NKG Working Group for

Geodetic Infrastructure

Report 2010-2014

Per Knudsen

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Keywords:

- GNSS, VLBI, SLR, Super conducting gravimetry
- Local ties
- Combined Techniques
- Permanent stations/time series
- Making reference frames available to users
- Data/meta data service

Members:

Denmark: Per Knudsen (chair)

Finland: Markku Poutanen and Ulla Kallio,

Iceland: Guðmundur Valsson and Þórarinn Sigurðsson,

Norway: Per Christian Bratheim,

Sweden: Gunnar Hedling and Rüdiger Haas

Activities:

Projects:

1. NCGN – NKG Combined Geodetic Network -
   Understanding the Sea Level Variation in the Fennoscandian area
   (Leader: Markku Poutanen)

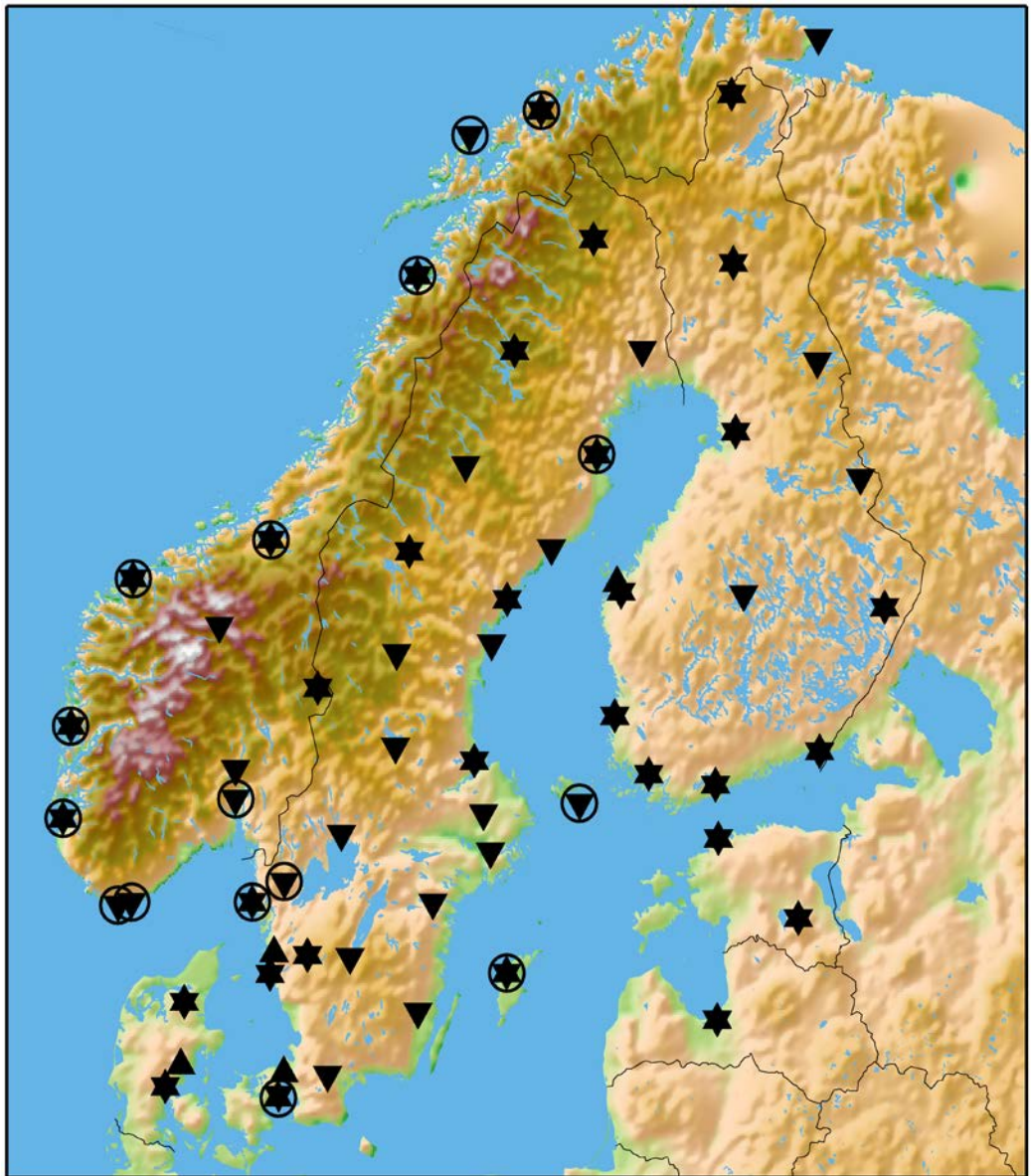
Workshops

NGOS original plan, network

Absolute gravity points (triangles)
Nordic permanent GPS network (upside down triangles)
Tide gauges (circles).

