

7th EUPOS Meeting

NATIONAL REPORT OF SLOVENIA

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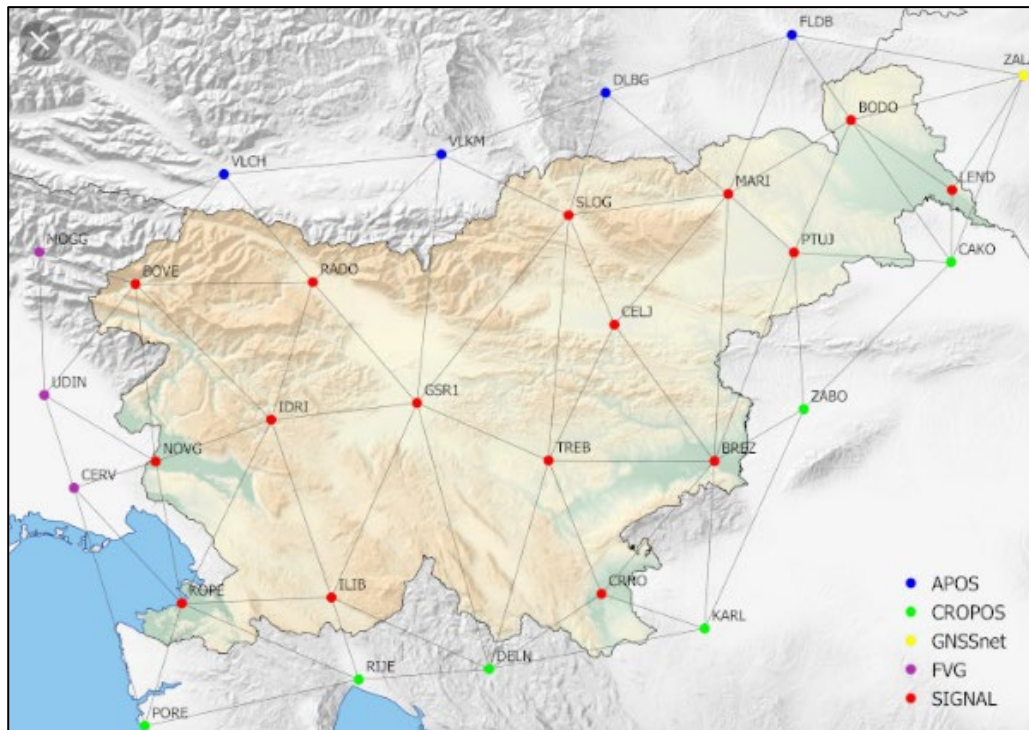
Bucharest - online, November 9–10, 2021

PRESENTATION TOPICS

- **Active GNSS Networks: SIGNAL & Zero Order Networks**
- **Newly Proposed EPN Stations**
- **Trimble Online Processing Service**
- **Passive GNSS Control Network**
- **New Freware Transformation Tools**
- **Targeted research project V2-1924**

SIGNAL NETWORK (GBAS)

- **16** continuously operating GNSS stations in Slovenia (8 Trimble + 8 Leica)
- **+14** continuously operating GNSS stations in Austria, Croatia, Hungary & Italy
- **1** EPN station (GSR1 – Ljubljana, EUREF Class A)
- Trimble Pivot Platform, Alberding Quality Control for monitoring



