



Working Committee of the Surveying Authorities
of the Laender of the Federal Republic of Germany



National Report

2024/2025

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Dear reader,

For the Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV), the years 2024 and 2025 were dominated by digitalisation. The digital transformation is shaping society in all areas. In the digitalised world, geospatial reference data has become an important government infrastructure service. It forms the basis for addressing key societal challenges such as national defence, internal security, disaster control, climate change and mobility. At the same time, geospatial reference data is an indispensable planning basis and a reliable decision-making aid in day-to-day administrative activities – for example, for infrastructure, urban development and environmental policy. It also acts as a driver of innovation for new technologies. Geospatial reference data leads to new value creation processes and accelerates digital change in almost all areas. It forms the basis for new business models, digital applications and data-driven solutions.



Digitalisation opens up two key dimensions for official surveying and geoinformation. On the one hand, geospatial reference data makes an indispensable contribution to digital renewal in administration, business and society. On the other hand, digitalisation makes it possible to optimise internal processes and to redesign the collaboration between surveying and geoinformation administrations in cooperation with the federal government within AdV, in a future-oriented manner. For decades, AdV has been one of the pioneers of digitalisation and today sees itself as a driver of digital transformation. With standardised geospatial reference data and many years of experience in handling digital data and processes, the surveying and geoinformation administrations are actively contributing their expertise to shaping digital change. An important milestone in this direction was the nationwide, uniform provision of unrestricted geospatial reference data as open data, agreed upon by AdV in 2024. By releasing this high-quality data, AdV has made an active contribution to digital transformation: innovations for business, science and society are being promoted and citizen participation is being strengthened.

For official surveying and geoinformation services, it is essential to tap into the potential of digitalisation within AdV. In view of ever shorter innovation cycles, increasing demands, dwindling budgets and a growing shortage of skilled workers, it has a key role to play. Digitalisation enables a paradigm shift in cooperation: cloud technologies promote cross-border collaboration by enabling the joint development and use of processes and services, agile development approaches create the basis for centralised solutions, big data analyses enable new evaluations, and artificial intelligence becomes a driver for efficiency and innovation.

Digitalisation is therefore both an opportunity and a challenge. It makes geospatial reference data a strategic component of digitalisation and at the same time opens up the possibility of strengthening federal cooperation in official surveying and geoinformation in the long term. AdV has proven that it can actively shape this role – as a driver of digitalisation and a catalyst for modern, sustainable administration.

I would like to express my special thanks to all those who have contributed with great dedication and expertise to advancing these developments and ensuring the efficiency of the official surveying and geoinformation system.

Karin Schultze
AdV-Chair

1. Organisation and Performance of Tasks

In the Federal Republic of Germany, the Laender are responsible for performing official surveying and mapping tasks. Since 1948, the responsible authorities of the Laender and the Federal Ministries of the Interior, Defence and Transport have been cooperating together in the Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV) to address technical matters of fundamental and national importance. The German Geodetic Commission, as a representative of geodetic teaching and research, and the German Federal Working Group Sustainable Rural Development, representing the field of land consolidation, have guest status in AdV.

Organisation of AdV

Figure 1 shows the organisation of AdV. Chair and plenum are its steering bodies. AdV is supported by the working groups and the management.

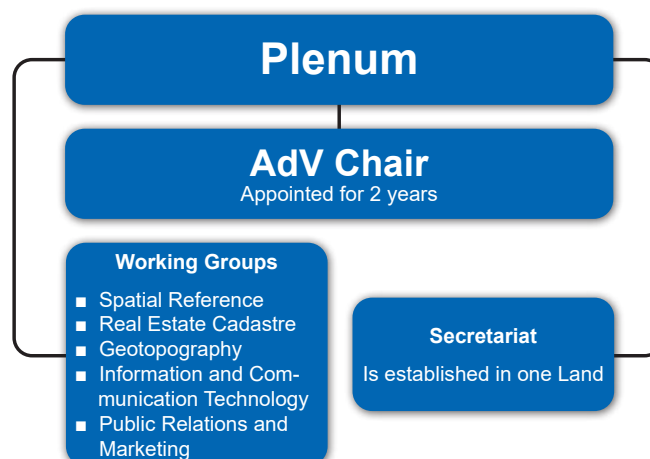


Fig. 1: Organisation of AdV

Objectives and Tasks of AdV

The member authorities collaborate within AdV to:

- regulate field-related matters of fundamental and cross-regional importance for the official Surveying and Mapping in a standardised manner,
- create a pool of geospatial reference data that is essentially standardised and geared towards meeting the requirements of the information society,
- provide the infrastructure for geospatial reference data as an important component for modern e-Government architectures.

In order to achieve these objectives, AdV performs the following tasks:

- creation and coordination of future-oriented collaborative concepts for the nationwide standardisation of the real estate cadastre, surveying and mapping and the geographic reference information system in order to meet the needs of politics, industry, and administration,
- promoting the joint execution of projects of cross-regional importance,
- steering and coordination of the norming and standardisation for the recording and management of geospatial reference data as well as the corresponding access and distribution methods,
- support in the expansion and development of the national and European geospatial data infrastructure and the corresponding electronic services,
- external representation of the official Surveying and Mapping,
- participation in international specialist organisations for the promotion of know-how transfer,
- collaboration with organisations and agencies from related fields and with institutions of geodetic research and teaching,
- coordination on issues of specialist training

Geobasis Steering Committee

In 2010 the Geobasis Steering Committee (LA Geobasis), in which all Laender are represented, was established by the administrative agreement for cooperation in the official Surveying and Mapping in Germany. The administrative agreement aims to further improve the operational implementation of the strategies agreed on in AdV and to further optimise cooperation across Germany. Furthermore, it is the objective that the Geobasis Steering Committee ensures that the geospatial reference data is provided in standardised form to all users in the required level of quality.

Der LA Geobasis hat zur Umsetzung strategischer Beschlüsse der AdV folgende Aufgaben und Befugnisse:

- monitoring and analysis of work and developmental progresses, including compliance with the defined quality standards and norms,
- analysis of cooperation possibilities and processing proposals towards their realisation,
- steering and collaboration between various Laender,
- quality control based on AdV standards regarding content and format consistency.

Surveying and Geoinformation Authorities of the Laender

The development of the surveying and cadastre sector into a modern geoinformation system is a process that was accompanied by comprehensive reforms. The key to modernising the administrative procedures of the mapping and cadastre authorities in the Laender is the opening of the administrative bodies to adjacent areas in order to provide the groundwork for infrastructural and spatial planning policy in the network.

The surveying and geoinformation administrations are attached to various ministries in the individual Laender, with the Interior Ministry being the most frequently represented. Structural changes have been made in many authorities. In certain Laender, the real estate cadastral authorities and in some cases also the regional development / land consolidation authorities are now integrated into the higher-level geoinformation authorities. In other Laender, local areas of responsibility have been expanded by the amalgamation of real estate cadastral authorities. The key aspects of the geoinformation system – management of the real estate cadastre and geotopography as well as land surveying including the provision of official reference systems – are the responsibility of the Laender. The original services offered include:

- the nationwide provision of spatial reference data via reference networks in the Authoritative Control Point Information System (AFIS®), based firstly on terrestrial control points and their documentation, secondly, on the satellite positioning service of the German national surveying agency SAPOS®,
- maintaining a nationwide image of the surface of the earth through geotopographic products in the Authoritative Topographic-Cartographic Information System (ATKIS®) using landscape and terrain models, official topographic cartography and orthophotos,
- the nationwide digital documentation of buildings and approx. 64 million cadastral parcels for the property rights in the real estate cadastre, which will be managed throughout the Federal Republic using the Authoritative Real Estate Cadastre Information System (ALKIS®),
- the harmonisation of the real estate cadastre and surveying and mapping data.

The following table provides an overview over the statistical data in reference to the official Surveying and Mapping of the Laender.

Land	Inhabitants	Reference Area in km ²	Cadastral Parcels in thousands	Number of Authorities		ÖbVI
				State Offices (-State enterprises)	Regional Offices	
Baden-Wuerttemberg	11.339.260	35.748	8.899	1	56	142
Bavaria	13.435.062	70.542	10.974	1	51	0
Berlin	3.782.202	891	403	1	12	39
Brandenburg	2.581.667	29.654	3.140	1	17	130
Bremen	691.703	420	207	1	1	4
Hamburg	1.910.160	755	260	1	—	7
Hesse	6.420.729	21.116	4.993	1	7	66
Mecklenburg-Western Pomerania	1.629.464	23.295	1.951	1	7	57
Lower Saxony	8.161.981	47.710	6.261	1	—	78
North-Rhine-Westphalia	18.190.422	34.113	9.375	1	53	325
Rhineland-Palatinate	4.174.311	19.858	6.198	1	6	70
Saarland	994.424	2.572	1.293	1	—	7
Saxony	4.089.467	18.450	2.833	1	13	81
Saxony-Anhalt	2.180.448	20.555	2.697	1	—	45
Schleswig-Holstein	2.965.691	15.804	1.962	1	—	33
Thuringia	2.122.335	16.202	3.270	1	—	49
Total for Germany	84.669.326	357.685	64.716	16	223	1.133

Tab. 1: Statistical data of AdV.

Source for number of inhabitants and reference area Municipality directory information system GV-Isys, as of 31 December 2023

<https://www.destatis.de/DE/Themen/Laender-Regionen/Regionales/Gemeindeverzeichnis/Administrativ/02-bundeslaender.html>

As of the reporting year 2016, the figures in the "Number of inhabitants" column are comparable with the previous year's figures only to a limited extent due to methodological changes and technical enhancements.

Due to a technical and methodological change in the surveying administration to the "Official Real Estate Cadastre Information System" (ALKIS®), the comparison of area data from 2014 with area data from previous years is only possible to a limited extent.

Deviations in the area figures are possible due to figure rounding.

© Data (commissioned by the Statistical Offices of the Federation and the Laender): Federal Statistical Office 2023

Source for cadastral parcels, number of authorities, ÖbVI: AdV, as of 31.12.2024

Federal Ministry of the Interior



The Federal Ministry of the Interior (BMI) is a member of AdV. Division H II 5 "Geoinformation" in the Department of Community, Subdivision H II Equal Living Conditions, Demography, Municipalities promotes the provision of geoinformation, provides information on its possible uses, spurs the use of geoinformation and corresponding standards and assumes the coordinating function between the parties involved in geoinformation within the federal administration, including through the Interministerial Committee for Geoinformation (IMAGI), as well as in dialogue with the Laender, e.g. within the framework of AdV and the Spatial Data Infrastructure Germany (GDI-DE). It supervises the Federal Agency for Cartography and Geodesy (BKG), the central service provider and competence centre for geoinformation and geodetic reference systems of the federal government.

The BKG deals with the collection and data management as well as the analysis and combination of geospatial data up to their provision and their use in applications. The work of the BKG serves federal institutions in particular. In addition, the public administration of federal states and municipalities as well as economy, science and almost every citizen in Germany benefit. Experts from a wide range of fields such as transport, disaster prevention, homeland security, energy, and the environment use geodata, maps, reference systems, service and information services as well as applications from the BKG for their work.

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The BKG fulfils in particular the following tasks in the field of geoinformation and geodesy (in cooperation with the Laender if required):

- The provision, editing and presentation of up-to-date analogue and digital topographic and cartographic information and the further development of the necessary processes and methods,
- the provision and maintenance of the geodetic reference networks of the Federal Republic of Germany, and
- the representation of the interests of the Federal Republic of Germany in the field of geodesy and geoinformation in the international arena.

In the field of geodesy, the BKG provides a uniform spatial reference system (coordinate system) for the entire federal territory. For this purpose, it operates three geodetic observatories with partner institutions in Wettzell (Bavarian Forest), La Plata (Argentina) and O'Higgins (Antarctica). The BKG collaborates with a network of observatories and analysis centres worldwide to determine the orientation of the Earth in space. This includes, for example, the actual orientation of the rotation axis and the Earth's current rotation speed. At the observatories, the BKG also observes the movements of the Earth's satellites. In international cooperation this data is used to determine satellite orbits, station coordinates, correction data and also changes in the Earth's surface. All these measurements are a prerequisite for functioning satellite navigation. In addition, the BKG opera-

tes the federal authority GEPOS™ in the joint federal-Laender project PPP-RTK satellite positioning service SAPOS®| GEPOS™.

At the Wettzell Geodetic Observatory, the BKG also determines the trajectories of space debris and observes space weather. The Remote Sensing Service Centre is the competent contact point at the BKG for obtaining satellite image data, while the Satellite-based Crisis and Situation Service (SKD) provides support in crisis situations.

In the field of geoinformation and cartography, the BKG is responsible for preparing, combining, providing, and updating topographic (location-describing) and cartographic information. For example, the BKG provides digital maps, terrain models, elevation models, aerial photographs, administrative boundaries, toponymy and other topographical data, as well as paper maps, which are used as valuable aids by, for example, the Federal Police, the Federal Agency for Technical Relief (Technisches Hilfswerk) or the Federal Foreign Office. The BKG's service centre is the central point of contact. Whether standard maps or individual needs - public administration, businesses, science and interested citizens will find practical services and products here. The creation and provision of such products is being further developed using the latest digital methods and possibilities, such as the Digital Twin Germany (DigiZ-DE) or hybrid maps.

The GDI-DE stands for the comprehensive networking of geodata at federal, Laender, and local authorities. With the GDI-DE coordination office, the BKG coordinates the development, expansion and maintenance of the federal share of the GDI-DE and operates its central components, for example the Geoportal.de (www.geoportal.de).

Beyond the borders of Germany, the BKG contributes in close cooperation with its European and international partners to the provision and realisation of a uniform spatial reference and the establishment of a European and global spatial data infrastructure.

Further information on the current work, services, and products of the BKG can be found on the website www.bkg.bund.de.

The Federal Ministry of Transport



Bundesministerium
für Verkehr

The Federal Ministry Digital and Transport (BMV) has been a member of AdV since 1950. Division DP23 coordinates the multi-layered use of geospatial reference information provided by the Laender within the Ministry and its executive agencies with more than 17 higher-level authorities and the transfer of know-how from surveying units of the “wet” directorates-general (i.e. waterways and shipping) to AdV.

