



Arbeitsgemeinschaft der Vermessungsverwaltungen
der Länder der Bundesrepublik Deutschland



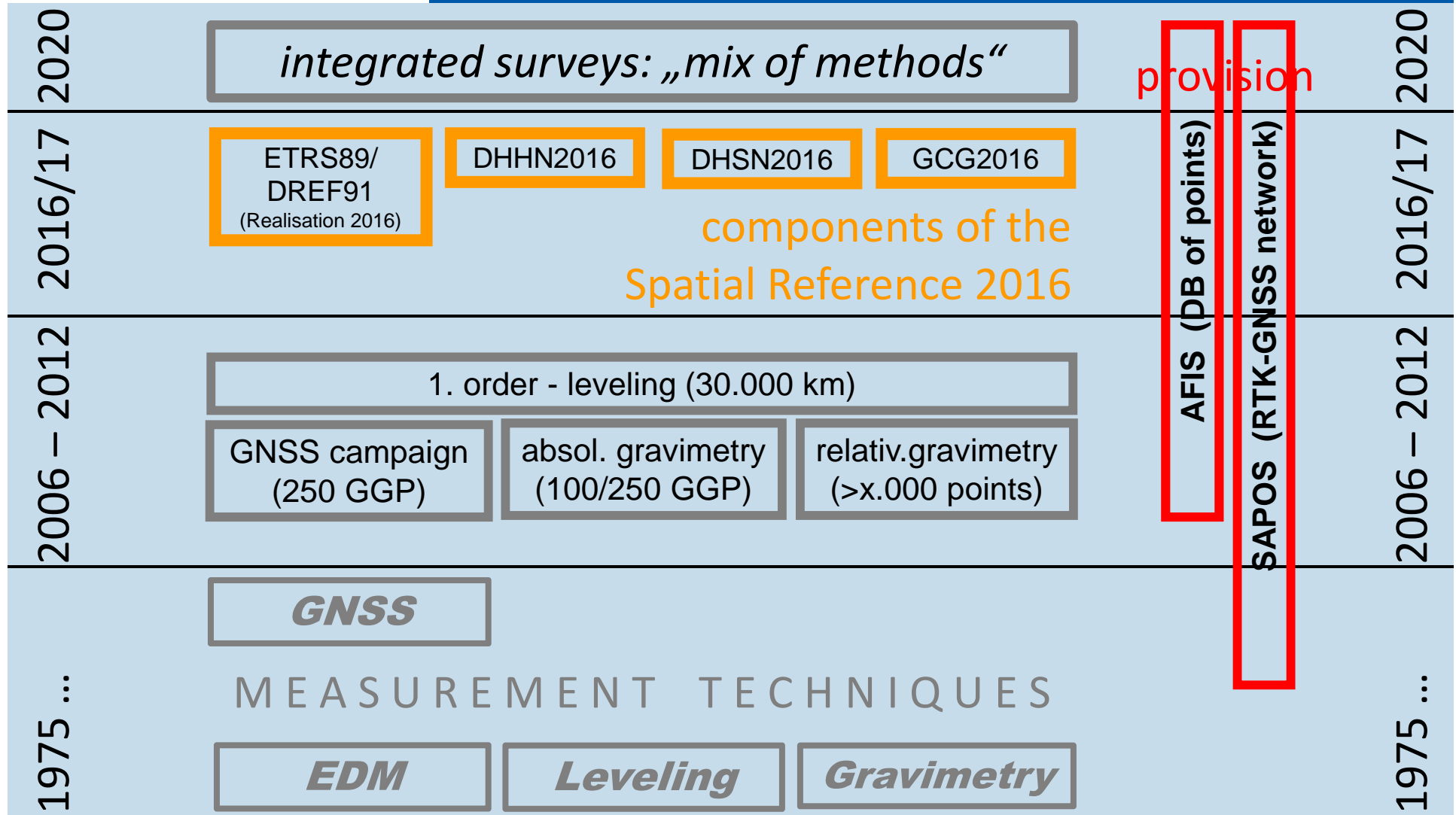
Germany: Integrated Geodetic Spatial Reference 4.0

