



Federal Agency for  
Cartography and Geodesy

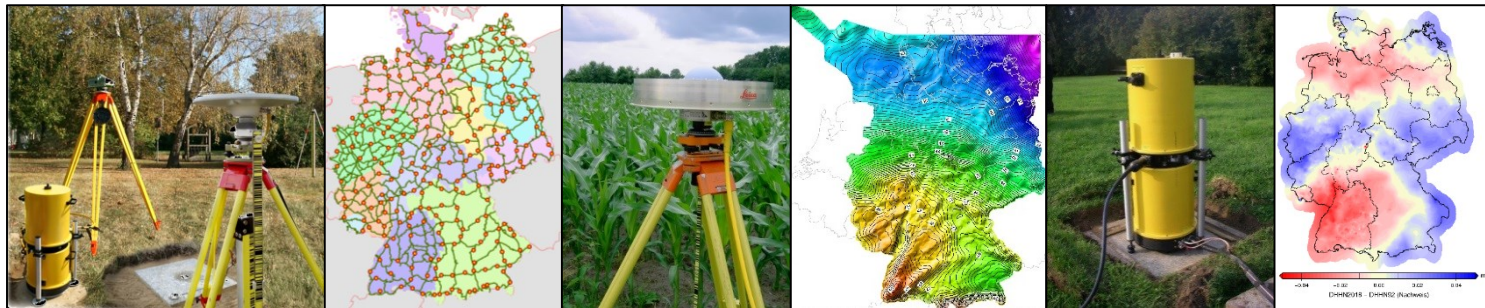
# National Report of Germany

Martina Sacher et al.

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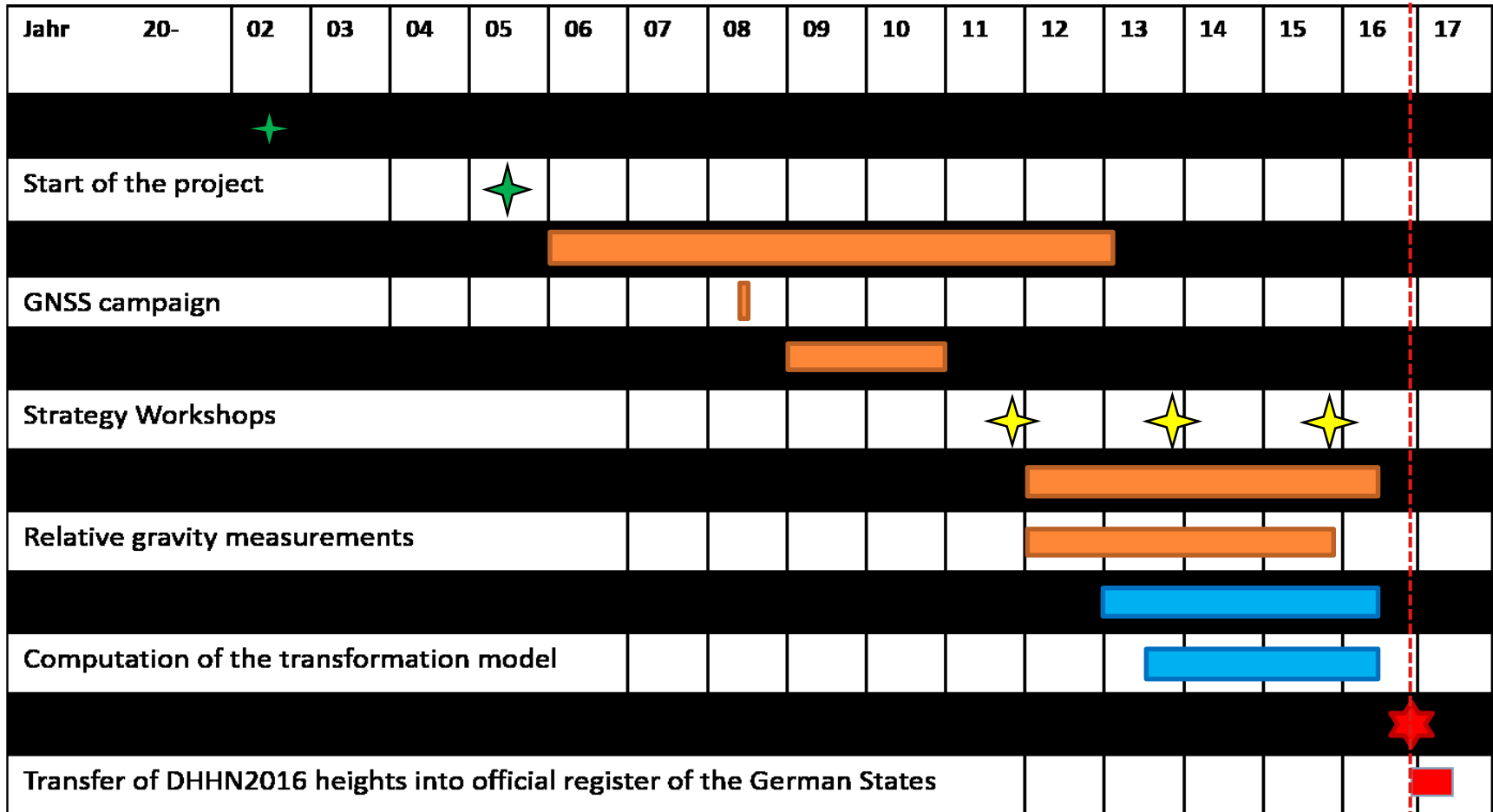
# Introduction of Integrated Geodetic Spatial Reference 2016

