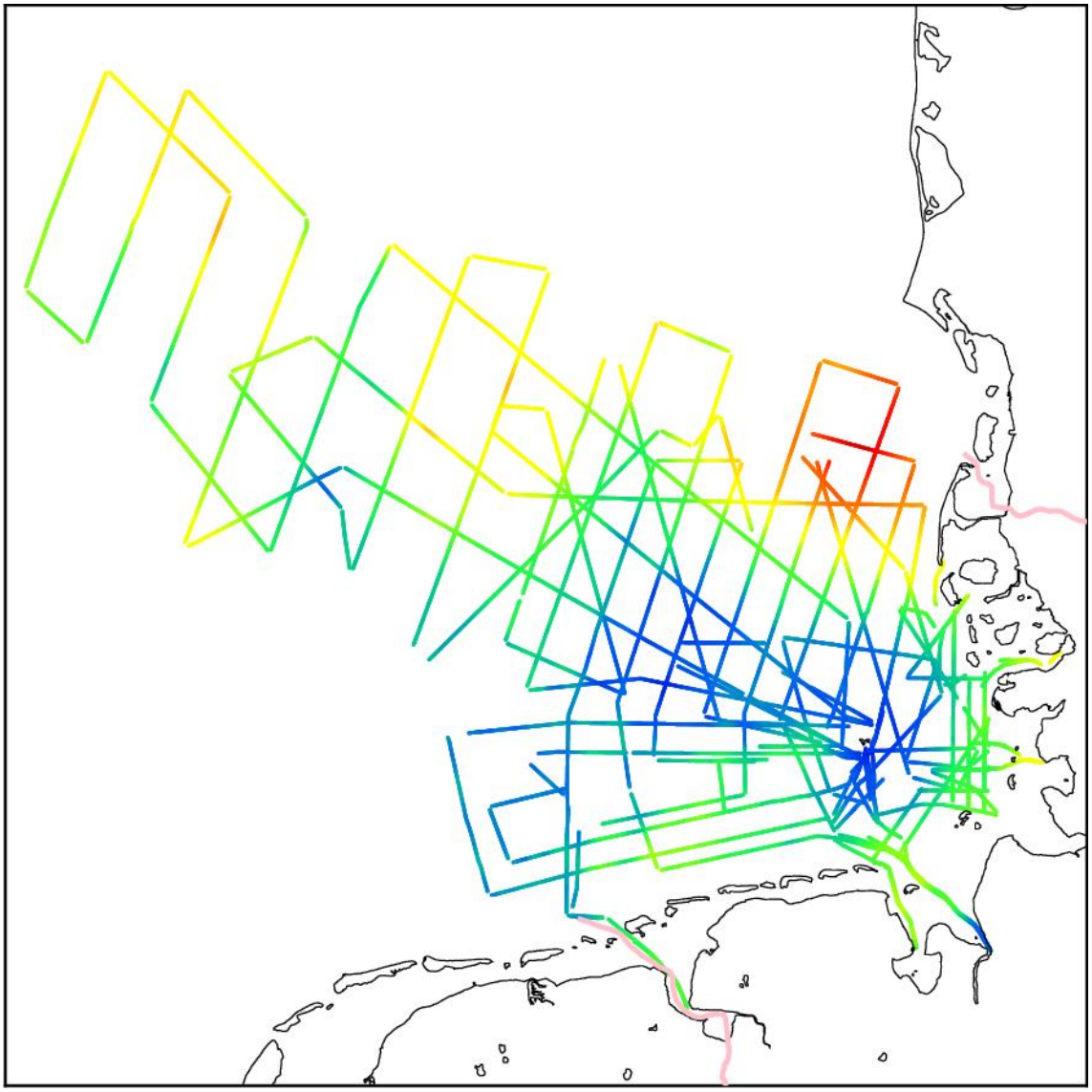
Bundesamt für
Kartographie und Geodäsie

Documentation

Gravity data from shipborne gravimetry (North Sea) shipgrav_northsea

Product as of June 2025



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2.2 Changes compared to previous version **Fehler! Textmarke nicht definiert.**

