Maintenance of ETRS89 in the Netherlands

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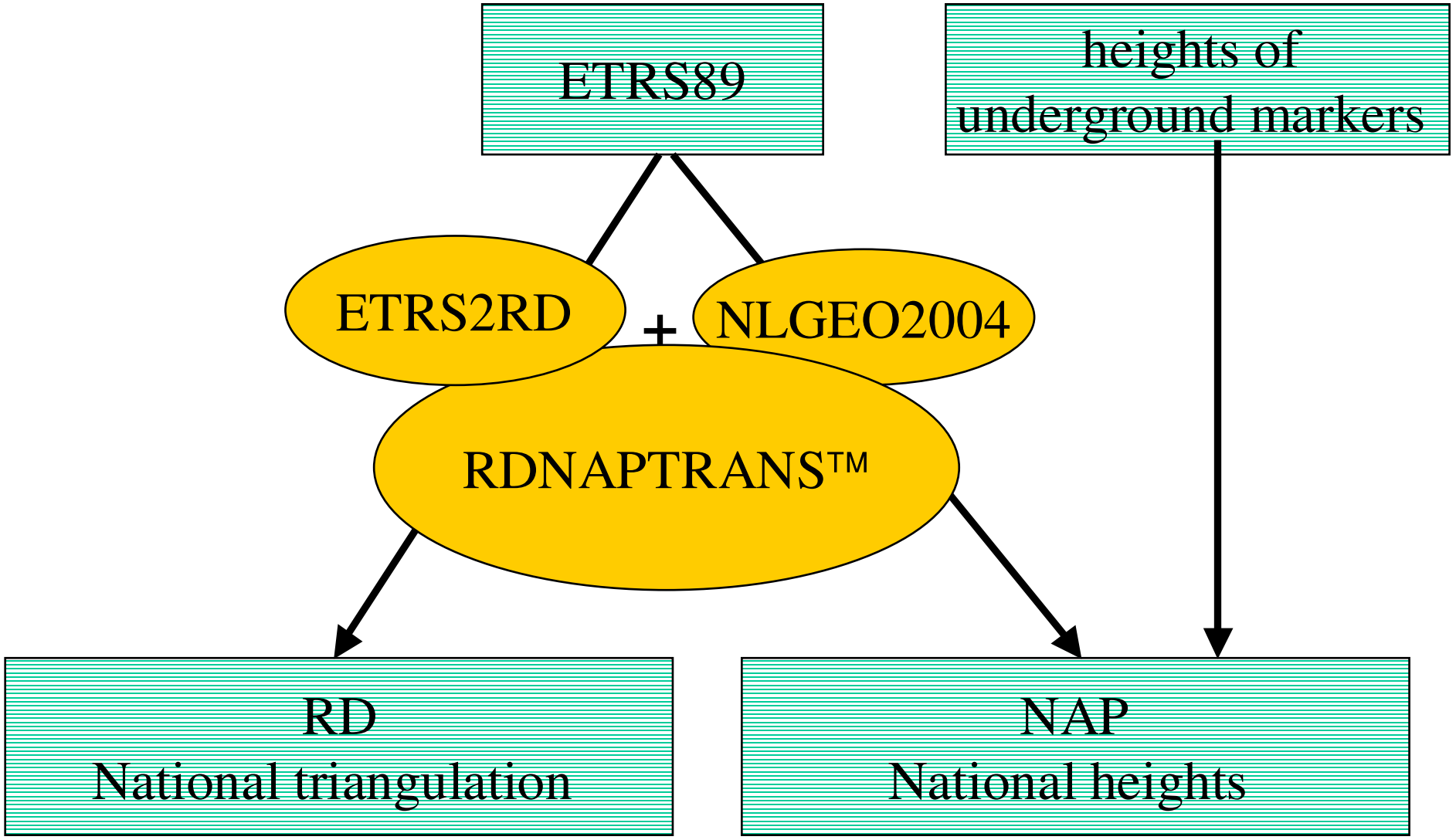
Use of ETRS89 in the Netherlands



