PARTNER

Netherlands' Partnership for Geodetic Infrastructure (NSGI)

Fit for the Future?

Dienst der Hydrografie – Kadaster – Rijkswaterstaat

Koninklijke Marine

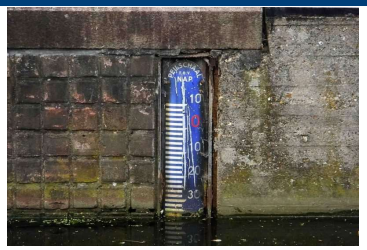
kadaster

Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Martin Salzmann
Lennard Huisman

NCG symposium 2025

Development of the geodetic infrastructure over time: Continuous development and adaptation



GPS kernnet

1994
1997

1989
1994

EUREF89
NEREF/MAREO

First GPS receiver Kadaster

1987

1985

Triangulation, Levelling
(RD,NAP)
GPS: disrupting technology?

1994
1997

5th primary
levelling

RDNAPTRANS

1997

AGRS.NL

2000

2001

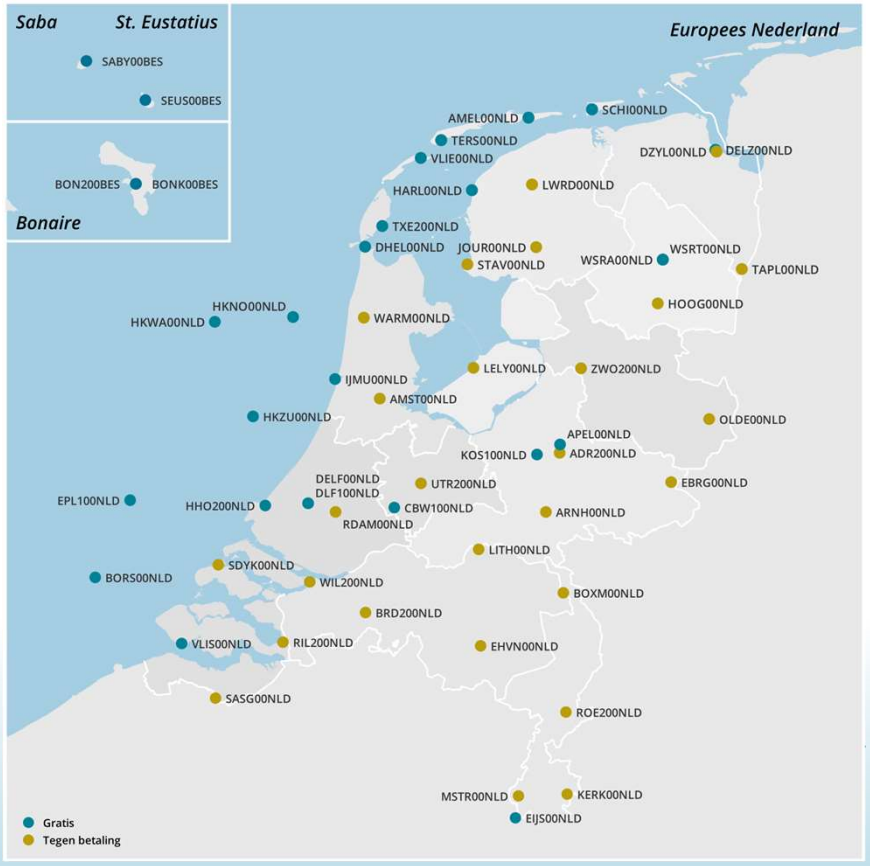
Certification GPS stations

2005

NETPOS

Active GNSS stations

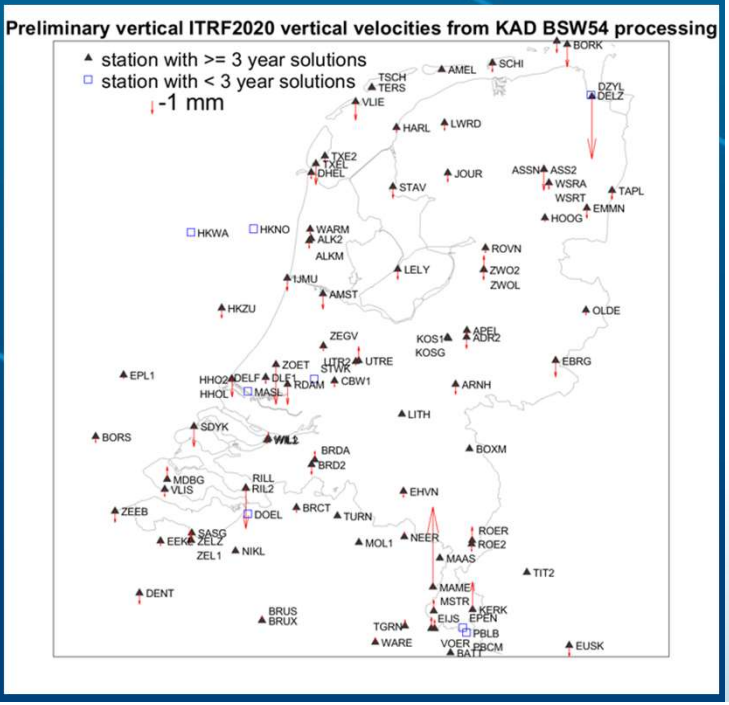
- Reference frame, scientific applications
  - AGRS.NL
    - 1997
      - 5 stations
      - Subscription
    - 2025
      - 20+ stations
      - Open data
- Densification for positioning
  - NETPOS
  - GNSS service providers