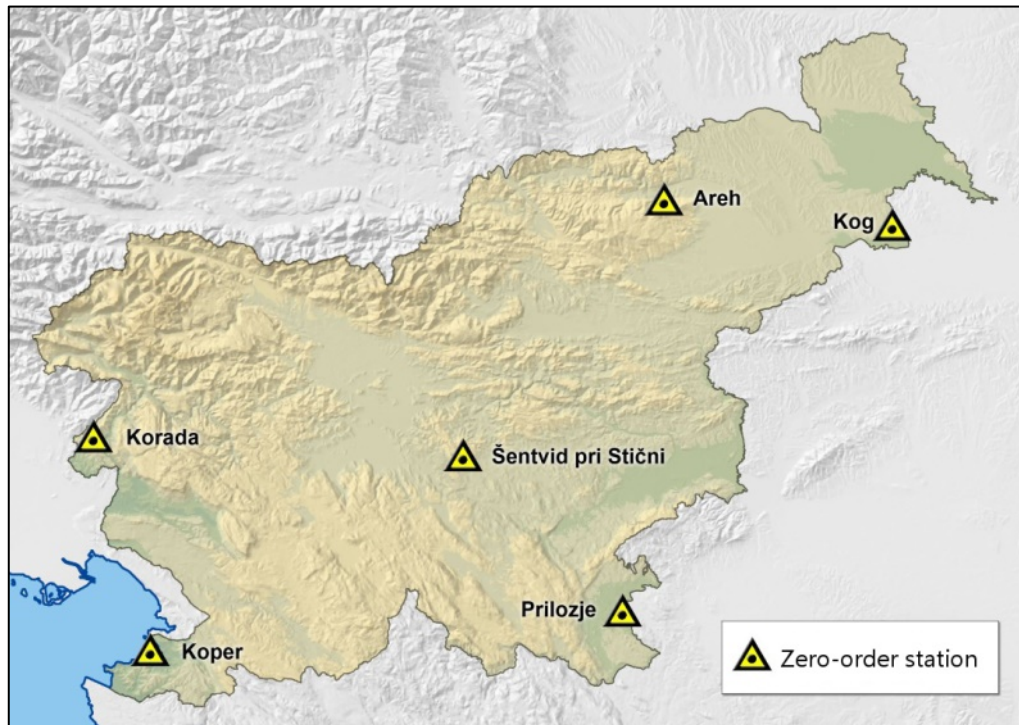
SIGNAL NETWORK (GBAS)

- New station coordinates in **ETRS89/D96-17** since January 1st 2020.
- Renaming 6 stations to be compatible with their IERS DOMES numbers.
- Since beginning of 2020 replaced 7 GNSS receivers/antennas – network now fully Galileo capable.
- New station in **Koper (KOPR)**, existing location is problematic.
- Planning upgrade to **multi GNSS** in December with Trimble RTX module, currently in testing phase.
- TOP module issue in TPP 4.3.
- New website.



ZERO ORDER GNSS NETWORK

- 6 continuously operating GNSS stations in Slovenia (Leica)
- 4 of them are **twin stations**, 1 combined with a **tide gauge station**, 1 with a **seismic station**, 1 near an old **triangulation point**, 1 near an **absolute gravimetric point**; all stations connected to the first order levelling network
- Operating for more than 5 years, Alberding Quality Control



ZERO ORDER GNSS NETWORK

- New station coordinates in **ETRS89/D96-17** since January 1st 2020.
- All stations are members of **EPOS Network** since October 2020.
- **1** GNSS receiver and antenna replaced.
- Sending station data to Slovenian Meteorological Service for **ZTD data**.
- New **0 Order Network website** as part of SIGNAL Network website.



ZERO-ORDER GNSS NETWORK

3 newly proposed EPN stations:

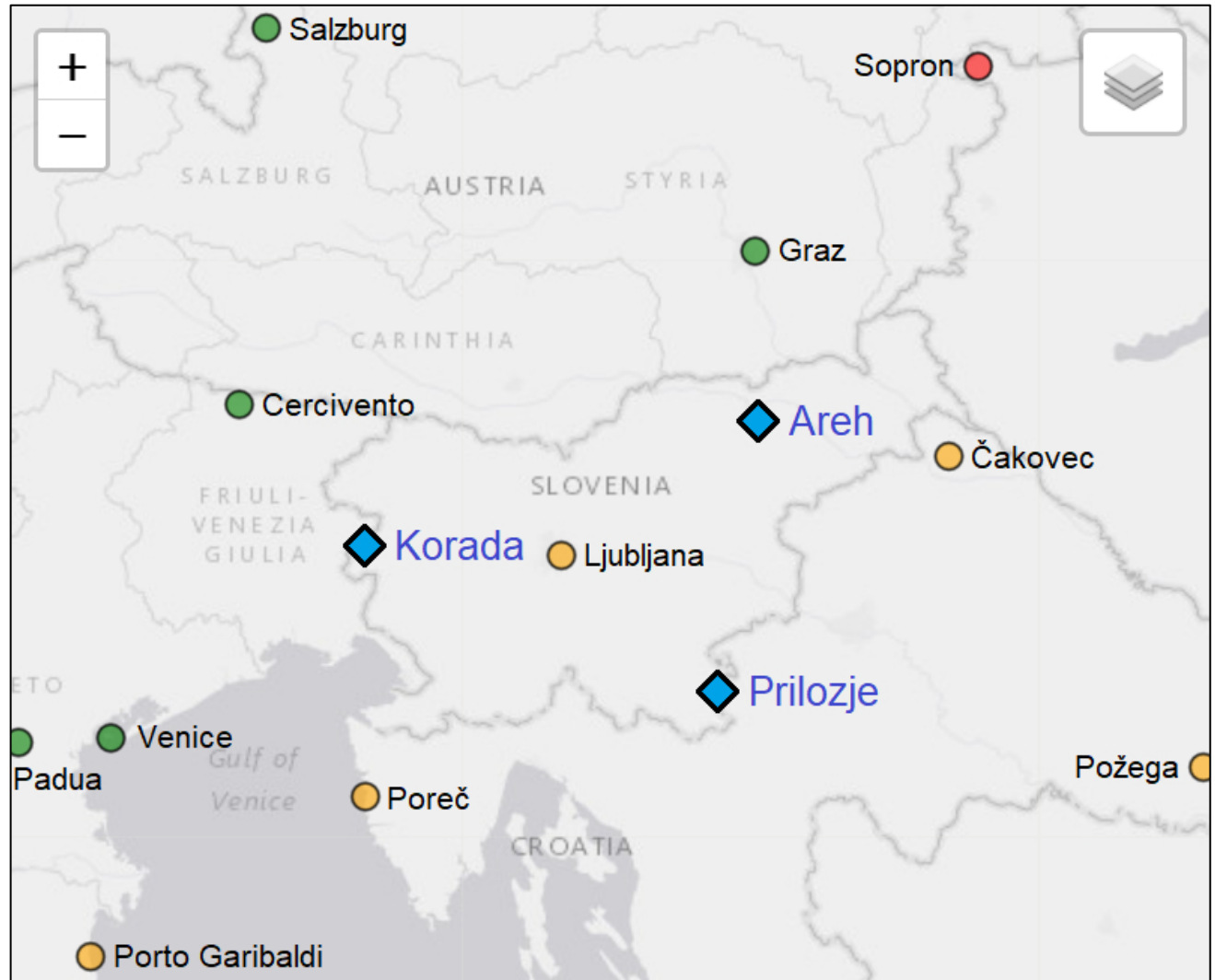
- ARA2 ... Areh east
- KDA2 ... Korada east
- PZA2 ... Prilozje east



ZERO-ORDER GNSS NETWORK

3 newly proposed EPN stations:

- Areh
- Korada
- Prilozje



ZERO-ORDER GNSS NETWORK

... twin stations:

- ARA2 (Leica GR25) ... collocated GNSS station ARA1 (Leica GR30),
micro weather station (Vaisala WXT520)
precision inclination sensor (Leica Nivel 210)
collocated absolute gravity point
- KDA2 (Leica GR25) ... collocated GNSS station KDA1 (Leica GR30),
micro weather station (Vaisala WXT520)
precision inclination sensor (Leica Nivel 210)
collocated first-order triangulation point
- PZA2 (Leica GR30) ... collocated GNSS station PZA1 (Leica GR25),
micro weather station (Vaisala WXT520)
precision inclination sensor (Leica Nivel 210)

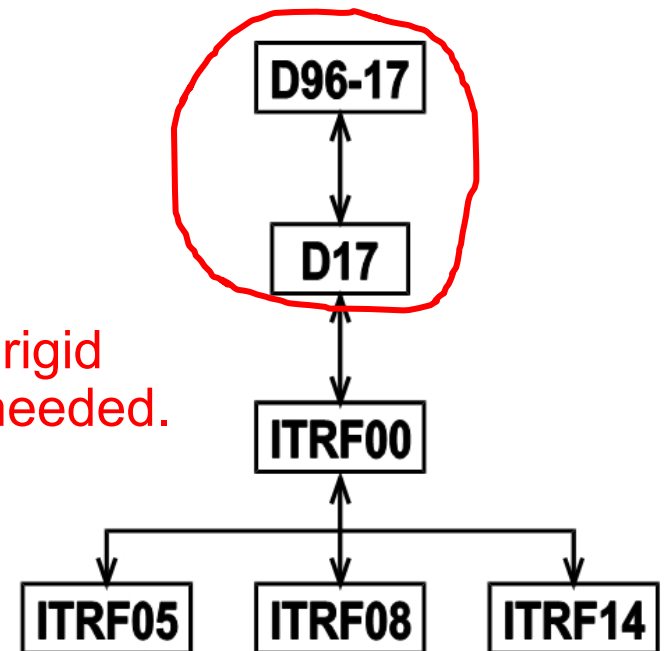
... direct connection to the first-order levelling network

SIGNAL NETWORK SERVICES – OPEN ISSUE

Trimble Online Processing (TOP) Module (for fast static GNSS surveys)

- ... problems with the application setup
(resulting in low accuracy of coordinates)
- ... an appropriate transformation to ITRF2014 needed
- ... any experiences to share?

