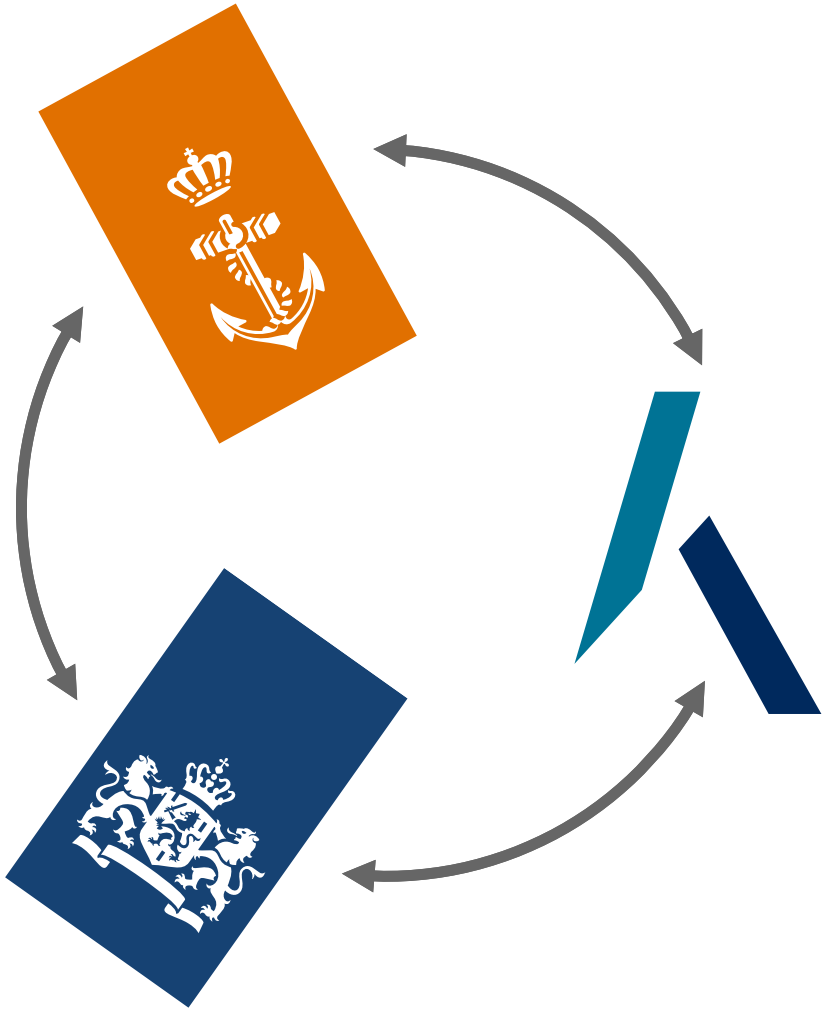


GNSS Certification in the Netherlands

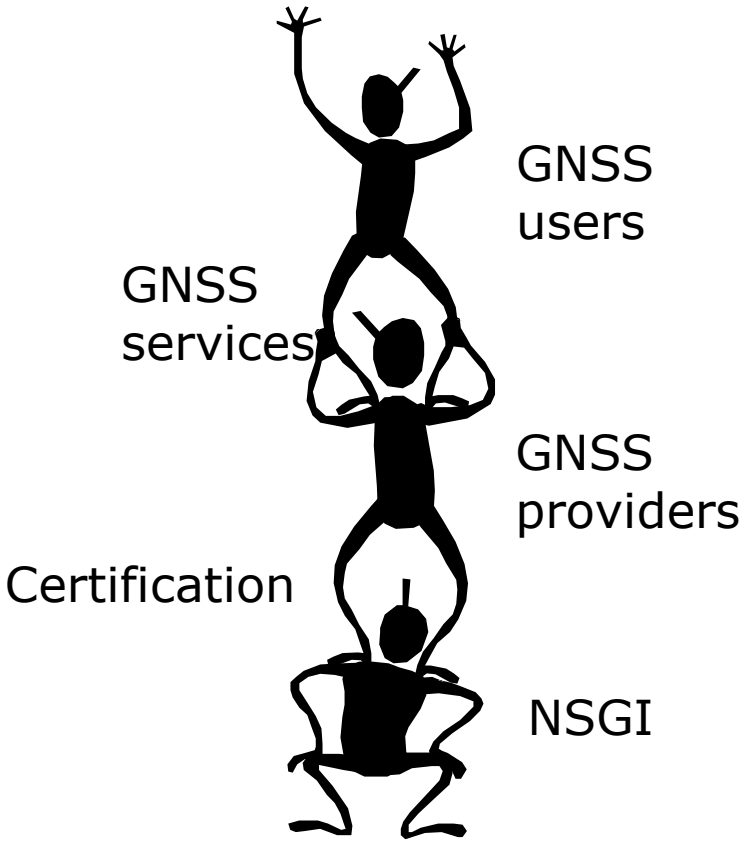
Lennard Huisman – NSGI

12th EUPOS® Council and Technical Meeting
Warsaw2026

Outline

- Recap current situation and developments 2016-2025
- Current focus
- Current process and product