Working Committee of the Surveying
Authorities of the Laender of the
Federal Republic of Germany (AdV)



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Integrated Geodetic Spatial Reference

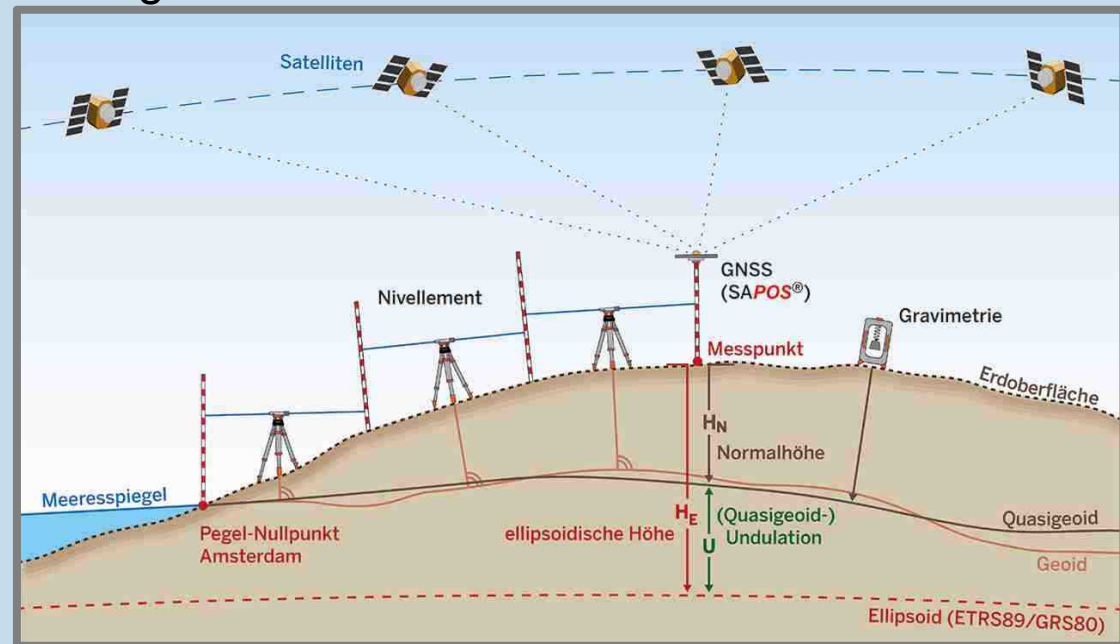




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Integrated Geodetic Spatial Reference

- **Holistic view of the geometrically and physically defined components** - Determination of 3D / 2D position / ellipsoidal height / normal height / gravity / undulation / geoid.
- **Geodetic Fundamental Points (GGP)** – multifunctional representatives of the integrated geodetic spatial reference.
- **„cm“-geoid**: precisely modeled height reference surface.
- points have a function as **geo-sensors**.
- monitoring with respect to the **product standard**
- Integrated Geodetic **Spatial Reference (t) !!!**





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Integrated Geodetic Spatial Reference

**absolute
gravity
100 GGP (D)**

**rel. gravity
6000 points
(example NRW)**

**GNSS
250
GGP (D)**

1. order leveling: 30.000 km (D)

**Reference
2016**

ETRS89/
DREF91
(realisation 2016)