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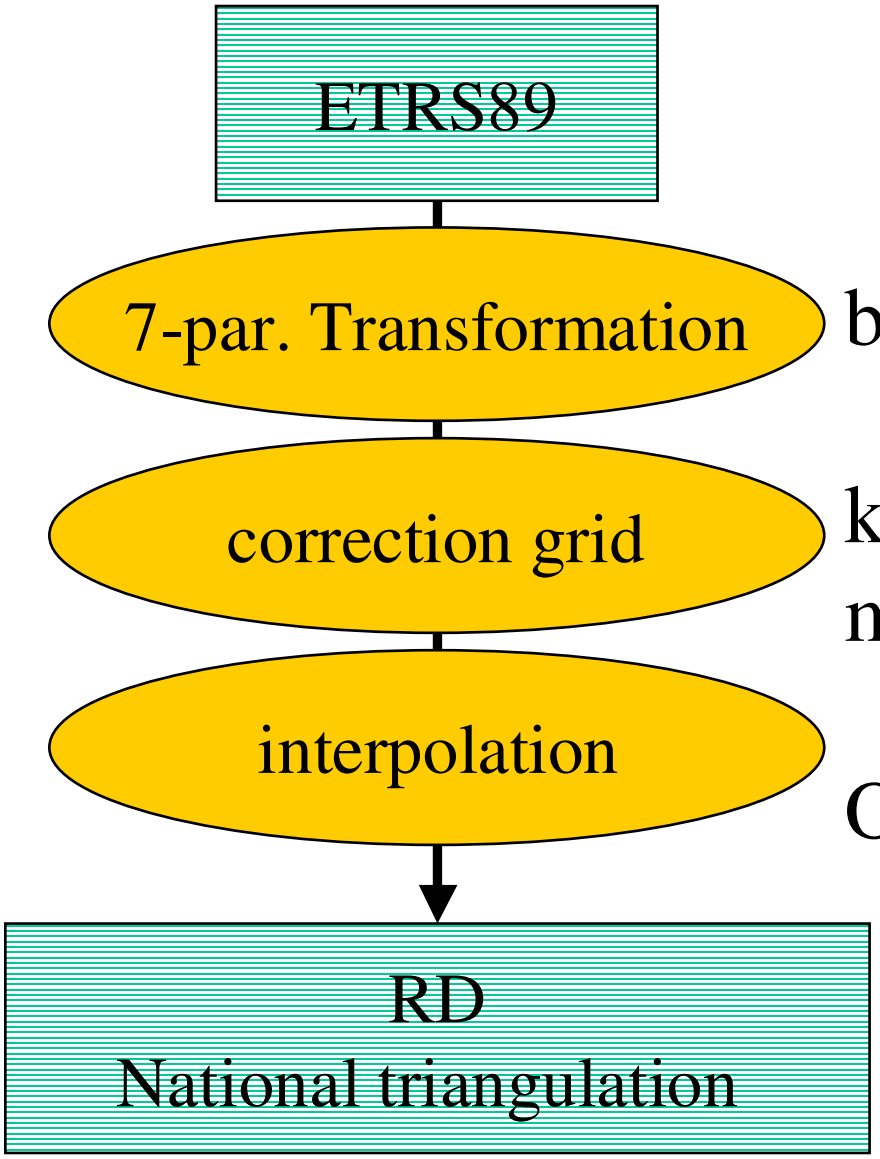
Transformation ETRS2RD



based on 15 NEREF points (1995)

km spacing;
max. correction 0.25 m

Overhauser spline

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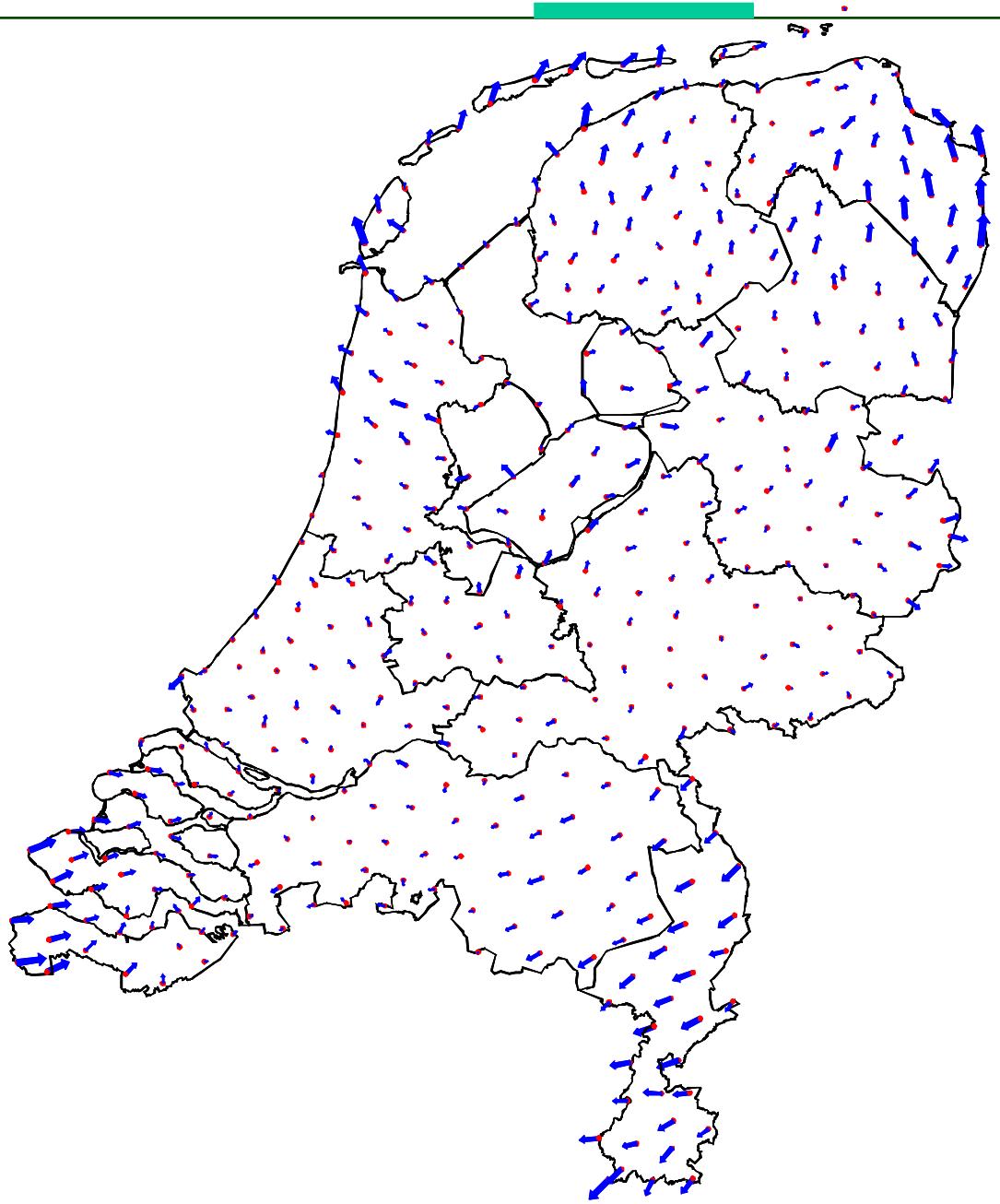
RD-correction grid



