



German Association of Geodesy,
Geo-Information and Landmanagement

Ministry of the Interior and
Local Affairs NRW, Germany



Geodetic Reference System 2015 - the Approach in North-Rhine Westphalia

subtitle: Do we still need reference point fields?

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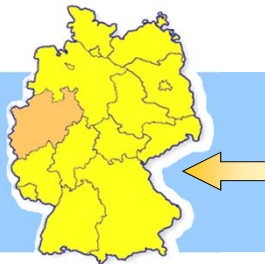


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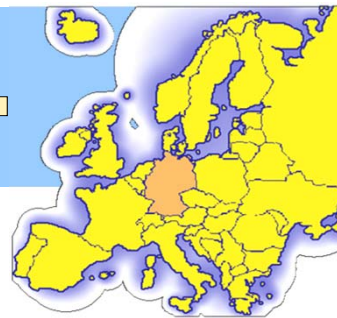
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⇒ **Germany**
16 federal states
– 82 Mill. people



⇒ **North-Rhine Westphalia**
– 18 Mill. people
– 5 administrative districts
– Centrality in Europe with
borders to Belgium and the
Netherlands



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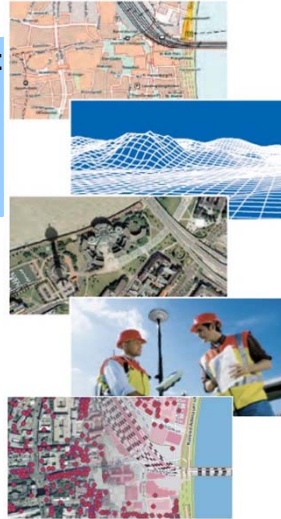
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Surveying and Mapping responsibility: North-Rhine Westphalia Cologne District Government, dep. 7 = GEObasis.nrw

- service provider for the whole of North-Rhine Westphalia (**280 staff members**)
- offers geobasis data (reference data) for citizens, public administration, trade and industry
- products and services
 - **Satellite Positioning Service (SAPOS®)** / coordinate reference
 - topographic maps / data
 - aerial views / orthophotos
 - terrain- and landscape-models
 - thematic maps / data
 - house-coordinates / addresses ...



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Developments in the Surveying and Mapping Administration

analogue digital services
----->
ca. 1800 ca. 1980 2010

Cadaster

Top.
Mapping

Geodetic
Reference

Cadastral maps

Topographic maps

Trigonometric points

ALK

ATKIS®

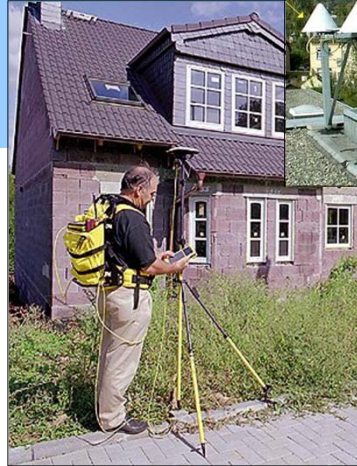
Pfiff

AAA®
SAPOS®
+ SDI

Employees responsible for the geodetic reference frame (NRW, Germany):
1980: ca. 115 today: ca. 45

210 Years Surveying and Mapping

- innovations over two centuries -



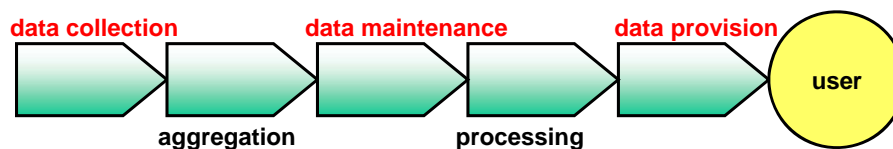
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surveying and mapping law in NRW

Vermessungs- und Katastergesetz NRW

§ 1 tasks

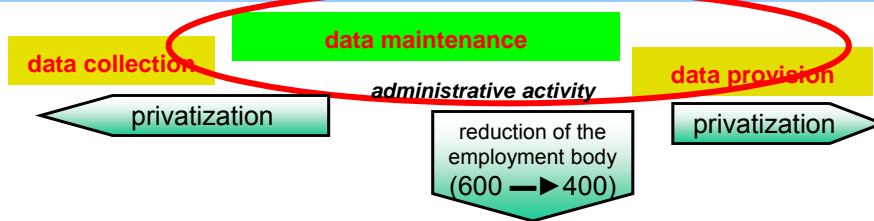
(1) ... The **collection, maintenance and provision** of the surveying and mapping **data** ... have to be continuously adjusted to the development of science and technique.