The Federal Waterways and Shipping Administration (WSV) is responsible for the maintenance (in terms of traffic and water-management) of the federal waterways (around 7,300 km of inland waterways and around 23,000 km² of sea waterways). In addition to its maintenance obligations, the WSV is also responsible for ensuring traffic safety on federal waterways. The Department for Surveying/Geoinformation provides, among other things, georeferenced data, processed into user-oriented products, e.g. on water depths and the topography of the waterbed. Official surveying tasks are carried out nationwide, which require close coordination within AdV. The WSV maintains its own basic network (position and elevation control points) along the waterways and maintains digital map series, the contents of which are incorporated into the ATKIS®-Basis-DLM: the Inland ENC (navigation chart for inland waterway transport) and the DBWK, the WSV's base map at a scale of 1:2,000. In addition, the ‘WSV transport network’ provides important information on the course and kilometrage of federal waterways.



Fig. 2: The WSV conducting surveying work on the Levensau High Bridge over the Kiel Canal.
Photo: Markus Erfert, Wasserstraßen-Neubauamt Nord-Ostsee-Kanal, 27 July 2022

For the maritime sector, the Federal Maritime, and Hydrographic Agency (BSH) performs marine surveys in the German North Sea and Baltic Sea – the most navigated waters in the world. Maritime surveys and maritime cartography provide necessary basic information for environmental protection, the construction of offshore installations, coastal protection, and hydraulic engineering. The area surveyed of the BSH covers around 57,000 km², which is equivalent to one sixth of the land area of Germany. This area is displayed on a set of nautical charts with around 317 datasets for electronic navigational chart systems plus 139 nautical charts in paper format. In addition, comprehensive datasets on the current and historical chemical, physical and biological condition of the water column in the German territorial sea plus operational information and forecasting services for the water levels, the tides, swell and drift are provided via a web-based spatial data portal as a maritime component of the Spatial Data Infrastructure Germany (GDI Germany).

The “Geodesy and Remote Sensing” division of the Federal Institute of Hydrology (BfG) advises the BMV and currently supports WSV in performing functions in the fields of geodetic measurement networks and engineering geodesy, surveying of water bodies, geotopography and construction surveying as well as the remote sensing issues. The expertise required for the provision of specialist scientific advice is present within the scope of applied research and project implementation. In this context, intensive cooperation with universities and other research establishments is obligatory to contribute to departmental research. Analogous to the maritime component in the BSH geodataportal, the BfG operates a geoportal under the leadership of the ‘Geodata Centre, WasserBLICK, GRDC’ department, which focuses on national inland waters. In addition to the obligatory functions of digital networking in the world of geodata, the geoportal provides access to relevant, nationally harmonised data from water management authorities in Germany.

All agencies and higher-level authorities cooperate closely with the surveying authorities of the Länder and in the AdV working parties. Their activities focus on the exchange of information regarding topography, information technology and spatial reference, as well as the use of SAPOS®-Dienste services, especially in the overseas reception range.

In addition, BMV has lead responsibility in coordinating the European Union's "Copernicus" earth observation programme within the Federal Government. With the German government's 'National Application Strategy' – The use of satellite signals and data provided by the European programmes Copernicus and Galileo as well as the meteorological programmes of EUMETSAT (12-2024) – the German government is continuing its commitment to further developing the data and services so that they can be used in a targeted and efficient manner.

More detailed information on geospatial information can be found on our website www.bmv.de.

Together into the future: Continued development of AdV's cooperation

The cooperation between surveying and geoinformation authorities is currently being further developed in a systematic manner. This process is driven by growing demands on geospatial reference data, increasing pressure to innovate, scarcer budgetary resources and a glaring shortage of skilled workers. The Laender are increasingly reaching their limits in terms of coping with the rapid developments on their own. Against this backdrop, it is important to consistently exploit the potential of digitalisation and to pool scarce resources in a targeted manner. To this end, cross-state cooperation with the federal government is being systematically expanded under the umbrella of AdV. This will ensure that the official surveying and geoinformation system remains efficient and, at the same time, lays the foundation for sustainable further development.

For decades, cooperation within AdV has been characterised primarily by the development of common standards to ensure national uniformity of geospatial reference data. With the creation of 'Central Offices', structures were also established to meet existing requirements for cross-state data provision. In the context of digital transformation and increasing pressure on resources, the focus of cooperation is now increasingly shifting beyond quality management and data provision to a joint production also. Where synergies with the federal government can be exploited, these are to be jointly utilised – while respecting federal responsibilities. Duplicate developments and the parallel operation of identical procedures are avoided. Technical and methodological expertise, which is increasingly scarce in the Laender, is concentrated. Experts work in agile teams and collaborate across administrations for everyone in AdV. This enables procedures to be carried out professionally, innovations to be put into practice more quickly and modern technologies to be firmly established.

The joint pooling of resources creates the basis for the long-term economic use of modern cloud applications or KI technologies. Cloud architectures in particular open up the possibility of jointly developing and operating processes while at the same time making them available in a decentralised manner in all Laender. This allows synergies to be exploited while preserving federal structures. This approach is also in line with the recommendations of the National Regulatory Control Council, which advocates greater centralisation of joint procedures while preserving federal responsibilities as the key to administrative modernisation in Germany.

Under the vision of 'Central Offices 2.0', cooperation within AdV is to be geared even more strongly towards joint operating structures in future. This conceptual approach consistently develops the established structures by ensuring the uniformity of geospatial reference data through joint quality management while at the same time opening up new forms of cooperation. The aim is to meet increasing demands despite scarce resources. The basis for this is a flexible 'toolbox' model, which creates a set of instruments that allows the Laender to choose different forms of cooperation as needed and to pool resources in line with demand. The success of this concept is already evident in practice – for example, in the joint technical operation of the Cop4All process for deriving land cover and the Smart Mapping process for the automated generation of cartographic products.

Together into the future: Continued development of AdV's cooperation

These examples illustrate that cross-state cooperation in collaboration with the federal government leads to greater efficiency and makes the work more future-oriented. At the same time, the federal anchorage remains an indispensable foundation. This allows AdV to pool resources, exploit synergies and drive innovation. In this way, AdV combines reliability with renewal: it preserves the stability of the Official Surveying and geoinformation system while developing it further in a future-oriented manner.



Geospatial reference data is a key to digitalisation. It enables data-driven solutions and is indispensable for successfully mastering key future challenges such as security, mobility, disaster control and equal living conditions. To ensure that this continues to be the case in the future, we must consistently exploit digital potential and pool our scarce resources and expertise in a targeted manner. Increased cooperation in AdV is the right way to achieve this.

*Dr. Lydia Hüskens,
Minister for Infrastructure and Digital Affairs of the State of Saxony-Anhalt*



Fig. 3: Jointly operated Smart Mapping process – an example of digital collaboration within AdV

2. Working Group Spatial Reference

New implementation for the integrated geodetic spatial reference

The evaluation of the GNSS campaign, carried out in the summer of 2021, has provided updated coordinates for the integrated geodetic spatial reference. At the two computing centres – the BKG in Frankfurt/M. and the Lower Saxony State Office for Geoinformation and Surveying in Hanover – new coordinates were determined for the 250 geodetic control network points (GGP) and for the reference station networks **SAP_{OS}**[®] and GREF (Integrated Geodetic Reference Network Germany). A positional accuracy of 1 mm and an elevation accuracy of 2 mm were achieved.

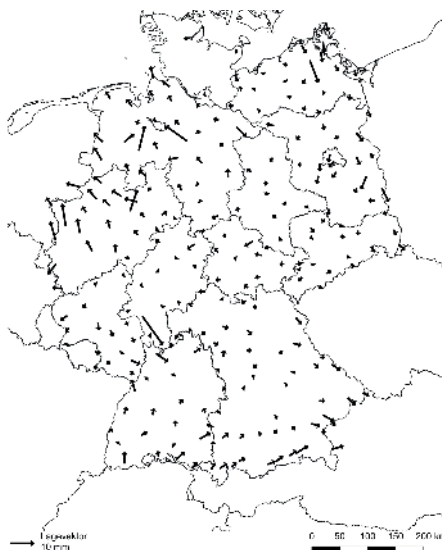


Fig. 4: Change in the position of the GGP for the 2021 campaign compared to the 2008 baseline measurement.

The results show, in comparison to the original determination of the spatial reference in 2016, some significant movements of the points in position and height. These are up to one centimetre over a period of 13 years.

With the new results of the GNSS campaign, a current homogeneous reference frame was created, which was to be put into use. This occurred on 1 July 2025 with the nationwide introduction of the new 2025 implementation in ETRS89/DREF91 for the official geodetic spatial reference. Consequently, all GGP and reference station points receive new coordinate values. The provision of this new spatial reference realisation is an important basis for quality assurance in reference station network monitoring and for the **SAP_{OS}**[®] and GEPOS[™] (German Satellite Positioning Service) positioning services.

The results of the GNSS campaign demonstrate the potential of geodetic measurement methods for detecting and monitoring temporal changes in the Earth's surface. These natural or man-made changes also affect the coordinates of the official spatial reference system and must be taken into account more effectively in future.

The Spatial Reference Working Group (AK RB) has set up the project group "Kinematic Spatial Reference" to deal with conceptual work on its establishment.

PPP-RTK service successfully launched

At the beginning of 2025, the joint PPP-RTK service provided by the federal and Laender governments entered its optimisation phase. This was preceded by extensive testing, the results of which were presented in a feasibility study in March 2024. The study demonstrated that the SAPOS®-HEPS specification for accuracy can be achieved.

The service is operated redundantly by the BKG and the SAPOS® central office. Both operational entities use the GNSMART software from Geo++ GmbH. The correction data is delivered in the open SSRZ format. In response to customer requests, the SPARTN format has been added to the data delivery options.



Fig. 5: Map of Germany

The years 2025 and 2026 will be used to further optimise the service. During this period, for example, the establishment of load balancing between the two instances and tests of other software products and data formats are planned. The operating instances are working to increase the performance of the PPP-RTK service; network configuration and software parameters are being investigated and improved in cooperation with the manufacturer. For monitoring purposes, there are now 27 GNSS stations distributed throughout Germany, which are operated by numerous Laender and the BKG. Forty-six GNSS receivers are installed at these monitoring stations, enabling comparisons between the results with correction data from the two operating entities and SAPOS® HEPS.

Shortly after the start of the optimisation phase, a comprehensive evaluation of measurements from the monitoring stations took place in February 2025 (baseline measurement). Despite strong ionospheric disturbances during this period, an improvement in quality was noted compared to the test phase of the service in the previous year.

The correction data is transmitted from both operating instances via Ntrip-Caster over the internet and from the BKG instance via DAB+ digital radio. The PPP-RTK service is available free of charge under a CC BY 4.0 licence; a registration is not required. The support for the development of new end devices is specifically requested.

On the PPP-RTK service website <https://gepos.sapos.de/>, potential users can educate themselves, contact representatives at both operating entities, and receive advice.

The new PPP-RTK service is being promoted at suitable events. First and foremost, of course, INTERGEO is to be mentioned. In 2024, the presentations at AdV and BKG stands, as well as the panel discussion, attracted keen interest from visitors.

The satellite positioning service of the Laender and federal government and the existing SAPOS® services operate under the joint umbrella brand SAPOS®-DE. The name of the PPP-RTK satellite positioning service of the Laender and federal government will be determined by the time the operational phase begins.



Fig. 6: Logos of the new PPP-RTK positioning service provided by the Laender and the federal government

Introduction of the radar control point (RAPP) into the Rili-RB-AdV – a strategic step towards integrating radar interferometry into official spatial referencing

Project group (PG) SAR interferometry of the AK RB has taken a significant step forward this year in the further development of the uniform integrated geodetic spatial reference: To update the guideline for the uniform integrated geodetic spatial reference for official surveying in the Federal Republic of Germany, version 4.0 dated 5 July 2024 (Rili-RB-AdV), a new type of control point was introduced – the radar control point (RAPP).

Radar interferometry is an established remote sensing technique for detecting ground movements over large areas. Thanks to the Copernicus programme, radar data with high temporal resolution is freely available, opening up numerous fields of application – from geokinematic monitoring to the monitoring of structures.

However, the integration of radar interferometric data into the official spatial reference system is not yet guaranteed. The results of interferometry are relative to a reference point and often cannot be directly traced back to the official spatial reference system. The new RAPP helps to remedy this situation: as a radar reflector perman-

ently connected to the Earth's surface, whose position and speed are determined with the aid of a connected GNSS reference station, it enables unambiguous positioning and long-term monitoring in the official reference system.



Fig. 7: Radar control point in Saarland (Eft-Hellendorf station, Perl).

The benefits are manifold: RAPPs enable the calibration and validation of radar interferometric data through direct coupling to GNSS measurements. They improve the comparability, accuracy and integrability of interferometry into existing geodetic infrastructures. They also provide valuable information for testing the stability of control point fields and can be used as a decision-making aid for densifying or thinning point networks – especially in the context of scarce human and financial resources in national surveying authorities.

The PG SAR Interferometry sees the introduction of RAPPs as a strategically important step towards better exploiting the potential of radar interferometry for official geodesy. In the long term, RAPPs can make a significant contribution to securing and further developing spatial reference in Germany and have the potential to significantly improve the data quality of radar interferometric results.

Geospatial reference data for digital construction and Digital Twins – AdV is driving digitalisation forward

AdV, bSD, and BDVI publish joint position paper on official geodata for digital construction

In May 2025, AdV, together with buildingSMART Germany (bSD) and the Association of Publicly Appointed Surveyors (BDVI), published the position paper 'Official geodata as the basis for digital processes in planning, construction and operation' (<https://buildingsmart-verlag.de/produkt/amtliche-geobasisdaten/>). The aim is to promote the integration of geospatial reference data into construction projects, thereby accelerating the digitalisation of the construction industry and making it more efficient.

The paper is the result of intensive professional exchange and stands for transparency, mutual understanding and cooperation. As the coordinator of the official German surveying and geoinformation system, AdV contributes not only geospatial reference data but also its many years of expertise in handling digital data and processes.

The position paper also contains a number of requests based on users' experiences with geospatial reference data. The next steps will involve constructively evaluating these suggestions and deciding which of them will be incorporated into concrete implementation processes. It will also be necessary to examine what can be achieved efficiently and effectively, how, when and at what cost.



Fig. 8: Signing of the document; from left to right: Rainer Brüggemann (BDVI), Karin Schultze (AdV Chair), Gunther Wölfle (bSD Managing Director), Dr Katharina Lundenberg (bSD and DVW)(Image: DVW e. V.)