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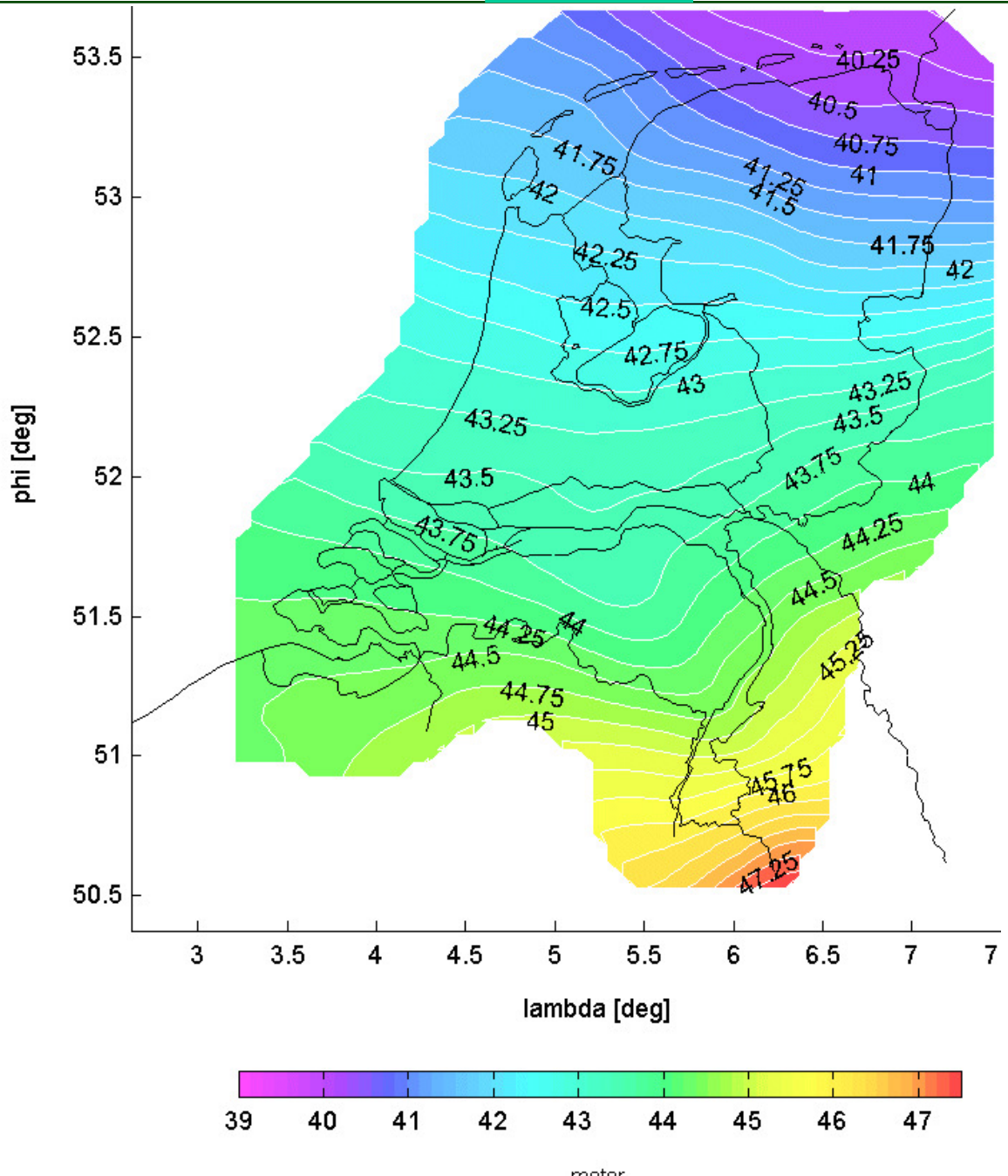
NLGEO2004


53.5
53
52.5
52
51.5
51
50.5
phi [deg]
3
3.5
4
4.5
5
5.5
6
6.5
7
7
lambda [deg]
40.25
40.5
40.75
41
41.25
41.5
41.75
42
42.25
42.5
42.75
43
43.25
43.5
43.75
44
44.25
44.5
44.75
45
45.25
45.75
46
47.25
39
40
41
42
43
44
45
46
47

NLGEO2004

- EGM96 + inner zone gravity data augmented with recent data from Belgium and Germany.
- Gravimetric geoid corrected with quadratic plane based on 82 GPS/levelling points.
- Revision of NAP-heights (on a national scale) taken into account.
- RMS of residuals on GPS/levelling points only 7 mm.
- Comparison with external information confirms:

cm-precision.

