Geodetic Activities in Germany

Jan Dostal
Responsibility for Surveying in Germany

- Surveying is in the responsibility of the German states ("Länder")
- 16 regional responsibilities, laws, agencies, …
- Surveying belongs to different ministries in the 16 countries, e.g.
  - Ministry of the Interior
  - Ministry of Finances
  - Ministry for rural area and consumer protection
  - Ministry for infrastructure and agriculture
Responsibility for Surveying in Germany

- Collaboration of the surveying authorities within the “Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany” (AdV)

- Federal members are Ministry of the Interior (BMI) – represented by BKG, Ministry for Traffic and Digital Infrastructure (BMVI) – represented by BfG, and Ministry for Defense (BMVG) – represented by ZGeoBW

- What about BKG?
  - Since 2012, a new law called BGeoRG is explicitly mentioning BKG and its responsibilities (§ 3)
  - BKG is a Higher Federal Authority under the Ministry of the Interior (since 2018: Ministry of the Interior, Building and Community – BMI)
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

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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 (>150?) new absolute measurements – validation of the level
- **HOETRA2016**: module for height transformation from DHHN92 to DHHN2016
German principal leveling network
DHHN2016

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

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>lines</td>
<td>991</td>
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<tr>
<td>Nodal points</td>
<td>680</td>
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<tr>
<td>Datum points</td>
<td>72</td>
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<tr>
<td>degrees of freedom</td>
<td>311</td>
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<td>$s_0$ of 1 km leveling</td>
<td>0.64 mm</td>
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<td>Length of overall loop</td>
<td>5 350 km</td>
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<tr>
<td>Closing error of overall loop</td>
<td>13.7 mm</td>
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<tr>
<td>Number of leveling points</td>
<td>59 583</td>
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<tr>
<td>Total length of measurements</td>
<td>29 809 km</td>
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Transformation model
HOETRA2016

www.hoetra2016.nrw.de

DHHN92  Transformation surface  DHHN2016
ETRS89/DREF91 Realization 2016

- GNSS campaign 2008
  - 250 control stations (GGP)
  - 350 reference stations (IGS/EPN/GREF/SAPOS)
- Adjustment without constrains (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
ETRS89/DREF91 Realization 2016

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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. +/- 3 mm
Positioning in Germany

- SAPOS is the German Positioning Service provided by the German states
- Approx. 275 stations
- Beside individual regional provision, central service, located in Hanover (NI)
- Provides various services (real-time, post-processing)
- Since 2010, special emphasis on quality management
- In 2018, new guidelines on „Monitoring of the coordinates of the reference station network“
- In 2019, test campaign for combination of individual regional solutions („EPN-like“)
Positioning in Germany

- Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV)
- Working Group Spatial Reference (AK RB)
- SAPOS® – Satellite Positioning Services of the German Landsurveying
- National Network around 270 Stations
Positioning in Germany

OPEN DATA politics

German states offering positioning services for free

- Thuringia
- Berlin
- North Rhine-Westphalia (since 1.4.2018)

For farmer/agronomist in rural areas only

- Bavaria
- Rhineland-Palatine
On the semi-annual conference of the Ministries for rural area on March 31, 2017 the following statement was noted:

**Resolution**

1. Die Ministerinnen, Minister und Senatoren der Agrarressorts der Länder sehen in der Digitalisierung landwirtschaftlicher Produktionssprozesse ein erhebliches Innovationspotenzial für eine effiziente, nachhaltige, ressourcen- und klimaschonende Landwirtschaft und Tierwohl fördernde Haltungsverfahren.


3. Sie halten es jedoch für erforderlich, weitere Potenziale für die Förderung der Digitalisierung in der Landwirtschaft, z. B. durch gezielte Schwerpunktsetzung im Innovationsprogramm oder in der GAK zu prüfen und zu erschließen. Bei Bedarf und hoher Nachfrage bitten die Ministerinnen, Minister und Senatoren der Agrarressorts der Länder den Bund, eine weitere Aufstockung der finanziellen Mittel im Programm vorzusehen.

4. Die Ministerinnen, Minister und Senatoren der Agrarressorts der Länder bitten den Bund dafür einzutreten, dass die Daten und Korrektursignale des amtlichen Satellitenpositionierungsdienstes SAPOS im Sinne von Open Data ebenso wie bspw. Geo-, Wetter- und Satellitendaten der Wirtschaft kostenfrei zur Verfügung gestellt werden, um die Potentiale von Smart Farming, wie z. B. Verbesserung der Ressourceneffizienz und Ressourcenschutz schneller realisieren zu können. Sie sind weiterhin der Auffassung, dass die fehlende Standardisierung von...
On the semi-annual conference of the Ministries for rural area on March 31, 2017, the following statement was noted:

- First German states are going to provide SAPOS data and corrections without fee for rural areas (BY, RP) or in general (BE, NW).

Positioning in Germany
Thank you for your kind attention!

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