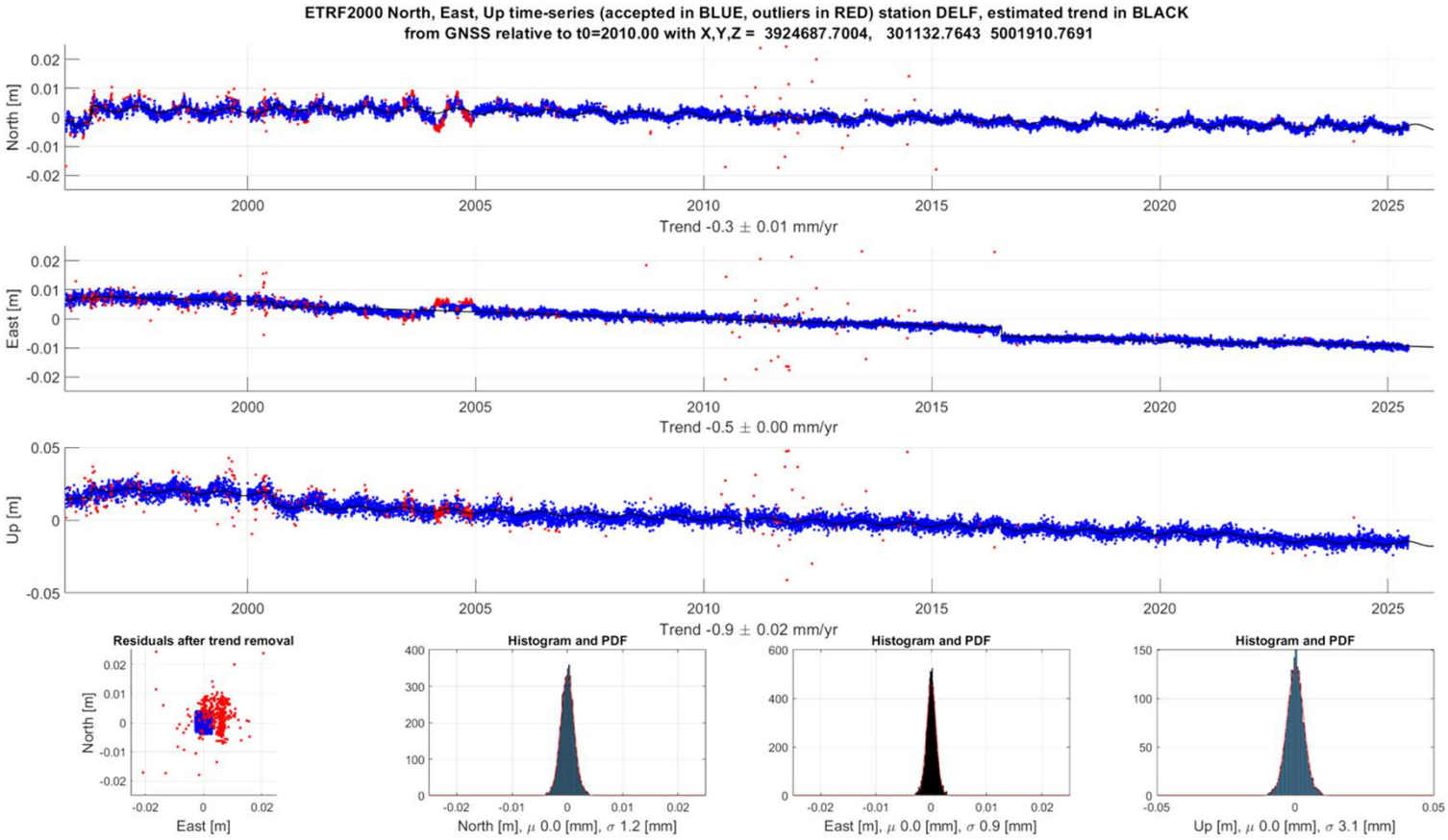


Martin Salzmann, Lennard Huisman
NSGI – Fit for the Future?, NCG symposium 2025

GNSS reprocessing

- **> 25 years data**
- Consistent time series
- Latest IERS conventions
- IAG EUREF reprocessing recommendations

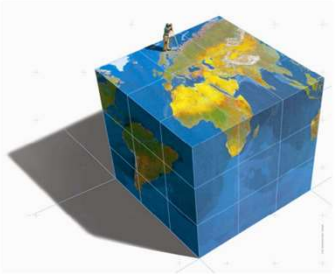




NCG
Nederlandse Commissie voor Geodesie Netherlands Geodetic Commission

Huidige organisatie en ontwikkelingsrichting van de geodetische infrastructuur in Nederland

