



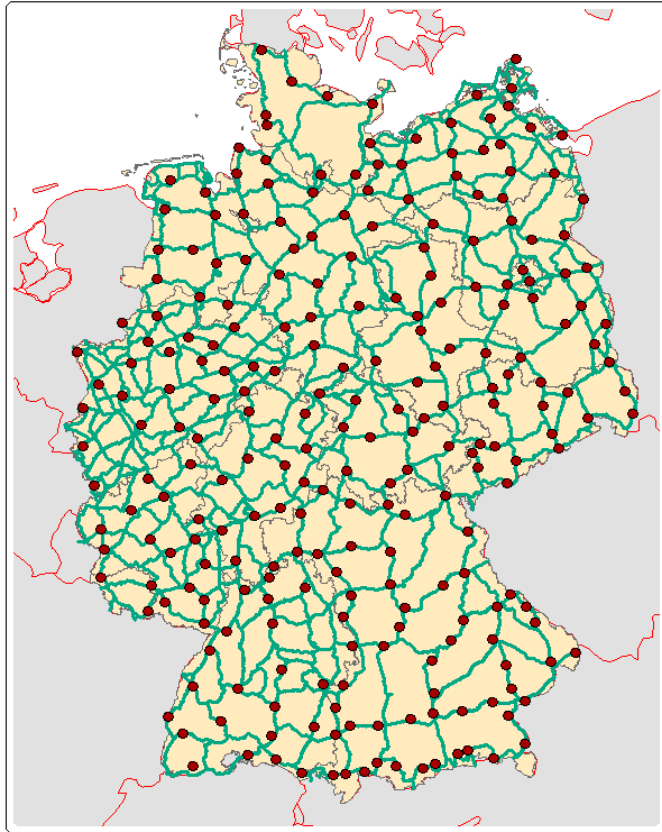
Federal Agency for  
Cartography and Geodesy

# National Report of Germany

J. Ihde, G. Liebsch, A. Rülke, M. Sacher, W. Söhne

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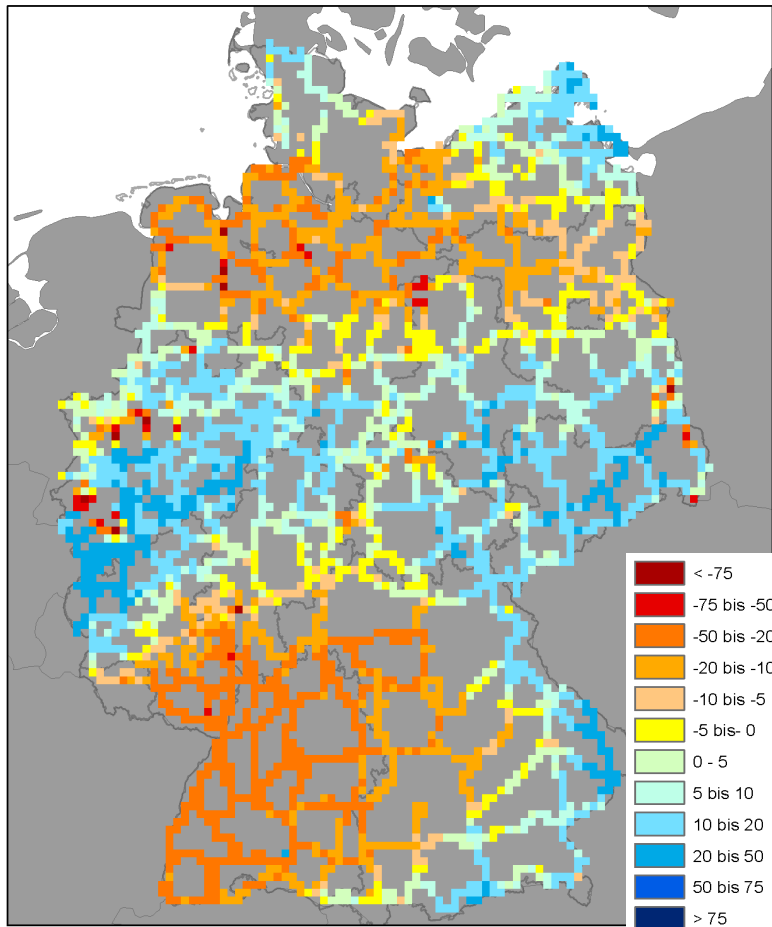
# Modernization of the German height reference frame – network configuration



