

# COUNTRY REPORT BERLIN GERMAN FEDERAL STATE

Dr. Christian Rentsch, Senate Department for Urban Development, Building and Housing  
8th EUPOS, Ljubljana, Slovenia, Nov. 15th+16th 2022

**BERLIN**



# Outline

- Technical transformation parameter ITRFxxx to ETRS89/DREF91
- GNSS campaign 2022 in Berlin
- Summary

# Technical transformation parameters from ITRFxxx to ETRS89/DREF91

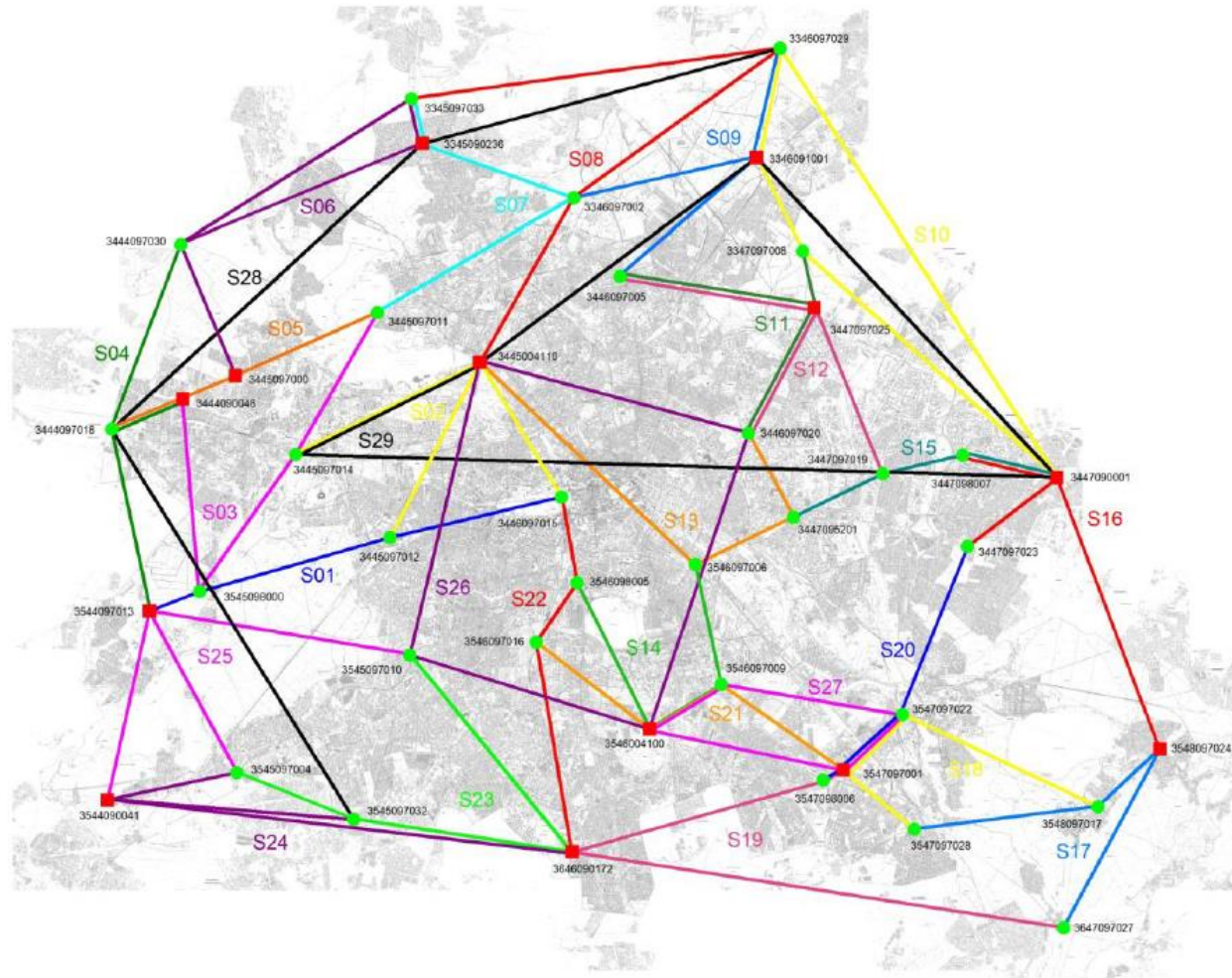
- Regarding drifts of the continental plates the coordinate system used as reference frame (ETRS89/DREF91) moves 1-2 cm per year respectively to the ITRFxxxx.
- The technical transformation parameters are estimated the first time 2022 and will be yearly estimated. The data of GNSS reference stations are used as basis for the estimation.
- The technical transformation parameters are going to be published on the AdV-webpage ([www.adv-online.de](http://www.adv-online.de)).