DHHN2016

DHSN2016

GCG2016

2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

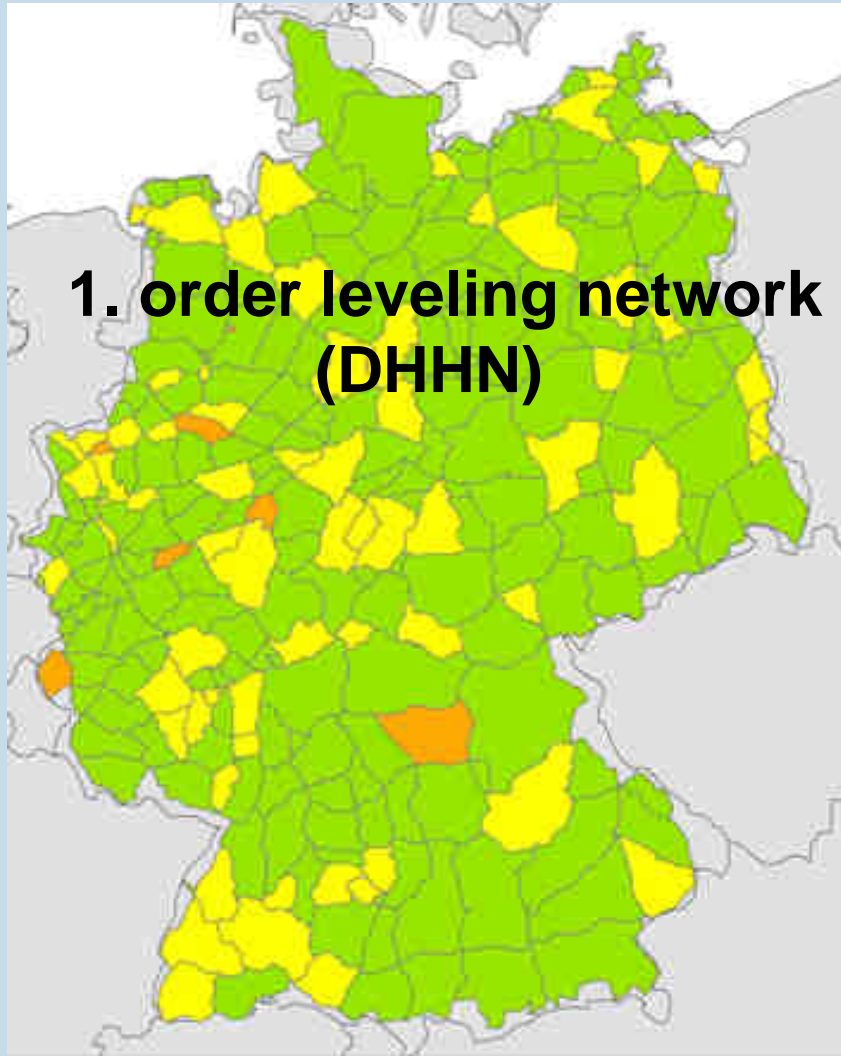




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1. order leveling 2006-2012

1. order leveling network (DHHN)



312 loops (level of error):
224 (72%) in the 1. third
78 (25%) in the 2. third
10 (3%) in the 3. third
permissible inconsistency