Recap QC of GNSS services (certification)



AGRS.NL / RDNAPTRANS™

- ~6 commercial RTK providers in NLD
- ~250 stations + 50 NSGI
- Certification is:
  - quality control
  - coordinate computation
- Anyone can operate an RTK service in NLD
- Certification usually required by contractors and surveying guidelines

Recap QC of GNSS services (certification)

GNSS users

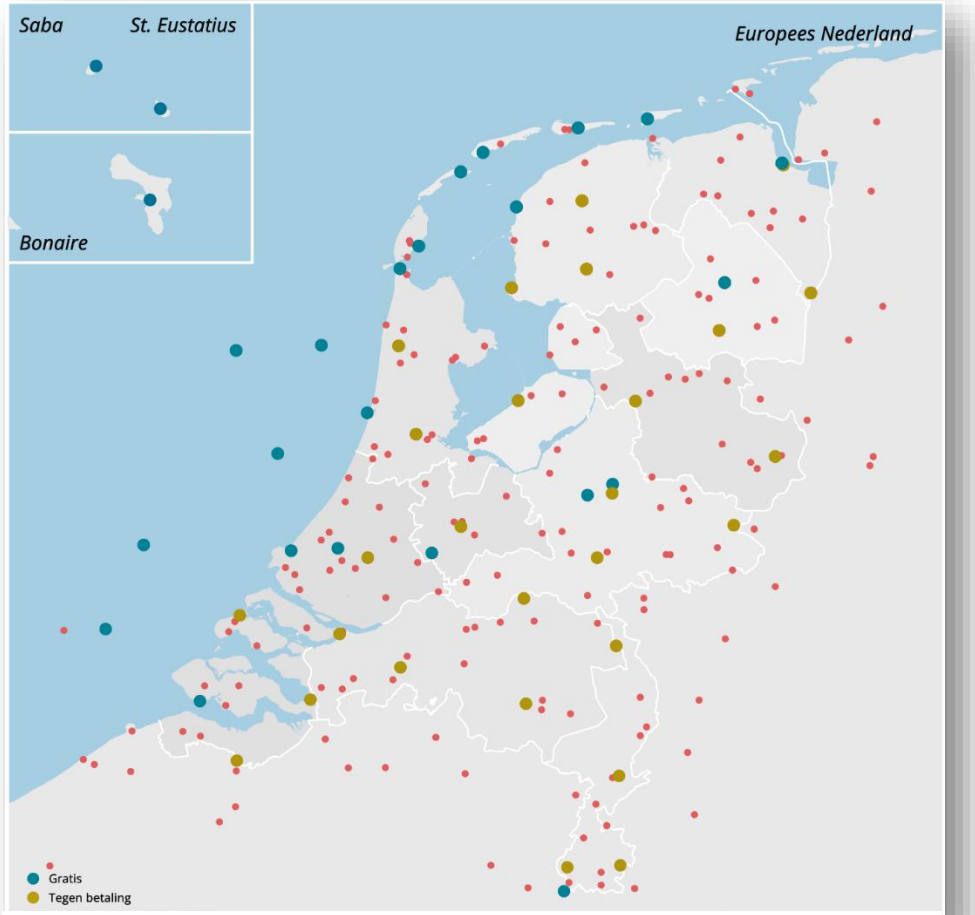
GNSS services

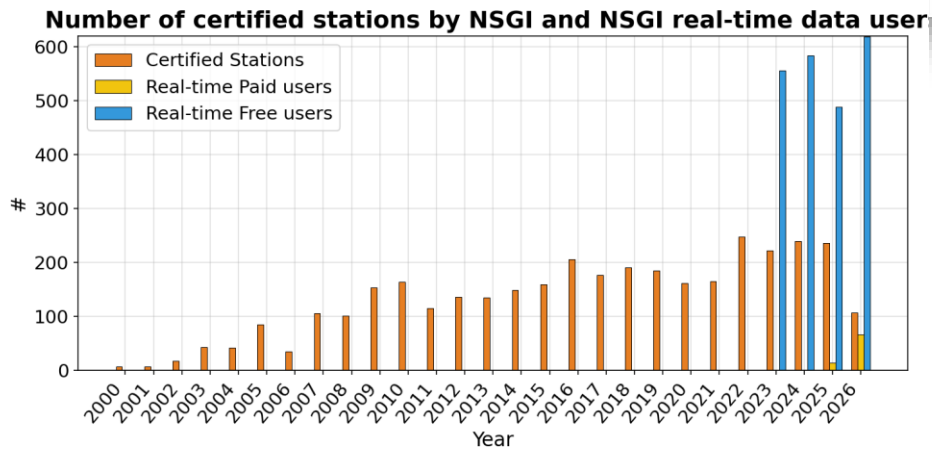
GNSS providers

Certification

NSGI

AGRS.NL / RDNAPTRANS™

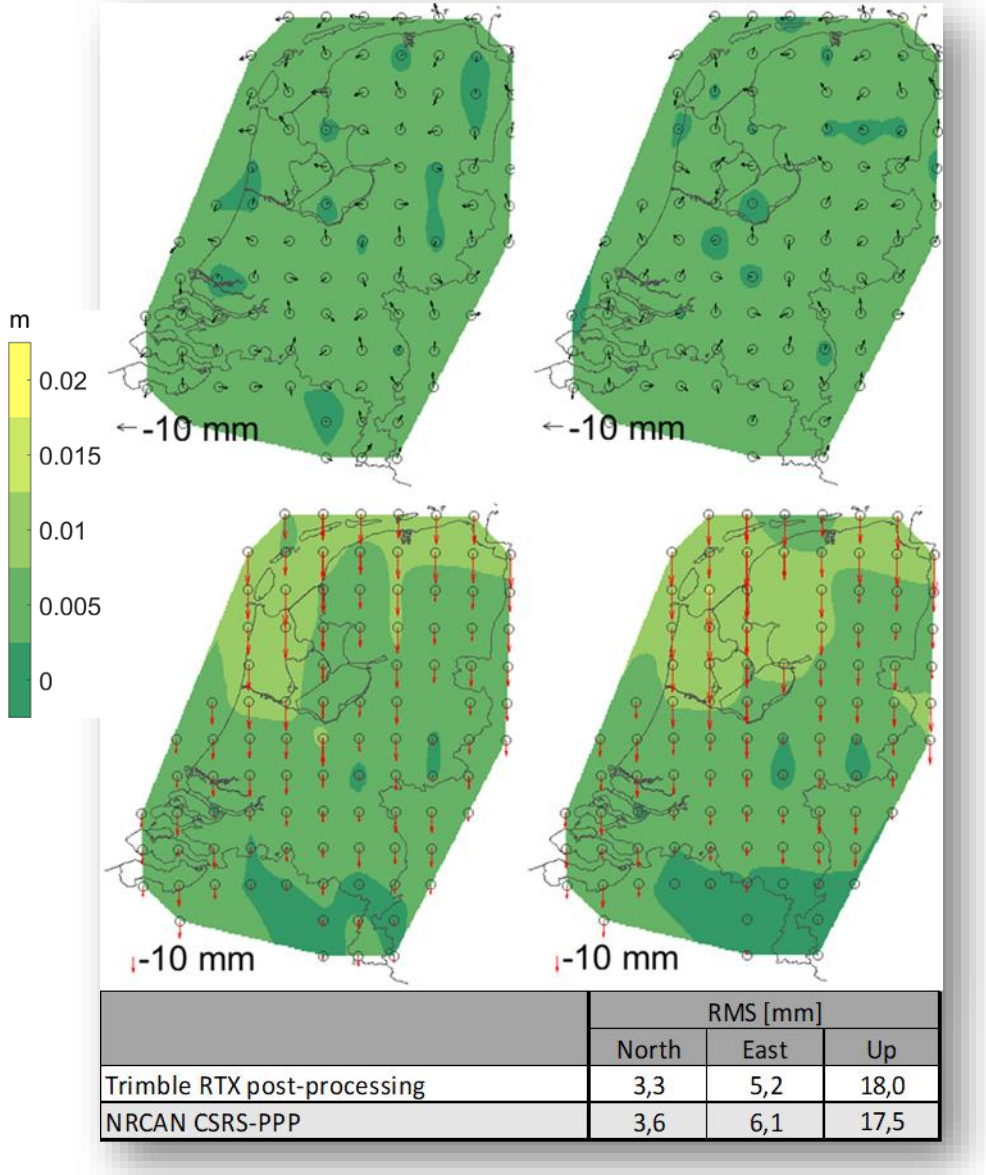




Note: 2026 data up to end of September.