Na vergelijking met onze buurlanden



2009 way forward: integration by cooperation

2014 NSGI established (initially as GSW)

2016 GNSS station at sea

2019 RDNAPTRANS2018 NLGEO2018, NLLAT2018

2019 GNSS open data (file based formats)

2024 GNSS open data (real-time streams)

Reference frame validation GNSS services

6th primary levelling

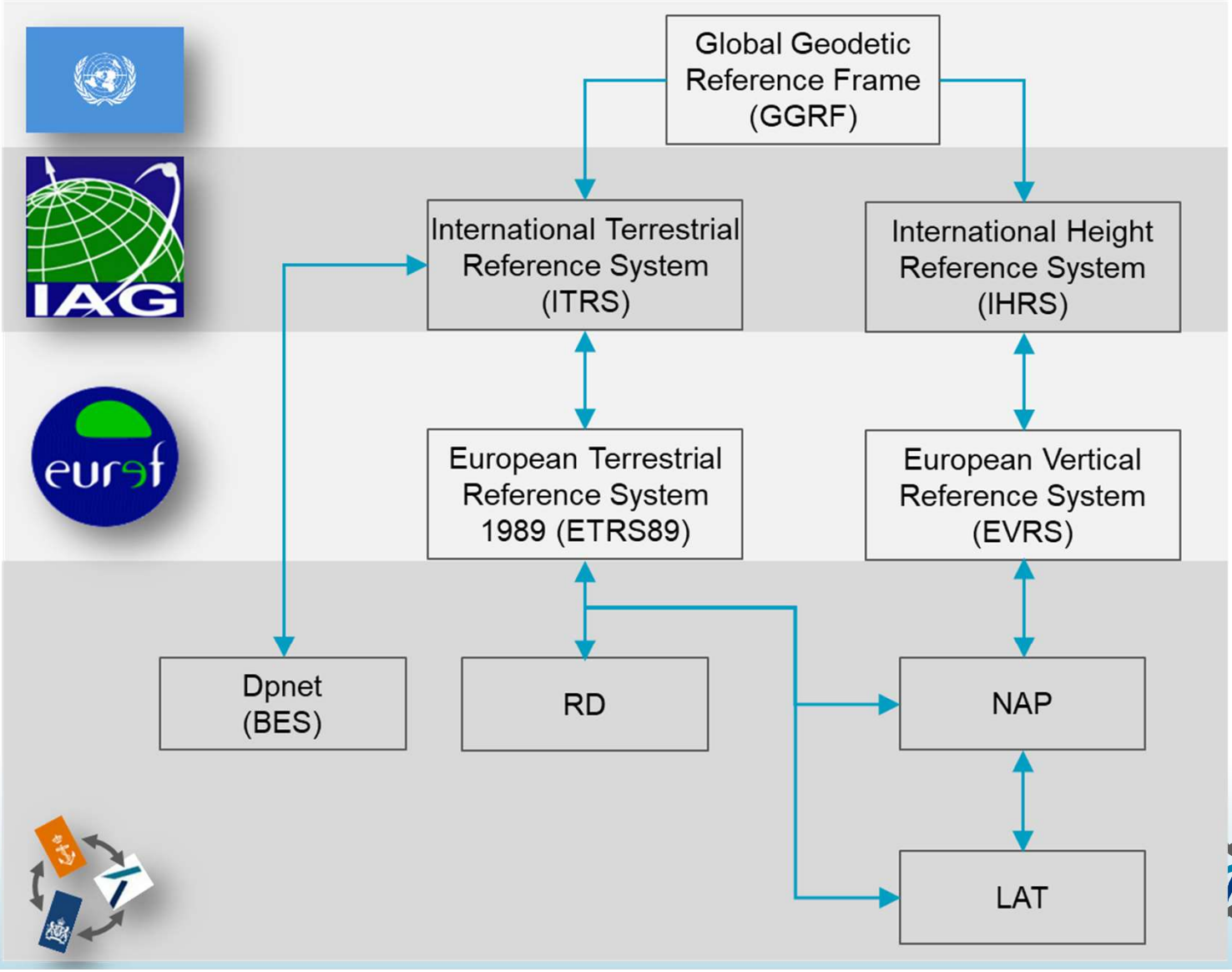
2nd GNSS reprocessing

Reference frame realisation

- Definition and Parameters
- Infrastructure

Access to CRS

- Information
- Real-time GNSS



About NSGI

3 organizations in virtual collaboration since 2014

Maintaining and ensuring a reliable and sustainable geodetic foundation as a building block of the global spatial data infrastructure

Everyone using the same coordinates for combining geo-information

Common interest: Public, economic, scientific

Each party responsible for their own tasks and budget

Pooling knowledge, coordinating activities, services

Communicating nationally and internationally as one for the Geodetic Infrastructure

GNSS Positioning Services

AGRS.NL / RDNAPTRANS™

25 years ago
- Single baseline RTK
- Commercial providers

NSGI activity (at that time RDNAP)
- Provide transformation procedure
- Certification of GPS reference stations
  - Quality Check
  - Coordinate Computation
- Land and Sea
- Carribean (cooperation with KNMI)