All absolute gravity points are occupied with a GNSS instrument.

Realization via NKG Working Groups and other existing entities



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NCGN – background

- Similar issues with ECGN (European Combined Geodetic Network)
- After discussion in the Euref TWG, in the Chisinau Euref meeting May 2011 it was decided after suggestion of Markku Poutanen and Martin Lidberg to propose a pilot project to demonstrate capability of ECGN

- To demonstrate ideas and usefulness of a ECGN type observing system and to utilize excellent geodetic networks, data and knowhow within the NKG the pilot project was proposed to be a part of NKG and Nordic geodetic infrastructure

NCGN – NKG Combined Geodetic Network – 1

Understanding the Sea Level Variation in the Fennoscandian area

To achieve the goal we need

- to observe absolute land uplift rates (GNSS time series)
- to utilize existing networks of repeated precise levelling
- to have a unified height system in the area
- to observe long sea level time series
- to understand and model land uplift
- to understand gravity changes
- to understand GIA models

Most of the components are in place, and the major task will be collecting and combining existing databases.

NCGN – NKG Combined Geodetic Network – 2

Understanding the Sea Level Variation in the Fennoscandian area

Observing networks exist:

- ✓to obtain the absolute land uplift rates (GNSS time series)
- ✓to utilize networks of repeated precise levelling
- ✓to have a unified height system in the area
- ✓to observe long sea level time series

Establishment of the NKG Metadata base (Collecting existing information, links to data arhives; collaboration of all NKG WGs)

NCGN – NKG Combined Geodetic Network – 3

Understanding the Sea Level Variation in the Fennoscandian area

Study on the sea level variation of the Baltic Sea; prediction of the future sea level rise at Fennoscandian coastlines. We need

- to understand and model land uplift
- to understand gravity changes
- to understand GIA models
- to measure and understand melting of glaciers and global sea level rise
- to understand mass transportation in large scale; distribution of melt waters

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NCGN – NKG Combined Geodetic Network – 4

Understanding the Sea Level Variation in the Fennoscandian area

NKG Working Groups and Officers Involved

WG of Geodetic Infrastructure: C-GNSS networks, local ties, old and new techniques

WG of Geoid and Height systems: levelling databases, gravity databases, geoid models, tide gauges

WG of Reference Frames, Positioning and Navigation: definition of reference frames, transformations between frames

WG of Geodynamics: Make uplift models available, crustal deformation, sea level changes

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NCGN – NKG Combined Geodetic Network – 5

Understanding the Sea Level Variation in the Fennoscandian area

- NKG Project accepted by Presidium 2012
- FGI hired a student to prepare a database on the NKG web page
- For his Diploma work, additionally a task to collect land uplift related material was added
- First draft of database done 09/2012
- Draft for publication 02/2013

- To be done:
  - update all information on database!
  - Add new material and links; contributions from WGs

Activities:

Workshops:

1. NKG Joint WG Workshop on Postglacial Land Uplift Modelling. Hönefoss, Norway, 16 April, 2012
2. NKG Joint WG Workshop on Postglacial Land Uplift Modelling. Reykjavik, Iceland, 12 March 2013