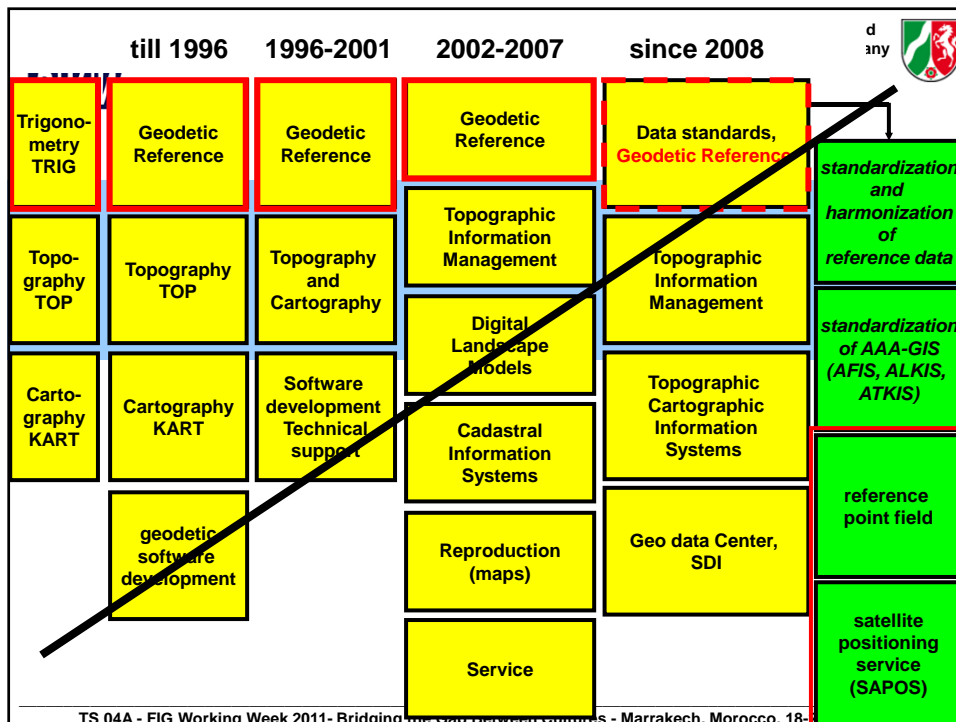
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Definition of kernel tasks and personal resources

- reorganization of the surveying and mapping administration
- guarantee of services in the surveying and mapping administration
- review of necessary tasks >>> reduction of administrative / state activities with respect to kernel tasks / definition of the spatial information infrastructure



kernel tasks = data maintenance and data provision
perspective: in close relation to INSPIRE





geodetic reference frame in Germany

3 Measurement Campaigns:

- a) 1st order leveling campaign „DHHN 2006-2011“
- b) GNSS-campaign 2008
- c) absolute gravity campaign 2008

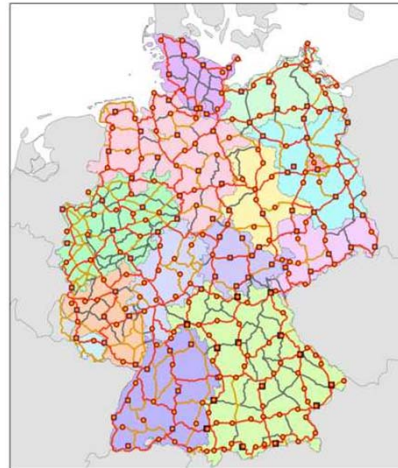
Integrated Reference Frame:

physical heights (a), 3D-coordinates (b) and gravity (c).

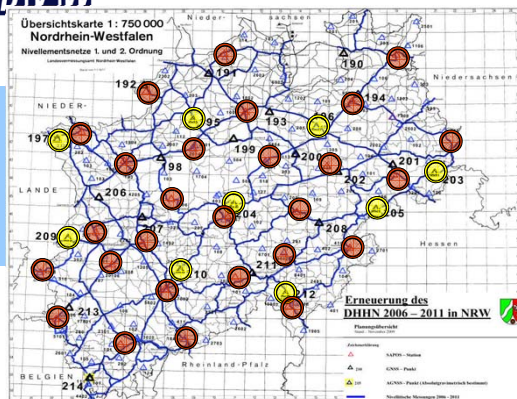
Vision:

new (harmonized European) Vertical Reference Frame + DE-Undulation (quasi geoid) ?