Recap QC of GNSS services (certification)

AGRS.NL / RDNAPTRANS™



	RMS [mm]		
	North	East	Up
Trimble RTX post-processing	3,3	5,2	18,0
NRCAN CSRS-PPP	3,6	6,1	17,5

- Current method: Only GNSS stations
- New method: GNSS networks including Network RTK, PPP-RTK, PPP, Galileo HAS and OS

2 phase approach

Validation of OSR (RTK) services: Grid Check

- Virtual users on a predefined grid
- Request VRS/RINEX data from service
- Compare coordinates provide by service with computed (certified) coordinates
- Detect spatially varying reference frame inconsistencies

Validation of SSR (PPP-RTK, DGNSS, …) services: Systematic Quality Control

- Grid-check stations used as monitoring users
- Compare estimated and known coordinates
- Monitor reference frame consistency and temporal stability

2 phase approach - status

Validation of OSR (RTK) services: Grid Check

- Virtual users on a predefined grid
- Request VRS/RINEX data from service
- Compare coordinates provide by service with computed (certified) coordinates
- Detect spatially varying reference frame inconsistencies

- 2016-2021: prototyping
- 2021-2025
  - Validation which other services:
  - National and international
- 2026: First official customer

Validation of SSR (PPP-RTK, DGNSS, …) services: Systematic Quality Control

- Grid-check stations used as monitoring users
- Compare estimated and known coordinates
- Monitor reference frame consistency and temporal stability

- Prototyping since 2016
- Low effort

Why focus on Grid Check now

- Validation very valuable for finding configuration errors
  - Missing signals
  - Incorrect antenna types
  - Outdated coordinates

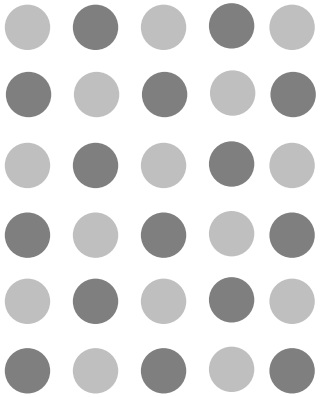
  - Has been helpful to improve services and build support

- Re-use of our data streams by other parties

  → current certification procedure does not apply

Current process

- Docker + rtklib based logging setup
- Collect minimal 3 days of data, preferably 7
- Option to alternate grid points over days



Days 1,3,5

Days 2,4,6

- Processing with same BSW54 procedure as current certification
- (Nearly) automatic reporting

Current product

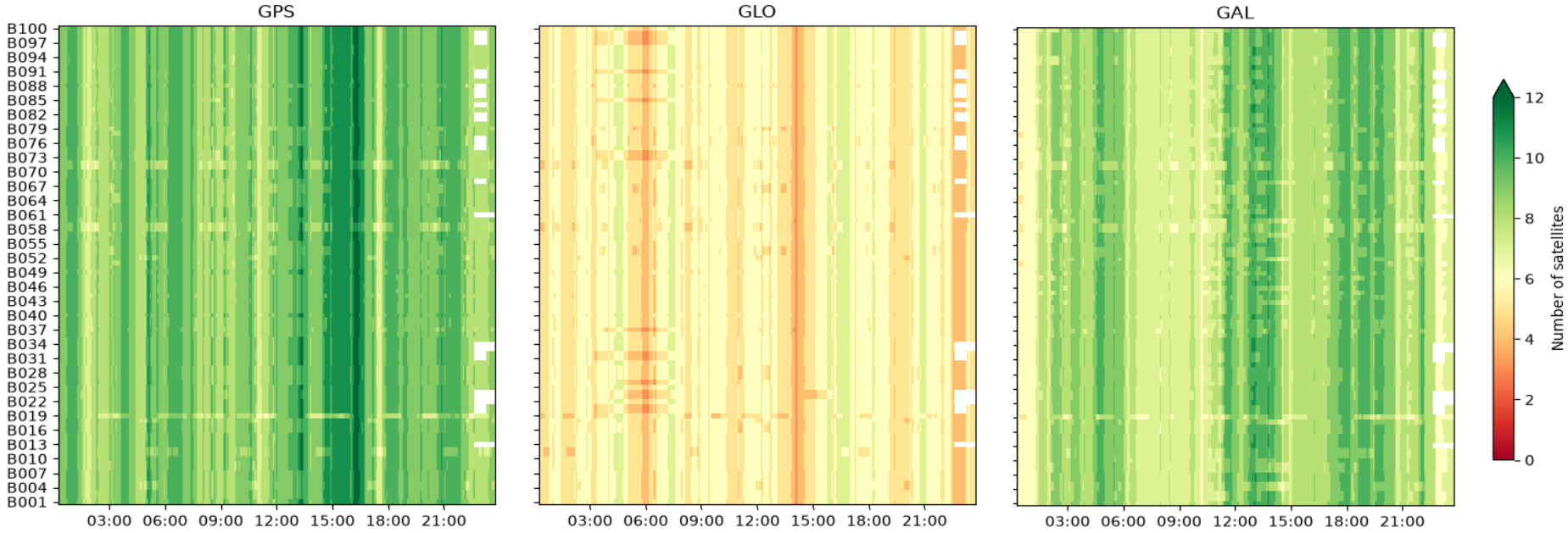
- Report with optional chapters
  - Methodology description
    - Data collection
    - Internal reference frame consistency check
    - National reference frame consistency check
  - Results
    - Data collection
    - Internal reference frame consistency check
    - National reference frame consistency check
  - Discussion on results