All components  
of the geodetic spatial reference  
(3d-position, height, gravity)  
have been planned, measured/observed and analyzed together  
in a common measurement epoch



# Timeline of the project

01.12.2016



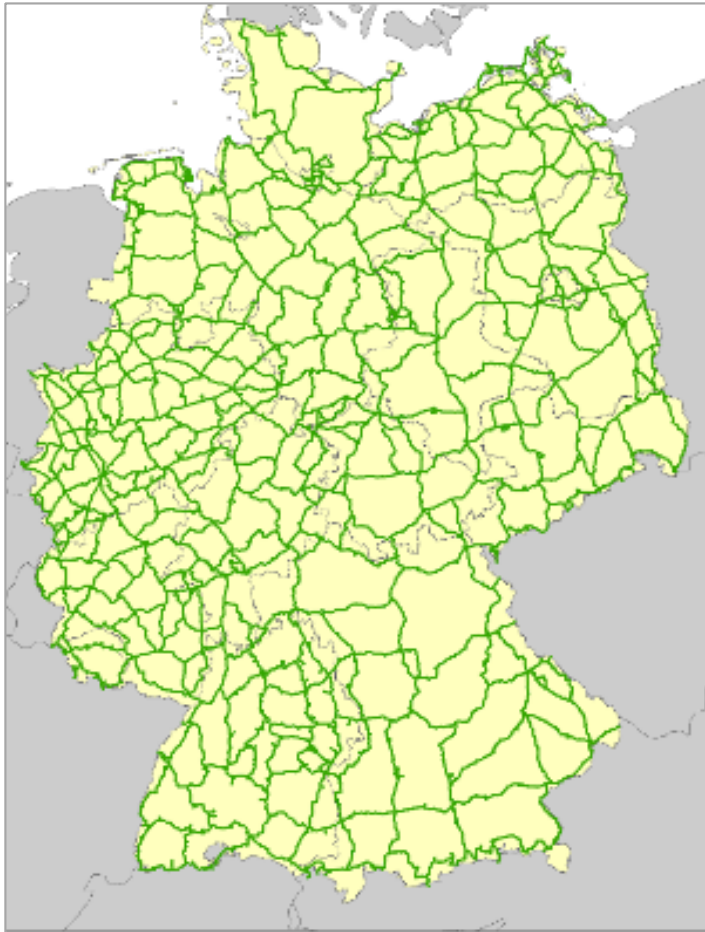
# Integrated Geodetic Spatial Reference 2016

## Introduction of the components

- [DHHN2016](#): new official realization of the German height reference system
- [ETRS89/DREF91/2016](#): improved coordinates for the German reference network SAPOS®
- [GCG2016](#): new official quasigeoid (German Combined Quasigeoid)
- [DHSN2016](#): official gravity reference frame
  - Many new absolute measurements – validation of the level
- [HOETRA2016](#): module for height transformation from DHHN92 to DHHN2016