$$Z_U = \pm 2 \cdot \sqrt{U}$$

mean error: 0,32mm/km

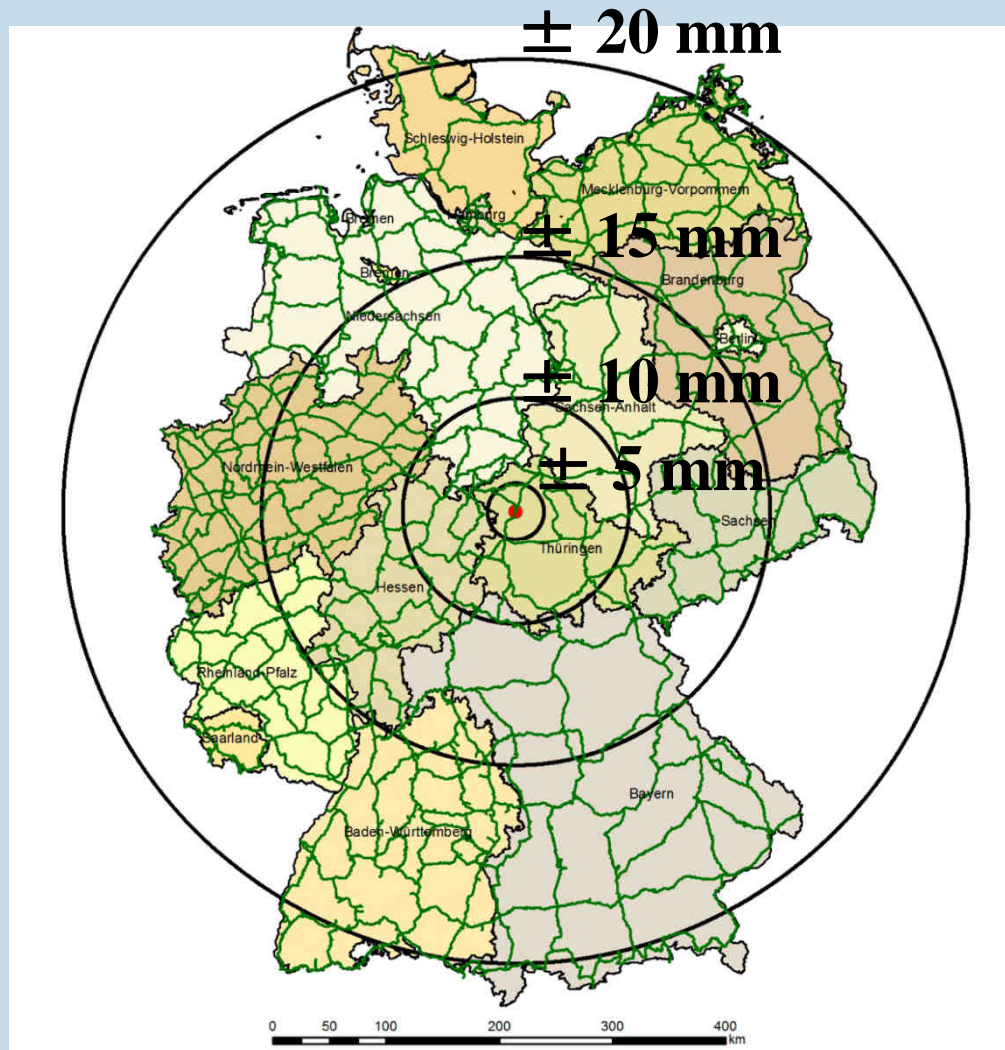
inconsistency of the outer loop of the
entire network (5350km):

	1992	2016
outer loop [km]	4743	5350
inconsistency [mm]	138,3	13,3
permissible [mm]	137,7	146,3



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accuracy 1. order leveling network (DHHN 2016)



source:



Bundesamt für
Kartographie und Geodäsie



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Integrated Geodetic Spatial Reference realisation 2016

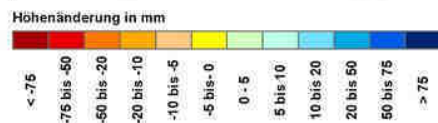
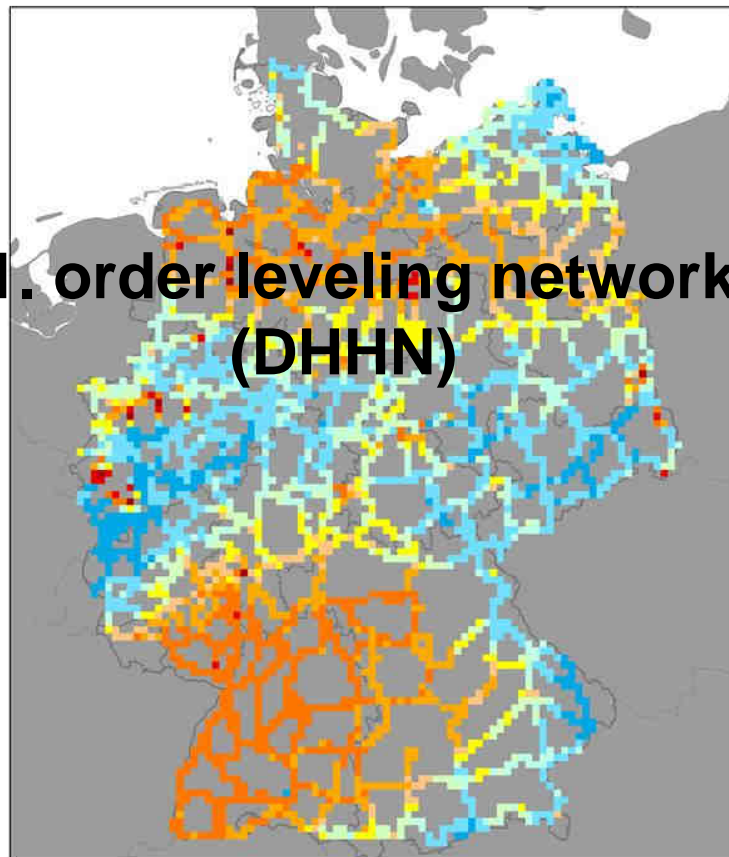
- **2D:** The introduction of (new) coordinates ETRS89 / DREF91 (realization 2016) in SAPOS has no impact on the real estate cadaster
- **height:** Elevation changes in the range of +/- 35 mm occur between (DHHN) 1992 and 2016, and significantly higher changes occur in areas with mining activities.
- **„1cm“-geoid:** GCG2016 (geoid derived by BKG) will increase the importance of GNSS. The GNSS measurement technique will replace other measurement techniques as the most economical and accurate one.
- **Geodetic Fundamental Points (GGP)** realize the integrated spatial reference, **SAPOS (RTK-GNSS-network)** actively provide the spatial reference as a contribution to the spatial data infrastructure.