Geospatial reference data for digital construction and Digital Twins – AdV is driving digitalisation forward



The successful digitalisation of the construction industry requires the seamless integration of geospatial data into BIM processes. With this joint position paper, we are laying the foundation for standardised data exchange between the GIS and BIM worlds. Only through close cooperation between all stakeholders can we make the “Digital Twin” a reality and thus sustainably increase efficiency in planning, construction and operation. Our goal is to develop open standards that benefit all stakeholders and drive the digital transformation of the entire industry.

*Prof. Dr. Cornelius Preidel,
Chairman of the Board, buildingSMART Deutschland e. V.*

Contribution of AdV to the development of Digital Twins

AdV intends to play a key role in the development of Digital Twins in Germany. It plans to provide application-neutral building blocks in the form of geospatial reference data, geospatial tools and geospatial applications for Digital (specialist) Twins at federal, Laender and local level. In line with the resolution of the 2nd Digital Ministers' Conference, it is seeking to establish strategic partnerships with other committees and organisations. These include, in particular, the Steering Committee of the German Spatial Data Infrastructure (LG GDI-DE), the specialist ministers' conferences and the local authority associations.

A digital twin from AdV should be usable in both spatially and thematically organised specialist twins. Interoperable tools and components should be used to meet the requirements of different digital specialist twins. This will promote a data storage and processing ecosystem for the federal government, states and local authorities.

A key element is close cooperation with GDI-DE. AdV and LG GDI-DE cooperate in clearly defined, complementary roles: AdV provides geospatial data building blocks, while GDI-DE is responsible for the technical infrastructure for interoperable data exchange and performs key tasks in the standardisation of geodata. Through this complementary interaction the basis for powerful digital twins is created.

In order to identify and overcome challenges in the development of Digital Twins, AdV and its member administrations are actively participating in pilot projects. Sustainable agile structures and the consistent further development and use of Digital Twins can strengthen cooperation between different administrative levels and specialist areas. A Digital Twin from AdV is therefore a central building block for the development and operation of Digital Twins in the federal environment.

*Geospatial reference data for digital construction and Digital Twins
– AdV is driving digitalisation forward*

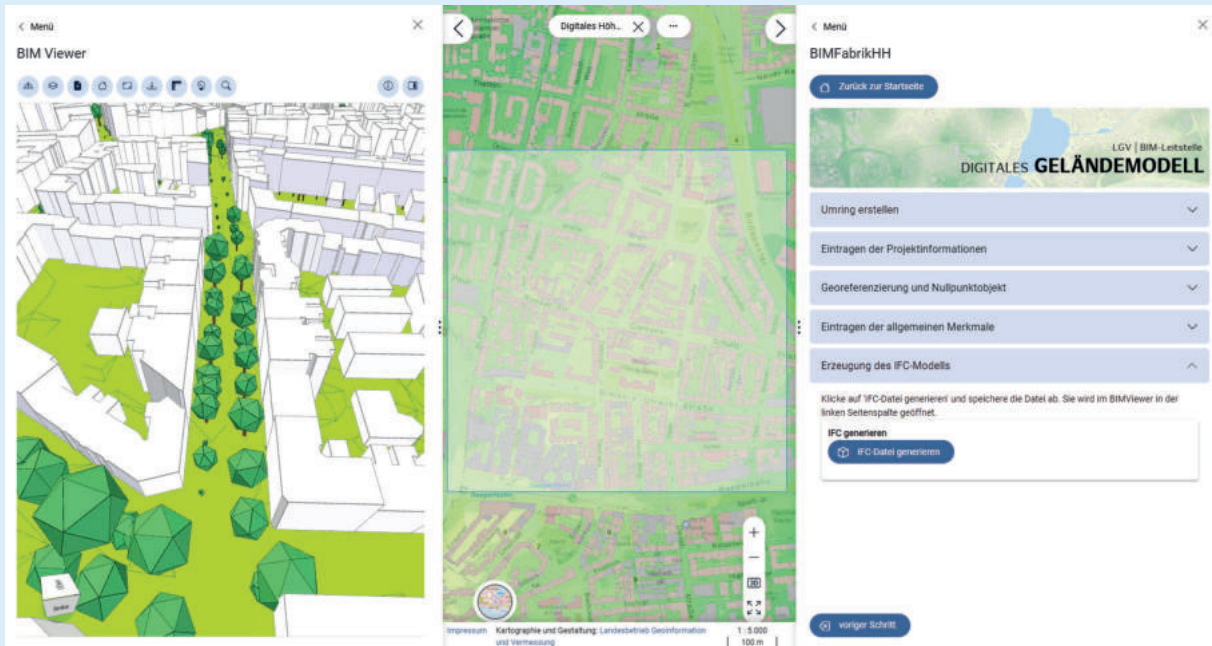


Fig. 9: Digital Twin Hamburg



The Digital Twin makes planning and approval processes easier, faster and more transparent. This benefits not only the administration and businesses, but also all citizens – through better services and a modern, liveable city.

Jacqueline Charlier,

State Councillor for Urban Development and Housing of the Free Hanseatic City of Hamburg

3. Working Group Real Estate Cadastre

The real estate cadastre as the foundation for network expansion

Nothing symbolises the land registry more than its parcels of land and the recording of their boundaries. Anyone who builds must be sure of where the boundaries of their property lie. Anyone who buys a plot of land wants to know how big it is. These are applications where the land registry plays to its traditional strengths by providing 'on-site accuracy'. However, the land registry does not only serve individual cases; it is also a geobasis information system that offers its data for applications on a state and national scale. The land registry is not only a source of information, but also a tool for planning and decision-making.

One such nationwide application is the Gigabit Land Register. The Gigabit Land Register is a federal information system designed to support infrastructure expansion in the telecommunications sector. Network operators are an important target group. The Gigabit Land Register is intended to provide them with the information they need for network expansion. Since it is assumed that it is particularly easy to build infrastructure on public land, publicly owned land is to be visualised in the Gigabit Land Register. As a data basis, the real estate cadastre is the first choice. As a first step, the federal government and surveying authorities have agreed to mark the property of the federal, state and local authorities. This approach follows a procedure that has been used successfully in North Rhine-Westphalia for a long time.

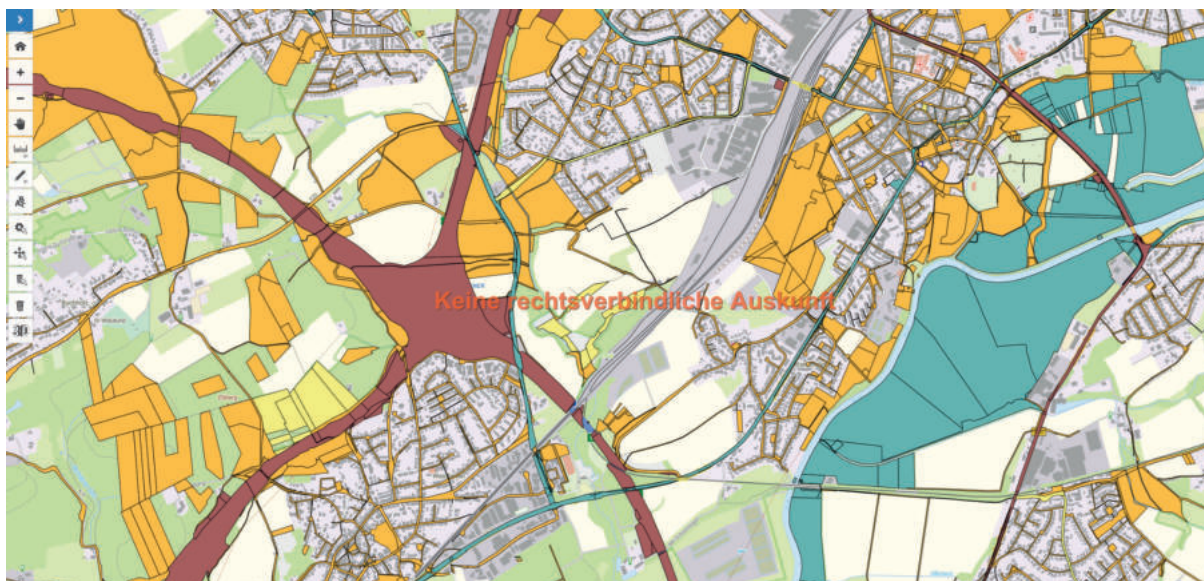


Fig. 10: Identification of property owned by the federal government (brown), state (green) and municipalities (orange) based on data from the real estate cadastre. Westhofener Kreuz

Centralised provision of the land registry?

It is not only the Gigabit Land Register that requires nationwide data from the land registry. Previously, its data also had to be made available for property tax reform and for the transparency register, a nationwide database for combating major crime. Long-term customers include the federal and state statistical offices, which use the data on land use to compile official land statistics. Additional nationwide applications are on the horizon. For example, the CO₂-reducing modernisation of existing buildings is part of the energy transition. Success can only be measured with a database that describes the energy status of buildings in Germany. The real estate cadastre would provide such a database with its buildings, which could then be enriched with the necessary technical information.

The value of the real estate cadastre is becoming increasingly apparent, not only in terms of legally binding property boundaries, but also as a nationwide geodatabase. It is therefore not surprising that the federal government – following a decision by IMAGI – has identified around thirty (!) applications in the federal administration that rely on data from the real estate cadastre.

This raises the question of how the real estate cadastre can be made accessible to the federal government or, rather, to individual applications. The real estate cadastre is maintained by the Laender. Therefore, there

is not a single real estate cadastre, but sixteen. Should the federal government contact and negotiate with the surveying authority of each Land individually? Or should each individual authority conduct these negotiations independently for its specific application?

AdV has long been familiar with Central Offices. These Central Offices offer users a central point of contact and a uniform nationwide service. They exist for geotopography data, satellite positioning service data, and addresses, building model and land parcels from the real estate cadastre. What could be more obvious than to meet the nationwide demand for land registry data in the future through a central land registry office? All the more so as it can be assumed that not only the federal government but also users from the private sector would appreciate such a service. The surveying and geoinformation authorities are currently examining whether this approach should be pursued. If they decide in favour of it, there are still major hurdles to overcome: How can the economic viability of a central land registry office be ensured, and how can personal data in the land registry be handled in a manner that complies with data protection regulations?

Smart Mapping – The new way to experience official maps

The digital transformation is opening up new paths for official surveying, including in the development, production and provision of official surveying standard products and services, including those relating to official geotopography. Standard products must meet constantly changing requirements resulting from user needs and technical developments within ever shorter development times. The AdV plenary has therefore set up a 'Smart Mapping' working group in which the federal and Laender governments have jointly developed a procedure that enables various cartographic products to be created centrally and, to a large extent, automatically on the basis of official geospatial data.

Until now, topographic maps have been produced digitally in a decentralised manner in the Laender and distributed both digitally (raster) and analogously (print/plot). As a result, the up-to-dateness of topographic maps varies greatly across Germany. Their uniform content and fixed scale sequences have ensured reliability for decades. At the same time, however, they have made flexible reuse difficult. The shift to predominantly digital use of maps on the internet is now almost complete, given the many map services on offer. Official cartography is also following this trend and will in future offer the results of topographic surveying in web presentations of geodata in vector format. Content-rich vector data as a product can be used more flexibly and is becoming increasingly important for subsequent use in numerous web applications, but also in geoinformation systems.

In the Smart Mapping process, AdV standard products are designed and implemented in a central cloud infrastructure using agile methods by the federal and Laender governments' own developers in consultation with experts from the AdV Geotopography Working Group (AK GT). This creates synergies in personnel deployment, cost reduction and time savings in development and production. The process consistently focuses on automatic production and quality-assured provision of comprehensive, uniform products with a high degree of up-to-dateness. In doing so, the 'open source first' strategy adopted by the AdV plenary session has been consistently implemented.



The new AdV standard products are being published under the newly introduced product group called basemap.de for flexible reutilization. Corresponding open data licences are now a matter of common practice. The focus of basemap.de is on modern web maps and interfaces, but in the future, presentation editions will also be published in the usual standard scales and made available for download. In addition to basemap.de Web Raster (WMTS service), basemap.de Web Vector (Vector

Tiles service) and basemap.de Web Shading (WMS service), a fully automatically derived presentation edition at a scale of 1:10,000 has been adopted and published for the first time under the name basemap.de P10. The

Smart Mapping - The new way to experience official maps

development of further standard scales (P25/P50) is currently a high priority, whereby the necessary automatic cartographic generalisation poses a particular challenge for the process.

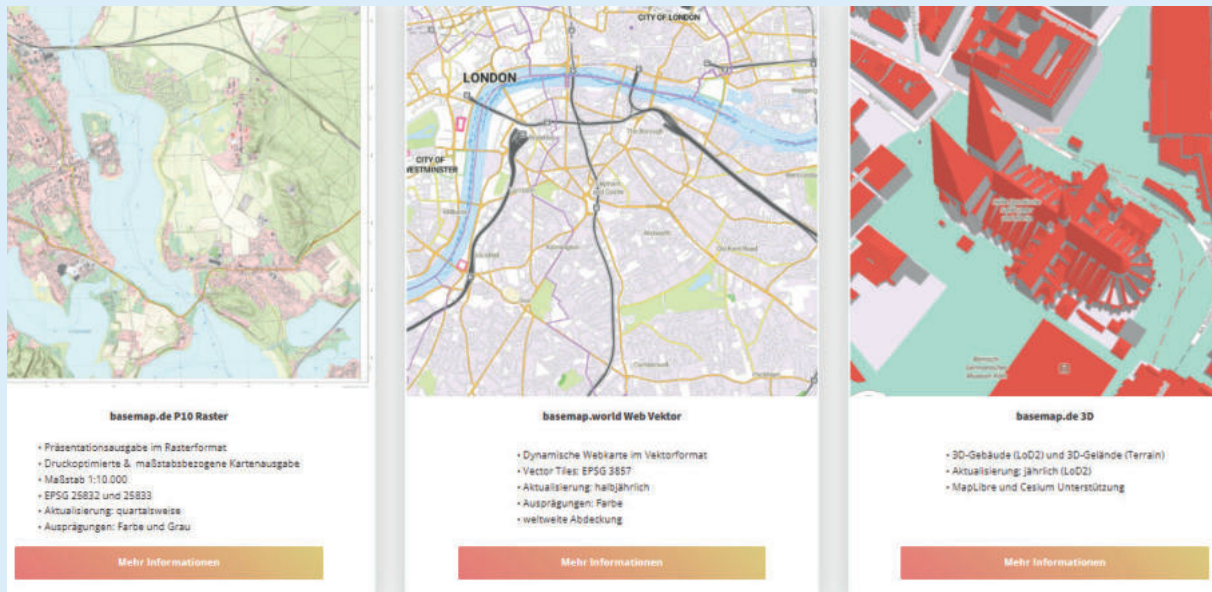


Fig. 11: Newly published basemap.de products.

