity recovery from on-orbit GOCE data with application over Indo-Pak region. Tectonophysics, 690(B), pp. 253–262.

Eshagh M., Hussain M., Tenzer R., Romeshkani M. (2016): Moho density contrast in central Eurasia from GOCE gravity gradients. Remote Sensing, 8(418), pp. 1–18.

Eshagh M., Hussain M., Tiampo K. F. (2016): Towards sub-lithospheric stress determination from seismic Moho, topographic heights and GOCE data. Journal of Asian Earth Sciences, 169(1), pp. 1–12.

Eshagh M. & Sprlak M. (2016): On the integral inversion of satellite-to-satellite velocity differences for local gravity field recovery: a theoretical study. Celestial Mechanics and Dynamical astronomy, 124, pp.127–144.

Eshagh M. & Zoghi S. (2016): Local error calibration of EGM08 geoid using GNSS/levelling data. Journal of Applied Geophysics, 130, pp. 209–217.

Eshagh M., Ebadi S., Tenzer R. (2017): Isostatic GOCE Moho model for Iran. Journal of Asian Earth Sciences, 138, pp. 12–24.

Eshagh M. & Tenzer R. (2017): Lithospheric stress tensor from gravity and lithospheric structure models. Pure and Applied Geophysics, 174(7), pp 2677–2688.

Eshagh M., Ashagrie A., Bedada T. B. (2018): Regional recovery of gravity anomaly from the inversion of diagonal components of GOCE gravitational tensor: a case study in Ethiopia. Artificial Satellites, 53(2), pp. 55–74.

Eshagh M., Johansson F., Karlsson L., Horemuz M. (2018): A case study on displacement analysis of Vasa warship. Journal of Geodetic Science, 8, pp. 43–54.

Eshagh M., Steinberger B., Tenzer R., Tassara A. (2018): Comparison of gravimetric and mantle flow solutions for lithospheric stress modelling and their combination. Geophysical Journal International, 213(2), pp. 1013–1028.

Hussain M., Eshagh M., Zulfiqar A., Sadiq M., Fatolazadeh F. (2016): Changes in gravitational parameters inferred from time-variable GRACE-data - a case study for October 2005 Kashmir earthquake. Journal of Applied Geophysics, 132, pp. 174–183.

Nozari M. & Eshagh M. (2014): An alternative approach to Eulerian Pole determination and unification of velocity fields of tectonic motions. Tectonophysics., 617, pp. 79–87.

Pitoňák M., Eshagh M., Sprlak M., Tenzer R., Novak P. (2018): Spectral combination of spherical gravitational curvature boundary-value problems. Geophysical Journal International, 214(2), pp. 773–791.

Romeshkani M. & Eshagh M. (2015): Deterministically-modified integral estimators of tensor of gravitation. Boletim de Ciências Geodésicas, 21(1), pp. 189–212.

Seif M. R., Sharifi M. A., Eshagh M. (2018): Polynomial approximation for fast generation of Associated Legendre functions. Acta Geodetica et Geophysica Hungarica, 53, pp. 275–293.

Sprlak M. & Eshagh M. (2016): Local recovery of sub- crustal stress determination from satellite-to-satellite tracking data. Acta Geophysica, 64(4), pp. 904–929.

Tenzer R. & Eshagh M. (2015): Subduction generated sub-crustal stress in Taiwan. Terr. Atm. Oceanic Sci., 26(3), pp. 261–268.

Tenzer R., Eshagh M., Jin S. (2015): Martian sub-crustal stress from gravity and topographic models. Earth and Planetary Science Letters, 425, pp. 84–92.

Tenzer R., Eshagh M., Shen W. (2017): The subcrustal stress estimation in central Eurasia from gravity, terrain and crustal structure models. Geoscience Journal, 21(1), pp. 47–54.

Zampal L., Tenzer R., Eshagh M., Pitonak M. (2018): Evidence of mantle upwelling/downwelling and localized subduction on Venus from the body-force vector analysis. Planetary and Space Science, 157, pp. 48–62.

Appendix 4.2 – University West: Conference proceedings and compilation works

Ebadi S. & Eshagh M. (2014): A method for calibrating errors of the Earth gravity models. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ebadi S. & Eshagh M. (2014): Investigations into the recent Earth's gravity models of GOCE in comparison with EGM08. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ebadi S. & Eshagh M. (2014): Precise geoid determination based on the recent developments in the gravimetric data. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Ghorbannia M. & Eshagh M. (2014): Evaluation of Gaussian equations of motion of a satellite for local Earth's gravity field recovery over Iran. Geomatics 93 Conference, 24–25 May 2014, Tehran, Iran (in Persian).

Norin D., Johansson J. M., Mårtensson S.-G., Eshagh M. (2016): National report of Sweden to the NKG General Assembly 2014 – geodetic activities in Sweden 2010–2014. In Kempe (ed.): Proceedings of the NKG General Assembly. NKG, 17th General Assembly, 1–4 September 2014, Lantmäterirapport 2016:4, pp. 52–77, Göteborg,

Sweden. Also as Lantmäteriet, Lantmäterirapport 2015:2, 62 pp., Gävle, Sweden (slightly different and with the title "Geodetic activities in Sweden 2010–2014").

Appendix 4.3 – University West: Other geodetic publications

Norin D., Jensen A. B. O., Bagherbandi M., Eshagh M. (2018): Geodetic activities in Sweden 2014–2018. Lantmäteriet, Lantmäterirapport 2018:4, 78 pp., Gävle, Sweden.