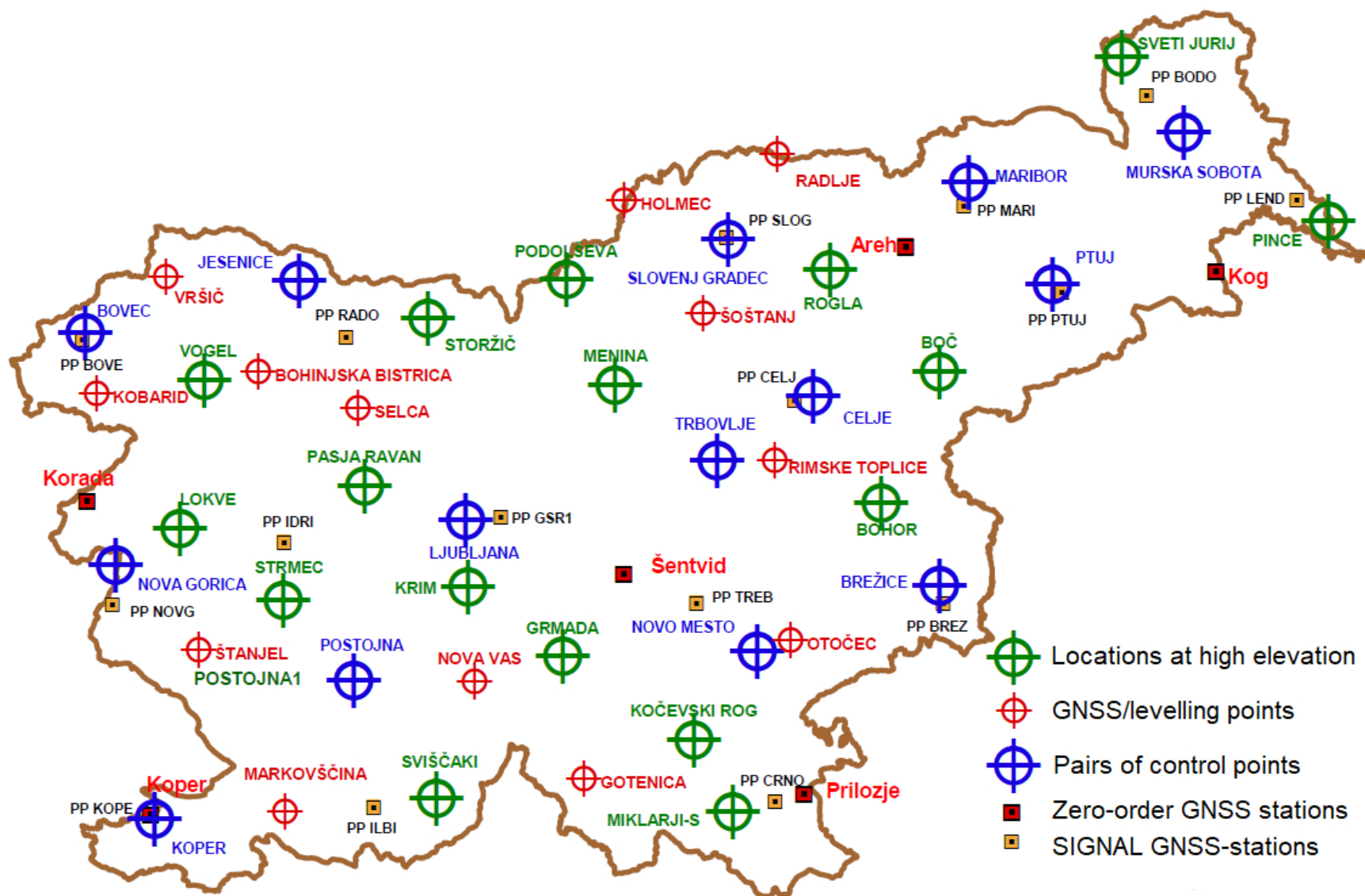
Specific character of D96-17: additional spatial rigid
(6-parametric) transformation to ETRF2000 is needed.