For the first time, a 3D terrain representation, including LoD2 buildings, is now being rendered in a nationwide uniform service and made available for subsequent use. A global map application that provides cross-border content in a uniform layout rounds off the offering.

Smart mapping has long since moved beyond the pilot project stage. The current top priority is to establish permanent operational support for the central production of basemap.de products. For this purpose, a new 'technical operations centre' with appropriate staffing has been set up at the Federal Agency for Geodesy and Cartography (BKG), which is jointly financed by the federal and Laender governments. In the future, the maintenance and further development of the process will be ensured by a 'Smart Mapping Development Centre' which is yet to be established. Through these innovations with new technologies, content and flexible application options, the official surveying system is making a sustainable contribution to the digitalisation of public administration.

4. Working Group Geotopography

Using the Authoritative Topographic-Cartographic Information System (ATKIS®), the surveying and geoinformation authorities of the Länder manage geospatial reference data that describes landscape in the product groups Digital Landscape Models, Digital Terrain Models, Digital Topographic Maps and Digital Orthophotos. This is supplemented by the AdV product group basemap.de. The individual products of these product groups are kept current with regular updates. For key topographic features in the Digital Landscape Models, the updates take no more than a few months. The data of the ATKIS® product range is provided in a customer-oriented way, with contents that are sufficiently up to date, of the desired quality, and within the scope of the staffing and financial capacities of the AdV member authorities. During the reporting period, numerous documents accounted for by the Working Group Geotopography were revised and standardised in order to make standardised product and quality standards available for producing member authorities as well as the product-benefiting users.

Digital Landscape Models

One of the key tasks of the surveying and geoinformation authorities in the field of geotopography is to manage and update the Digital Basic Landscape Model (Basis-DLM) as the basis for the establishment of various specialised information systems in administration and business. Starting on 31 December 2023, reference version 7.1 is valid for all member administrations of AdV. Since 1 February 2025, the ATKIS®-Basis-DLM database has been migrated to this reference version and continues to serve as the basis for the derivation of small-scale digital landscape models, such as ATKIS®-DLM50, -DLM250 and -DLM1000, as well as for the production of official digital topographic maps and is also an essential data source for the AdV Smart Mapping project and the basemap.de products generated with it.

The regular updating of the Basis-DLM database takes place in different time frames. These cover the period from the emergence of change in the landscape up to the release of the updated database. A distinction is made between a peak update of three, six or twelve months for the object types or attributes that are most important for the users and the base update of the entire pool of data, in which the ATKIS®-Basis-DLM is checked and

continued in the event of changes. The basic update period is three years. The DLM50 is derived fully automatically from the ATKIS®-Basis-DLM using model generalization. DLM250 and DLM1000 are processed and maintained by the BKG and are updated annually.

The model accuracy of the ATKIS®-Basis-DLM is at least ± 3 m and refers to the geometry of essential linear objects such as roads, rail-bound traffic routes (also on or in structures), the topological nodes (e.g. intersections of the economic road axes with the traffic road axes) in the network of roads and rail-bound traffic routes, essential structures: towers, wind turbines, masts, free-standing chimneys and surface waters.

For quality assurance during the recording process, modelling examples are kept and maintained for the ATKIS®-Basis-DLM, which help to achieve a uniform implementation in the Laender.

The degree of surface sealing for freestanding photovoltaic systems must be verified by recording 54001 AX_Vegetationsmerkmal with vegetation BWS 1500 "Grass".

Furthermore, a specifically developed testing platform – the AdV-Testsuite – is set up in order to verify the requirements from AdV specifications in a quality-assured manner. To this end, approximately 315 test criteria for AAA®-AS 7.1.2 have been updated for ATKIS®-Basis-DLM and over 182 for ATKIS®-DLM50.

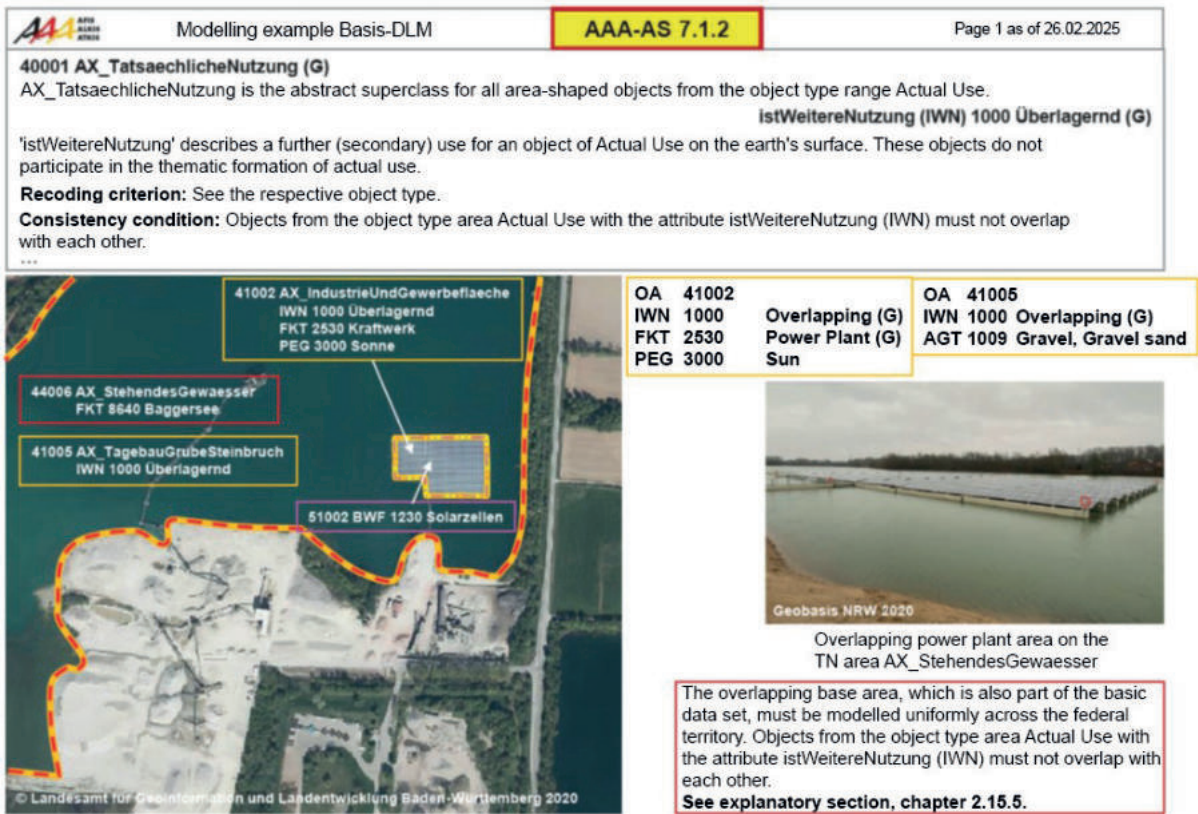


Fig. 12: Modelling example of Basis-DLM, 40001 AX_TatsaechlicheNutzung IWN 1000 Overlay, 2025

	Modelling example Basis-DLM	AAA-AS 7.2	Page 8 as of 14.08.2023
51002 AX_BauwerkOderAnlageFuerIndustrieUndGewerbe (G)		Building function (BWF) 1230 solar-cells photovoltaic system (G)	
The photovoltaic system is an electric power system that uses solar cells to convert sunlight into electrical energy. These systems are installed at ground level on open spaces (open-space systems). See #6301 at http://services.interactice-instruments.de/gsm/issues/6301 Capture criterion: Complete if located at 41002 FKT 2530 power plant (basic data set), outside 41002 FKT 2530 power plant ≥ 0.1 ha, for the basic data set ≥ 0.5 ha applies. NAM is only a basic data set in conjunction with BWF 1280. Consistency condition: The attribute type "Zustand" with value type 2200 can only occur in conjunction with the attribute type "Bauwerksfunktion" and value types 1310 and 1320.			
		BWF 1230 solar-cells photovoltaic system NAM BEZ ZUS  © Kramer 2023 View of a photovoltaic system	

Fig. 13: Modelling example of basic DLM, 51002 AX_BauwerkOderAnlageFuerIndustrieUndGewerbe, 2023

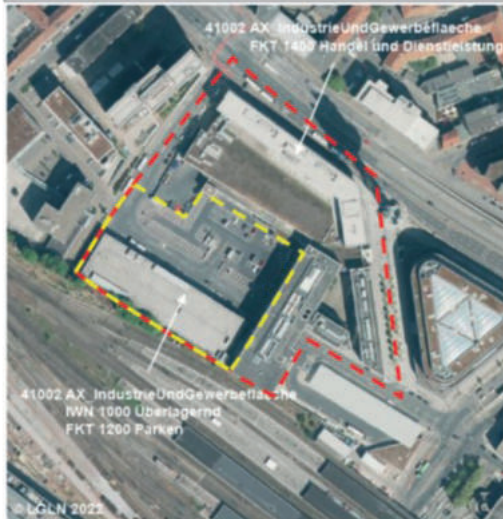
	Modelling example Basis-DLM	AAA-AS 7.1.2	Page 3 as of 21.08.2024
41002 AX_IndustrieUndGewerbeflaeche (G)		istWeitereNutzung (IWN) 1000 Overlapping Function (FKT) 1200 Parking	
'istWeitereNutzung' describes a further use for an object of actual use on the earth's surface. These objects do not participate in the thematic formation of Actual Use. 'Parken' refers to an area that is primarily used for parking vehicles and may be equipped with buildings, structures, facilities or markings for this purpose. Recording criterion: Area > 0.5 ha Consistency condition: For value type 1200 "Parken" of attribute type "Funktion", attribute type "istWeitereNutzunge" must always be assigned value type 1000 "überlagernd". If value type 1200 "Parken" is assigned to attribute type "Funktion", no other attribute type may be assigned except for attribute type "istWeitereNutzunge" with value type 1000 "überlagernd". The areas must be located within or on an area of the same object type. Areas with the value type 1200 "Parken" of the attribute type "Funktion" must not overlap each other.			
		IWN 1000 Overlapping FKT 1200 Parking For information on usage-based parking, see also: Explanatory section, Chapter 2.15.5.2  © Wegener 2024 View of the parking garage area	

Fig. 14: Modelling example Basic DLM, 41002 AX_IndustrialAndCommercialArea, IWN 1000 Overlay, FKT 1200 Parking, 2024

The AdV test suite, as certified test software, has been available nationwide since 2022 and has been in use at the Central Office for Geotopography (ZSGT) in BKG since March 2023. The focus is on the test results of category a and b, which were sent to the Laender per test report for error correction in the Q1 / 2023.

- a (= error; i.e. serious defect; impeding production or exchange; to be rectified immediately, relevant for AdV quality standard, immediate error correction. For the Basis-DLM model type, this means that no data release will take place, e.g. area coverage error or inadmissible geometry type or missing structure)
- b (= warning; i.e. moderately severe defect; tolerable for users; to be remedied in the short term, relevant for AdV quality standard, data release, prompt correction within one year (e.g. incorrect combination assignment))

The tabular overview of all test criteria (as of 26 June 2024) and their explanation is published on the AdV website.

Digital Terrain Models

In addition to the Digital Landscape Models that describe position, the surveying and geoinformation authorities manage Digital Terrain Models (DGM) with varying levels of resolution to represent height as a third dimension. These models are available to authorities and businesses as part of the geotopographic core data for setting up Geographic Information Systems (GIS). Digital Terrain Models are digital, numerical models of the terrain heights and shapes of the earth's surface reduced to a regular grid. They do not contain any information about structures (e. g. bridges) and vegetation.

The products of the product group Digital Terrain Models (ATKIS®-DGM) are structured according to their grid size. DGMs with a larger grid size are then usually automatically derived from DGMs with the lowest available grid size. For the ATKIS® technical concept, the object type catalogue-DGM is available in the GeoInfoDok, the data quality is documented in the product and quality standards for Digital Terrain Models. For the DGM1, for example, this stipulates a terrain-type-related height accuracy of ± 0.15 m to ± 0.30 m with a confidence level of 95 % (2σ). The foundation for this high precision is usually the high-precision Airborne Laser Scanning (ALS), which generates data for the DGM mostly automatically by now.

Currently, DGM data sets with a grid size of 1 m (DGM1), 200 m (DGM200) and 1,000 m (DGM1000) are available nationwide for the whole of Germany. The harmonisation of elevation data collected by the Laender in the overlapping areas between the Laender is carried out by the BKG. For the DGM data sets with a grid width of 5 m (DGM5), 10 m (DGM10), 25 m (DGM25) and 50 m (DGM50), the data was last released by the ZSGT in 2024. The current Digital Terrain Model of Germany, available with a grid size of one meter, and all the other

above-mentioned lower resolutions are constantly updated and continuously improved on the basis of the data updates of the Laender.

In the surveying and geoinformation authorities, Digital Surface Models (DOMs) are created in addition to DGMs. DOMs are digital, numerical models reduced to a regular grid of the heights and shapes of the Earth's surface and the objects located on it, such as vegetation and buildings. As with products in the DGM product group, DOM products are structured according to their grid size. DOMs with larger grid sizes are usually derived automatically from the DOM with the smallest available grid size by means of re-interpolation. DOMs are generated on the basis of ALS data or image-based digital surface models (bDOM) from the correlation (usually dense image matching (DIM)) of oriented aerial photographs (OLB). A continued increase in demand for these products by users can be observed. The DOM, with their data quality, are defined by the product and quality standard for digital surface models.

Figure 15 shows the Telemax Hannover as a DOM; Figure 16 shows the Telemax Hannover as a DOM and as high-resolution ALS data coloured by height. The Telemax is a telecommunications tower and, with a height of 282 m, the tallest building in Lower Saxony and the fifth tallest of its kind in Germany. Its characteristic architecture with a square shaft and asymmetrically arranged operating pulpit (tower basket) in the form of a cube gives it a special visual position and makes it a modern architectural landmark.