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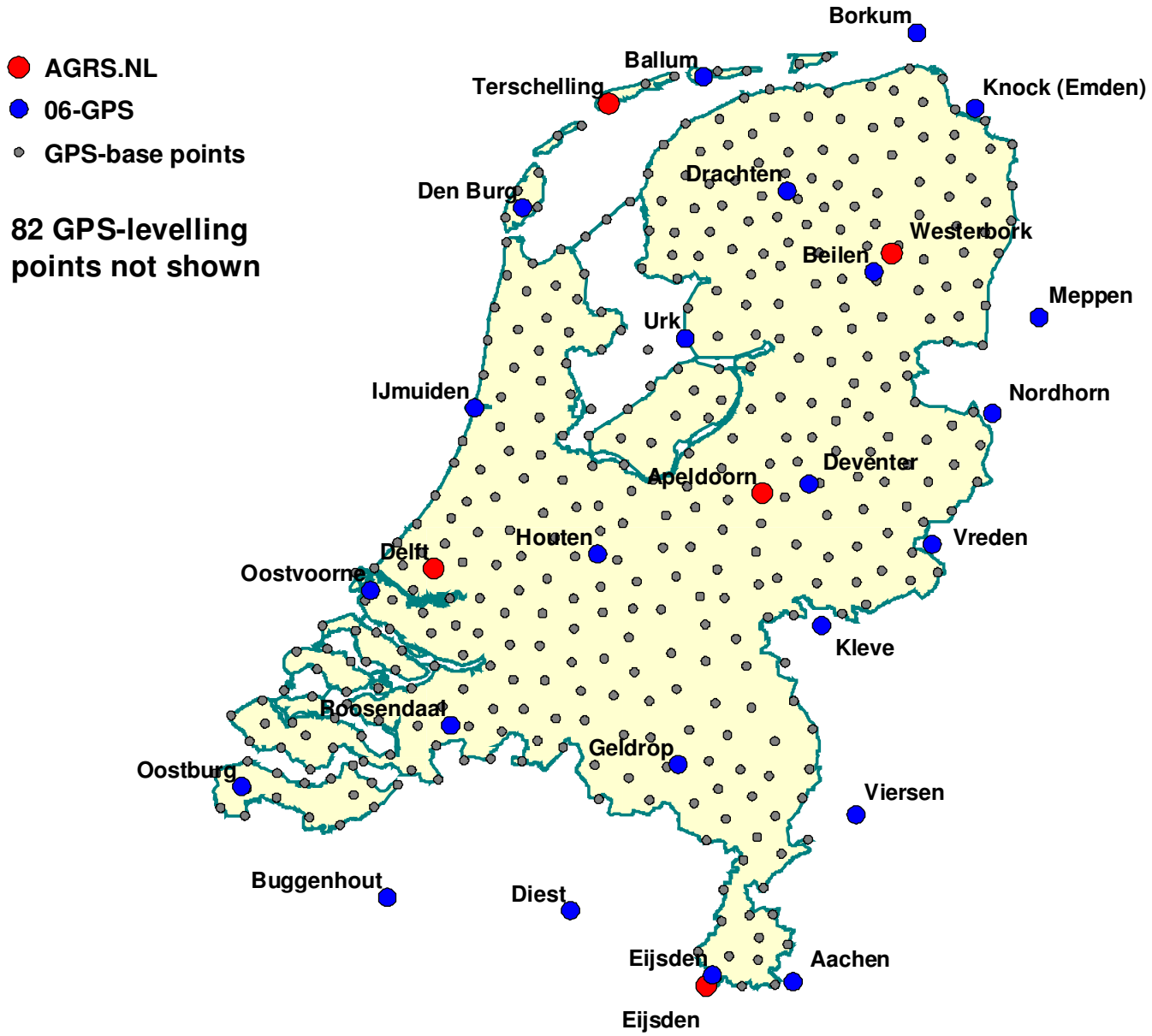
Densifications of ETRS89



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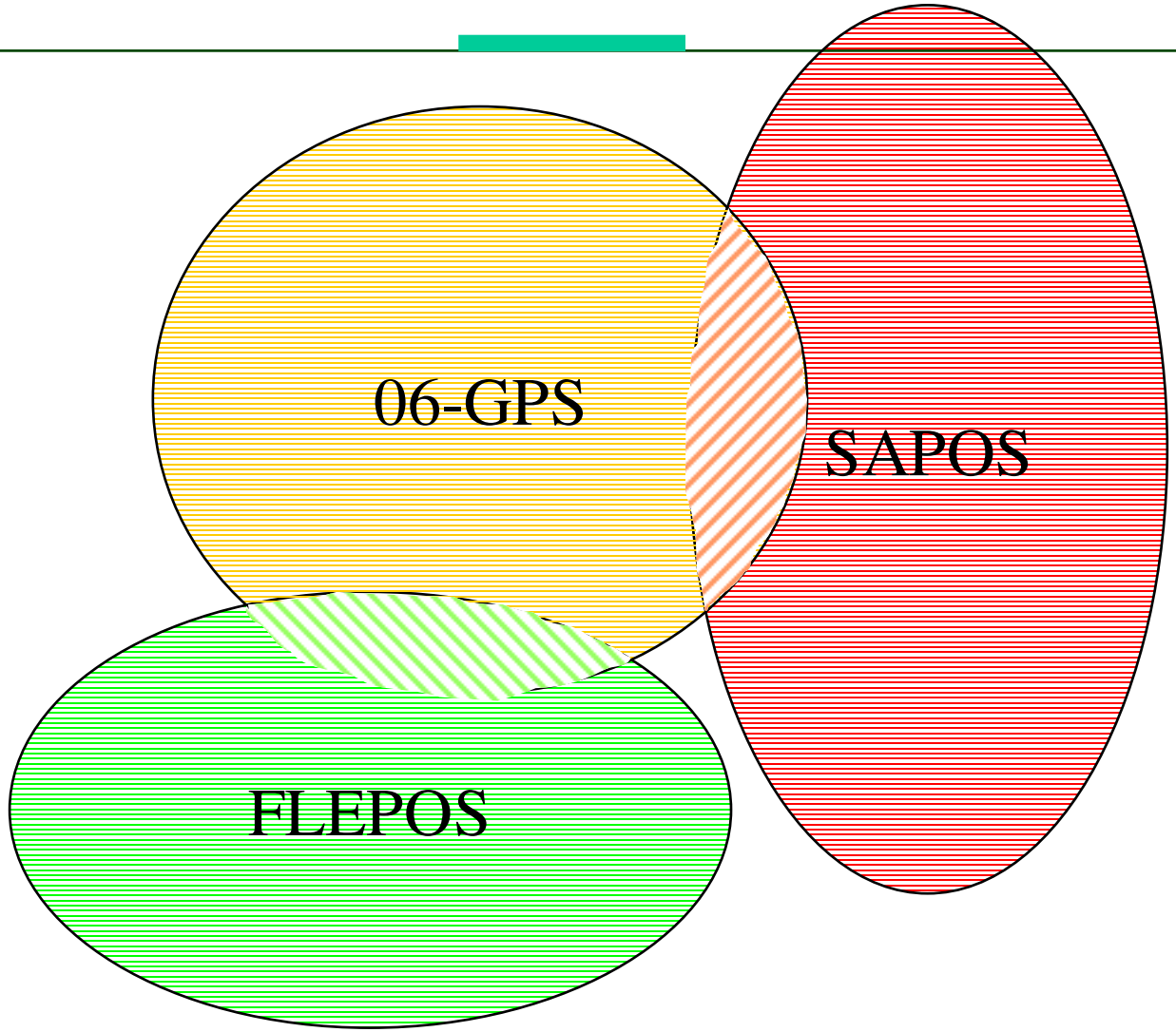
Certification of RTK-reference-stations