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1 Overview

Product:	Gravity data from shipborne gravimetry (North Sea) (shipgrav_northsea)
Content:	Shipborne observations of the Earth's gravity acceleration
Area:	Exclusive Economic Zone of Germany in the North Sea and adjacent areas
Spatial structure*:	3-d profile data
Spatial reference*:	Original: 3-d position (latitude, longitude, ellipsoidal height): WGS84 / GRS80 Derived: Physical heights: Normal height above GCG2016 quasigeoid resp. EGG2015 quasigeoid (EVRS/NAP)
Position accuracy:	2-d positions: <0,1 m Height: <0,1 m Gravity: 1 mGal (equals to 10^{-5} ms^{-2}) (estimated values)
Currentness:	2025-06
Resolution:	Mean point distance ca. 280 m (min. point distance ca. 80 m, max. point distance ca. 460 m) according tot he time interval 60 s of the provided dataset 2-d position: 0.01 m Height: 0.01 m Gravity: 0.1 mGal (equals to 10^{-6} ms^{-2}) These specifications are related to the sampling interval of the data points along the measurement profiles as well as to the number of digits in the respective data fields. The actual resolution of the gravity signal itself in the processed measurements is roughly 1 km (half-wavelength) at a cruise speed of 5 m/s given the applied low-pass filter.
Data formats*:	ASCII (CSV format with comma as delimiter)

Data supply*:	Dataset as download
Modification against last Dataset:	Not applicable
Data volume:	1.7 MB
Data source:	Field campaigns with survey vessels OLAND (2015), DENEB (2021), WEGA (2022, 2023, 2024) of the Federal Maritime and Hydrographic Authority (BSH) Cooperation: Fedeal Agency for Cartography and Geodesy (BKG), GFZ Helmholtz Centre for Geosciences (GFZ), Technical University of Darmstadt (TUDa)

* Please note that not all forms of delivery can be provided with each georeferencing and data format. If you have any questions, feel free contact the Service Centre (DLZ)..

2 Description

2.1 Content

The dataset contains the results of shipborne gravimetric campaigns in the German Exclusive Economic Zone in the North Sea (including adjacent areas) that were carried out jointly by the Federal Agency for Cartography and Geodesy (BKG), GFZ Helmholtz Centre for Geosciences (GFZ) and Technical University of Darmstadt (TUDa). The data are provided along profiles and include absolute gravity values with ca. 1 mGal accuracy at exact 3-d coordinates in the system WGS84 with respect to the GRS80 ellipsoid. Additionally, heights "above mean sea level" (realized by means of a quasigeoid model) are provided which, at the level of accuracy, are consistent with normal heights in the European vertical reference system EVRS as well as with the national German heights (DHHN2016).

The gravimetric observations were carried out in five campaigns on various survey vessels of the Federal Maritime and Hydrographic Agency (BSH) and of the State Agency for Coastal Protection, National Park and Marine Conservation Schleswig-Holstein (LKN.SH): 2015 OLAND (LKN.SH), 2021 DENEB (BSH), 2022-2024 WEGA (BSH). To that end, various types of gravimeters were utilized for the measurements on the moving platforms (spring gravimeters: Chekan, strap-down inertial gravimeters: iMAR iNAV, iMAR iCORUS), at times several instruments in parallel. The trajectories of the campaigns are displayed in Fig. 1. An overview of the utilitzed instruments during specific campaign segments is given in Johann et al. (2026, Table 1).

Raw gravimeter readings of each instrument were first processed and analyzed individually by the respective operators of the instruments (BKG, GFZ, TUDa). Due to the application of low-pass filters with a wavelength of 400 seconds the effective resolution of the gravity signal is ca. 1 km half-wavelength at a cruise speed of 5 m/s. Then, a comprehensive calibration and combination of the data of all gravimeters and campaigns was done at TUDa. The procedure is explained in detail in Johann et al. (2026). Relevant steps included:

1. Drift correction individually for each gravimeter and cruise leg
2. Computation of a representative mean value of all available gravimeters at a given observation epoch
3. Cross-over point calibration and correction by means of a constant bias parameter per profile segment (where applicable)

The normal height (height above mean sea level) with respect to the national height reference frame of Germany (DHHN2016) was derived by transformation using the quasigeoid model GCG2016 (Schirmer et al. 2018). Outside the GCG2016 model area the gravimetric quasigeoid model EGG2015 (Denker 2015) was used with a seamless transition. Within the limits of accuracy (< 10 cm) the normal heights are compatible with the European height reference system EVRS (reference tide gauge NAP/Amsterdam).