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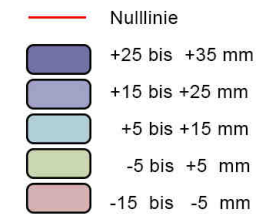
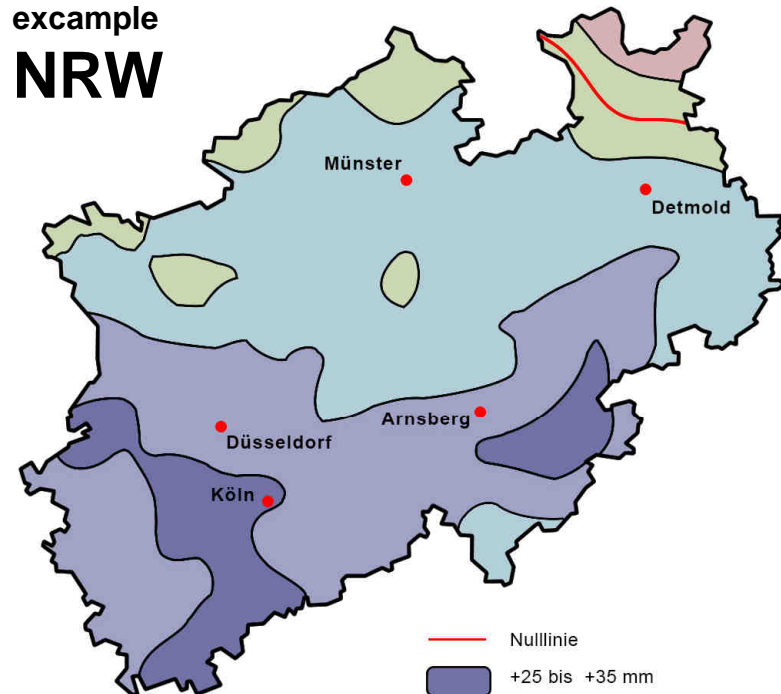
1. order leveling network (DHHN) changes between the realisations 1992 - 2016