Computation

- 3 x 24 hours of data
- Bernese Software 4.2
- Fixed coordinates: published ETRS89 of AGRS.NL

Differences with SAPOS and FLEPOS



Different RTK-networks give different coordinates

Certification of RTK-reference-stations

Differences with SAPOS and FLEPOS

- < 1 cm
- Coordinates fixed to AGRS.NL are more consistent with RDNAPTRANS2004™
- Each RTK-network optimal for own region

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Update of ETRS89 for AGRS.NL

- ETRS89-coordinates of AGRS.NL differ significant from published coordinates.
  - changes in network configuration (Kootwijk -> Apeldoorn); coordinates of new station Apeldoorn less precise
  - since May 2000 new GPS hardware;
  - since November 2001 new realisation of ETRS89;
- Necessary improvement of the accuracy of orthometric NAP heights from

  GPS-measurements

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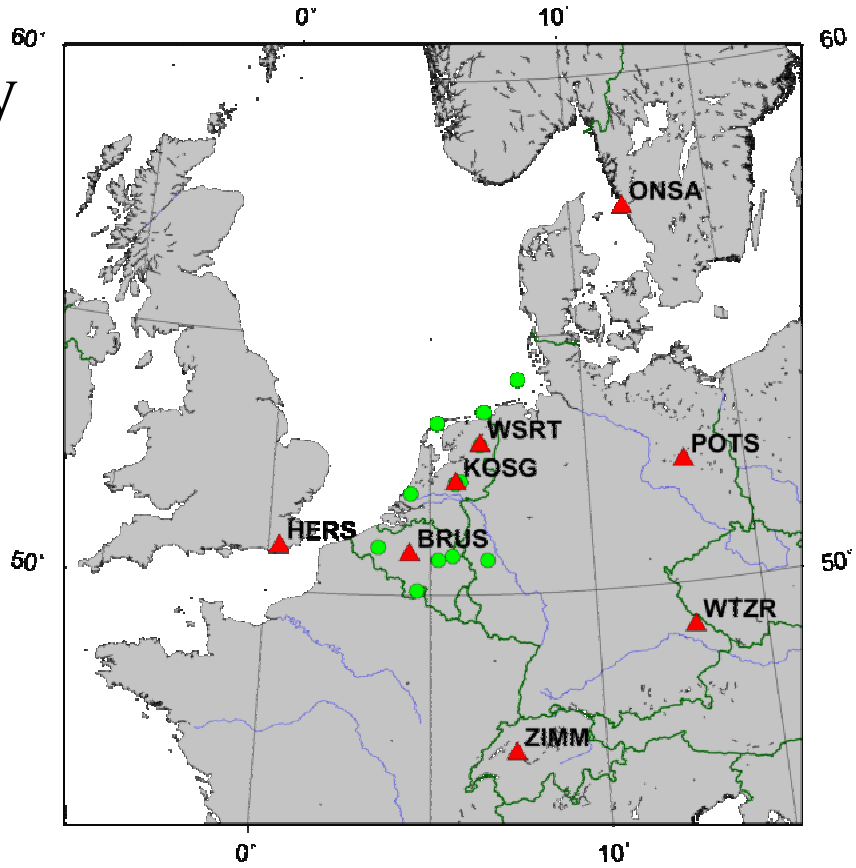
AGRS.NL in IGS network

- coordinate computation on daily basis;
- Bernese Software, vs. 4.2;
- 5 AGRS.NL plus 6 IGS stations;
- daily and yearly solutions in ITRS and ETRS89.



