

WORK PLAN MARINE GEODESY COMMITTEE

Work plan, Coordination of education, Coordination of professional practice, Research agenda

Stimulation of research proposals and coordination of research

Research is stimulated on the basis of a research agenda, based on the marine geodetic part of the agenda of the Dutch Geoinformation Research Infrastructure (NEDGEOS) [1]. The agenda items are related to the Top Sectors of the Dutch government [2]. The committee maintains a list of research institutes on its website that are internationally active on these topics.

The agenda items are:

1. Realization of vertical references at sea (related to Top Sector Water, themes 2: extraction at sea; 5: transport over water);
2. Optimization of collection strategies (related to Top Sector Water, theme 5: transport over water & Top Sector Creative Industry & Top Sector High-tech systems and materials);
3. Quality improvement of collection techniques (related to Top Sector Water, theme 5: transport over water & Top Sector High-tech systems and materials);
4. Development of methods for automatic data processing (related to Top Sector Water, theme 5: transport over water & Top Sector High-tech systems and materials);
5. Connection of marine data and terrestrial data (related to Top Sector Water, themes 3: life in deltas; 4: sustainability & Top Sector Life sciences);
6. Innovation in the presentation of geographical information (related to Top Sector Water, themes 5: transport over water; 10: complex maritime systems);
7. Integration of navigation systems (related to Top Sector Water, theme 2: winning at sea; 10: complex maritime systems & Top Sector Agriculture and Food & Top Sector High-tech systems and materials).

Coordination of education

The courses represented in the committee are Geomatics from TU Delft, the KIM (Royal Naval Institute) courses for naval officers from the NLDA (Netherlands Defense Academy) and Ocean Technology from the MIWB (Maritime Institute Willem Barentsz).

The committee coordinates in the following areas:

1. Support for education from professional practice

Activities: formulating and supervising graduation assignments; provide guest lectures.

2. Connection between education and professional practice

Activities: coordination; advise on the connection between university courses and professional practice.

3. Promotion of the field with a view to student recruitment

Activities: actively think along

Coordination of professional practice

The committee coordinates in the following areas:

1. Coordination of the government's geodetic-infrastructureal responsibilities

The infrastructureal responsibilities have been described by the Geodetic Infrastructure working group of the Dutch government. The marine field is represented by the DID of Rijkswaterstaat and the Hydrography Service of the Royal Navy. Infrastructure responsibilities include providing differential corrections for satellite positioning; ensuring unambiguous coordinate systems at sea; connection with coordinate systems in use on land; and offering knowledge in the marine geodetic field. A multi-year plan will be drawn up for this subject in 2012. The results of the North Sea Geoid project will be distributed by the Hydrographic Service and implemented in hydrographic systems.

Activities: Support Rijkswaterstaat and the Hydrographic Service

2. Ensuring the availability and standardization of geographical information

Information about the North Sea is no longer only used for seafarers. This information is increasingly being used for the installation of wind turbines, the exploitation of oil and gas, fishing and nature management. In recent years, under the leadership of Geonovum, the Dutch government has worked hard to make geo-information available, via the National Georegister (NGR) and the EU Directive Infrastructure for the Spatial Information in the European Community (INSPIRE). The NWO project application MAPS4SCIENCE aims to do this for scientific purposes.

3.

Activities: Advise Rijkswaterstaat and the Hydrographic Service

4. Information about the marine scope within geodesy

For many sub-processes in geodesy, the differences between marine and terrestrial geodesy disappear. This offers the NCG an opportunity for more intensive cooperation between the marine and terrestrial domains, from which both domains can benefit.

Marine geodesy differs from terrestrial geodesy in a number of important respects. The main reason for this is that the sub-processes in marine geodesy are less easy to unravel than those in terrestrial geodesy. This is primarily caused by the lack of fixed reference points at sea. Secondly, the long travel time to and from the operating area requires statistical quality control in the area itself. Thirdly, measured changes may pose a direct safety risk, so that a short processing and publication time for changes is necessary.

Marine geodesy also differs in personnel size. Although the marine scope is geographically more extensive than the terrestrial, the sector is smaller in size. This more limited scope can partly be compensated for by the high degree of automation of the measuring process and the smaller number of activities in the marine environment.

Activities: drawing attention to the marine scope, within the NCG and elsewhere.

5. Exchange of information about activities at national and international level

Information from the relevant international organizations in these areas (IHO/NSHC, FIG and IFHS/HSB) is exchanged within the committee. This is done, for example, by distributing circular letters from the IHO, and coordinating input into the Resurvey Working Group and Tidal Working Group of the North Sea Hydrographic Committee (NSHC). The appointment of a new Dutch representative in FIG Committee 4 Hydrography will be particularly important for the activities surrounding references at sea, a topic on which FIG Working Group 4.1 Ellipsoidally Referenced Surveys is active. Coordination within the IFHS will also receive a boost in 2012, because an HSB committee will organize the Hydro12 conference on behalf of the IFHS in the autumn.

Research agenda

Elaboration of the research agenda

1. Realization of vertical references at sea

In 2012, TU Delft completed a study into the location of the North Sea geoid in relation to the ellipsoid, MSL, and LAT levels, which is important for the accurate use of heights from satellite navigation at sea and the improvement of current models. The project is financially supported by the NCG and the European project Bringing Land And Sea Together (BLAST). Various members of the committee support the STW research application NETREF for a follow-up project, which will provide a single geoid level for both land and sea.