University West (2018): Basic concepts in Global Navigation Satellite Systems. University West, Department of Engineering Science, Division of Surveying Engineering, Lecture notes, Trollhättan, Sweden (in Swedish).

University West (2018): Geodetic measurement theory. University West, Department of Engineering Science, Division of Surveying Engineering, Lecture notes, Trollhättan, Sweden (in Swedish).

Appendix 4.4 – University West: Poster and oral presentations

Alizadeh-Khameneh M. A. & Eshagh M. (2014): Optimization of Lilla Edet land slide GPS monitoring network. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Eshagh M. (2014): On the relation between Moho and sub-crustal stress induced by mantle convection. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Eshagh M. (2015): On the Swedish and Iranian academic systems. Invited speech by Iranian embassy in Stockholm, 25 January 2015, Stockholm, Sweden (oral presentation).

Eshagh M. (2015): Determination of crust-mantle density contrast by combination of seismic and satellite gradiometry data. IUGG, 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (oral presentation).

Eshagh M. & Alizadeh-Khameneh M. A. (2014): Two-epoch optimal design of displacement monitoring networks. NKG, 17th General Assembly, 1–4 September 2014, Göteborg, Sweden (poster presentation).

Eshagh M. & Romeshkani M. (2014): Determination of sub-crustal stress due to mantle convection using GOCE gradiometric data. UNESCO, 5th GOCE users workshop, 25–28 November 2014, Paris, France (poster presentation).

Eshagh M. & Tenzer R. (2014): Sub-crustal stress induced by mantle convection from gravity data. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (oral presentation).

Eshagh M. & Tenzer R. (2015): Sub-crustal stress determined using gravity and crust structure models. IUGG, 26th General Assembly, 22 June–2 July 2015, Prague, Czech Republic (oral presentation).

Eshagh M. & Hussain M. (2016): An approach to Moho discontinuity recovery from on-orbit GOCE data with application over Indo-Pak region. ESA, Living planet symposium, 9–13 May 2016, Prague, Czech Republic (poster presentation).

Fernandez J., Tiampo K. F., Rundle J. B., Eshagh M. (2014): Geodynamical studies using integrated gravity studies. AGU, Fall Meeting, 15–19 December 2014, San Francisco, USA (oral presentation).

Gu X., Tenzer R., Eshagh M., Hwang C. (2014): Crustal stress in Taiwan. IAG/IGFS, 3rd General Assembly (IGFS 2014), 30 June–6 July 2014, Shanghai, China (oral presentation).

Pitonak M., Eshagh M., Sprlak M., Tenzer R., Novak P. (2017): Spectral combination of spherical curvature boundary-value problems. EGU, General Assembly, 23–28 April 2017, Abstract EGU2017-3632, Vienna, Austria (poster presentation).

Pitonak M., Eshagh M., Novak P., Sprlak M., Tenzer R. (2018): Recovery of the gravitational potential at the Earth's surface by spectral combination of first-, second- and third-order radial derivatives of the gravitational potential measured by satellite sensors. EGU, General Assembly, 8–13 April 2018, Abstract EGU2018-12995, Vienna, Austria (poster presentation).

Pitonak M., Eshagh M. Novak P., Sprlak M., Tenzer R. (2018): Recovery of surface gravity anomalies by spectral combination of first-, second- and third-order radial derivatives of the gravitational potential measured by satellite sensors. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (oral presentation).

Tenzer R. & Eshagh M. (2014): Stress field along continent-to-continent collision zones. The 5th International workshop on multi-observations and interpretations of Tibet, Xinjiang and Siberia (TibXS), 10–15 August 2014, Guiyang, China (oral presentation).

Tenzer R. & Eshagh M. (2015): Global sub-crustal stress field from gravity data. Wuhan University, Second SGG International Workshop on Geodetic and Geophysical Observations, Applications and Implications, 19–20 January 2015, Wuhan, China (oral presentation).

Tenzer R. & Eshagh M. (2015): Gravity recovery of lithospheric structure and stress field of planetary bodies – examples for Earth and Mars. Slovak Technical University, International Workshop on Geodetic and Geophysical Observations for understanding Earth's structure and Processes, 9 February 2015, Bratislava, Slovakia (oral presentation).

Tenzer R. & Eshagh M. (2015): Evidence of active regional tectonism on Mars from gravity and topographic data. Wuhan University, International Workshop on Earth and Planetary Data Applications and Interpretations, 15 May 2015, Wuhan, China (oral presentation).

Zampa L., Tenzer R., Eshagh M., Pitonak M. (2018): Origin of Venisuan surface deformations from gravity and topographic models. IAG/ICCT, IX Hotine-Marussi Symposium, 18–22 June 2018, Rome, Italy (oral presentation).

Reports in Geodesy and Geographical Information Systems from Lantmäteriet (the Swedish mapping, cadastral and land registration authority)

2010:7 Lord Jonas: Test av GNSS-mottagare från DataGrid.

2010:11 Ågren Jonas & Engberg Lars E: Om behovet av nationell geodetisk infrastruktur och dess förvaltning i framtiden.

2011:2 Jansson Jakob: Undersökning av mätosäkerheten i det förtätade SWEPOS-nätet i Stockholmsområdet – vid mätning med nätverks-RTK.

2011:3 Liu Ke: A study of the possibilities to connect local levelling networks to the Swedish height system RH 2000 using GNSS.

2012:3 Lundell Rebecka: Undersökning av nätverks-RTK-meddelande tillsammans med olika GNSS-mottagare – vid nätverks-RTK-mätning i SWEPOS nät av fasta referensstationer.

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