- leveling, GNSS and gravity (mostly absolute) measurements on 250 identical points
- GNSS observation campaign in May/June 2008 (middle of levelling epoch, period of low solar activity)
- 2 X 24 h observation
- 250 stations are the backbone of the Geodetic Fundamental Network

— Leveling lines epoch 2006-2012  
● Stations of the GNSS campaign 2008

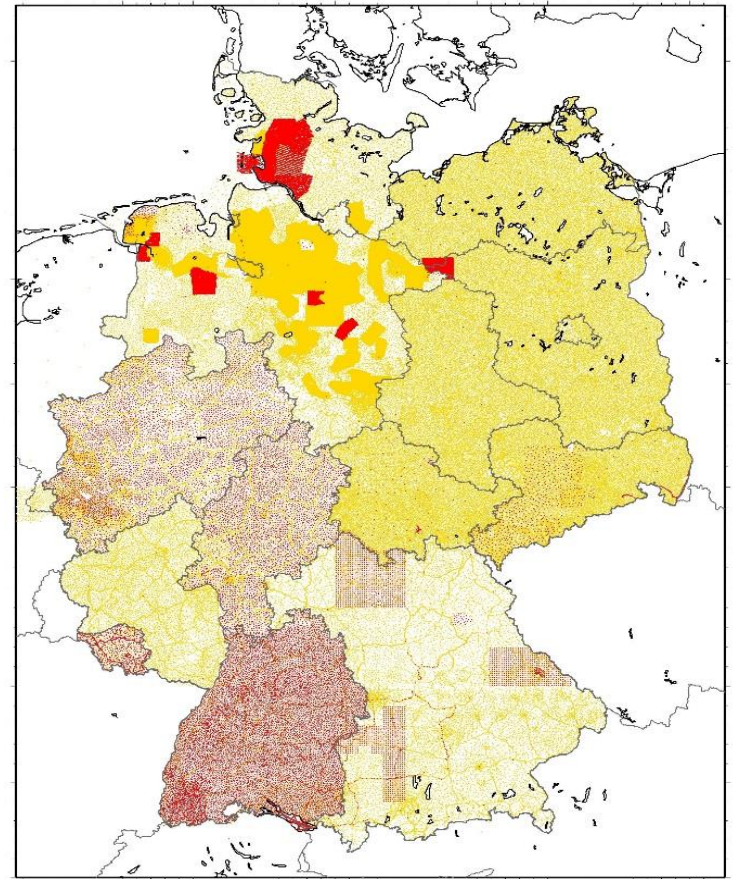
# Height differences in mm between DHHN2016 and DHHN92



- Blue: uplift, Red: subsidence
- Maximum of height differences between -35mm and +33mm (besides of single height changes in mining areas)
- Interpretation is pending
- In the north-east (island of Rügen): assumed uplift because of postglacial rebound
- Uplift in the Eifel and Taunus region (Rhenish Slate Mountains) is well-known by geologists
- In some areas (south-East) differences go into reverse by comparison of older epochs (1985-1960)

