Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

Market consultation document

for

InSAR based deformation map of the Netherlands

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Version: 1.0

Contents

1. Introduction

1.1 About Rijkswaterstaat
Rijkswaterstaat (the Directorate General for Public Works and Water Management) is the executive agency of the Ministry of Infrastructure and the Environment dedicated to promoting safety, mobility and the quality of life in the Netherlands. We want to live in a country that is protected against flooding, where there is sufficient green space and an adequate supply of clean water and where we can travel quickly and safely from A to B.

Rijkswaterstaat is in the Netherlands responsible for the design, construction, management and maintenance of the main road network (5,695 km), the national waterways network (1,686 km of canals, rivers and 6,165 km of navigation channels in open water) and the national water system (65,250 km2). Figure 1 shows the organizational structure of Rijkswaterstaat.

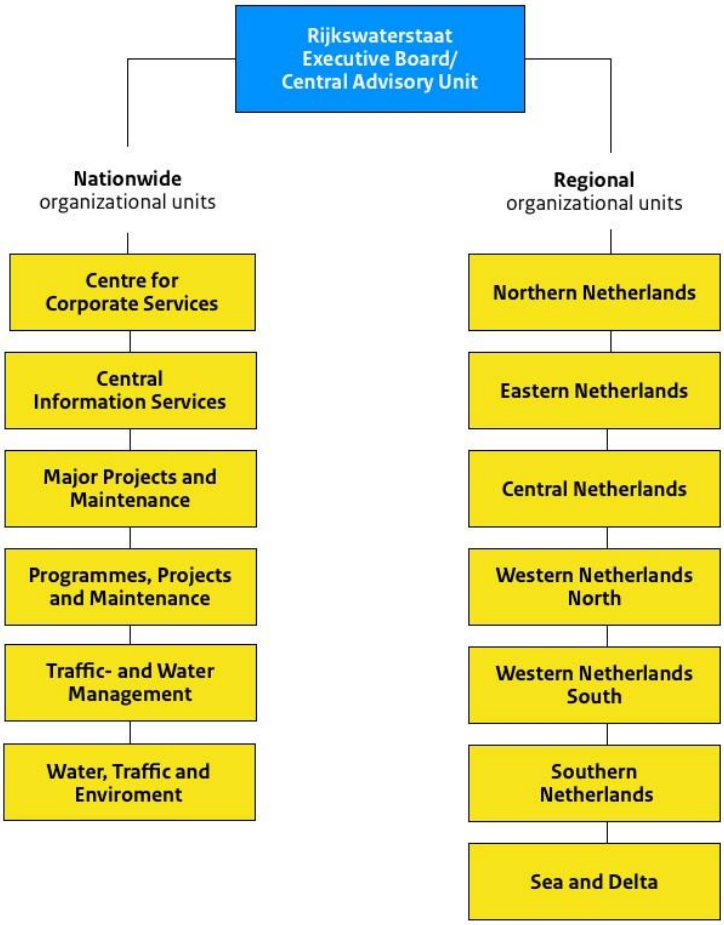

Figure 1: Organisational structure of Rijkswaterstaat

The Central Information Services (CIV) service of Rijkswaterstaat (RWS-CIV) is one of the national organisation units of RWS. RWS-CIV is responsible for collecting, managing and distributing data, as well as ICT management and development. Furthermore, CIV supports in office automation. Within CIV, the department of IGA (in Dutch: Inwinning en Gegevens Analyse) is responsible for the process from data

acquisition to facilitation of information distribution. This market consultation is written by RWS-CIV.

The website www.rijkswaterstaat.nl provides more information about Rijkswaterstaat and RWS-CIV.