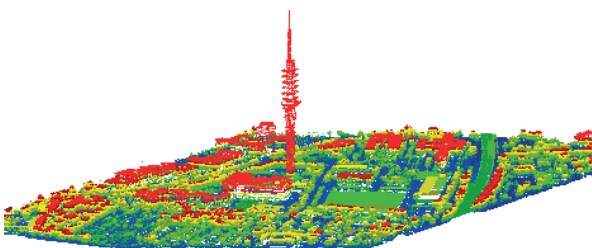


Fig. 15: Telemax Hannover visualised as DOM, © GeoBasisDE/ LGLN Lower Saxony, 2023

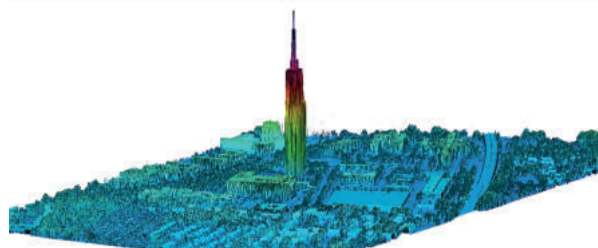


Fig. 16: Telemax Hannover as DOM and as high-resolution ALS data coloured according to elevation, © GeoBasisDE/ LGLN Lower Saxony, 2023

3D Building Models

The surveying and geoinformation authorities within AdV have been offering the product 3D Building Models since 2013. The data is collected on the basis of the product and quality standards for 3D Building Models and the data format description in the AdV CityGML profile. The AFIS®-ALKIS®-ATKIS® model has been expanded to include 3D buildings and 3D structures as part of the AAA® modelling application scheme 7.1.

Nationwide, 3D Building Models have been available in the first degree of detail with the Level of Detail 1 (LoD1) for several years now. Here all buildings and structures are given a flat roof ("block model"). For the Level of Detail 2 (LoD2), a nationwide uniform database has also been available for several years, provided by the Central Office for House Coordinates and Building Polygons (ZSHH) at the Bavarian Agency for Digitisation, High-Speed Internet and Surveying for cross-state use. In total, this database comprises more than 57 million buildings that have been modelled using standard roof shapes. Since LoD2 data is now available nationwide in Germany, the central distribution of LoD1 data by the ZSHH took place for the last time in 2024.

Due to user requirements, the pool of data was expanded to include essential structures with 3D relevance in addition to the buildings. Modelling examples and realistic standard values are available for these additional object types such as towers, bridges, pylons, etc. (possible use with surface data that is not up-to-date). The additional structures have been available nationwide since 2021.

So far the LoD2 data is currently available in the OGC standard CityGML 1.0. In order to adapt the 3D building models to future challenges, the data is supposed to be converted to the latest standard, CityGML 3.0. CityGML 3.0 is to be adopted without modification. The AdV-specific adjustments that were previously implemented as an AdV schema in CityGML 1.0 will be carried out through downstream validation processes in the future. This will allow the capabilities offered by CityGML 3.0 to be fully utilized while ensuring that the AdV specifics continue to apply. The necessary validation procedures are currently being developed and the quality standard for the 3D building models is being redefined, enabling a transition to CityGML 3.0 during the course of 2026.

Digital Topographic Maps and basemap.de

Based on the Digital Landscape and Terrain Models, the surveying and geoinformation authorities produce the DTK on the basis of the ATKIS® portrayal catalogues as part of the GeoInfoDok of the AFIS®-ALKIS®-ATKIS® model. The portrayal catalogues are available in a formalised form that is aligned with all the aforementioned information systems. For the sector of Digital Topographic Maps (ATKIS®-DTK), the signature catalogues are part of the product and quality standard, which combines all existing specifications on DTK within AdV.

The DTK are available in all Laender at the scales 1:25,000, 1:50,000 and 1:100,000. For DTK50 and DTK100, the surveying and geoinformation authorities have made an agreement with the German Federal Ministry of Defence that they should be maintained and published as joint civilian and military map series.

At BKG, the small-scale topographic maps 1:250,000 (DTK250), 1:500,000 (DTK500) as well as 1:1,000,000 (DTK1000) are derived from the digital landscape models DLM250 and DLM1000 and are updated regularly.

The analogue provision of the DTK has been subject to great dynamics for some years. Although the distribution of printed topographic maps (TK) is declining, it remains indispensable for certain user groups such as the Federal Armed Forces and authorities with public-order and security responsibilities (BOS).



Fig. 17: Map section from basemap.de presentation edition at a scale of 1:10,000 (P10)

Digital orthophotos

Digital orthophotos (DOP) are produced from aerial photographs. They provide a georeferenced, distortion-free and highly vivid representation of the landscape. They are therefore ideal for displaying in combination with other data sets and thus form an important and now indispensable background display and working basis for a wide variety of tasks and applications, such as the analysis and updating of digital landscape models, digital topographic maps, land registry data and property valuation.

The land surveying authorities of the Länder therefore commission annual aerial photography, which, from spring to late summer, generate up-to-date aerial image information for around half of the Federal Republic's territory.

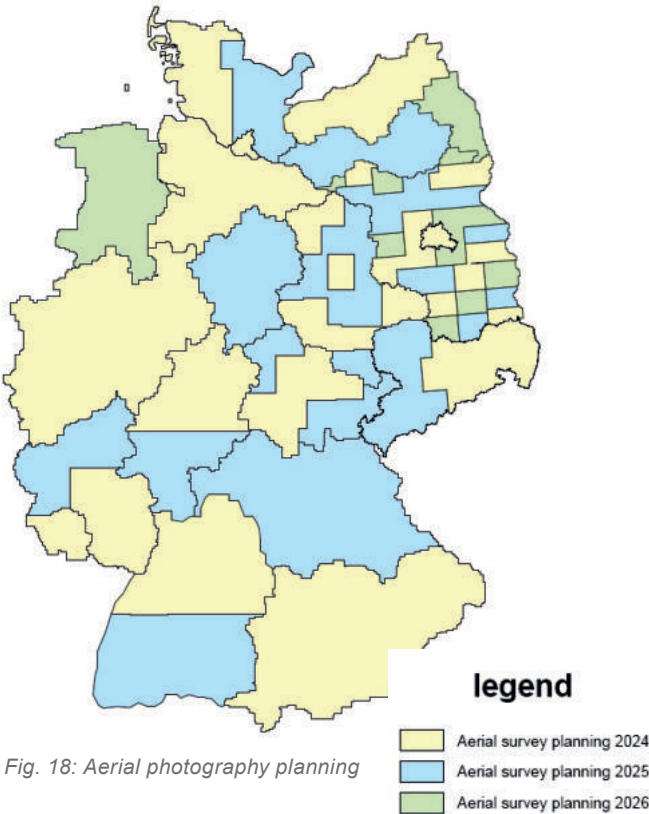


Fig. 18: Aerial photography planning

For many years, digital orthophotos (ATKIS®-DOP) with a ground resolution of 20 cm (DOP20) have been reliably available for Germany with a renewal cycle of three years at the most. Individual Laender produce orthophotos with a ground resolution of 10 cm (DOP10) or 5 cm (DOP05). As a rule, both aerial photographs and orthophotos are produced as multi-channel images, which allows the simultaneous use of black-and-white (PAN), colour (RGB) and colour-infrared (CIR) aerial image data. The information from the Near Infrared (NIR) channel is primarily used for applications in surveying, forestry, agriculture and environmental administration.

The AdV member administrations decided in 2017 to further develop the AdV standard product DOP into a TrueDOP. TrueDOP does not contain any tilting effects, depicts all objects in the correct position and no occluded areas remain. They can therefore be used very effectively for floor plan representations and analyses.

In addition to the ATKIS® DOPs, preliminary and intermediate products of the DOP production process are increasingly being offered by the state surveying authorities. These include oriented aerial photographs or preliminary DOPs, which make up-to-date aerial image information available much faster after the aerial survey for time-critical applications, such as the IACS procedure. Another intermediate product is the image-based Digital Surface Model (bDOM), which is generated using image correlation (image matching) and presents the image information in three dimensions.

In addition to providing the data, the Laender also publish ATKIS®-DOP as a nationwide uniform database via their ZSGT, which is based at the BKG. An essential prerequisite for this is a uniform quality level throughout Germany, which is achieved through existing product and quality standards for digital aerial images, digital orthophotos and image-based surface models. These standards are continuously adapted to technical developments and changing user requirements.

In addition to current image information, the surveying and geoinformation authorities hold extensive collections of historical aerial photographs and orthophotos. These stocks, some of which date back 70 years or more, form a valuable cultural-historical data pool that makes it possible to fulfil monitoring tasks by using time series. Therefore, the digitisation of aerial photographs, some of which are still available in analogue form, as well as long-term preservation and history management, continue to be topics to which the surveying and geoinformation authorities are addressing. For this purpose, the Geotopography Working Group, in cooperation with the archive administration, has also defined uniform minimum standards and provided various guidelines to the Laender.



Fig. 19: Time series showing the enclosure of the A4 motorway near Jena with aerial photographs from 2004, 2008 and 2024 (from left to right), ©GDI-TH

Remote Sensing and Copernicus

In recent years, satellite-based remote sensing has gained significantly in importance, including in the context of surveying. The project group Satellite Remote Sensing and Copernicus (PG SatFernCop) was established to systematically monitor developments in this field, identify interfaces with national surveying, and coordinate the activities of the member administrations. Through a continuous exchange of information, the PG SatFernCop pursues the goal of sustainably anchoring remote sensing in official surveying. A particular focus is on the European Earth observation programme Copernicus of the European Space Agency (ESA).

Copernicus is the European Union's Earth observation programme, implemented in cooperation with the ESA. It provides free and openly accessible data collected by a series of Sentinel satellites. These regularly provide up-to-date information on land use, vegetation, soil moisture, water quality, air pollution, climate developments and much more. Copernicus thus offers a valuable database for land surveying – for example, for updating geo-spatial reference data, monitoring changes or supporting planning processes.

To capture the current status of Earth observation activities in the state surveying offices, a joint product catalogue was created. This catalogue consolidates all remote sensing initiatives of the member administrations and serves as a central information source for both published and planned products. Each member enters its remote sensing projects in a structured form and describes their content and areas of application. The catalogue is continuously updated and further developed (Fig. 20).

	Provision as...					area / devision	actuality	availability	plattform/company	special features/planned	Legend:	
	download		WMS								published	in progress
	10 m	20 m	RGB	CIR	NDVI							
BKG			x	x		nationwide/Europe	yearly/ 3-year cycle	2018- 2021/2018	BKG website	Open Source, complex partly manual corrections	(x) external mosaics are displayed	
BE			(x)	(x)		nationwide	2021	2021	FIS Broker Berlin	WMS-Sentinel2-service of the BKG (layers selectable: RGB, Nir, NirRER, updates		
BW	x	x	x	x		entire Land	monthly	starting 01.03.2020	Geosystems: Sentinel Made Simple	WCS Download: 10 m in RGBI, 20 m in 10 lines, time series function in the geoportal		
BB	(x)		(x)	(x)		nationwide	2021	2021	Brandenburg-Viewer	WMS-Sentinel2-service of the BKG (Nir, NirRER and updates directly selectable; RGB displayable via WMS Import		
HE			x	x		entire Land	monthly	since 2021	novaFACTORY, Geoportal Hesse	Open Source, better cloud correction (presumably tile- by-tile)		
HH			x	x	x	entire Land	quaterly	since 2018 - today	CODE-DE	Open Source, time series function in the protal, additional daily update		
MV	x		x	x		entire Land	monthly, if possible	since 2018	GeoPortal MV	IMAGINE NoCloud, homogenisation		
NI						districts	approx. 20/year	since 2015	CODE-DE	Open Source, up to date		
NW			x	x		entire Land	every 2-3 days, when cloudless	since 11/2021	tim-online.nrw.de / website Geobasis NRW	very high temporal resolution, indication of recording date		
SL			x	x	x	entire Land	at least monthly	as of 2015	GeoportalSL (saarland.de) / Zora	Open Source		
RP			x	x	x	entire Land	monthly	since 2018	local	Open Source		
ST	x	x	x	x	x	entire Land	biannually	as of 2018	novaFACTORY [MOSS]	IMAGINE NoCloud, homogenisation high topicality		
SH			x	x		entire Land	current/quarterly	as of 2019	CODE-DE/local	current mosaic and quarter mosaic, better cloud mask and atmospheric correction		
TH	x		x			entire Land	quaterly (1.,2.,3.)	as of 2018	Thuringia Viewer / Opendata Portal	OpenSource, WMS services via Copernicus Ecosystem		

Fig. 20: Summary of product catalogue

In order to ensure uniform quality and comparability of remote sensing products in the state surveying authorities, the PG SatFernCop pursues the goal of defining technical standards for various data sets in the future. These include both product specifications and quality criteria. An important step in this process was a nationwide survey conducted in 2022, in which participants from state authorities, ministries, research institutions and other specialist areas contributed their experiences and requirements in dealing with remote sensing data. The findings – supplemented by information from the existing product catalogue – serve as the basis for the development of initial standardised product definitions.

A particular area of focus over the last two years has been the development of a product and quality standard for cloud-free Sentinel-2 mosaics. The aim is to formulate uniform requirements for the database, processing and presentation of results for such mosaics throughout Germany.

The project group is pursuing a holistic approach: in addition to defining uniform end products, the data processing itself is to be harmonised and, where possible, centralised in the future. With the help of new cloud technologies, in particular via the CODE-DE platform (Copernicus Data and Exploitation Platform – Germany), standardised process chains should be established and shared. Not only will this enable data to be processed more efficiently, it will also ensure that it is provided in comparable terms of quality and consistency throughout Germany.

The project group regularly holds workshops and events with cloud providers, companies and research institutions. The objective is to discuss new technologies and developments in remote sensing and cloud data processing, develop practical solutions and promote common standards. These events strengthen the exchange and cooperation between the various stakeholders and support the further development in this field.

In accordance with the open data strategy, the project group is also committed to bundling various remote sensing data in a shared cloud infrastructure. The aim is to make existing products easier to find and use, and to significantly expand the range of publicly accessible remote sensing data. Centralised provision is intended in particular to simplify access for research institutions, universities and other interested parties and to promote knowledge transfer. This will ultimately create an open, collaborative database that supports innovation and promotes the use of remote sensing data on a broad scale.