GNSS for 2D-coordinates and height (NHN / Molodensky) .



— Pflichtlinien ● GNSS-Station
— optionale Linien ■ Absolutehöhenpunkt
— restliche Linien des DHHN02 ■ GNSS-Absolutehöhen

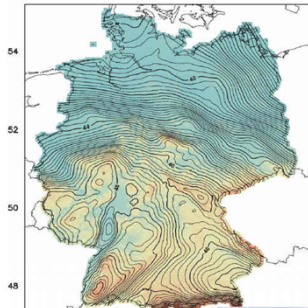


DHHN in NRW

absolute gravimetric measurements
→ 10 AGRAV-points

GNSS permanent stations:
→ 3D- coordinates (x,y,z)
→ height (NHN)
→ gravity





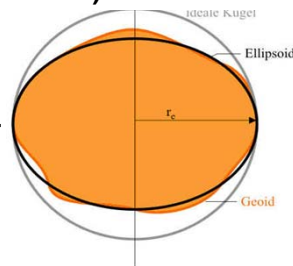
Stand der Dokumentation: 30.01.2009

ellipsoidal height
+ (quasi) geoid undulation

= NHN height



+



= NHN

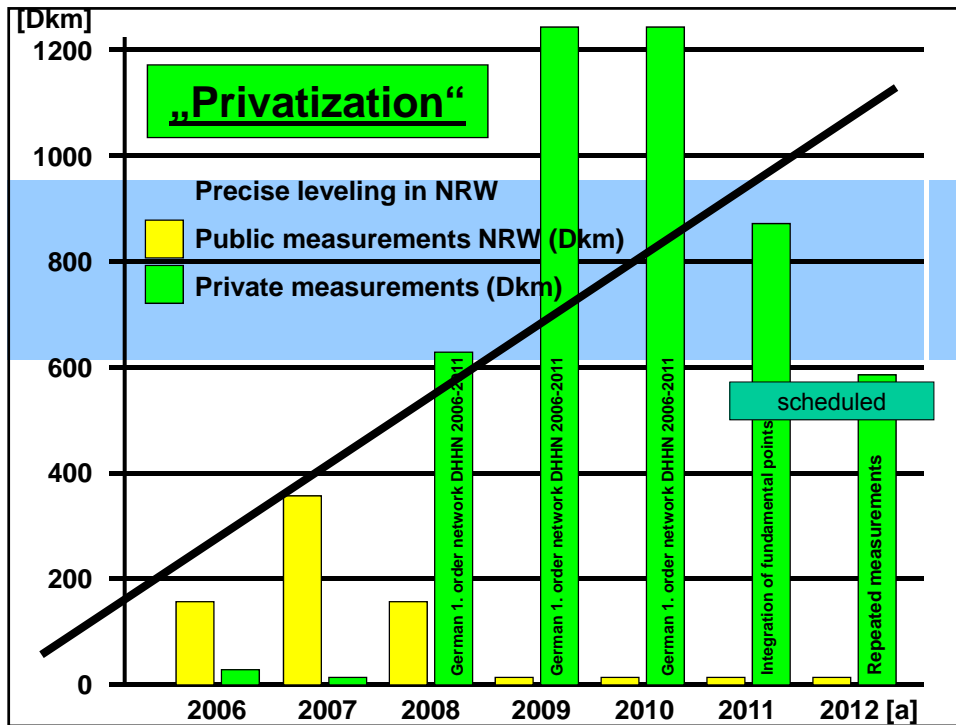
The accuracy of GNSS- satellite technique to determine NHN- heights in the official geodetic reference frame is dependent (restricted) on the accuracy of the ellipsoidal height of the (CORS GNSS) SAPOS-stations and the accuracy of the geoid (undulation model).