Data availability: Example NETPOS 4 days

- Number of RTCM stream epochs per day by gap duration (aggregated over all stations).

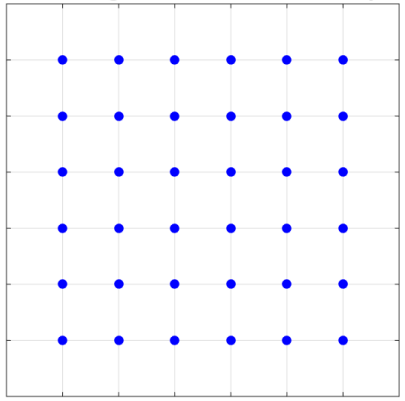
Day	No gap	2–5 s	6–30 s	>30 s
2026-09-23	8379798	0	0	19
2026-09-24	8452313	0	2	45
2026-09-25	8454925	0	4	29
2026-09-26	8425930	0	10	201

- Daily plots

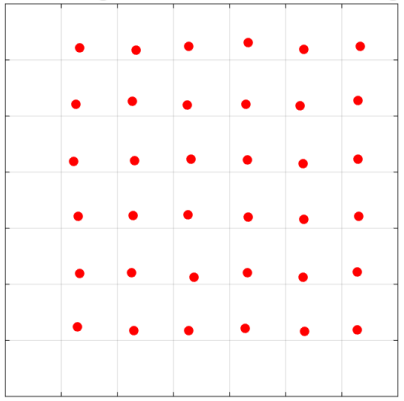


Internal reference frame consistency check

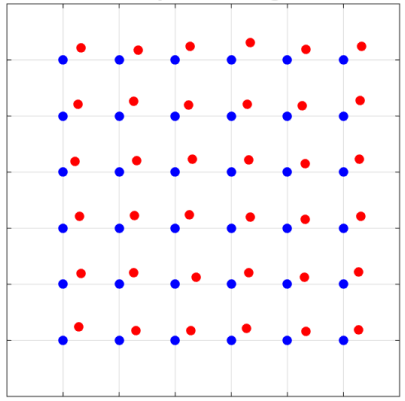
Virtual station grid in reference frame provider



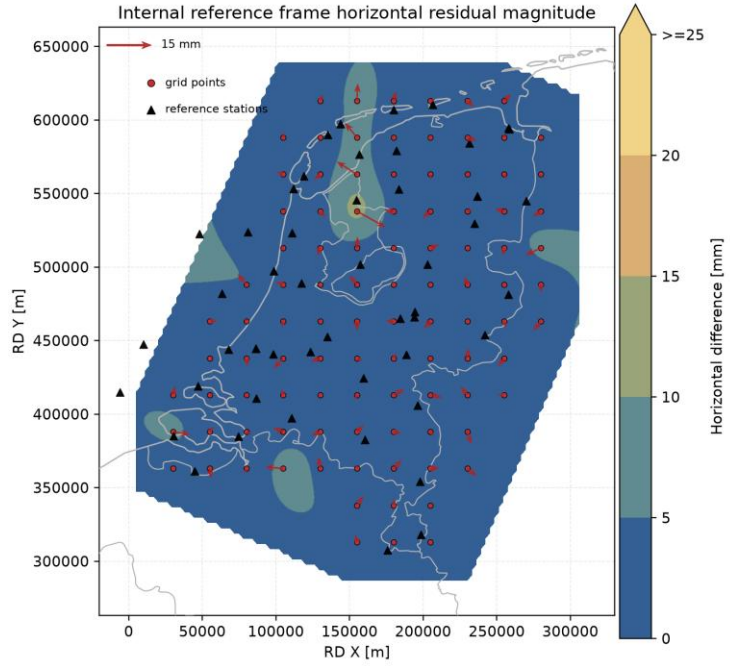
Bernese processing result for virtual station grid in ITRS