1.2 Background of deformation in the Netherlands
One of the tasks of Rijkswaterstaat is to carefully map the surface height of the Netherlands. The Netherlands, which is mainly a large delta that is located for a significant part below sea level, is very vulnerable and hence needs to be protected against large water discharge through the rivers and sea level rise. Large water defence systems are built, such as storm barriers and large dikes. Furthermore, projects are executed in which flood plains are widened and deepened.
Besides the threat of rising water levels, the land suffers from subsidence, not only due to the well-known mining activities but also due to peat compaction. Mining activities, in the Netherlands mainly gas and salt mining, lead to subsidence bowls related to the size of the reservoirs. Land subsidence due to peat oxidation is a problem in the Westland and the centre (Groene Hart) caused by pumping water in order to reclaim land.
The combination of increased water levels and subsiding soil, makes accurate height information one of the key safety factors in the Netherlands.
Other main types of surface deformation that occur in the Netherlands are uplift above abandoned coal mines and periodic deformation due to gas storage. Furthermore, there is the monitoring of infrastructure, such as the water defence systems, settling of new roads and degradation of old roads, stability of bridges, aqueducts, and buildings.

This document is a first step towards a planned tender: "InSAR based deformation map of the Netherlands". RWS-CIV is eager to actively involve the market parties before the actual tender is generated. Therefore Rijkswaterstaat kindly invites you to participate in this market consultation.

1.3 Purpose of the market consultation
RWS-CIV has published this market consultation document on TenderNed in order to interest market parties for InSAR and encourage them to contribute their thoughts.

The main goal of this consultation is to get an overview of market opportunities and parties which could potentially contribute to the InSAR based deformations map of the Netherlands.

By launching this market consultation, RWS-CIV aims to:
a) map the relevant available capabilities in the market place;
b) get an overview of the products that can be implemented operationally;
c) gain insight in to be developed or underdeveloped products;
d) involve the market in an early stage to facilitate early feedback on the scope in order to write feasible tenders according to the current market situation.

RWS wishes to emphasise that this market consultation is not part of the tendering procedure and that no rights may be derived from this document.
Any insights gained from the market consultation will be used by RWS (wherever relevant) in preparing the tendering procedure and the tendering documents. RWS reserves the right to not (fully) make use of these insights.

2 Determining the scope

2.1 Measuring the height

Normaal Amsterdams Peil (NAP) is the reference level for heights in the Netherlands. It consists of a network of levelling benchmarks, that have been measured for more than 200 years by traditional levelling. Rijkswaterstaat manages these measurement campaigns, which are in general executed in a 10-years cycle. Some areas are measured more frequently due to their high or unexpected deformation rates. Examples are the provinces of Groningen, South-Holland and Limburg. On top, there are other parties and municipalities performing their own measurement campaigns.

Levelling campaigns are very labour intense and time consuming. The country is accommodated with a dense network of approximately 35000 levelling benchmarks. These benchmarks are connected to approximately 300, deeply founded, underground benchmarks, which are assumed to be stable.

For more information about the Dutch height system, we would like to refer to our website: https://www.rijkswaterstaat.nl/zakelijk/open-data/normaal-amsterdams-peil

2.2 Space geodesy

Recent developments in geodesy contain the upswing of Interferometric Synthetic Aperture Radar (InSAR) to measure surface deformation. Through the InSAR technique dozens of SAR images are stacked from which amplitude and phase information is used to detect, either permanent or distributed, scatterers and estimate surface displacements up to mm-accuracy, respectively.

The recent launches of the Sentinel-1 satellites provide assurance for the future to continue the historic measurements of ESA's ERS and Envisat satellites. The loss of the Envisat satellite would have resulted in a gap in the C-band measurements, if the Netherlands Space Office would not have committed to a subscription for nationwide acquisitions from the Canadian RADARSAT-2 satellite. These acquisitions are secured to 2020.

With InSAR every month millions of measurements are made in a single acquisition over areas of at least 100 by 100 km. With the Sentinel-1 satellites the repeat time even increases to 6 days and the coverage grows to 250 by 250 km. This is promising in terms of temporal decorrelation, which can be an issue in moist and vegetated areas.