Conclusions (I)

→ CORS GNSS (SAPOS®) is the fundamental measurement technique to determine 3- or 2D- coordinates. In the future this technique will be available to determine heights (dynamic information)


→ other measurement techniques will loose importance

→ the determination of the (accurate) 1 cm-geoid is an important goal



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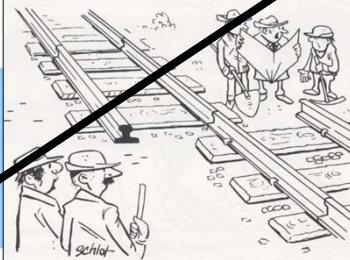

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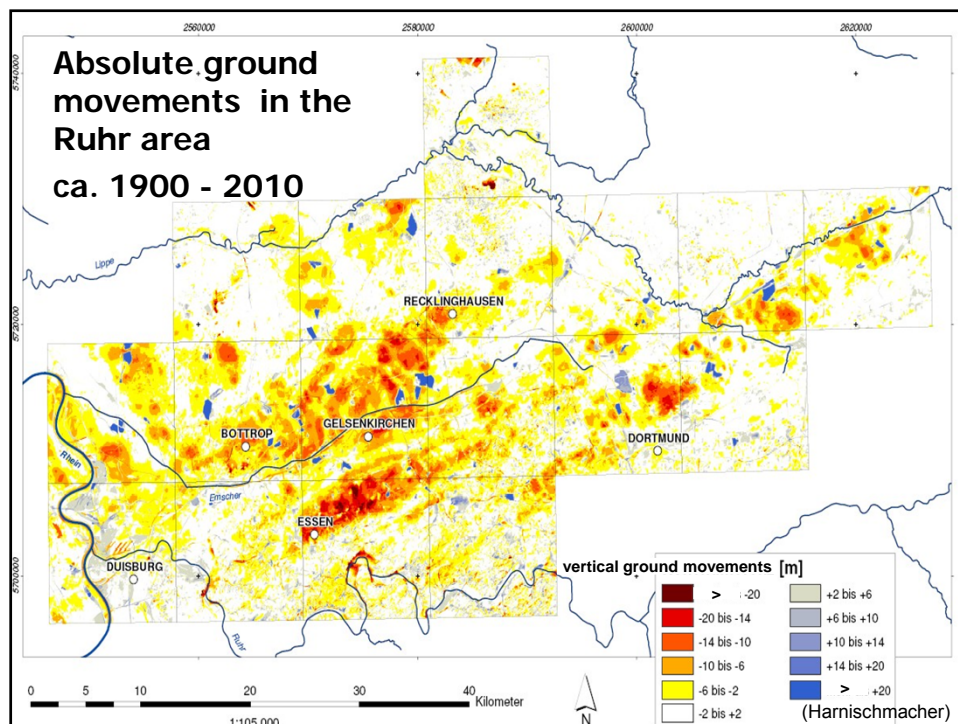
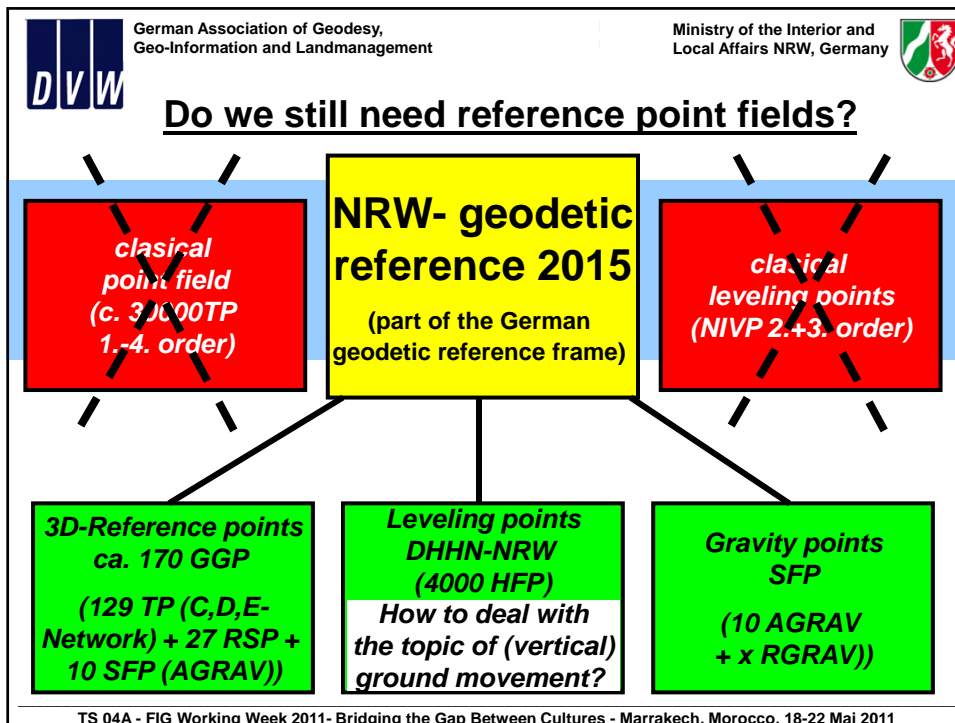
Geodetic reference