# Deutsches Haupthöhennetz

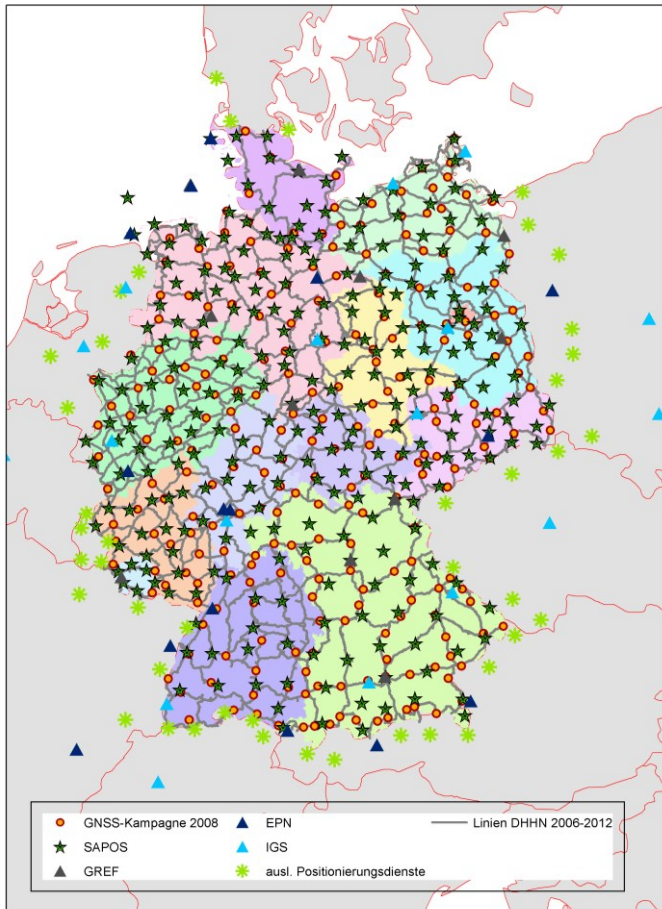
## DHHN2016



- Normal heights referred to NAP
- Mean tide system
- Height differences to former realization DHHN92: +/- 35 mm (except for mining areas)

Parameter	
lines	991
Nodal points	680
Datum points	72
degrees of freedom	311
$s_0$ of 1 km leveling	0.64 mm
Length of overall loop	5 350 km
Closing error of overall loop	13.7 mm
Number of leveling points	59 583
Total length of measurements	29 809 km

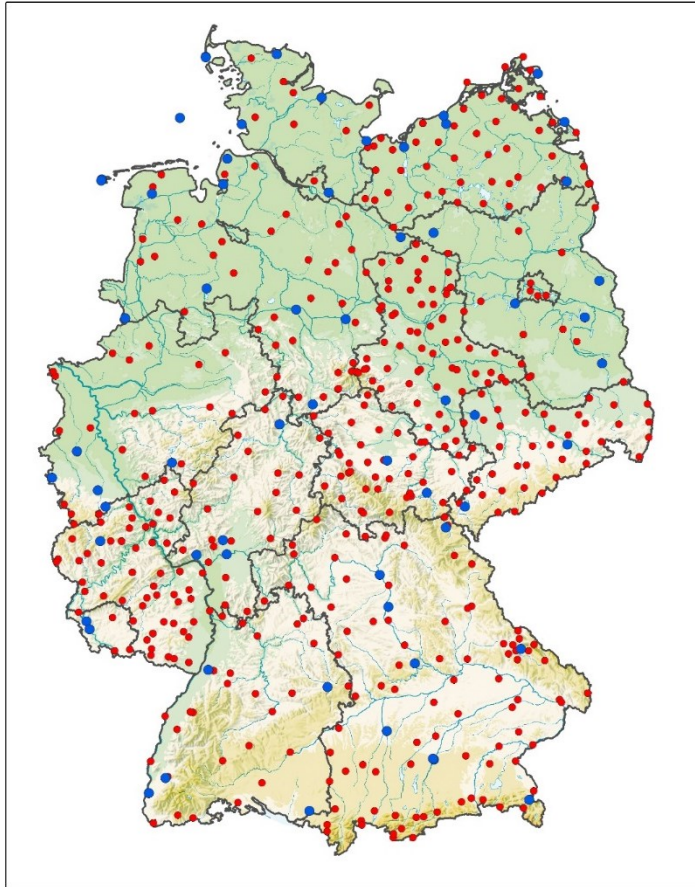
# ETRS89/DREF91 Realization 2016



- GNSS campaign 2008
  - 250 control stations (GGP)
  - 350 reference stations (IGS/EPN/GREF/SAPOS)
- Adjustment without constraints (orbits IGS2005)
- Transformation into ITRF2005
- Transformation into ETRF2000 (memo 8)
- Systematic differences to the Realization ETRS89/DREF91(2002)
- Transformation into ETRS89/DREF91/2016 (3 rotations)
  - Differences in the position minimized (no relevant to real property cadaster)
  - Almost no height changes compared to ETRF2000



# Absolute gravity measurements in Germany



Measurements since 2005:

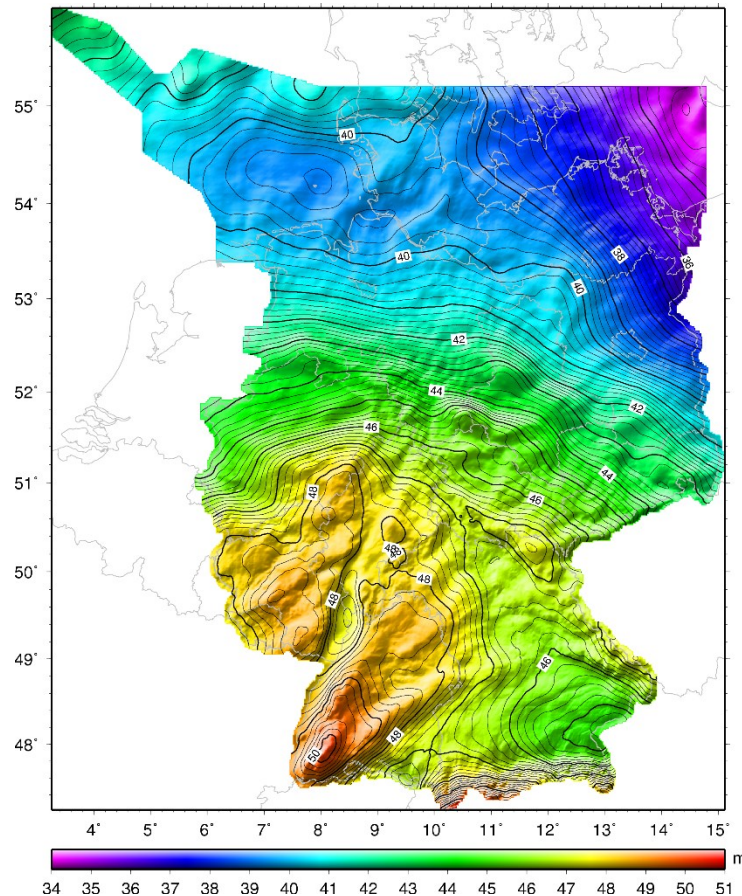
- 64 with FG5
- 499 with A10

**Absolute gravity measurements with**

• FG5 • A10

# German Combined Quasigeoid

## GCG2016



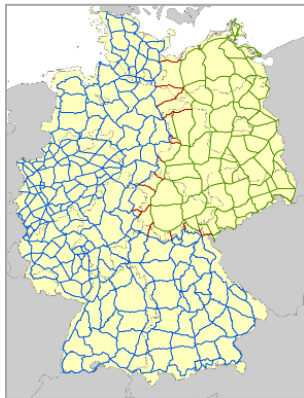
- Inclusion of GOCE data
- Denser terrestrial data
- Improvement of the software for terrain corrections and geoid modelling
- Residuals of the gravimetric quasigeoid including a correction surface to the GPS/leveling points:
  - Extrema -9 mm, +9 mm
  - Standard dev. +/- 3mm



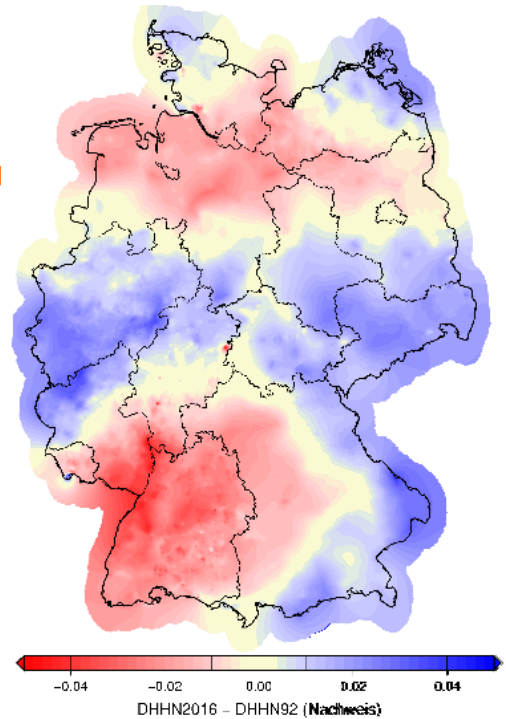
# Transformation model

## HOETRA2016

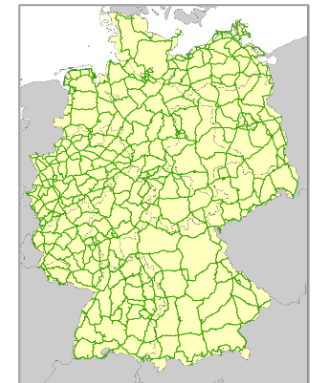
[www.hoetra2016.nrw.de](http://www.hoetra2016.nrw.de)



DHHN92



Transformation surface



DHHN2016

# Thank you for your kind attention!

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