1. order leveling network (DHHN)



source:
 Bundesamt für
Kartographie und Geodäsie

example NRW



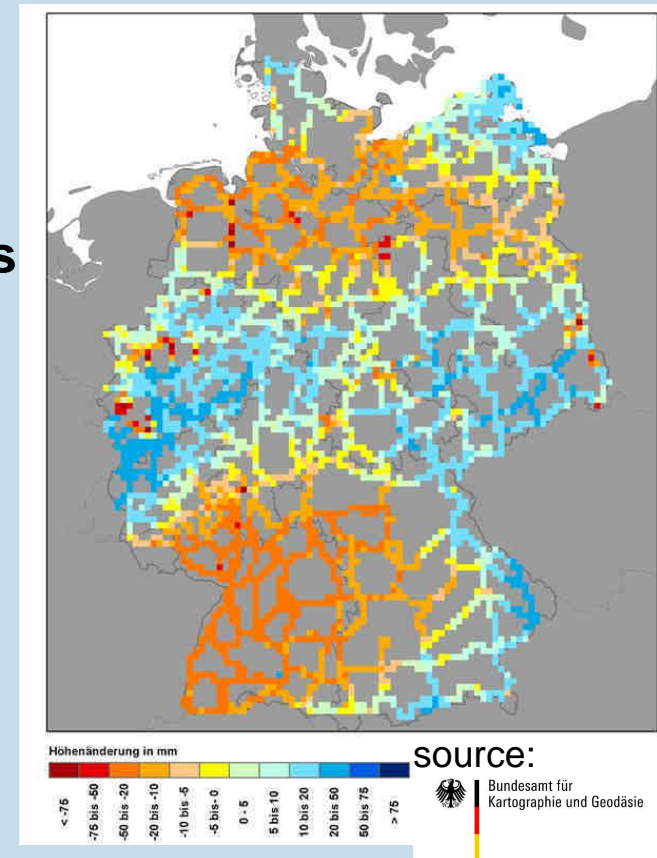
source:
 GEObasis.nrw



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Integrated Geodetic Spatial Reference temporal changes

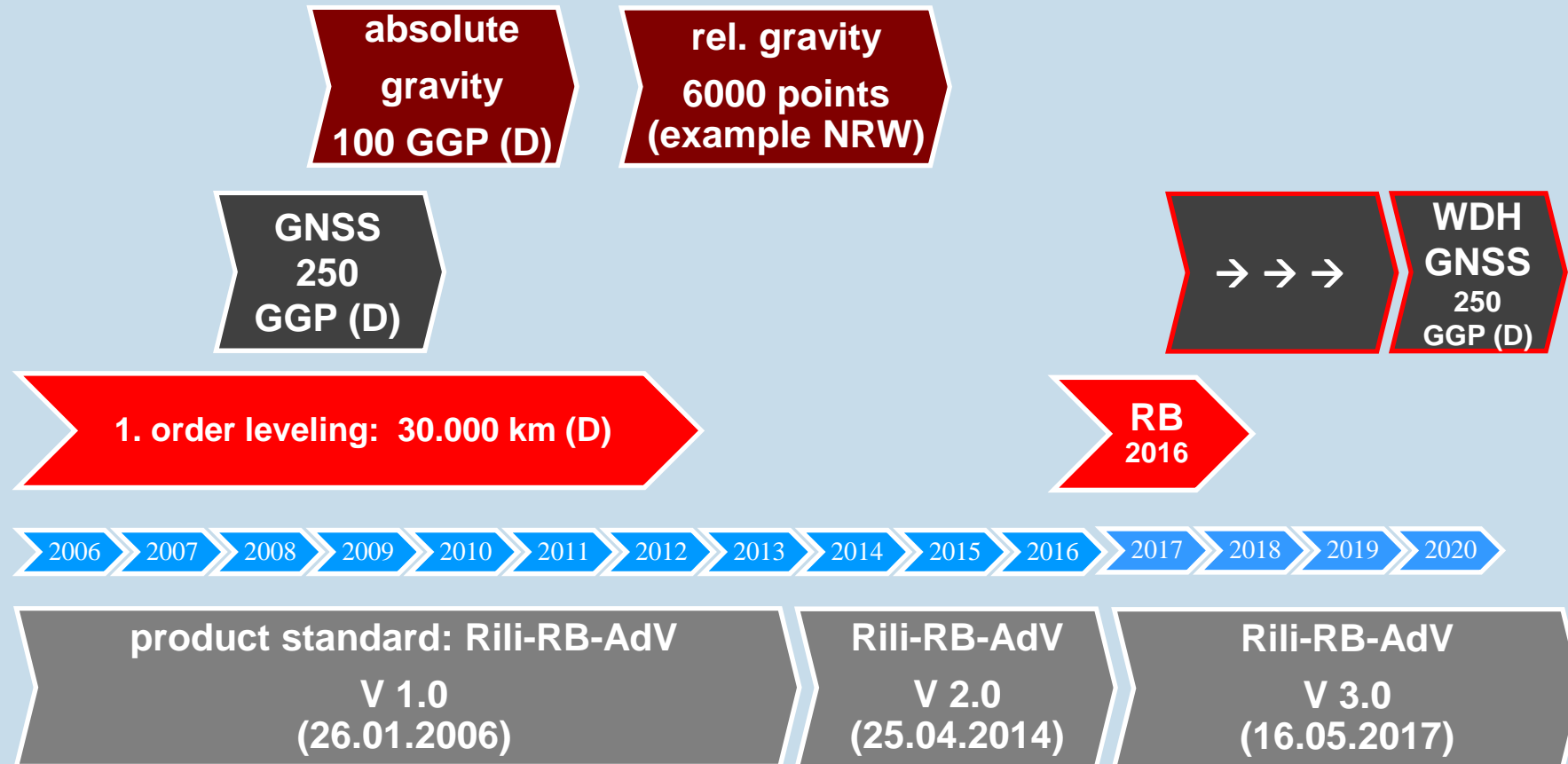
- **Time series show relative movements** (for example, long-term coordinate monitoring in GNSS networks (SAPOS) or in leveling networks)
- **Marked points** lose their original importance. As **geo-sensors**, they can provide a monitoring function.
- the **updating of 2D/3D** coordinates and heights will be a result of significant changes.
- The **scientific and social benefit** (e.g., climate change) can be exploited by evaluating (historical) measurements.
- Tendency: **Integrated Survey Concept** ("mix of methods")