PASSIVE GNSS CONTROL NETWORK

- **Established to:**
 - monitor the quality of GNSS network products and services
 - verify the quality of GNSS measurement methods and equipment
- **44 locations in total:**
 - 14 locations with calibration baselines (pairs of points) for testing according to ISO 17123-8
 - 17 control points at high elevations
 - 13 GNSS/levelling points

PASSIVE GNSS CONTROL NETWORK



PASSIVE GNSS CONTROL NETWORK

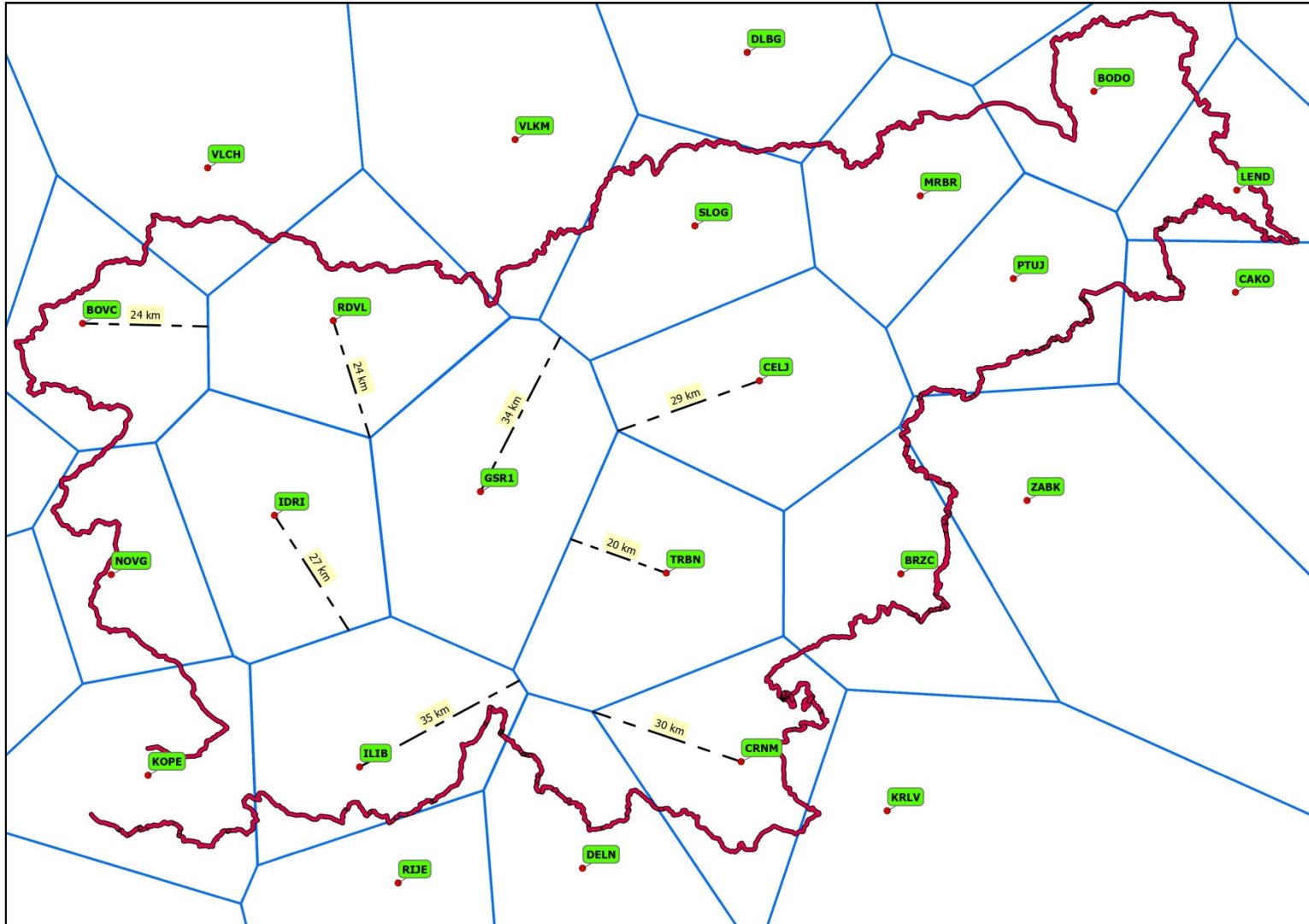


Test measurements on
pairs of control points



RTK QUALITY CONTROL IN CRITICAL AREAS

- More than 20 km from the nearest GNSS station



FREEWARE TOOLS FOR TRANSFORMATIONS

SiVis ... an online application for:

- height transformation between the old and new Slovenian height reference systems (SVS2000 ↔ SVS2010)

... only for GNSS-based heights

Format:

- TXT

SiVis - Pretvorba višin med višinskimi sistemi RS

Interaktivni vnos koordinat

φ / n

λ / e

h nad GRS80

Rezultat: H v SVS2010 (Koper)

45.25 < φ < 46.99992, 13.25 < λ < 16.75

Branje podatkov iz datoteke

Datoteka: Datoteka ni izbrana.

* Datoteka max 60 KB - pribl. 1500 točk

[Navodila - PDF](#) [Navodila - HTML](#)

v2.0 - maj 2019

Podatki

fi	45.987890
lambda	15.789654
H v SVS2000 (Trst)	100.0000

Rezultati

N v SVS2000 (Trst)	45.5891
N v SVS2010 (Koper)	45.8337
H v SVS2010 (Koper)	99.7554

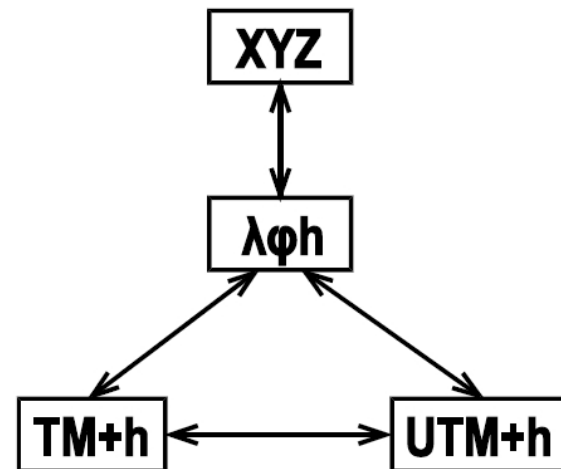
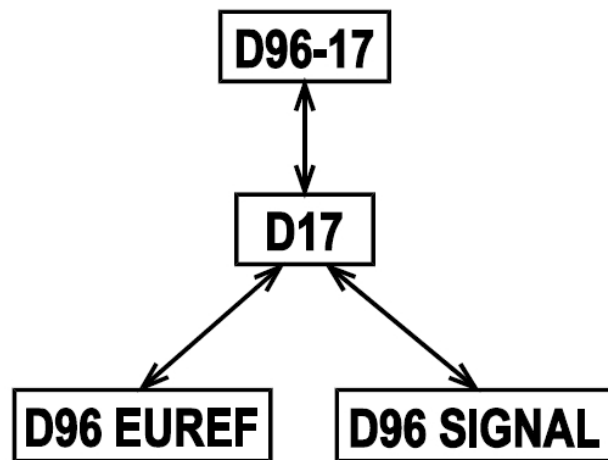
[Nov izračun](#)

FREEWARE TOOLS FOR TRANSFORMATIONS

ETRS89-SI ... a desktop application for:

- coordinate transformation between the Slovenian realizations of ETRS89 (D17, D96-17, D96 EUREF, D96 SIGNAL)

Datum transformations & Coordinate conversions



FREEWARE TOOLS FOR TRANSFORMATIONS

ETRS89-SI

Formats:

- CRD
- CSV
- TXT
- XYZ

The screenshot shows a software window titled "ETRS89-SI – Transformacije koordinat med slovenskimi realizacijami ETRS89". The window is divided into four main sections for selecting source and target geodetic datums and coordinate systems. In the "Izvorni geodetski datum:" (Source geodetic datum) section, "D96 SIGNAL" is selected. In the "Ciljni geodetski datum:" (Target geodetic datum) section, "D96-17 (v uporabi od 1. 1. 2020)" is selected. In the "Izvorni koordinatni sistem:" (Source coordinate system) section, "Kombinirani TM+h (e, n, h)" is selected. In the "Ciljni koordinatni sistem:" (Target coordinate system) section, "Kombinirani TM+h (e, n, h)" is selected. At the bottom, there is a file selection area with a question mark icon, a "Datoteka" button, and the text "PRIMER.TXT". Below this are two buttons: "Transformacija" and "Izhod".