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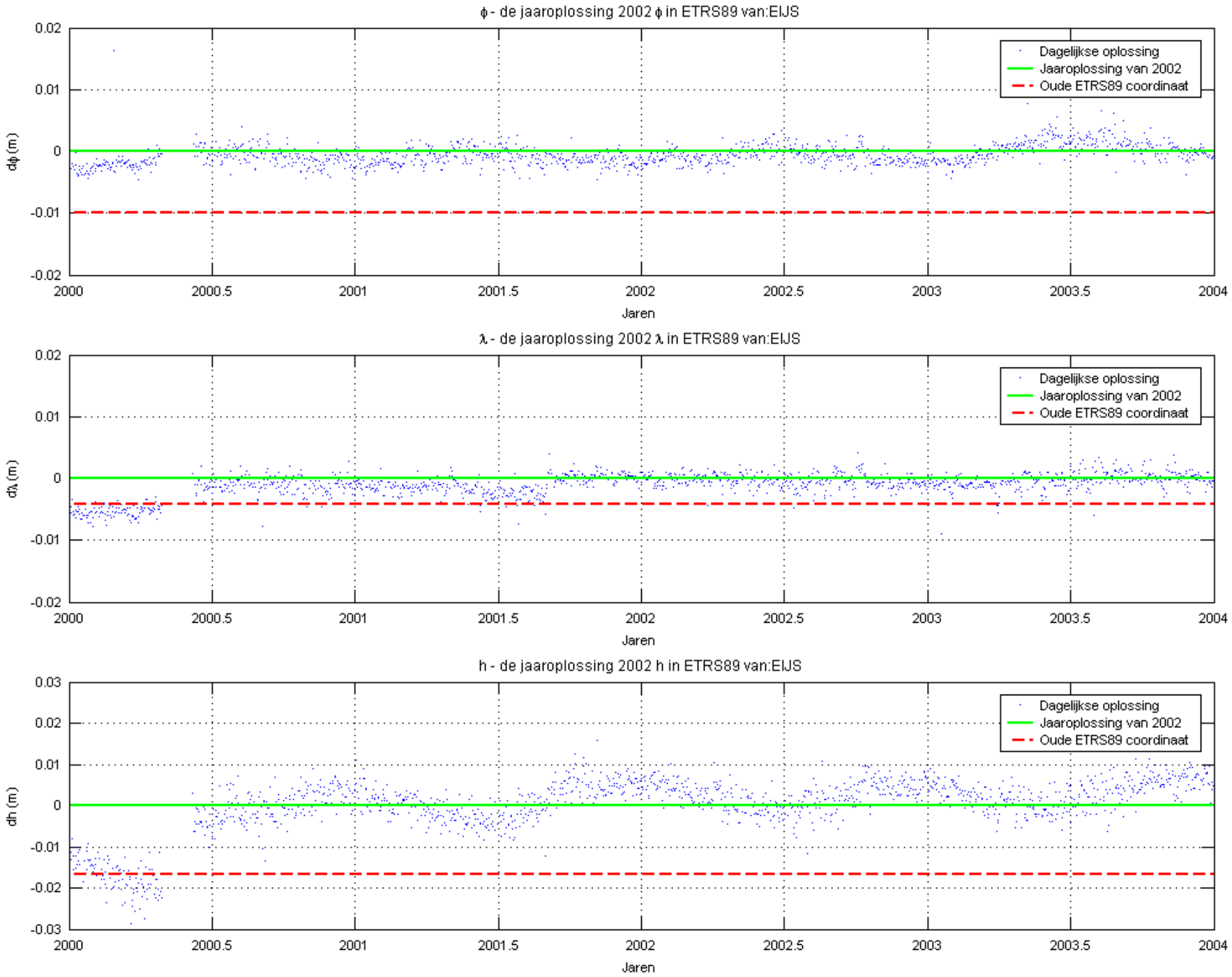
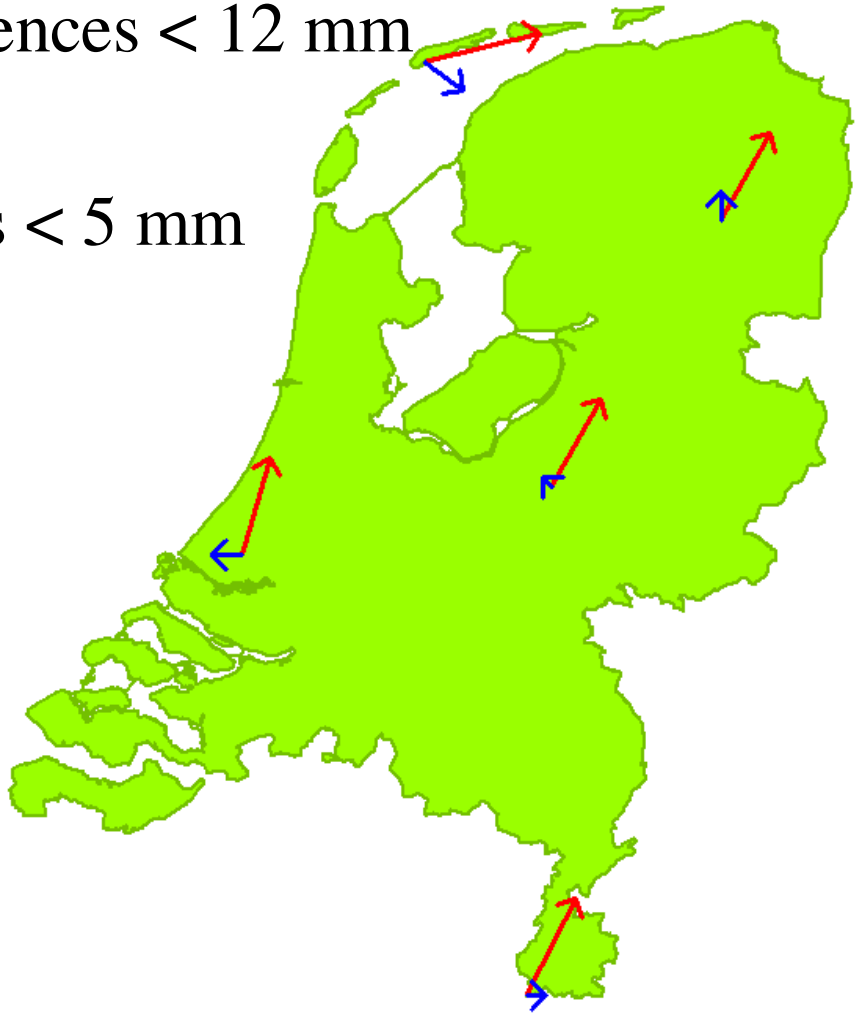