2.3 Nationwide deformation maps

Rijkswaterstaat has a growing interest for nationwide deformation maps for several reasons:

- Verify the stability of our reference benchmarks
- Assist in the planning of the levelling campaigns by
    - Defining stable areas
    - Defining deforming areas (linear, non-linear, seasonal, exponential)
    - Detection of deforming areas which are not covered by levelling
- Provide measurements in areas uncovered by levelling (think about compacting peat areas)
- Assist in the asset management of our civil infrastructure.
- Alarming in case of sudden deformation

We therefore would like to get an overview of market parties who are able to perform either:

- InSAR processing, both Persistent scatterer and Distributed scatterer techniques, of historic as well as current freely available C-band data acquired over the Netherlands
- Potentially, InSAR post-processing: gridding, decomposing, connecting deformation maps from different sensors

Rijkswaterstaat intends to deploy corner reflectors at various locations in the Netherlands. These locations are focused on the Sentinel-1 satellite and are located in overlap areas of neighbouring tracks, in burst and swath overlap areas, near permanent GNSS station and underground benchmarks. Reflections from these targets have to be included as from the moment a sufficient time series is available to define not only consistency in deformation estimates obtained from acquisition geometries but also geo-localisation performance. Furthermore reflectors will be installed in areas where the deformation is poorly understood, such as e.g. in (agricultural) fields.

3. Process of market consultation

3.1 Procedure
The procedure for this market consultation is as follows:

1) The market consultation will be launched with the publication of this document, including the questions from RWS-CIV on TenderNed.

2) Any interested market party that considers itself able to contribute to the market consultation, is requested to reply to the questions in this market consultation. The replies should be submitted by e-mail to inkoopcentrum-iv@rws.nl before the closing date and time, referred to in paragraph 3.2.

3) On the basis of the submitted reactions, RWS-CIV retains the option to invite parties to give face-to-face verbal additional explanations to their answers. RWS-CIV will contact these parties and in consultation plan a meeting during the period referred to in paragraph 3.2.

3.2 Planning
RWS-CIV will operate the following planning timetable:

Activity	Date and time
Publication of market consultation document	19 May 2017
Closing date for submitting questions about the market consultation document	14 June 2017 12:00 hours
Publication of answers to questions about the market consultation document.	22 June 2017
Closing date for submitting completed questionnaire	30 June 12:00 hours
Dates for additional interviews	5 July through to 28 July 2017

Interested parties may derive no rights from the planning timetable above. RWS-CIV reserves the right to alter the planning timetable. This planning timetable is therefore indicative. The greatest possible effort will be made to comply with the planning timetable.

3.3 Questions about the market consultation document
As RWS favours transparent and clear communication, there is the opportunity to pose your questions about confusions in this market consultation document. This can be done by e-mailing inkoopcentrum-iv@rws.nl, before the deadline as stated in Section 3.2. The answers to these questions will be published (anonymously) at the date as listed in Section 3.2.

3.4 Submitting the questionnaire
Any interested market party that considers itself able to make a contribution to the market consultation is requested to submit the answers to the list of questions in chapter 3 of this market consultation document by e-mail to: inkoopcentrum-iv@rws.nl, before the "Closing date for the submission of completed questionnaire" referred to in paragraph 3.2. Please make use of the enclosed questionnaire in Excel format.

3.5 Confidentiality
RWS will treat the input from all participating market parties as confidential. RWS will exclusively reveal this information to employees and consultants directly involved in the market consultation and/or the tendering procedure, unless on the basis of legal provisions, RWS is required to make that information available to a broader audience. RWS is entitled to make use of the information provided for preparing the tendering documents. RWS will not include any specific references to participants or commercially sensitive information in the tendering documents.

3.6 Other provisions in relation to market consultation
The market consultation is not part of the tendering procedure. In order to avoid placing participants in the market consultation in a prejudiced position, RWS-CIV will be publishing the outcomes of the market consultation in the tendering documents. In addition, all information shared by RWS-CIV during the market consultation will be part of the tendering documents.
In the tendering procedure, no distinction will be made between parties that did or did not participate in the market consultation.