Toponymy

In collaboration with the Permanent Committee on Geographical Names (StAGN), BKG offers a standardised (gazetteer) service that provides the toponymy (GN-DE) from the vector data pool of the products DLM250, VG250 (Administrative Areas 1:250,000) and GN250 (Geographical Names 1:250,000). GN250 is generally available in a classification of names corresponding to the feature types of ATKIS® in the AFIS®-ALKIS®-ATKIS® data model. The data pool comprises around 187,000 entries of geographical names, including names of municipalities, parts of municipalities, landscapes, mountain ranges, mountains, islands, rivers, canals, lakes and seas.

In cooperation with AdV, the object type group 'Geographical Areas' was expanded to include a new object type, the so-called 'Metropolitan Regions' (according to <https://deutsche-metropolregionen.org/>). Also, in 2024, the AAA® application schema 'Geographical Information' was jointly developed. The new application schema forms the basis for the collection and provision of geographical name data.

The GN-DE database is usable as a standardised Web Feature Service (WFS) at the BKG Service Centre in accordance with the specifications of the OGC. This data set has been provided in INSPIRE-compliant form as a service for the European Open Data Portal. In the future, the data set is also intended to be made available as a GeoPackage (database).

In accordance with the relevant resolutions of the United Nations Group of Experts on Geographical Names (UNGEGN), in 2024 the StAGN published the “List of Country Names” (15th edition). This list primarily provides a synoptic overview of the officially prescribed short and long forms used in Germany, Austria and Switzerland.

Furthermore, the map ‘Germany Landscape Map – Names and Boundaries’ (1:1 million, 2024), which was prepared by the BKG and is available to users both as a digital database at the BKG and in a printed version, has been republished (ISBN 978-3-86482-153-0).

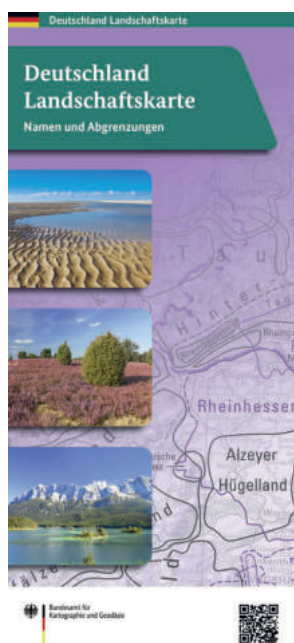


Fig. 21: Screenshot – new map cover



Fig. 22: Map excerpt landscapes

From space to administration – CODE-DE for the surveying authorities of the German Laender

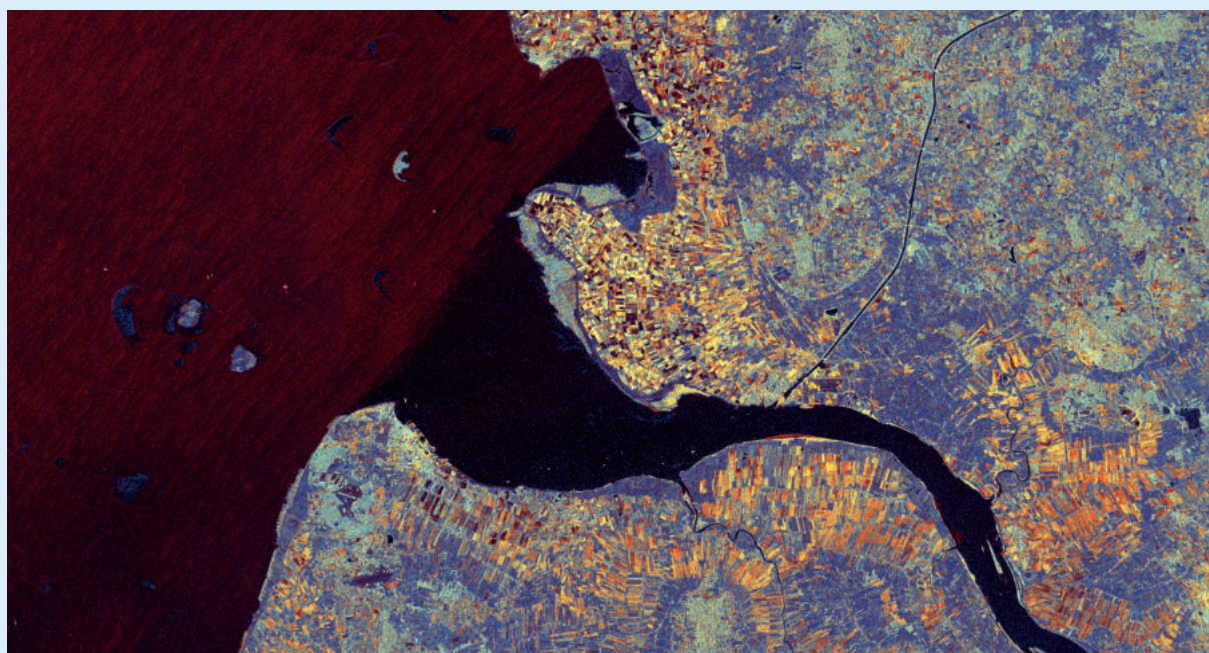


Since 2016, the national Copernicus data platform CODE-DE (Copernicus Data and Exploitation Platform – Germany) has been providing access to Copernicus programme data for users in Germany, including direct data processing in the cloud. CODE-DE is currently in project phase 2 and is operated on behalf of the German Space Agency at DLR (DLR RFA) with funding from the BMV.

Under Copernicus, around 20 TB of Earth observation data is generated every day – since the launch of the first satellite in 2014, more than 90 petabytes of data have been collected in total. With the next generation of satellites, this data volume will increase significantly yet again. These enormous amounts of data require powerful infrastructures for their distribution and processing. In recent years, cloud services have become increasingly established, which allow data to be processed directly online. Based on the principle of “bringing users to the data,” users can avoid the expense of building costly local infrastructure. Furthermore, the enormous amounts of data do not need to be transferred or downloaded beforehand, but can be processed directly where they are stored. The European Space Agency (ESA) provides such central infrastructures, which have been bundled in the Copernicus Data Space Ecosystem (CDSE) since 2023. The CDSE is a very powerful service, but it does not meet some specific German requirements. Therefore, since 2016, the national platform CODE-DE has been operating to fulfil these requirements.

CODE-DE enables high-performance access to all Sentinel data in Germany – for example, Sentinel-1 regularly provides high-resolution radar data, while Sentinel-2 with its imaging sensor is used amongst other things for vegetation monitoring, and Sentinel-3 and Sentinel-6 provide climate and ocean data. The platform fulfils three key requirements of national authorities as an important target group: firstly, CODE-DE offers extensive data processing capacities. This allows authorities to process the data directly in the cloud free of charge. The allocation of resource quotas is handled by the German Space Agency at DLR as the contracting authority. The actual processing takes place primarily on high-performance virtual machines (VMs) that users configure themselves. Secondly, CODE-DE is certified in accordance with the requirements of the Federal Office for Information Security (BSI) and provides national authorities with a secure working environment which enables them to use the cloud service to begin with. Thirdly, CODE-DE attaches particular importance to supporting users. This is done with the help of a dedicated helpdesk, but also through training courses, webinars and events that are offered regularly for users. In addition to Copernicus data, CODE-DE also offers other data sets that can be processed together in a synergistic approach.

These include, for example, various reference data sets (e.g. on the state of cultivation of crops or on land cover), but also data sets from the Federal Agency for Cartography and Geodesy.



*Fig. 23: Mouth of the Elbe River into the North Sea
Sentinel-1 IWVV VH RGB, date of recording: 30 September 2021*



*Fig. 24: Northern edge of the Alps with Lake Forggensee
Sentinel-2 L2A True Colour, date of recording: 7 April 2025*

From space to administration – CODE-DE for the surveying authorities of the German Laender

In 2021, EO-Lab was started as a sister project to CODE-DE, which is aimed specifically at the scientific community and is methodologically focused mainly on the development of AI applications. EO-Lab has extensive quantities of graphic cards available for this purpose. In addition, EO-Lab provides access to additional data sets that significantly expand the Copernicus portfolio – in particular data from the national Earth observation missions Terra-SAR/TanDEM-X and EnMAP, as well as data from commercial providers (e.g. PlanetScope). CODE-DE and EO-Lab are currently sharing a common infrastructure. The next phase will see the integration of EO-Lab's offering into CODE-DE, so that all data offerings are equally available to all users and the two platforms become a joint, powerful Earth observation platform for public institutions.

CODE-DE has more than 5,500 users and over 70 institutions who actively use the platform's processing infrastructures. In addition, there are various federal authorities and, increasingly, authorities at the state level. To date, 11 state surveying offices have actively used resources on CODE-DE. For some administrations, CODE-DE is fully integrated into their own workflows, and operational services are developed and provided via the platform.

The surveying authorities benefit from the extensive processing resources available on CODE-DE. The State surveying authority in North Rhine-Westphalia (Geobasis NRW), for example, is currently investigating the synergistic use of digital orthophotos (DOPs) and Sentinel-2 data for land cover classification in a pilot project. Both the DOP and Sentinel-2 data are available on CODE-DE for direct processing. Since the remote sensing data is to be evaluated using AI-supported methods, powerful graphics cards (GPUs) are provided by CODE-DE in addition to various other infrastructure components.



CODE-DE shows how modern technologies can improve administrative work. With the latest satellite data, many tasks can be completed faster and more accurately. Therefore, we have established a separate department for satellite remote sensing at the North Rhine-Westphalia State Surveying Office. I am convinced: geoinformation and digital solutions such as CODE-DE play a pioneering role in the digital transformation of civil administrations.

Dr. Thomas Wilk, District President of Cologne

The Lower Saxony State Office for Geoinformation and Surveying (LGLN) has developed an operational service that can be used to automatically identify buildings in aerial photographs. This service is an important tool for updating ALKIS® data. It makes the laborious manual search for changes obsolete. The tool is based on image segmentation using AI – also here, CODE-DE GPUs are used. Efforts are also underway to develop AI-based change detection of large areas of the basic DLM using Sentinel data. The platform thus supports the improvement of a technical procedure (the updating of ALKIS® data) and contributes to establishing the use of remote sensing methods by AI applications in administration. The LGLN also uses data from Sentinel-2 for the operational creation of image mosaics of all districts in Germany, which form an important basis for various specialist applications (e.g. in the environmental sector). The procedure was developed at the LGLN, and the results are now freely and publicly available to all users (<https://lgl.n.community.code-de.org/>). CODE-DE thus offers the advantage that new products can be made available to others in an uncomplicated manner and no new procedures need to be established in other authorities.

Meanwhile, the first state surveying authorities are making their DOPs available via CODE-DE (currently Thuringia and North Rhine-Westphalia), thus making them accessible to other users. For North Rhine-Westphalia, a 2.5D mesh based on open data principles is also available there. The use of the platform by the state surveying authorities also has advantages for CODE-DE itself. With additional data sources synergies emerge, as these can be processed and analysed together with Copernicus data. Various members of the surveying authorities also share their know-how in training events for CODE-DE. They actively provide their own information materials and help develop CODE-DE services (e.g. the Thuringian State Office for Land Management and Geoinformation is helping develop a WebGIS feature).

A particular advantage of CODE-DE is the possibility of collaborative work on the platform. Several state surveying authorities and partners from research and federal authorities can carry out projects, exchange data and jointly develop analyses within shared cloud-based working environments. This promotes cross-state cooperation and actively supports professional exchange between institutions. The platform not only enables innovative pilot projects, but is already improving day-to-day operations in the national surveying authorities – through automated data processing, the use of powerful computing resources and the immediate availability of remote sensing and reference data. At the same time, CODE-DE allows member administrations to make their own data products available to third parties without having to set up additional technical infrastructure. CODE-DE has thus become an important tool for the member administrations of AdV. Many land surveying authorities are actively involved in the further development of the platform – for example, by designing new services, providing training or making their own content available. The close feedback loop between application and development not only strengthens the platform itself, but also contributes to the overall advancement of Earth observation infrastructure in Germany.

5. Working Group Information and Communication Technology

Cloud Computing

Important administrative systems must be able to cope with stress scenarios at all times. Traditional computer infrastructures make it difficult to respond, for example, to unexpected peak loads flexibly. Resilience and scalability must be integrally incorporated into the software and operating architecture and be testable at any time. A dynamically scalable operating architecture also reduces costs, as the system can be scaled down during periods of low load. For this reason, modern applications must follow cloud-based development and operating principles. If these approaches are implemented in full, significant personnel savings are possible, particularly in operations.

When providing online services for citizens, businesses and public authorities, systems must be available around the clock, seven days a week. By making use of cloud services, this level of availability is possible in the first place and reached in a much more cost-effective way.

The threat landscape in IT security is dynamic and aggressive; it constantly adapts to the latest prevailing technologies. Combined with the unstoppable trend towards convenient, device-independent access to, and control of, services via the internet, 'isolated' networks whose 'outer boundaries' (perimeter) are protected by special security measures – such as the government network – are becoming increasingly vulnerable to the risk of penetration. The modern and current IT security approaches that are most appropriate to the current technology paradigm (e.g. Zero Trust, DevSecOps) originate from the context of cloud technologies.

Modern software architectures are characterised by services that have high availability and easy connectivity. The scalability of applications, without changes to tools, architecture or development processes, should always be ensured in order to promote maximum agility with the architecture. Therefore, microservice architecture as

'state of the art' is to be adapted. In addition to the functional technological perspective, the organisational and legal advantages for the owners of the applications/services created in this way should also be highlighted.

The focus in the area of digital sovereignty lies, in future, on the general ability to comprehensively evaluate the most modern technologies that are best suited to a particular application and to use them in a practical, effective and flexible manner. The increased use of hybrid multi-cloud solutions in line with a 'cloud-first principle' also reduces the amount of government expenditure on development and operation.

The need to make the innovative technology of cloud computing usable for public institutions is increasingly visible and indispensable for the digital transformation. Cloud computing is also seen in public administration as an efficient solution to economically store large amounts of data, to jointly develop software applications, to use information independent of location and device, and to flexibly use IT resources of all kinds according to actual needs without having to incur their own acquisition and operating costs. Instead, a transparent payment based on actual consumption is made through user fees. Cloud computing fundamentally changes the traditional way of thinking with regard to IT resources.