ϕ - de jaaroplossing 2002 ϕ in ETRS89 van:EIJS
dϕ (m)
Jaren
Dagelijkse oplossing
Jaaroplossing van 2002
Oude ETRS89 coordinaat
λ - de jaaroplossing 2002 λ in ETRS89 van:EIJS
dλ (m)
Jaren
Dagelijkse oplossing
Jaaroplossing van 2002
Oude ETRS89 coordinaat
h - de jaaroplossing 2002 h in ETRS89 van:EIJS
dh (m)
Jaren
Dagelijkse oplossing
Jaaroplossing van 2002
Oude ETRS89 coordinaat
0.02
0.01
0
-0.01
-0.02
0.03
-0.03
2000
2000.5
2001
2001.5
2002
2002.5
2003
2003.5
2004

Differences 1996 - 2002

differences < 12 mm

residuals < 5 mm



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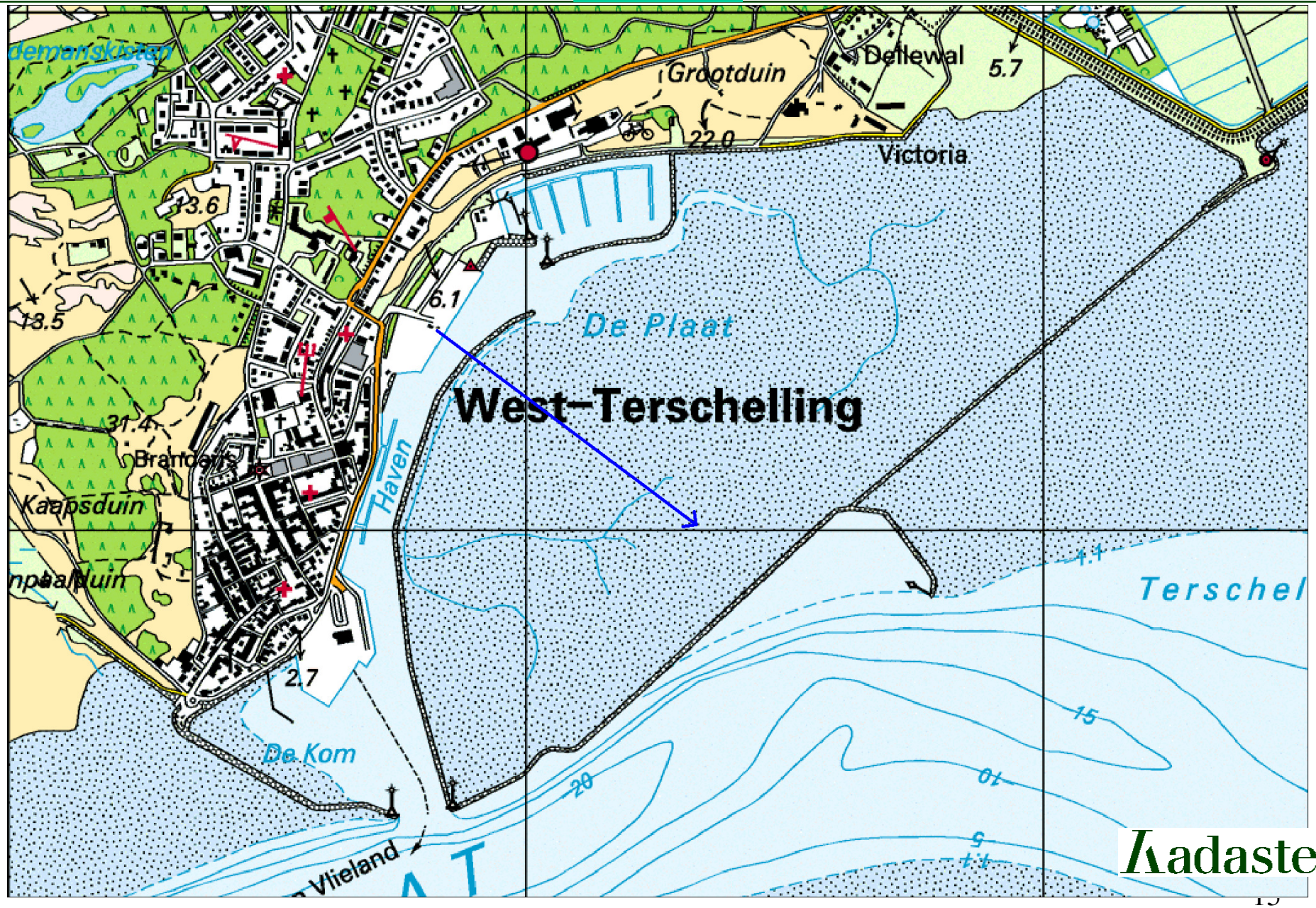
Displacement of station Terschelling



Tolerances for AGRS.NL coordinates

ETRS89-coordinates of the AGRS.NL reference stations are updated if the most recent yearly solution of the coordinates of one or more stations differ more than 3σ (~99.7% confidence region) of the published value.