Information in this market consultation document may deviate from information issued at a later stage (in the framework of a tendering procedure or any other acquisition procedure). No rights may be derived from the information issued in the framework of the market consultation. The information is purely indicative and intended exclusively to enhance the quality of the market consultation. If this information is contradictory to information issued at a later stage, the later information shall prevail.

RWS-CIV will not make any payment to participants in the market consultation.

4. Questionnaire

The organisations that want to participate in this market consultation are requested to answer the following questions as good and detailed as possible.

A General information

1) Name and address of your organization
2) Contact person (Name, function, e-mail address and phone number)
3) What distinguishes your organization from competitive ones?

B Nationwide deformation maps

This set of questions relates to the nationwide deformation maps we would like to retrieve from InSAR. The first subset (1 - 4) are some general brainstorm questions, in which we would like to invite everyone to join. The second subset (5 - 15) focuses on the processing capabilities, methodologies, etc.

General

RWS is planning to obtain nationwide deformation maps generated by InSAR. On the one hand there are the historic maps from the retired ERS and Envisat satellites. On the other hand there are the maps from the active stacks and their updates (RADARSAT-2 and Sentinel-1).

1) Which advantages and opportunities of any kind do you foresee for either market parties or RWS when such a national service becomes available?
2) Which disadvantages and risks of any kind do you foresee for either market parties or RWS when such a national service becomes available?
3) On a scale from 0 to 10 (with 0 being not feasible and 10 entirely feasibly) how would you describe the feasibility of this idea? Can you explain the number given?
4) Which strategy would you use to produce these nationwide maps? Think about handling the historic data, integration with newly acquired data, and other measurements (leveling, GPS, AHN, etc).

Deliverables

5) Which deformation products can you deliver?
   - ☐ ERS deformation map ☐ nationwide
   - ☐ Envisat deformation map ☐ nationwide
   - ☐ RADARSAT-2 deformation map ☐ nationwide
   - ☐ Sentinel-1 deformation map ☐ nationwide
6) To what extent is WAP (Wide Area Processing) automated within your organization? Please, explain.
7) Which InSAR time series processing techniques does your organization master? Please provide a short description and if possible references.
8) Which (combination of) processing methodologies would you recommend for our national deformation map for each of the available data sets (ERS, ENVISAT, RADARSAT-2, SENTINEL-1)?
9) How do you define the quality of the InSAR results? How are the InSAR measurements validated?
10) Do you see value/opportunities in connecting data (time series?) obtained from different sensors? Please explain? How would you connect data from different time series?

11) How and in what format are you able to deliver, present and disseminate the results? Do you provide access to a WEBGIS-system? How is the access to this service organized?
12) Are you willing to document and share the processing details? Why (not)?
13) Are you able to provide:
    - ☐ Single mapping products (single product)? --> skip question 14
    - ☐ Monitoring products (frequent updates)?
14) In case of monitoring products, in your opinion, what would be a good and feasible updating strategy?
15) Would your organization need time to develop new tools or methodologies to meet our information request? Please explain.

C Pricing

1) Could you list a breakdown of the different components in the development and operationalization of such a service?
2) Could you indicate the largest cost-drivers?
3) We highly appreciate if you could provide us with indicative pricing of:
    a) ERS and Envisat WAP
    b) RadarSat-2 WAP: Envisat-Sentinel-1 gap only
    c) RadarSat-2 WAP: the ramp up or initialization phase and operational phase of the service
    d) Sentinel-1 WAP: the ramp up or initialization phase and operational phase of the service

D Legal aspects

1) What is your organization's policy on licensing and proprietary law of the delivered products?
2) What conditions does your organization usually set in terms of licensing?
3) What is your policy on sharing the products with partners of RWS?
4) What is your policy on sharing the products with the public, i.e. open data?

E Other

You are invited to list other ideas, thoughts, suggestions or remarks here. If you expect risks or challenges that we didn't cover in this questionnaire, you are also welcome to share them with us here.