The member administrations of AdV strive for resource bundling and the possibility of an agile utilisation of resources. In addition, the focus is on further technological AdV uniformity through joint developments, joint operation and increased joint, central deployment of internal and external services. Digital cooperation is to be increased in order to ultimately find innovative solutions to the challenges faced by the federal IT infrastructures. To this end, the AdV member administrations intend to use a federal and decentralised cloud infrastructure provided by the data centres of the federal and Laender governments, by established hyperscalers (including Microsoft, Google, Amazon, IBM), or by sovereign administrative clouds. An initial concept of such a structure within AdV is shown in Figure 23.

The outlined cloud strategy should be further discussed and finalized with initial application scenarios. In various Proof of Concepts (PoC), initial use cases for the Platform as a Service (PaaS) and Software as a Service (SaaS) service models will be tested. Using the knowledge gained from the PoCs, an action plan for establishing future structures and necessary resources will be presented.

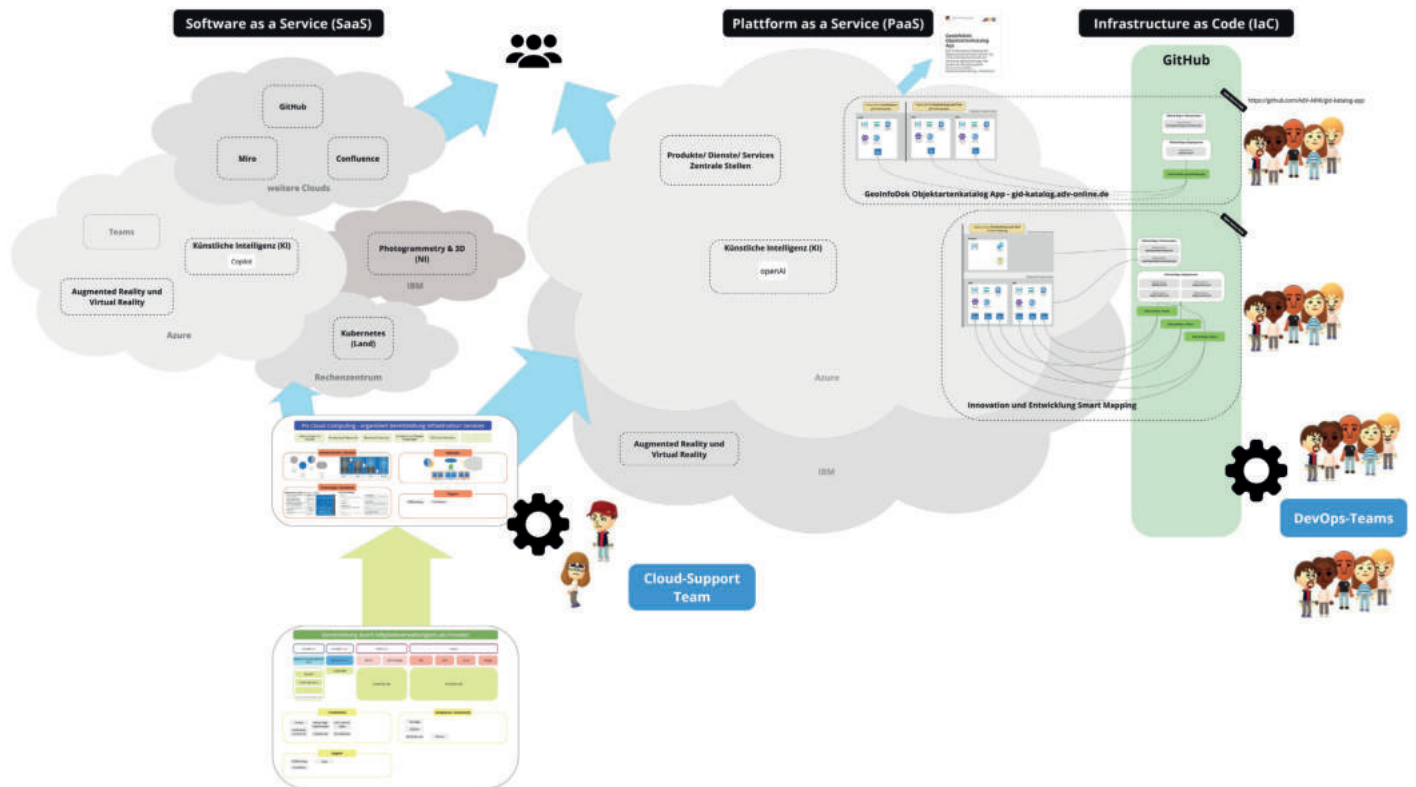


Fig. 25: Cloud architecture

The core of this future strategic approach is the willingness to develop joint, project-related, innovative IT solutions. In order to achieve solution agility, individual projects can be implemented by all, a few or even just individual member administrations, but always for everyone. The common platform is the unifying element. To achieve this, cooperation to establish and expand competencies in the areas of (geo)informatics and to establish and expand competencies and structures for agile cooperation is strived for.

Generic Simplified Data Schema

The concept of a generic, simplified data schema for the provision of object-structured geospatial reference data was initiated. This includes the analysis of existing AdV specifications (including ALKIS®-WFS, building polygons, land use) and the current implementation status of smart mapping. The aim of the concept is the de-

definition of universally valid abstraction conventions as well as compatibility and simplification levels in order to facilitate the interpretation and integrated use of different geobasis products.

Furthermore, generic definitions and rule sets that describe the derivation process of simplification in relation to the AAA® application schema (source schema) are now being conceptualised. These include operators such as:

- Naming attributes and relations
- Resolution of relations
- Marking of location designations
- Resolution of catalogue objects
- Simplification of geometry
- Filtering of object types
- And many more

The concept is designed, on the one hand, to find suitable definitions for existing interface formats such as Shape, GeoPackage and GML and, on the other hand, to support a shift towards JSON-FG. The results should be suitable for native implementation in the provisioning IT system as well as for schema transformation from AAA®-NAS. Once the concept has reached a viable stage of maturity, it should be applied to existing products by means of an impact analysis. This may also lead to a consolidation of schema transformation sets and reduce maintenance costs.

In this context, current international standardisation activities should also be evaluated, with a particular focus on examining the suitability of JSON-FG for the provision of geospatial reference data in order to ensure compatibility with modern, user-friendly forms of provision. If the evaluation is positive, usability should be demonstrated using an example prototype.

The review focuses explicitly on the business process of providing object-structured geospatial reference data via the medium of derived output products in the form of geodata sets and geodata services. The data model for collection and management (including the AAA® application schema with its conceptual and external schema for NAS, NBA and NAS output data types) is therefore not part of this review. The raster data products of AdV and the AdV INSPIRE products are also excluded from this review.

User orientation in focus: needs assessment for the further development of geospatial reference data

For optimal dissemination of geospatial reference data, geodata products are to be generated and made available in a user- and purpose-oriented manner within the framework of the sovereign activities of the surveying and geoinformation administrations. The Needs Assessment and Analysis Project Group (PG BB), which is part of the Public Relations and Marketing Working Group (AK PRM), collects, analyses and documents the demand for geobasis products and the requirements for geospatial reference data from citizens, public authorities, local authorities, companies and other market participants. This involves regularly aligning user requirements with the current range of geospatial reference data and the channels through which it is provided. The aim is to tailor the geodata product portfolio to current needs.

One way of gathering the relevant information is to conduct surveys. In 2024, three surveys were conducted by PG BB. The first survey aimed to determine the demand for the product 'basemap.de P10 Vector offline'. With the presentation edition 1:10,000 (P10), a topographical map series jointly developed by the federal government and the Laender was already available as a new AdV standard product (<https://basemap.de/produkte-und-dienste/p10-raster/>). The plenary session of AdV had decided upon this in 2023. The working group on geotopography then defined the 'product and quality standard basemap.de presentation editions' for the AdV standard product. Through the use of new technologies, the P10 could now also be generated in vector format in the future. With this in mind, a survey was conducted to determine the need for a P10 in vector format and to ascertain user requirements. The majority of survey participants – the target group was existing users of the P10 in raster format, such as local authorities and companies – welcomed a P10 in vector format, so PG BB will recommend its implementation. The proposed GeoPackage format was also mentioned by the majority. The majority also supported the provision of data per Land, similar to the current procedure for providing P10 raster data. The development of a vector tile service and a cartographic visualisation component in an online version were also desired. Providing data in vector format offers advantages over raster format: the data can be flexibly configured, is interactively accessible, always appears sharp against its surroundings, is slim, and can be rotated and tilted. Additionally, attributes can be added to the data, and it supports smooth zooming, which is particularly important for internet applications. The survey results and customer requirements are then incorporated into further product development, together with the technical requirements for the quality of an AdV product, taking into account the availability of resources.

Two further surveys conducted by PG BB focused on selected future topics that had been decided upon by AdV. AdV strategically focuses on specific future topics in the field of official surveying and geoinformation in order to tap into the potential of spatial reference data as an important building block of digitalisation at an early stage and in a sustainable manner, and to utilise innovations for its own processes. The second survey therefore focused on determining the current status of the use of oblique aerial images. Oblique aerial images are an

alternative to pure nadir images with a strictly vertical axis of capture and open up additional possibilities for interpretation, presentation and evaluation.

The bird's-eye view of the Earth's surface makes it possible to identify objects or parts of objects in oblique images that are not visible in nadir images. In addition, the images are easy to interpret, even for inexperienced viewers. However, this is offset by additional costs that may need to be incurred for a potential nationwide aerial survey and the storage capacity required for subsequent processing of the oblique images. The results of the survey reflect that the topic of oblique aerial surveying is still in its initial or experimental stage among the survey participants. At the same time, with the wide range of possible uses and applications mentioned one can recognise the interest in oblique aerial images and the products that can be derived from them. However, the high costs and technical requirements remain a major challenge for many. The topic will continue to be monitored and it is recommended that the matter be revisited at an appropriate time.



Fig. 26: Oblique aerial photograph of the Kleingartach subdivision of Eppingen in the Heilbronn district, land consolidation procedure (right half of the image), LGL BW, 2025

In a third survey conducted in 2024, 'Resilient data availability for authorities and organisations with security tasks' took centre stage. Authorities and organisations with security tasks (BOS) are governmental (police and non-police) and non-governmental actors that perform specific tasks to maintain and/or restore public safety and order. Specifically, these include the police, the fire brigade, the Federal Agency for Technical Relief, the state disaster control authorities and private aid organisations, insofar as they are involved in civil protection. Today, authorities and organisations with security tasks face major challenges and are faced with high expectations as a result. The geospatial reference data provided by the surveying and geoinformation administrations of the Laender can be one piece of the puzzle in efficiently completing the tasks at hand. The geospatial reference data and georeferenced specialist data are made available to the emergency services in an interoperable and interdisciplinary manner by the essential users of the authorities and organisations with security responsibilities, depending on the situation. Essential users are the federal government, the Laender and the local authorities. The overall objective is to harmonise and improve technical cooperation between police and non-police actors on the basis of valid, interdisciplinary, centralised geodata. With the survey, an understanding of the current use of geospatial reference data by the BOS was to be gained. The survey showed that the timeliness of the AdV products was rated highly by the participating BOS, that geodata is desired both online and offline, and that 3D

User orientation in focus: needs assessment for the further development of geospatial reference data

data will become more important in the future. 3D data is already in use by authorities and organisations with security tasks, for example in flood forecasting. Future demand will increase, so this area will continue to be monitored and work will continue on a strategy for the cross-state provision of geospatial reference data for the essential users of the BOS.

In terms of public relations, the focus should be even more on providing information from BOS about the availability and different provision channels for geospatial reference data, as the survey revealed a deficit in this area.

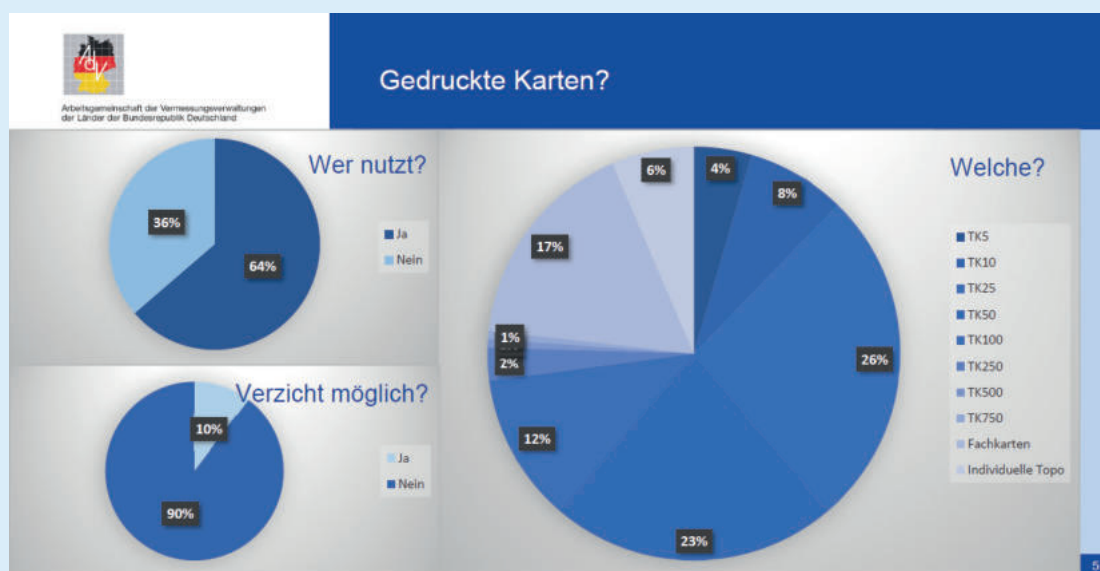


Fig. 27: Survey on BOS – printed maps.

The results of the survey will be factored into further strategic considerations, such as how to intensify cooperation between the federal government and the Laender on the provision of geospatial reference data and product development for the needs of essential users of authorities and organisations with security tasks, and how geospatial reference data relating to critical or particularly sensitive infrastructure should be classified. The final evaluation and the derivation of possible consequences with regard to geospatial reference data provision, product development and public relations will also be reported in due course.



Fig. 28: Representatives of authorities and organisations with security responsibilities.
(BOS) Source: © MIK Land Brandenburg

6. Working Group Public Relations and Marketing

Geospatial reference data standardised nationwide as open data

A historic step towards transparency and innovation is marked by the provision of open geospatial reference data for everyone. Since mid-2024, all geospatial reference data has been available nationwide without access restrictions as open data uniformly in the Laender.