# GNSS campaign 2022 in Berlin - Overview

- GNSS campaign 2022 in Berlin on 42 geodetic groundnetwork points (GGP)
- Observations
  - February 28th - March 25th 2022
  - 29 sessions a 2 hours
  - 1 s data recording for 4G (GPS, GLONASS, GALILEO, BEIDOU)
  - Each GGP observed at least tow times
  - 4 surveying teams with GNSS reference station antennas and receivers
  - SA*POS* reference stations in Berlin and Brandenburg
- First analyses by a master student
- Goal of the GNSS campaign: Survey and validation of the GGP.



# GNSS campaign 2022 in Berlin



# Goals of the master thesis

- Master thesis in cooperation with the Berliner Hochschule für Technik (BHT)
- Analyses with the software tool „Wapnet“
- Preliminary outlier check of data
- Investigations with the observed data
  - Calibration correction files
  - GNSS constellations
- Preliminary coordinates for further investigations at the Senate Department.

# Results of the Master thesis (1)

## Calibration files

- Least square inversion calibration files: chamber calibration, roboter-based calibration files, GNSS antenna type-based calibration files and no calibration files.
- Result of the observed data in Berlin: Individual calibration files are required for high accuracy. GNSS antenna type-based are less accurate than the individual calibration files. If no individual calibration files exist, the use of GNSS antenna type-based calibration files will increase the accuracy.
- The coordinate computation will use roboter base correction files.

Kalibrierung	$\sigma$ -North [mm]	$\sigma$ -East [mm]	$\sigma$ -Höhe [mm]	max. rel. Verb. [mm]	$\sigma_0$ (rel. Pos.) [mm]
Roboter	0,9	0,9	2,0	9,0 (7022: H)	2,3
Kammer	0,9	0,9	1,8	7,9 (7015: H)	2,2
Typ	1,4	1,1	1,8	7,5 (7015: H)	2,5
ohne	1,4	1,1	2,5	9,3 (7033: H)	3,1

Tabelle 5.6: Ergebnisse der Hauptanalyse 3 (Einfluss der Antennenkalibrierung). Quelle: Eigene Darstellung

# Results of the Master thesis (2)

## GNSS constellations

- Least square inversion: 4G (GPS/GLONASS/GALILEO/BEIDOU), 2G (GPS/GLONASS), GPS/GALILEO and GPS/GALILEO/BEIDOU
- Result of observed data in Berlin: The best results are derived for 4G. The constellation of GPS/GALILEO and GPS/GALILEO/BEIDOU are less accurate. The results of 2G are less accurate as the results of 4G.
- The coordinate computation will use 4G data.

GNSS	$\sigma$ -North [mm]	$\sigma$ -East [mm]	$\sigma$ -Höhe [mm]	max. rel. Verb. [mm]	$\sigma_0$ (rel. Pos.) [mm]
4G	0,9	0,9	2,0	8,6 (7022: H)	2,4
GPS + GLO	0,9	0,9	2,4	15,7 (7015: H)	2,6
GPS + GAL	0,9	0,9	2,1	11,2 (7022: H)	2,5
GPS + GAL + BEI	0,9	0,9	2,1	9,0 (7022: H)	2,5

Tabelle 5.5: Ergebnisse der Hauptanalyse 2 (Einfluss der GNSS-Konfiguration). Quelle: Eigene Darstellung



# Additional points to the GNSS campaign 2022 in Berlin

- Further investigations will be based on the preliminary results of the Master thesis.
- Additional investigations and computations are in progress.
- Further measurements are performed in winter 2022/23.
- It is planned to finalize the investigation in 2023.



# Summary

- Technical transformation parameter are yearly computed and published.
- GNSS campaign in the federal state of Berlin has been performed. In a first step data have been investigated in a Master thesis.
- GNSS-antenna Calibration data are important for achieving high accuracies.
- 4G improves the accuracy of surveying with GNSS. According to the Master thesis GPS/GLONASS is less accurate than 4G, GPS/GALILEO or GPS/GALILEO/BEIDOU.

# Thank you.

Senate Department für Urban Development, Building and Housing  
Dept. III - Geoinformation  
Group III B 1 - Geodetic Reference Systems  
Dr. Christian Rentsch  
Fehrbelliner Platz 1  
Germany

Tel.: +49 (0) 90139 5370

Mail: [Christian.Rentsch@Senstadt.berlin.de](mailto:Christian.Rentsch@Senstadt.berlin.de)

**BERLIN**