Developments since 2000

GNSS users

GNSS services

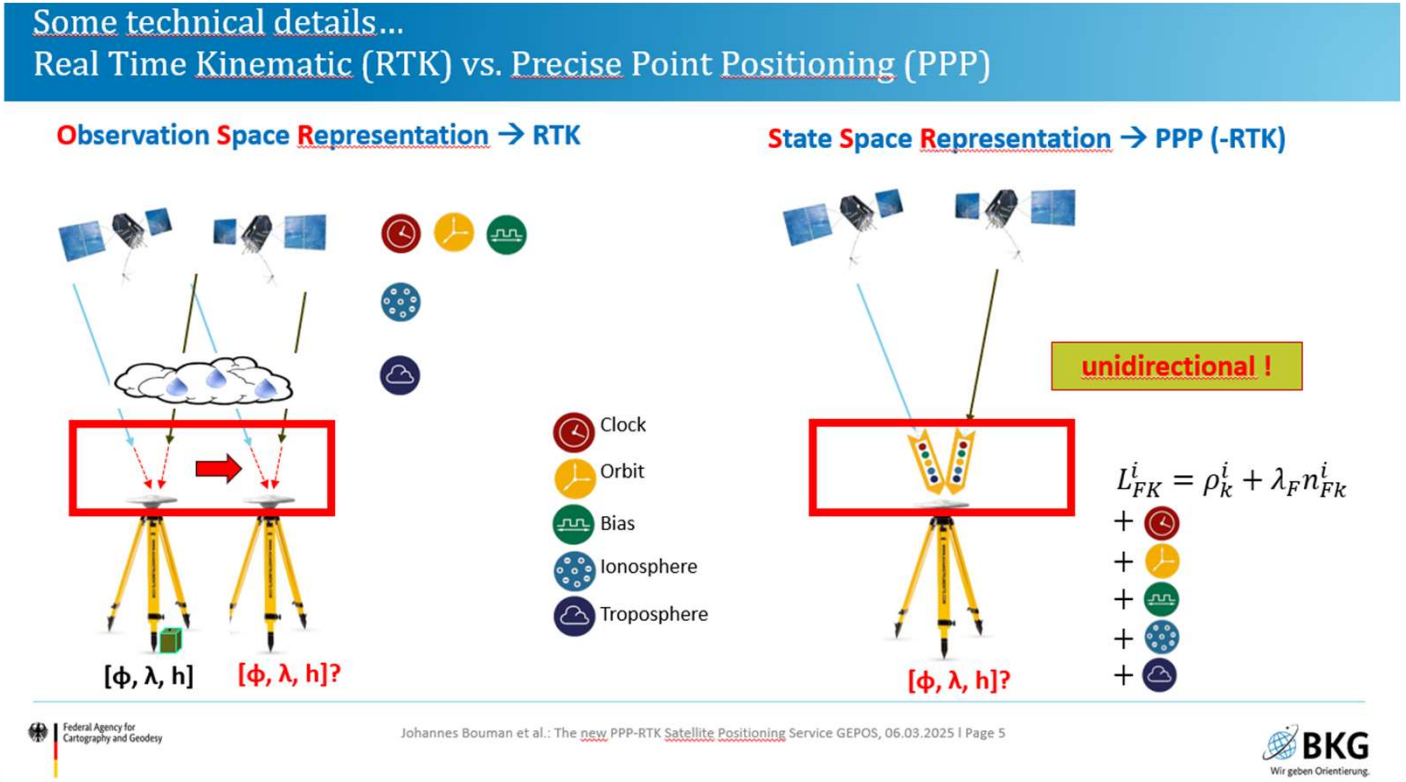
GNSS providers

Certification

NSGI

AGRS.NL / RDNAPTRANS™

- Network RTK, PPP and PPP-RTK or OSR vs SSR



- Open data policy
- NETPOS (2005 – 202?)

Developments since 2000

AGRS.NL / RDNAPTRANS™

- New approach: Validation of the reference frame provided by GNSS service
- Ability to validate Network RTK (Grid Check) and PPP and PPP-RTK (Systematic Quality Control)
- Current status:
  - Methodology published and presented (IAG REFAG 2022)
  - Proof-of-concept operational
  - Tested with public and private providers
  - Tested in multiple countries (Presented at IAG EUREF symposia)

Developments and challenges ahead

Education and training: geodetic capabilities

UN-GGIM
United Nations Global Geodetic Centre of Excellence

One Satellite Signal Rules Modern Life. What if Someone Knocks It Out?
NY Times interview with Nick Brown, Head of Office UN-GGCE, 28-03-2024

2020 UN-GGCE

2nd GNSS reprocessing

Reference frame validation GNSS services

6th primary levelling

GNSS disrupted?

Fit for the future?

It is a permanent consideration!

GNSS and other data usage has exploded

- Military and science: Innovation and algorithms
- Public sector: Public infrastructure
- Private sector: Professionalisation and product/service development
- Users request high precision everywhere and at any moment
- Ground motion and sea level variations always a topic of interest

→ What infrastructure is needed for the future?

Fit for the future?

It is a permanent consideration!

GNSS and other data usage has exploded

- Military and science: Innovation and algorithms