ETRS89-SI – Transformacije koordinat med slovenskimi realizacijami ETRS89

Izvorni geodetski datum:

- ☐ D96 EUREF
- ☒ D96 SIGNAL
- ☐ D96-17 (v uporabi od 1. 1. 2020)
- ☐ D17 (ni bil uveljavljen)

Ciljni geodetski datum:

- ☐ D96 EUREF
- ☐ D96 SIGNAL
- ☒ D96-17 (v uporabi od 1. 1. 2020)
- ☐ D17 (ni bil uveljavljen)

Izvorni koordinatni sistem:

- ☐ Kartezični (X, Y, Z)
- ☐ Geodetski (la, fi, h)
- ☒ Kombinirani TM+h (e, n, h)
- ☐ Kombinirani UTM+h (e, n, h)

Ciljni koordinatni sistem:

- ☐ Kartezični (X, Y, Z)
- ☐ Geodetski (la, fi, h)
- ☒ Kombinirani TM+h (e, n, h)
- ☐ Kombinirani UTM+h (e, n, h)

? Datoteka PRIMER.TXT

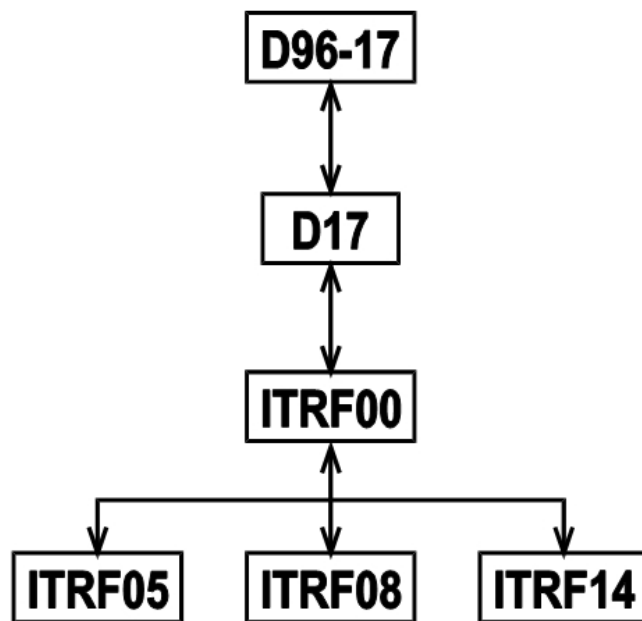
Transformacija Izhod

FREEWARE TOOLS FOR TRANSFORMATIONS

ITRS-SI ... a desktop application for:

- time-dependent coordinate and velocity transformation between the Slovenian realizations of ETRS89 (D17, D96-17) and realizations of ITRS (ITRF2000, ITRF2005, ITRF2008, ITRF2014)

Datum transformations



Source and target frames

Transformacija iz v → ↓	D96-17	D17	ITRF00	ITRF05	ITRF08	ITRF14
D96-17	–	2	1	1	1	1
D17	2	–	1	1	1	1
ITRF00	1	1	2	2	2	2
ITRF05	1	1	2	2	2	2
ITRF08	1	1	2	2	2	2
ITRF14	1	1	2	2	2	2

... with the number of transformation steps

FREeware TOOLS FOR TRANSFORMATIONS

ITRS-SI

Formats:

- CRD & VEL
- CSV
- TXT
- XYZ

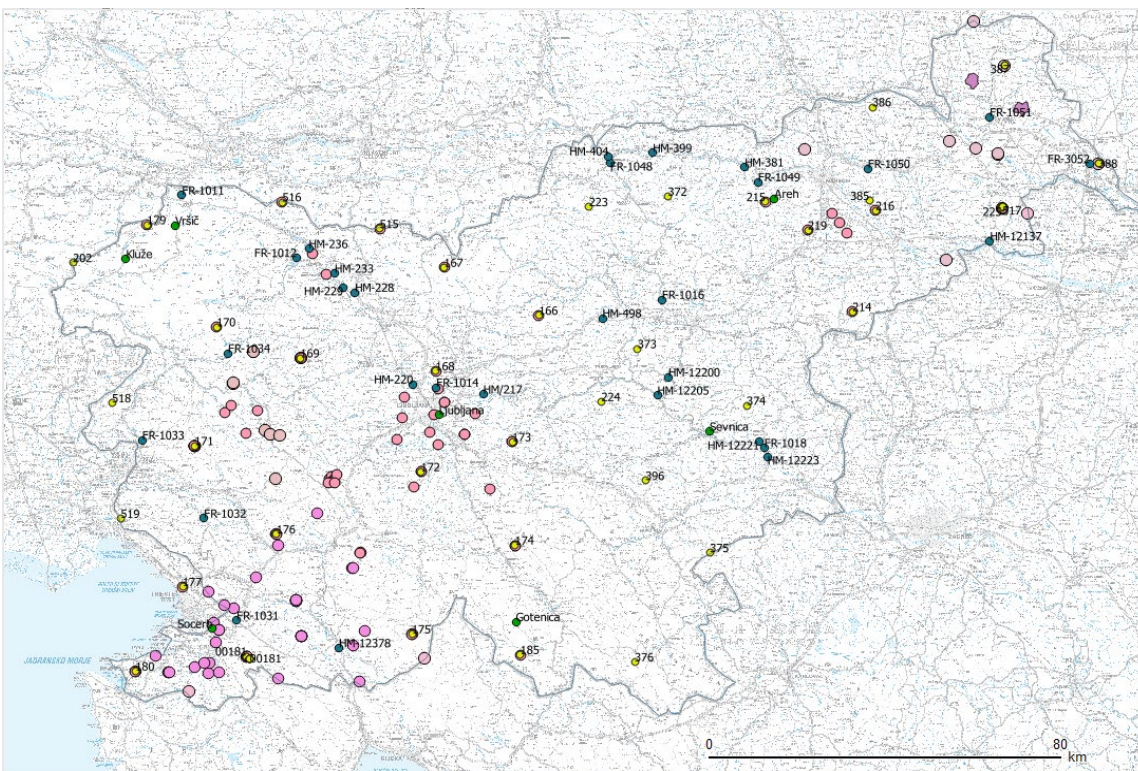
The screenshot shows the 'ITRS-SI – Transformacije med slovenskimi realizacijami ETRS89 in realizacijami ITRS' window. It contains several configuration sections:

- Realizacija ETRS89:** Radio buttons for 'D96-17' and 'D17 (ETRF2000)'. 'D17 (ETRF2000)' is selected.
- Realizacija ITRS:** Radio buttons for 'ITRF2020', 'ITRF2014', 'ITRF2008', 'ITRF2005', and 'ITRF2000'. 'ITRF2014' is selected.
- Čas določitve ITRS-koordinat (v UTC):** A time selection area with input boxes for 'leto' (2020), 'mesec' (1), 'dan' (1), 'ura' (0), 'minuta' (00), and 'sekunda' (00).
- Smer transformacije:** Radio buttons for 'ETRS89 --> ITRS' and 'ITRS --> ETRS89'. 'ETRS89 --> ITRS' is selected.
- Vektorji hitrosti:** Radio buttons for 'ničelni (v ETRF2000)', 'iz vhodne datoteke', and 'iz modela (različica 1.0)'. 'iz vhodne datoteke' is selected.
- File handling:** A section with a question mark icon, a 'Datoteka' button, and the text 'PRIMER.TXT'.
- Buttons:** 'Transformacija' and 'Izhod' buttons at the bottom.

TARGETED RESEARCH PROJECT V2-1924: PERMANENT GEODETIC MARKS AS A BASIS FOR THE HIGH-QUALITY PERFORMANCE OF THE GEODETIC PROFESSION, 2019-2021

Conducted by Geodetic Institute of Slovenia and University of Ljubljana, Faculty of Civil and Geodetic Engineering

Financed by the Slovenian Research Agency and the Surveying and Mapping Authority of the Republic Slovenia.



Identified locations of interesting geodetic marks with potential for future cultural heritage preservation. Pink – proposals from interviews, blue – benchmarks, green – gravimetric points, yellow – first order trigonometric points.

Slovenian National Report, EUPOS Symposium 2021



Past cadastral and at the same time trigonometric mark, 1819



Past trigonometric pillar, 1926

Thank you for your attention