# New quasigeoid model

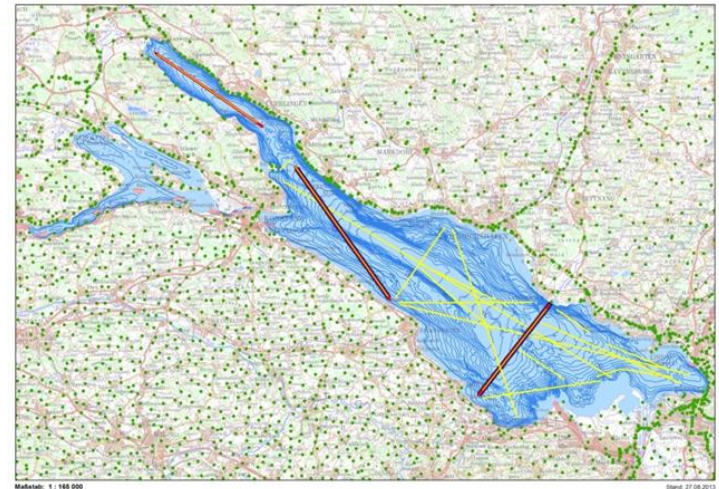
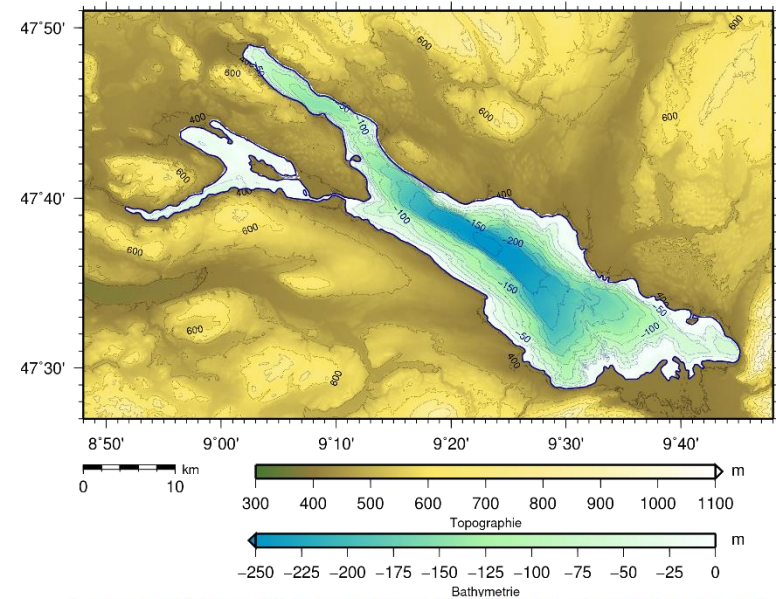
- New gravity data
  - In Germany (red points in figure) from the German states
  - Data exchange with neighboring countries, e.g. Czech Republic, Netherlands, Belgium
  - Data from International Gravimetric Bureau (BGI), e.g. France, North Sea
  - Oil industry
  - measurements of BKG in cooperation with several partner
- New digital elevation model
  - Germany (DGM25)
  - Bathymetric data of Lake Constance
- Improvement of the software for terrain corrections and geoid modelling





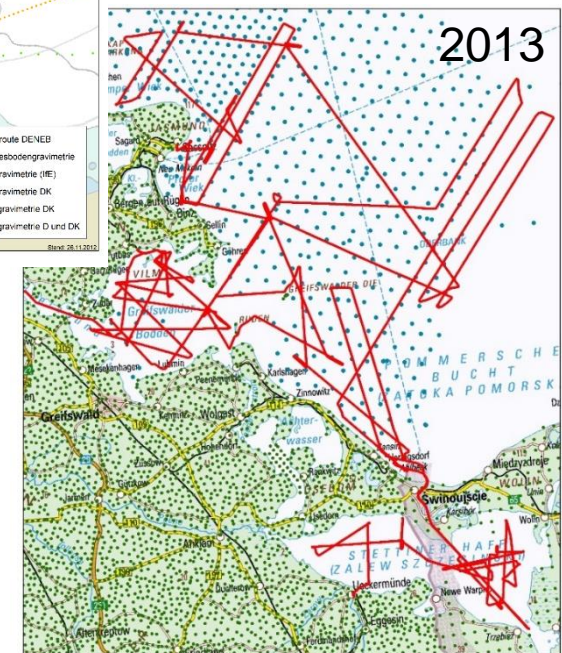
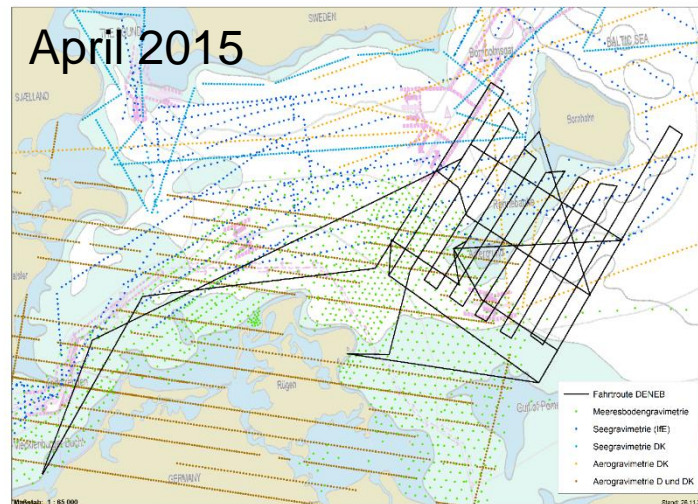
# Example I: Lake Constance