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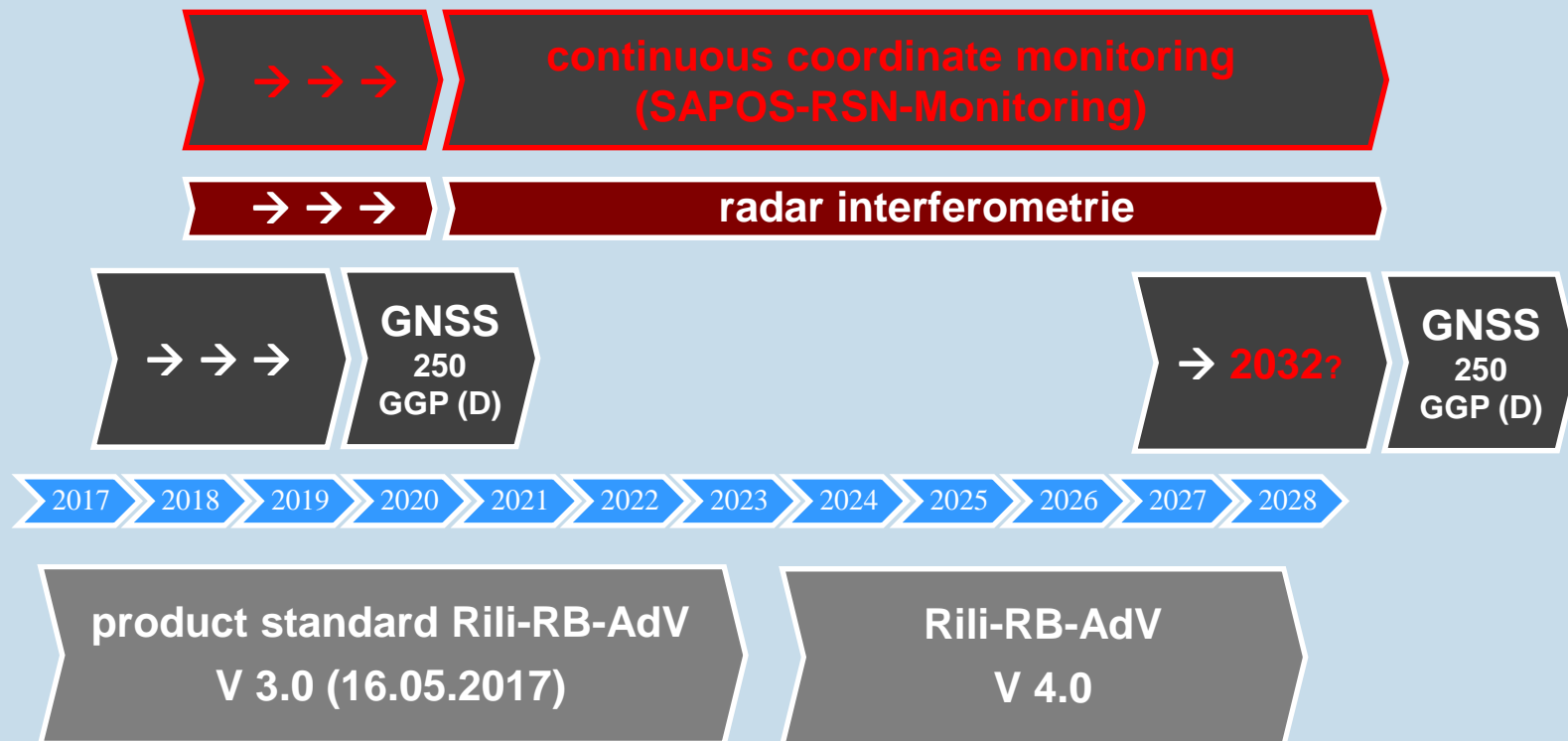
Integrated Geodetic Spatial Reference quality management “GNSS campaign 2020”