The supply of water levels in relation to the vertical datums is provided by Rijkswaterstaat and the Hydrographic Service via Premo. Premo is a computer

program that uses an advanced interpolation method, applying both permanent tide stations and the latest current models. This makes real-time water levels available with a precision of one decimeter. Both organizations work together as clients in this project, which is carried out by Deltares.

Accurate satellite navigation systems, such as NETPOS from Kadaster and systems for marine use from Fugro, are an alternative to Premo. NETPOS is already in use by Rijkswaterstaat for the coastal zone, and the Hydrographic Service is investigating systems that can be used worldwide. Future integration of both could provide optimal control and precision.

Activities: coordination; coordinate with the Geodetic Infrastructure and Reference Systems Committee.

2. Optimization of collection strategies

Knowledge of the dynamics of the sea and river bottom makes it possible to determine an optimal collection strategy, so often measure where the bathymetry is highly variable and limited where there is little dynamics. Within the Netherlands, idealized models are being developed at the University of Twente to predict the properties of soil patterns. TU Delft develops models that predict currents and sediment transport. For coastal management, Deltares uses a complex morphodynamic model that is applied in consultancy projects. Rijkswaterstaat and the Hydrographic Service work together to supervise the Deltares projects VALHYD and ODYN, which try to achieve an efficient measurement policy at sea and inland waters. The aim is to arrive at a joint inclusion policy plan within the Dutch Hydrographic Institute (NHI) partnership.

Activities: coordination; coordinate with the Soil Movement and Sea Level Variation Committee.

3. Quality improvement of collection techniques

The multibeam echo sounder (MBES) is the main acoustic system. The main sources of error that limit the measurement precision concern changes in the sound characteristic of the water column near the coast, and the reduction in the water level further away from the coast. Rijkswaterstaat and TU Delft are collaborating on the first topic, the second falls under agenda item 1.

In addition, TU Delft has developed methods to obtain information about the soil composition in addition to water depths, for both single-beam (SBES) and MBES systems. Most existing methods for classification based on the MBES backscatter measurements rely on variations in the measured values instead of absolute values. This approach makes the methods insensitive to uncorrected system effects on the backscatter measurements. However, the presence of system effects on the backscatter measurements is an obstacle for methods that do rely on absolute backscatter measurements.

Alternatives to MBES are phase differencing bathymetric sonar (PDBS), laser systems and radar systems. A PDBS measures depths along a wide swath, just like

MBES. However, the resolution of PDBS along the swath does not deteriorate towards the ends of the swath, allowing measurements along larger aperture angles. However, the actual resolution to be achieved is unclear and needs to be investigated. The Netherlands has a relatively large amount of shallow water, where this system can provide significant efficiency gains. Coastal radar and radar measurements from satellites are used to monitor the dynamics of the seabed in coastal areas. This means, among other things, that changes that endanger safe navigation are quickly detected.

Activities: coordination; encouraging research into alternatives to MBES.

4. Development of methods for automatic data processing

Together with the Spatial Basic Data Committee, the committee is trying to find an answer to the question of how to deal sensibly with very large datasets containing depth data. The largest datasets are produced using the Water Column Imaging (WCI) technique, which can process MBES measurements into a three-dimensional dataset in the water column, for mapping underwater objects. The committee is following the WCI research with a view to application possibilities.

Activities: coordination; coordinate with the Basic Spatial Data Committee.

5. Reconciliation of marine data and terrestrial data

Seamless geographical information of the coastal zone is of great importance for protection against natural disasters, response to sea level rise, recreation and nature conservation. The BLAST project tries to realize this, with TU Delft and Deltares as Dutch partners. A new BLAST project will be submitted to the European Union in 2012.

The NETREF project, mentioned under agenda item 1, offers the possibility of a single reference level on land and at sea. This project offers opportunities to improve the quality of the connection of the Wadden Islands and offshore platforms to the NAP, and thus contribute to the study of land subsidence in the Wadden area.

Activities: coordination; stimulating research into the connection of marine and terrestrial geo-information, coordinating with the Land Subsidence and Sea Level Change Committee.

6. Innovation in the presentation of geographic information

Electronic navigation (E-navigation) at sea and its ergonomic use still requires a lot of research and regulations. This is currently an important topic within the International Maritime Organization (IMO). For the very shallow and dynamic North Sea, the method of publishing the quality of the depth information is considered inadequate, for both electronic and paper nautical products. The IHO Data Quality working group is looking for a solution for this, whereby the visualization aspects will be tested on the ECDIS simulator of the University of Southern Mississippi (USM).

Activities: coordination; coordinate with the possible new Geovisualization committee.

7. Integration of navigation systems

New satellite navigation systems are being developed by more and more states and international organizations, providing unprecedented opportunities for precise real-time position determination. However, the reliability of these positions against disruptions is low, while the chance of intentional or unintentional errors and failure is high. Integration with other systems is the solution: combination with inertial navigation systems, terrestrial positioning systems such as eLoran, and terrain reference are possible solutions. Underwater navigation is also not possible with GNSS, which requires repeated surface measurements, use of submarine beacons, or terrain referencing.

Coordinating developments in the field of satellite navigation in the Netherlands is done by the Netherlands Institute for Navigation (NIN) and Geoinformatie Nederland (GIN), in particular in their joint working group Exploration of Positioning and Navigation (VPN).

Activities: coordination; stimulating research into systems integration.

References

[1] Marine Geodesy Committee Research Agenda, April 2, 2009.

[2] The research agenda of the NCG Marine Geodesy Committee in relation to the top sectors of the Dutch government, July 13, 2011.