- Depth of the lake of up to 250m was neglected in geoid modelling so far
- Larger differences between gravimetric geoid and GNSS/Levelling data over the lake and in the vicinity of the lake (up to 10cm)
- 2012: Gravimetric measurements on the lake in Cooperation with Geoforschungszentrum Potsdam (GFZ) and the Institut für Seenforschung Langenargen (ISF)
- Total profile length: 320 km within 3 days



# Example II: Seaborne gravity measurements in the Baltic Sea and the North Sea

2013: Baltic Sea,  
10 days, 1500 km  
2015 (April): Baltic Sea  
10 days, 1600 km  
2015 (June): North Sea

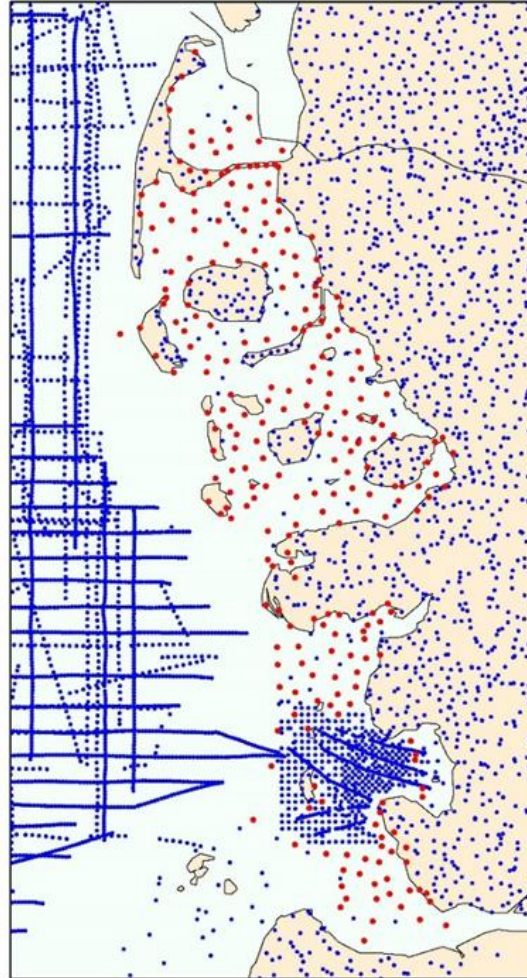


- Cooperation with
  - Geoforschungszentrum Potsdam (GFZ)
  - Bundesamt für Seeschifffahrt und Hydrographie (BSH)
  - Landesbetrieb für Küstenschutz, Nationalpark und Meeresschutz Schleswig-Holstein
  - FAMOS project



# Example III: Gravimetric Survey of intertidal mudflats

- Almost no gravity data in the intertidal mudflats so far
- Measurements 2014 (red points in the map) and 2015: about 450 points in cooperation with
  - Landesbetrieb für Küstenschutz, Nationalpark und Meeresschutz Schleswig-Holstein
  - Landesamt für Vermessung und Geoinformation Schleswig-Holstein
  - Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz
  - Wasser- und Schifffahrtsverwaltung
  - Landesamt für Geoinformation und Landesvermessung Niedersachsen