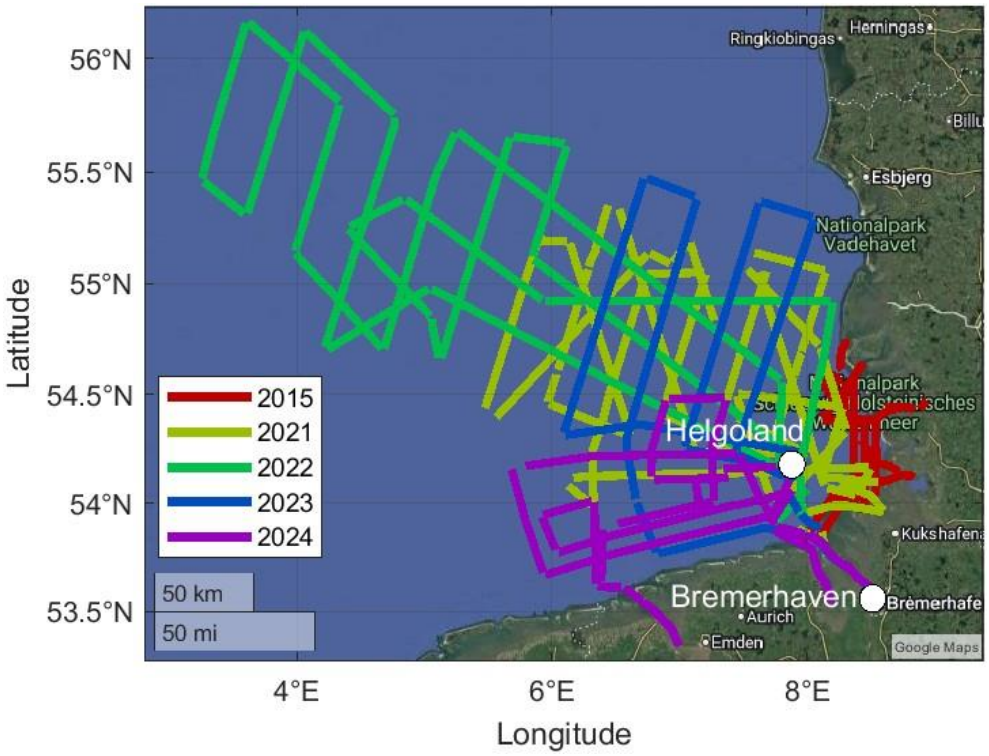


Fig. 1 Trajectories of the five gravimetric measurement campaigns (Johann et al. 2026, Fig. 1)

2.1.1 Description of the data format

CSV file (ASCII, comma-delimited text, one row with names of data fields as header)

Data fields:

1	Camp	Year of campaign
2	Cruise	Cruise segment in the year of the campaign (equals DoY at start of cruise)
3	Segment	Number of profile segment, consecutively numbered
4	DoY	Day of Year (GPS time = UTC + 17 resp. 18 seconds)
5	SoD	Second of DoY (GPS time = UTC + 17 resp. 18 seconds)
6	Lon	geographical longitude WGS84 in decimal degrees
7	Lat	geographical latitude WGS84 in decimal degrees
8	h_GRS80	ellipsoidal height WGS84 in meters
9	H_DHHN	Normal height DHHN2016 resp. EVRS/NAP in meters
10	g	Gravity value in mGal (10^{-5} ms^{-2})
11	dg	Gravity disturbance in mGal (10^{-5} ms^{-2})

2.1.2 References

This dataset:
Liebsch, G., Schwabe, J., Knappe, S., Förste, C., Ince, E.S., Johann, F. (2026) Multi-year shipborne gravimetry in the German Exclusive Zone of the North Sea. Published by BKG with contributions from GFZ and TU Darmstadt. https://doi.org/10.76103/shipgrav_northsea

Related scientific publication:
Johann, F., Knappe, S., Liebsch, G., Förste, C., Schwabe, J., Ince, E.S., Bauer, T.B., Schröder, L., Westfeld, P. (2026) Evaluation and combination of multi-sensor shipborne gravity surveys in the North Sea for the German national geoid model. Marine Geodesy (submitted)

Further references:
Denker, H. (2015) A new European Gravimetric (Quasi)Geoid EGG2015. Poster presentation at the IUGG Symposium 2015, Prague 2015. https://doi.org/10.15488/14432
Schirmer et al. (2018) Modellierung des Quasigeoides GCG2016. In: Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland – Arbeitskreis Raumbezug (Hrsg.): Die Erneuerung des Deutschen Haupthöhennetzes und der einheitliche integrierte geodätische Raumbezug 2016, 197 – 225. Oktober 2018, https://doi.org/10.5675/Raumbezug_2016_Hauptdokument

3 Further Information

Further information concerning the product are available at gdz.bkg.bund.de. In case of any questions, you are welcome to contact our service centre at dlz@bkg.bund.de.

General information regarding the Federal Agency for Cartography and Geodesy can be found on our homepage www.bkg.bund.de.