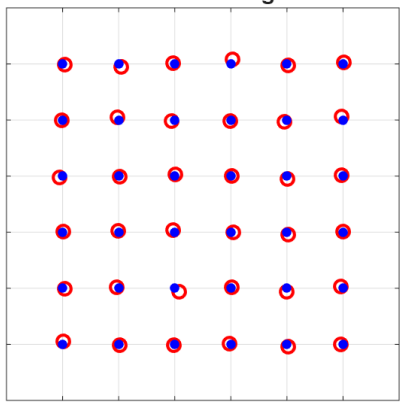
Grid and processing result



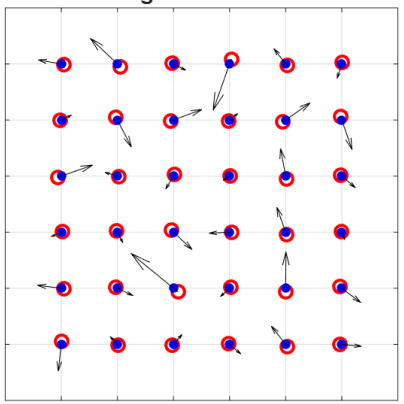
Internal reference frame horizontal residual magnitude



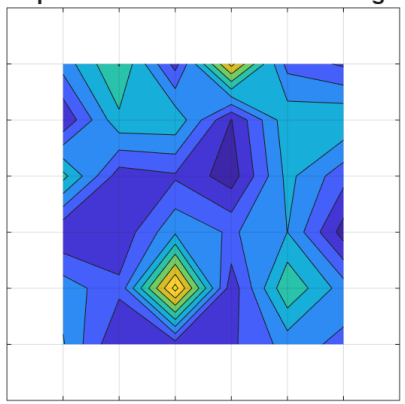
Bernese processing result transformed to virtual station grid



Bernese processing result transformed to virtual station grid with residual vectors



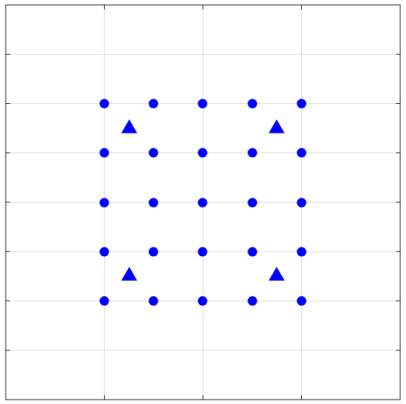
Interpolation of residual vector lenghts



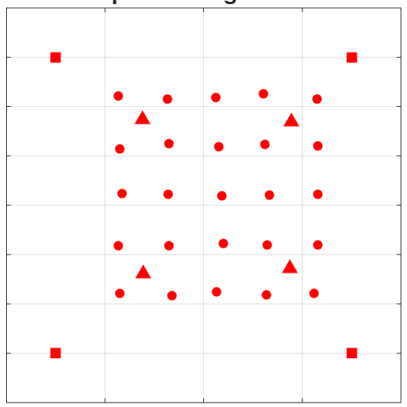
Metric	Value	Unit
Horizontal RMS	3	mm
Horizontal P95	6	mm
Vertical RMS	5	mm
Vertical P95 ($\|U\|$)	9	mm

National reference frame consistency check

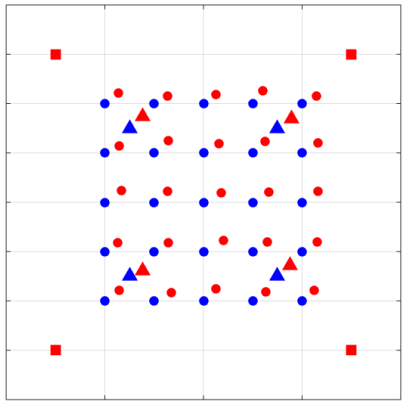
Expected coordinates in national reference frame