# Introduction of DHHN2016

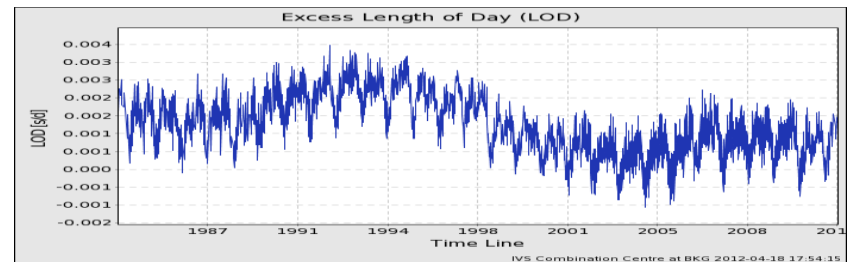
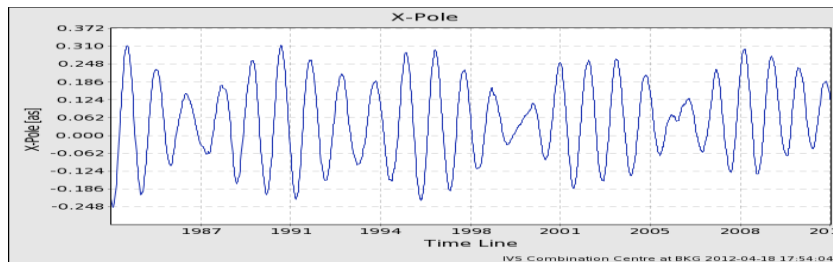
- Accurate determination of physical heights by GNSS methods needs coordinates of SAPOS<sup>®</sup> stations, height reference frame and quasigeoid to be high accurate, up to date and consistent
- After providing of the adjustment results 04/2014 German countries need time for
  - further measurements in subordinated leveling networks
  - including the data of subordinated leveling networks (new or digital available old data) in the new reference frame
- At the same time computation of a new German quasigeoid by BKG
- Computation of a model for height transformation from old to new height reference frame and providing in the internet
- 2017: synchronized introduction of heights: DHHN2016, quasigeoid: GCG2016, gravity: DHSN2016 and coordinates: ETRS89/DREF91/2016



# Twin Radiotelescope Wettzell

First telescopes worldwide according to VLBI2010 specifications

- Performance of the first tests as from the beginning of 2013
- Completion/entry into service of the first TWIN telescope by the end of April 2013
- The second TWIN telescope will be operational by the end of 2015



# BKG Ntrip Client (BKG)

- **New version BNC 2.12 under development**
  - **Modification of PPP module**  
necessary with respect to additional constellations and new signals  
on different frequencies  
multiple PPP solutions with one BNC command, individual  
configuration for each mountpoint possible
  - **Rx2 <-> Rx3 conversion**
  - **SINEX TRO format output**
  - **Quality control checking feature extended to Rx3**
    - Observation statistics
    - Multipath analysis sky plots
    - Signal-to-noise ratio sky plots
    - PDOP plots
    - Satellite availability and elevation plots
    - Man/machine readable ASCII output format

# BKG Ntrip Client (BKG)

```
soehne@
Datei Bearbeiten Ansicht Suchen Terminal Hilfe
QC Format Version : 1.0

Navigation File(s): brdm0120.15p
Ephemeris       : 6118 OK  2 BAD
  Bad Ephemeris : brdm0120.15p S29 2015 01 12 22 25 04
  Bad Ephemeris : brdm0120.15p R02 2015 01 12 23 30 00

Observation File : cut00120.15o
RINEX Version    : 3.02
Marker Name      : CUT0
Marker Number    : 59945M001
Receiver         : TRIMBLE NETR9
Antenna          : TRM59800.00 SCIS
Position XYZ     : -2364337.2971 4870285.5843 -3360809.8188
Antenna dH/dE/dN : 0.0000 0.0000 0.0000
Start Time       : 2015-01-12 00.00.00.0
End Time         : 2015-01-12 23.59.30.0
Interval         : 30
Navigation Systems: 1 C

C: Satellites: 13
C: Signals : 3 1I 6I 7I

C: 1I: Observations : 29488
C: 1I: Slips (file+found): 131 + 2
C: 1I: Gaps : 12
C: 1I: Mean SNR : 42.2
C: 1I: Mean Multipath : 0.39

C: 6I: Observations : 29456
C: 6I: Slips (file+found): 142 + 2
C: 6I: Gaps : 32
C: 6I: Mean SNR : 44.8
C: 6I: Mean Multipath : 0.25

C: 7I: Observations : 29456
C: 7I: Slips (file+found): 142 + 2
C: 7I: Gaps : 32
C: 7I: Mean SNR : 44.3
C: 7I: Mean Multipath : 0.28
```