NKG Working Group

Geoid and Height Systems

Report 2010-2014

Jonas Ågren

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WG Background

The WG of Geoid and Height Systems was the result of merging the old WG of geoid determination with the WG of height determination.

Keywords from *NKG structure 2010-2014, proposal for working groups*:

- EVRS
- Sea Level
- Height determination methods
- Maintenance of levelling networks and height systems
- Geoid modelling methods
- NKG geoid
- Data requirements
- Data management
- Ocean circulation

Members/contributors

- Jonas Ågren (chair)
- Per-Ola Eriksson
- Lars E Sjöberg
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- Tarmo Kall
- Harli Jürgenssen
- Ivars Aleksejenko
- Janis Kaminskis
- Ksenija Kosenko
- Eimuntas Kazimieras Paršeliūnas
- And more …

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WG Meetings

1. May 30-31, 2011, Lantmäteriet, Gävle, Sweden
2. March 8-9, 2012, DTU Space, Lyngby, Denmark
3. March 14, 2013, National Land Survey of Iceland, Reykjavik
4. March 11-12, Lantmäteriet, Gävle, Sweden

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Projects

Much of the work have been made in the following projects:

- Computation of the NKG2014 geoid model
- Investigations of the requirements for a future 5 mm (quasi)geoid model
- Review of current and near-future levelling technology
- Empirical land uplift modelling

Computation of the NKG2014 geoid model (1)

- Project leader: Jonas Ågren
- Main purpose is to compute the next official NKG (quasi)geoid model, with the working name NKG2014 geoid.
- So far, this project has achieved the following tasks:
  - Detailed specifications have been written.
  - The NKG gravity database has been modernised, thoroughly updated and quality checked, for all the Nordic and Baltic countries (except Iceland).
  - A new NKG 3'' x 3'' DEM has been created.
  - GNSS/levelling has been collected, which will be used to create a new NKG gravity database.
  - A preliminary quasigeoid model has been computed and evaluated using preliminary GNSS/levelling.

Computation of the NKG2014 geoid model (2)

- The following tasks remain:
  - One quasigeoid model will be computed per computation center (there are five computation centers).
  - Investigations of methodological issues.
  - Computation workshop in Estonia in November 2014.
  - Choice of final model, presentation and documentation.
- The project is planned to finish before the IUGG General Assembly 2015.
- See further the presentations:
  - **Report from the on-going project to compute the new NKG2014 geoid model** - Jonas Ågren et al.
  - **Investigations towards the NKG2014 geoid model in Estonia** - Silja Märdla et al.

Investigations of the requirements for a future 5 mm (quasi)geoid model (1)

- Project leader: Lars E Sjöberg
- The main purpose is to investigate what is required in theory and in practice (what data is needed?) to reach the goal of a (quasi) geoid model with 5 mm standard uncertainty in the future.
- General questions about the project details were raised in two circular letters. In two specific studies it was shown that
  - the average 5 km resolution and quality of the gravity data in **Sweden** are sufficient for the task provided that the data are updated for systematic errors and data gaps. Gravity data in the surrounding areas also need to be improved, e.g. in the Baltic Sea.
  - systematic errors in DEMs are not a problem over **Sweden**, where a high resolution DEM with high quality is available, at least not as long as the same DEM heights are used both in the remove and restore phases of the topographic corrections.
  - some methodological improvements may be needed.

Investigations of the requirements for a future 5 mm (quasi)geoid model (2)

- Recommendations:
  - The above and further studies should be extended to the rest of member countries to reach a conclusive goal of the project.
  - The need for methodological improvements should also be further investigated. Various limitations of the error propagations should also be dealt with.
  - However, it is questionable whether this study is suitable as a NKG project. The more theoretical and methodological questions are very difficult and time consuming. External funding would be required for academic researchers to work deeply on this.
  - One alternative would be to continue as a PhD project, but this would also require funding
- See further the poster :
  - **Investigations of the requirement for a 5 mm geoid model – a project status report** - Lars E Sjöberg and Jonas Ågren

Review of current and near-future levelling technology

- Project leader: Olav Vestøl
- The purpose of this study project is to make a literature and experience-based review that sums the current levelling methods and capacities in the Nordic countries, and also identifies promising areas for further study and development.
- One motivation behind the project is to secure the knowledge of a number of key persons that are about to retire.
- The project has achieved its goal and published a 50-pages report.
- See further the report, and the poster:
  - **Review of current and near future levelling technology** - Olav Vestøl et al.

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Lantmäterirapport 2014:2

Reports in Geodesy and Geographical Information Systems

Review of current and near-future levelling technology

– a study project within the NKG working group of Geoid and Height Systems

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Gävle 2014

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Empirical land uplift modelling

- Project leader: Olav Vestøl
- The main purpose is to compute an updated version of the **NKG2005LU** model that includes a new GNSS solution and levelling data from the Baltic countries plus Denmark. Also some additional levelling from Norway will be included.
- The project has fulfilled its purpose and first computed a new purely empirical model using the above data updates.
- This empirical model has then been combined with the GIA model **i82_g5104** of Holger Steffen et al., which resulted in **NKG2014LU_test** (for testing and evaluation).
- See further the presentation:
  - **A new updated empirical land uplift model** - Olav Vestøl et al.