- Public sector: Public infrastructure
- Private sector: Professionalisation and product/service development
- Users request high precision everywhere and at any moment
- Ground motion and sea level variations always a topic of interest

→ What infrastructure is needed for the future?

High-precision GNSS is complex

Reference frame depends on reference products
Quality assurance for users
Not enough geodesists (knowledge base)

→ NSGI as authority for geodesy sector or also mass-market?

Fit for the future?

It is a permanent consideration!

GNSS and other data usage has exploded

- Military and science: Innovation and algorithms
- Public sector: Public infrastructure
- Private sector: Professionalisation and product/service development
- Users request high precision everywhere and at any moment
- Ground motion and sea level variations always a topic of interest

→ What infrastructure is needed for the future?

High-precision GNSS is complex

Reference frame depends on reference products
Quality assurance for users
Not enough geodesists (knowledge base)

→ NSGI as authority for geodesy sector or also mass-market?

GNSS is vulnerable

- Signals easily disrupted or even spoofed
- No fallback for high precision positioning and navigation
- Supply chain relies on best effort agreements
- Integration of sensors for robustness
- Public/private partnerships

→ What is the required vital (minimum) infrastructure?
→ What can geodesists do to make GNSS more robust?

Take away:
Make use of our
> 25 years (> 10.000 days)
data and consistent
time series!

Thank you for your attention!

nsgi.nl

contactform NSGI

Het Geoforum