- European Terrestrial Reference System (ETRS89)
- Universal Transversal Mercator projection (UTM)

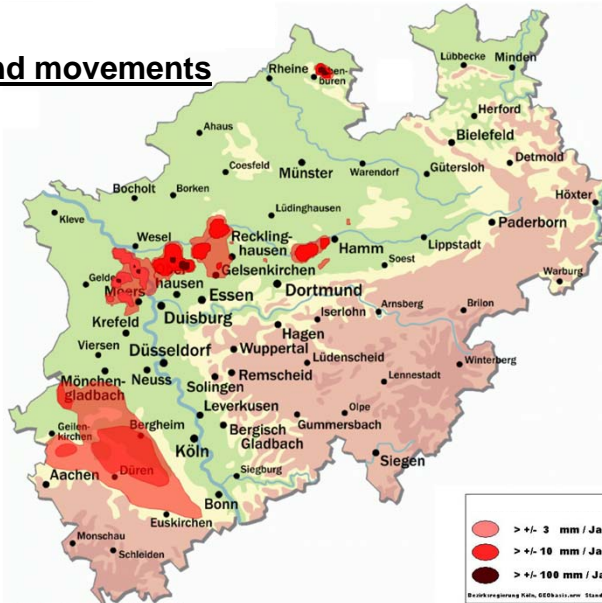
as a common base
for Germany
(cadastre and
surveying & mapping)

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Areas with ground movements TODAY



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conclusions

Mining activities cause ground movements

Legal mandate (§4 DVOzVermKatG):
The reference point field has to be kept up to date. To detect changes the spatial information system also includes historical data.

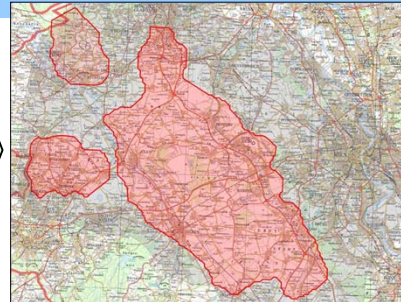
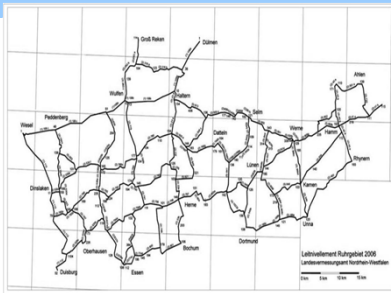
Periodic re-leveling campaigns under management of the Surveying and Mapping Administration (Geobasis NRW):
The state surveying authorities use classical precise leveling and rely on collaboration with many institution (mining companies, local authorities, ...).

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From leveling points to ground moving areas

Result of re-leveling:
new height values
for leveling points

Determination of
ground moving area
(because of mining)



Grey: ground movement area (old)
Red: ground movement area (new) 3mm/a

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The future of reference point fields

**NRW- geodetic
reference 2015**

(part of the German
geodetic reference frame)

3D-Reference points
ca. 170 GGP
(129 TP (C,D,E-
Network) + 27 RSP +
10 SFP (AGRAV))

Leveling points
DHHN-NRW
(4000 HFP)
+ points in areas of
ground movements

Gravity points
SFP
(10 AGRAV
+ x RGRAV))

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Conclusions (II) - a view behind 2015...

→ CORS GNSS (SAPOS®) is the fundamental measurement technique to determine 3- or 2D- coordinates and heights.

→ an accurate 1 cm-geoid is usable

→ new measurement techniques might gain importance, if they are a) inexpensive (less men power), b) fast in the field and in general contact-free. This might be:

→ Photogrammetry (to detect changes in height)

→ UAV, Unmanned Aircraft Vehicles (to determine high resolution orthophotos and digital terrain models)

→ classical point fields have less (no) importance

Conclusions (II) → virtual geodesy 2020!