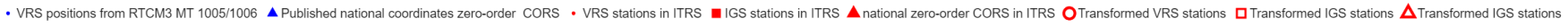


Bernese processing result in ITRS

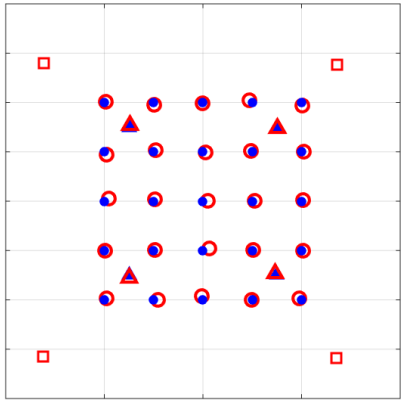


Grid and processing result without transformation

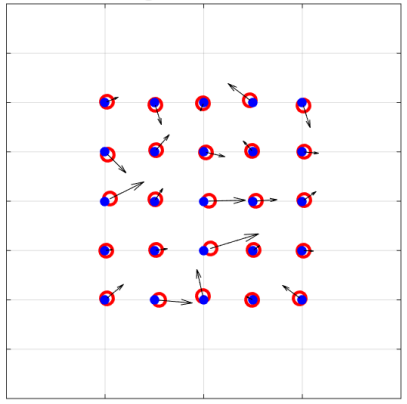




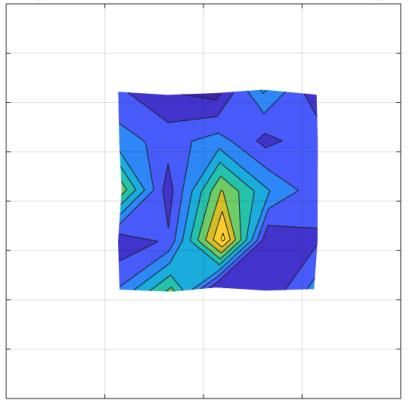
Bernese processing result transformed to national zero-order CORS

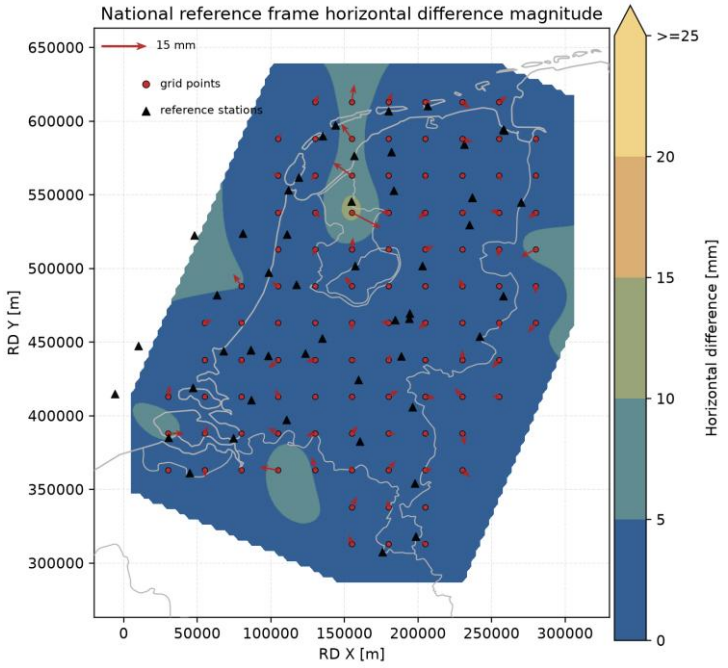


Transformed Bernese processing result for virtual station grid with residual vectors