Validation of AGRS.NL 2002.5 coordinates

yearly solution 2002.5:

	rms	tolerance
lat/lon	1,5 mm	5 mm
height	3,4 mm	10 mm

- tested against 2000, 2001 and 2003 solutions;
- tested against EPN weekly solutions over 2002;

  Differences:

  – maximum 2 mm lat/lon and 5 mm height;

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AGRS.NL 2002.5

ETRS89-coordinates of the AGRS.NL reference stations are fixed on the values of the yearly solution of 2002 and are referred to as:

ETRS89, based on the ITRS realisation ITRF2000 at epoch 2002.5.

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Consequenses of AGRS.NL update

- **RDNAPTRANS™2004**
  - New 7 par. Transformation for

    ETRS89 < > Bessel ellipsoid (RD)
  - RD-grid unchanged !
  - NLGEO2004
- **Re-computation of GPS-base points and certified reference stations**

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Résumé

- yearly solutions of 5 permanent stations in NL are a sufficient base for the maintenance ETRS89;
- tolerance of 3σ for update is practical;
- differences 1996 / 2002.5 justify update;
- 7-par. similarity transformation models the 1996 –2002.5 differences.
- Different coordinates for identical EUREF densification points such as RTK reference stations may exist

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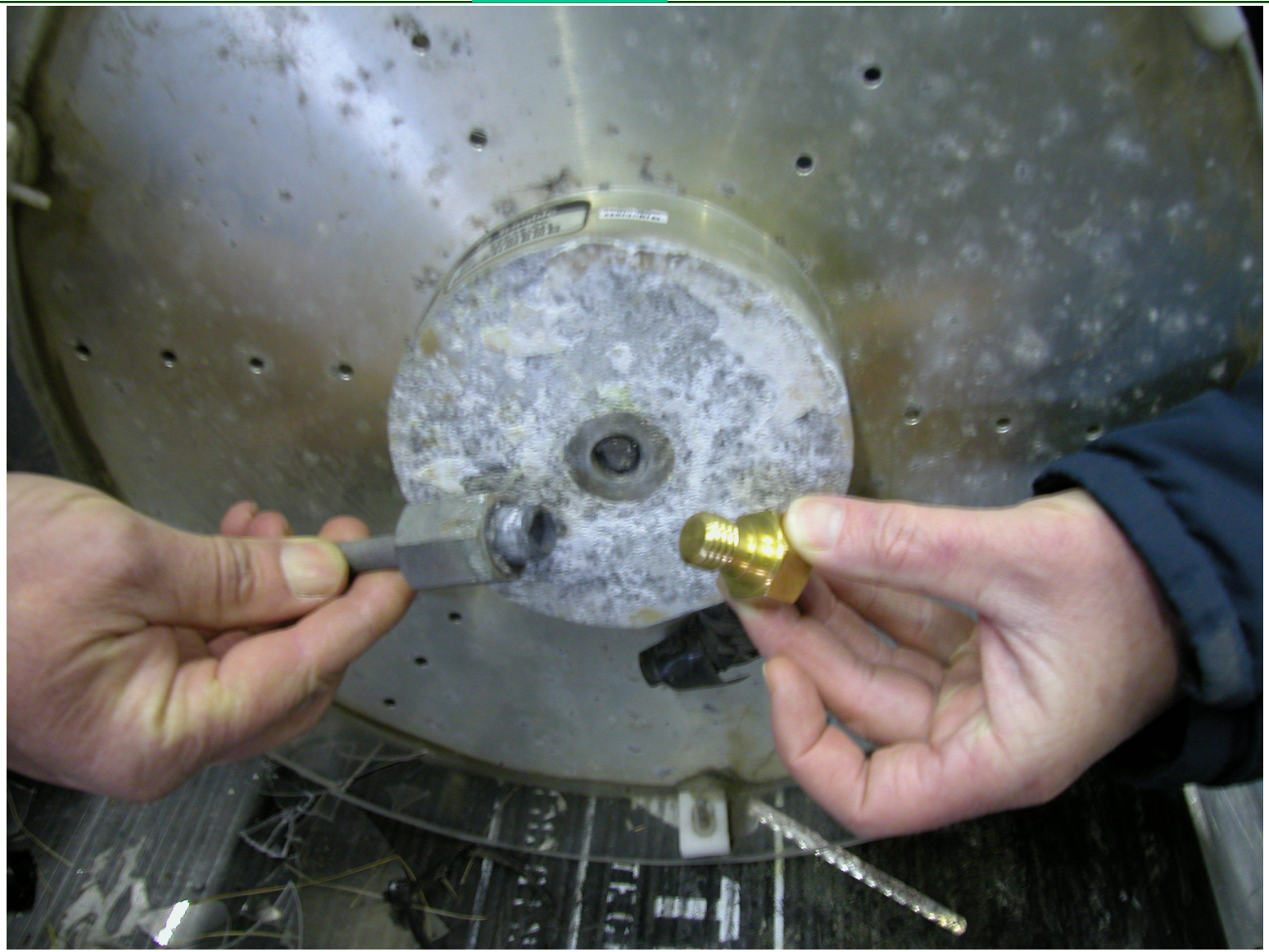
Always remind the monumentation



Aadaster