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Integrated Geodetic Spatial Reference quality management 2020++





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Integrated Geodetic Spatial Reference product view & quality management

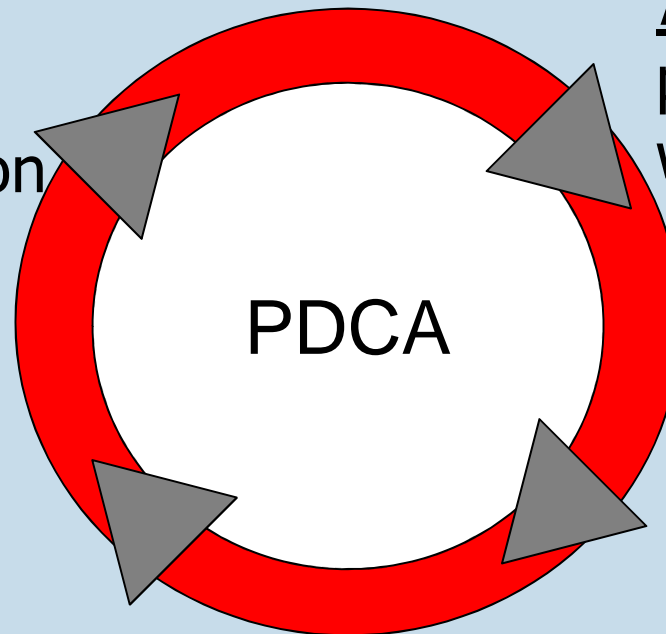
“The currently available **geodetic infrastructure** is ready for future applications, for example, for the centimeter-accurate vehicle navigation as a component of autonomous driving or for precision farming.”

Plan

and provide
product definition

Do

provide the product
with respect to definition



Act

and improve
product definition

Check

product definition



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Gracias

Tānan

Tack

Сағ олун

Merci

Thank you

Kiitos

Tak

Děkuji vám

Danke

Ačiū

Dākujem vám

further reading: <http://www.adv-online.de>

Paldies

Dank u

Grazie

ευχαριστο

Dziękuję

Mulțumesc

Obrigado

Köszönöm

Благодаря

Hvala