Interpolation of residual vector lenghts

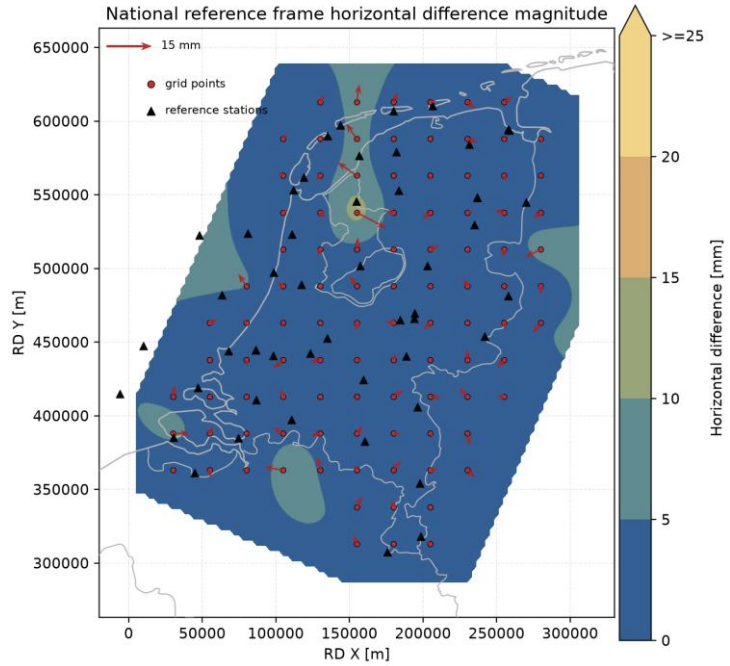




Metric	Value	Unit
Horizontal RMS	3.3	mm
Horizontal P95	6.0	mm
Vertical RMS	5.5	mm
Vertical P95 ($\|U\|$)	11.2	mm

Preliminary criteria for acceptance

- Continuity of collected data
- Horizontal RMS < 5 mm
- Vertical RMS < 10 mm
- No outliers

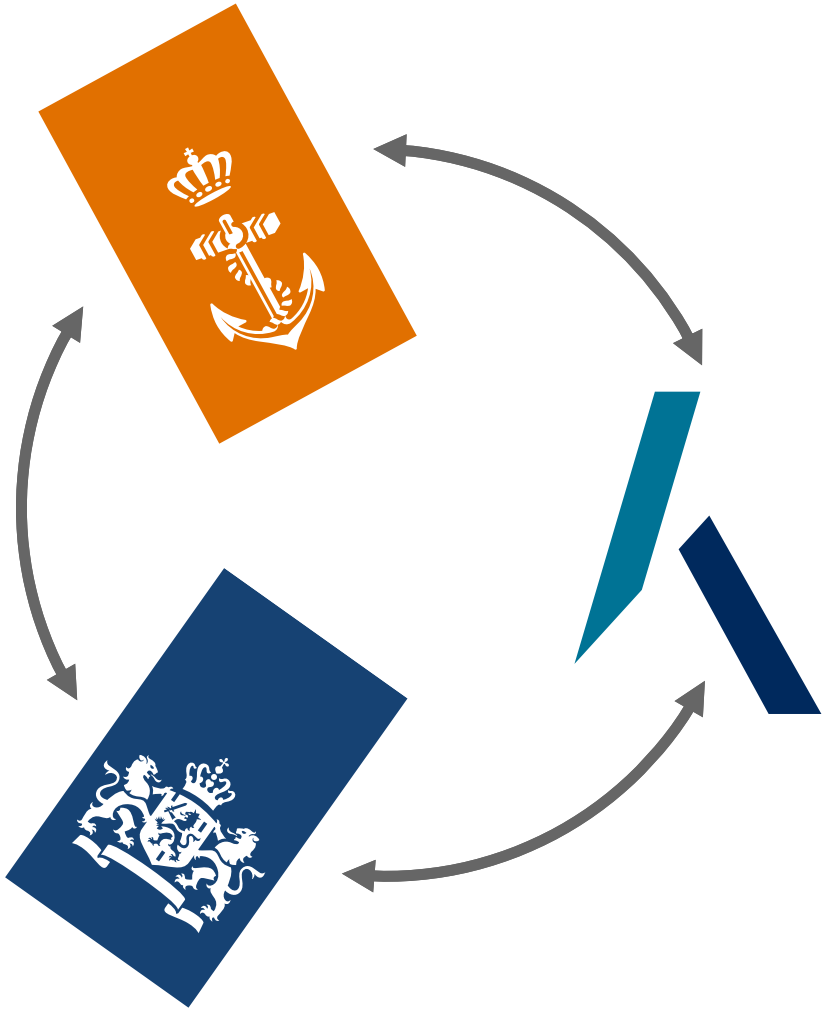


Metric	Value	Unit
Horizontal RMS	3.3	mm
Horizontal P95	6.0	mm
Vertical RMS	5.5	mm
Vertical P95 ($\|U\|$)	11.2	mm

Summary and outlook

- Grid check:
  - 2016-2026: From prototyping and testing to actual product
  - Continue collaboration with other agencies and providers
    - Share tools
    - Tips and tricks for implementation
    - Collect and / or process data

- Systematic quality control
  - Still ambitions for further development



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