Recommendations

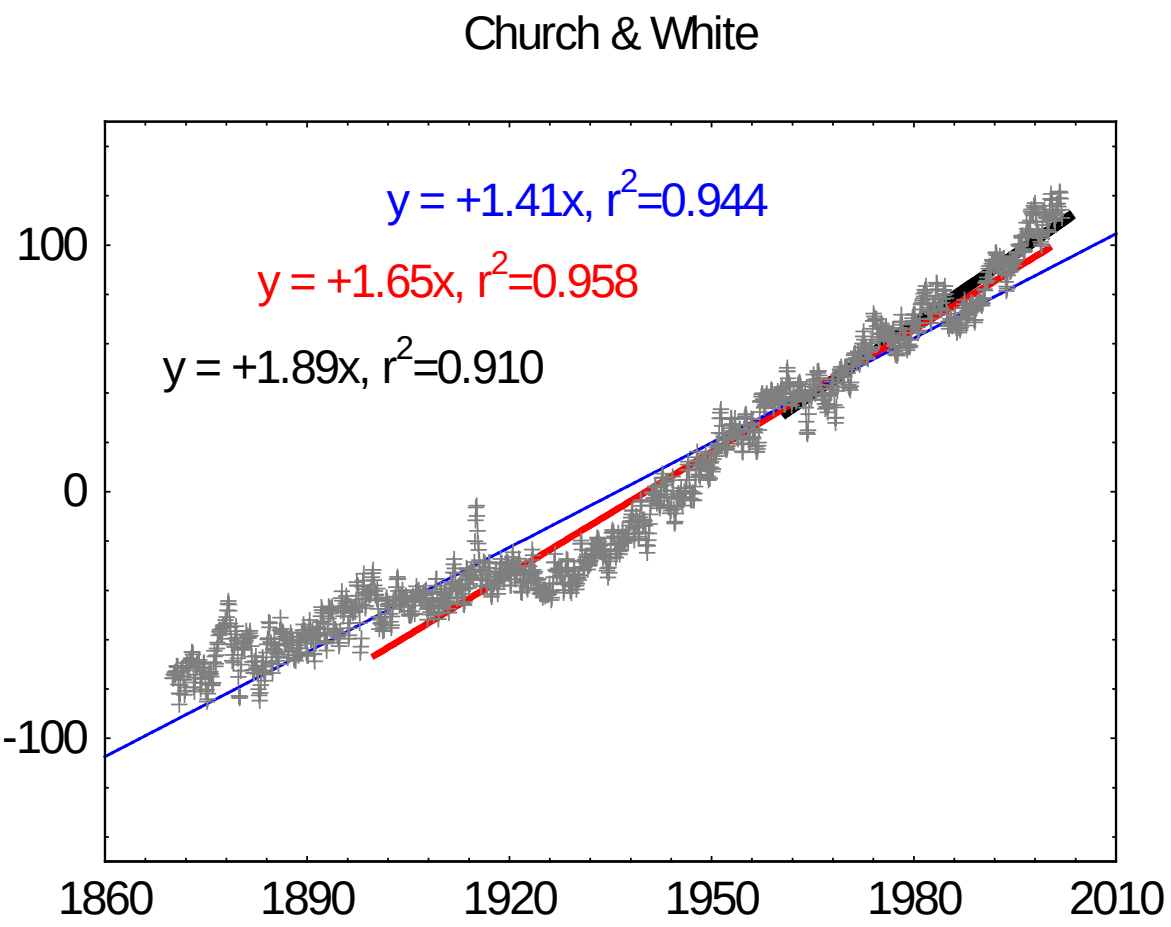
- NKG will continue to work on both approaches, i.e. the empirical modelling as well as the rigious GIA modelling.
- All WGs will continue to develop time series, carry out comparision, and derive error estimates associated with the time series.
- All WGs will attempt to describe biases and correlated errors in the data series, eg ITRF related. Important for the comparisons as well as the model assimilation.

Recommendations

- WG on Geodetic Infrastructure will prepare an outline/recommendations for tide gauge analyses and data access.
- WG on Geodetic Infrastructure will facilitate access to data through the development of NCGN and the establishment of the NKG Metadata base.
- WP on Geodynamics will lead the general planning of the activities related to GIA modeling taking into account the dependencies between working groups as well as influence on existing projects.

Tide Gauge analyses

Global reconstructed sea level



Recommendations

Accelerations in sea level and inter-annual variability cause published sea level trends to varying from 1.7 to 3.1 mm/year.

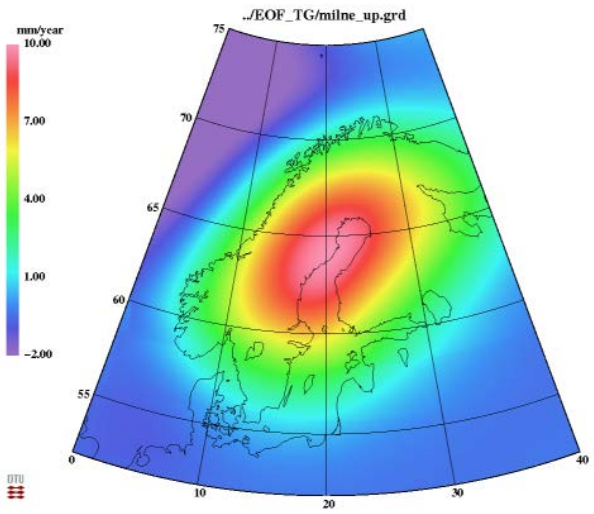
Recommendations:

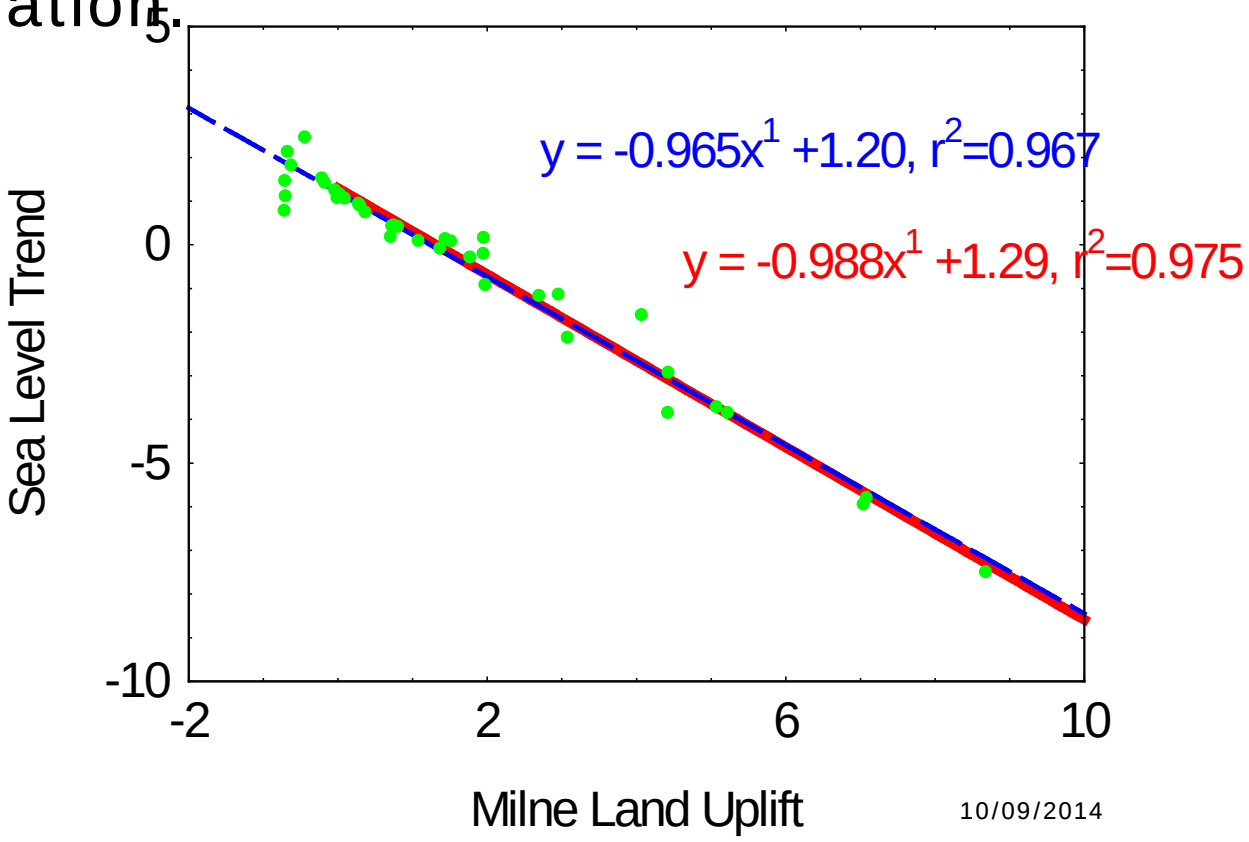
1. Publication of time periods together with trends is crucial.
2. Local trends over less than 10-15 years should not be computed.
3. Local trends over less than 40-50 years should not be published.
4. Global trends over less than 5-10 years should not be published.

Sea level trends vs Milne model

Comparison of sea level trends (1900-2000) with the Milne uplift model

Very good correlation.





Towards NGOS+

- New structure of NKG in 2010; NGOS was dissolved into Working Groups
- A pilot project within NKG was accepted: NCGN (NKG Combined Geodetic Network) in 2012
- A meta database established

- Region-specific needs for GOS, e.g. sea level variation or crustal deformation
- We need *regional dense networks*
- We need regional multi-technique data/sites and products *in a coordinated way*

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Future:

Recommendations for future WG:

1. Still needs for
   - Clarification of common issues
   - Joint interaction with GGOS/EPOS/ECGN
   - Dissemination of reference frames
2. Re-consider interfaces with other WGs
3. Focus objectives (more WGs/projects)