9 June 2024 marked an important milestone in the history of digital transformation and open data culture in Germany: high-quality data sets from the public sector have since been available free of charge, in machine-readable formats via application programming interfaces (APIs) and, in most cases, also via bulk download as open data. Among the high-quality data sets is also a large portion of the countries' geobasis data. These high-quality geodata sets from the surveying and geoinformation authorities of the federal states may, in the future, be reused for any commercial or non-commercial purpose under the terms of the Creative Commons BY 4.0 licence (CC-Attribution, CC-BY) or the equivalent 'Data Licence Germany – Zero/Attribution – Version 2.0'.

AdV and its member administrations, directly after the list of data sets classified as high-value by the EU Commission at the end of 2022 was published, identified the relevant AdV standard products and took the necessary measures to make all non-restricted geospatial reference data uniformly accessible as open data nationwide. A significant step towards the digital future was thus taken in close cooperation with all Laender.

Open data offers a wealth of opportunities for business, science and society by promoting transparency, enabling innovation and strengthening citizen participation. The protection of personal data continues to be guaranteed.



The nationwide standardised provision of geospatial reference data as open data shows that the Laender are prepared to fully harness the potential of the digital world in order to break new ground in public administration with open data, such as the development of Digital Twins for example.

Karin Schultze, AdV-Chairperson

Especially for cross-state application scenarios, for example for questions relating to renewable energies, for the expansion of mobile communications networks, for applications of artificial intelligence, for interdisciplinary data mining, or for nationwide digitization issues with spatial reference, AdV, via the Central Office for Geotopography, the Central Office for House Coordinates, Building Polygons, 3D Building Models and Land Parcel Information, as well as via the Central Office SAPOS®, offers the geospatial reference datasets consolidated and harmonized from the Laender as a customized service on request.

The release of high-quality data sets is pursuant to Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (Open Data and PSI Directive for short). The directive includes, among other things, practical rules to simplify the reuse of open data. Freely accessible open data is a valuable resource for promoting economic and social values. The directive thus ensures transparent government action and fair competition for stakeholders interested in reusing public sector data.

The Open Data and PSI Directive was implemented in Germany through the Data Use Act (DNG) of 16 July 2021. The DNG stipulates that public sector data which is accessible under national freedom of information legislation is, in principle, available for reuse. Public authorities are only allowed to charge above marginal costs for the reuse of their data in very limited cases. Small and medium-sized enterprises and start-ups can use public sector data to tap into new markets by developing data-based products and services.

The Open Data and PSI Directive emphasises that an EU-wide list of data sets with particular potential for generating socio-economic benefits, combined with harmonised conditions for reuse, is an important prerequisite for cross-border data applications and services. For years now, there has been growing interest in geodata in general and in the geospatial reference data of surveying and geoinformation administrations in particular. The surveying and geoinformation administrations of the federal states are among the most intensive data producers in terms of data collection, gathering and processing. This has also been recognised by the European Union, which, in addition to other data, has included a specific selection of geospatial data on so-called high-value datasets within this EU-wide list and in the annex to the EU Implementing Regulation (2023/138) of 21 December 2022 establishing certain high-value datasets and the modalities for their publication and re-use (DVO-HVD). The DVO-HVD will be applicable 16 months after its entry into force, i.e. from 9 June 2024.

In general, the DNG, the DVO-HVD and, where applicable, other special (Laender) regulations issued by the Laender and local authorities, as well as by public bodies such as public service companies, must be observed. While the technical provision of open data is, in many respects, complex yet manageable, the financing of open data for the regional authorities and public bodies concerned remains a major challenge.

Simple licences and fees for nationwide geospatial reference data

Nationwide building coordinates, 3D building models, land parcel information, digital orthophotos, SAPOS® real-time positioning and many other types of geospatial reference data have been available and usable at significantly lower cost from the central offices of the Laender since mid-2024. This is based on the AdV Fee Guideline (AdV-GR) version 4.0.1, which has been in force since 9 June 2024. The new AdV Fee Guideline represents a paradigm shift from its predecessor: away from realization fees and towards service fees. This results in flat-rate fees and significantly simplified licensing regulations.

A large proportion of the geospatial reference data in the Laender is directly affected by the DVO-HVD and is therefore free of charge in accordance with Section 9 DNG.

For the central provision of nationwide data sets, the geospatial reference data of the 16 Laender of the Federal Republic of Germany are collated, harmonised and their quality assured by their central authorities under the umbrella of the Geodata Steering Committee. This additional service is reflected in the reduced fee rates, which are calculated on the basis of the costs incurred. The original data for each respective area is available in the federal states. This primarily consists of high-quality data sets that may be used free of charge.

The provision by the central authorities is carried out in accordance with the regulations in the Data Use Act (DNG) of 16 July 2021, which implements Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (Open Data and PSI Directive for short) into national law.

The tasks and products of the three central offices for a) House Coordinates and Building Polygons, 3D Building Models and Land Parcel Information, b) Geotopography, and c) SAPOS® can be summarised as follows:

a) The task of the Central Office for House Coordinates, Building Polygons, 3D Building Models and Land Parcel Information (ZSHH), which is based at the Agency for Digitisation, High-Speed Internet and Surveying (LDBV), is to make selected secondary products of the real estate cadastre of the Laender available for widespread use in the form of German-wide databases.

b) The Central Office for Geotopography (ZSGT) provides digital, cross-border geodata for Germany to industry, science, administration and all citizens on behalf of the Laender of the Federal Republic of Germany. The ZSGT is operated by the BKG. Users benefit from a comprehensive range of internet services, which can be conveniently integrated into their own applications and continually access the latest geodata. Furthermore, conventional data provision is also possible.

c) Last but not least, the SAPOS® Central Office (ZSS) provides the official geodetic spatial reference in the form of a Germany-wide network of GNSS reference stations. The SAPOS® service is based on a network of around 270 GNSS reference stations permanently operated in the Laender, as well as additional reference stations in Germany's neighbouring countries. This ensures that highly accurate and uniform correction data services are provided for the entire country in the official three-dimensional reference system (ETRP89/DREF91).

As soon as AdV-GR 4.0.1 came into force, work began on evaluating the fee structures with a view towards further optimisation and simplification. The goal is to publish the updated version of AdV-GR in mid-2026. In parallel, the standard templates for licence agreements, such as the general terms and conditions of business and use and the model licence agreement, will be revised on the basis of AdV-GR 4.0.1 and translated into English. In addition, the licences for the AdV products 'Land Cover' and 'SAPOS®-DE PPP-RTK Positioning Service' have already been redefined and the recommendation for the editorial note for topographic maps has been updated. A licensing policy for the P10 vector product for basemap.de will follow.

New AdV product Land Cover for the whole of Germany now available

Since August 2025, the Technical Office for Land Cover, consisting of Geobasis NRW and the BKG, has been providing an initial version of land cover (LB) data for the whole of Germany.

Accurate information on land cover forms a key basis for numerous environment-related issues. These include, among others, analysing the degree of soil sealing, landscape and spatial planning, conducting climate simulations and fulfilling reporting obligations to the European Commission. What began in mid-2023 according to the 'one for all' approach (see p. 39 AdV Activity Report 2022/2023) has now been validated by the nationwide provision of this new AdV product. At its closed-door meeting in April 2024, the AdV plenary session decided, on the recommendation of the AK PRM, on the licences to be used for the LB product, which is to be derived automatically nationwide and made available centrally under open data conditions: Creative Commons BY 4.0 licence and Data Licence Germany – Attribution.

The land cover data is now available both as a WMS (Web Map Service) and as a download, as previously mentioned, under open data conditions, via the Central Office for Geotopography. Further information can be found in the product information¹.

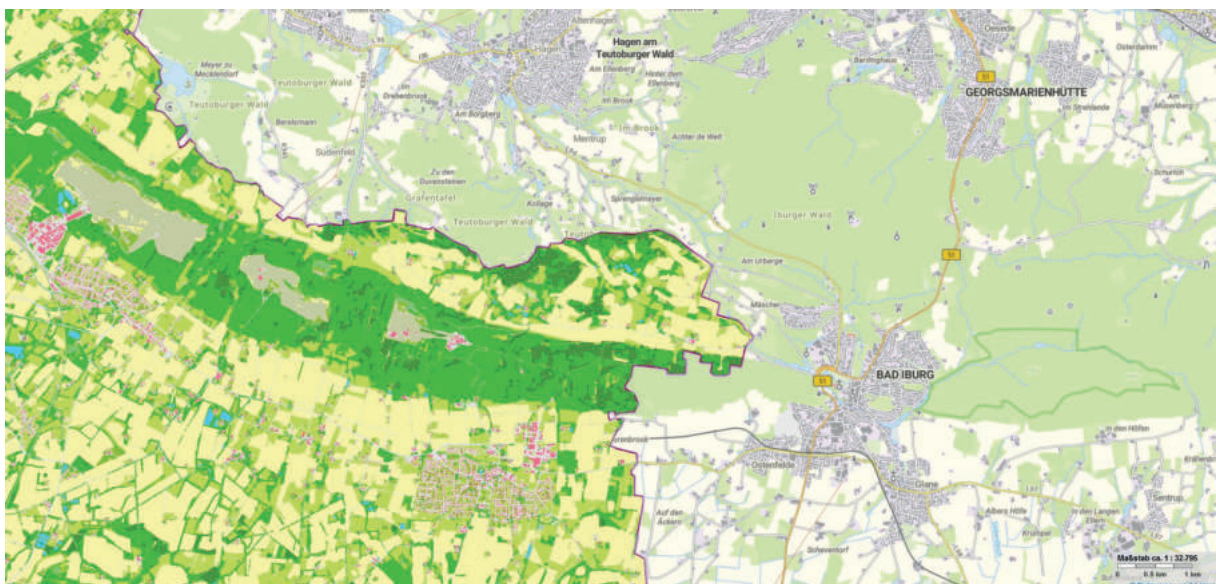


Fig. 29: Visualised excerpt from the Land Cover product. Image: BKG With the open data product



The open data product Land Cover is an excellent example of successful co-operation between the federal and Laender governments in AdV. The North Rhine-Westphalia State Surveying Authority and the BKG have jointly taken on this challenging project and are looking very confidently to the continuation and further development of this cooperation.

*Kerstin Will, Deputy Chair of AdV,
Ministry of the Interior of North Rhine-Westphalia*

¹ https://www.bkg.bund.de/LB-DE_Produktinfo

AdV geocoding service for OZG services throughout Germany

The digitalisation of public administration is a key lever for making planning, approval and implementation procedures in Germany more efficient, faster and more citizen-friendly. In the course of implementing the Online Access Act (OZG), AdV is making a key contribution with its AdV geocoding service for addresses and geonames.

The AdV geocoding service for addresses and geonames enables addresses to be converted into coordinates in a quality-assured and nationally standardised manner. It thus forms the basis for numerous digital administrative processes – from location determination in application procedures to the provision of geoinformation in citizen portals. In the OZG implementation project DiPlanung, which aims to provide planning documents and facilitate participation in planning procedures, the availability of accurate geodata is a key success factor (Figure 30). This simplifies approval processes and significantly accelerates the implementation of infrastructure projects.



Fig. 30: OZG implementation project DiPlanung



With the AdV geocoding service for addresses and geonames, we are creating a reliable and data protection compliant infrastructure that significantly supports the digitalisation of public administration in Germany. AdV is thus demonstrating how important geodata and a strong geodata infrastructure are for the successful digitalisation of public administration.

Katrin Weke, Chair of the GDI-DE Steering Committee

The AdV geocoding service for addresses and geographical names is now also available free of charge for cross-border digitalisation projects and can be obtained from the national surveying authorities. Federal authorities will continue to receive this geocoding service via the BKG service centre.

Through close cooperation between the Laender and continuous development of the geocoding service, AdV ensures that geocoding consistently meets the latest requirements and can be flexibly integrated into a wide variety of administrative processes. In this way, AdV is making a significant contribution in the advancement of the digital transformation of public administration in Germany.

Introduction of Confluence as a collaboration platform at AdV

Starting in early 2025, AdV introduced the Confluence collaboration platform step by step. Prior to this, the platform was tested by selected AdV committees and evaluated as a suitable collaboration tool. Confluence is provided as software-as-a-service and is a building block of the AdV cloud computing strategy. The platform supports the essential processes of communication, documentation and information exchange within the committees and between the various AdV committees. Currently, up to 500 colleagues working in the AdV committees use Confluence for their committee work. Additionally, other employees from member administrations can be granted specific access to certain committees via guest accounts. Since September 2025, all AdV committee members have been active in Confluence, marking the end of the implementation phase. This is followed by the process optimisation phase, with the goal of using Confluence even more efficiently for AdV's tasks.

Through the introduction of Confluence, AdV has created a unified platform for committee activities. Documents can be created collaboratively, coordinated across committees and published internally. All users consistently work with the same up-to-date data, which allows for better utilisation of technical synergies and eliminates the need for manual document distribution. The platform increases the transparency and traceability of committee work, supports efficient knowledge management and thus strengthens federal cooperation within AdV. The resulting simplification of administrative processes noticeably increases the efficiency of AdV. At the same time, it frees up personnel and time resources, which can be used for AdV's technical tasks.

Maintenance of the AdV website

In 2024, the focus was on collaborating on the creation of strategy papers and concepts for modernising the AdV website. The work had to be carried out quickly, as the company that had previously managed and hosted the AdV website was set to close in the foreseeable future and discontinue maintenance and servicing of the software. At the beginning of 2025, work began on migrating the internal workspace to Confluence, which was completed in the first half of the year, marking the achievement of an initial milestone. Another goal is the re-launch of the entire website, which is scheduled to be successfully implemented by early 2026.

Throughout the implementation phase, the current members of the web design team will continue to support the project.



Fig. 31: Work of the web design department,
Source: LGL BW, 2025

Geospatial reference data in use: The BKG provides guidance on heavy rain preparedness

Flood risks know no boundaries – the Federal Agency for Cartography and Geodesy (BKG) is developing a Germany-wide map showing heavy rainfall risks. This is based on the BKG's geodata and the nationally standardised geo reference data of the Laender, which is provided in accordance with AdV standards. With their official spatial reference, these AdV products enable the nation-wide networking of geoinformation from a variety of sources, in particular precipitation data from the German Weather Service (DWD), building information from the Federal Highway Research Institute (BASt) and Deutsche Bahn (DB).

Influenced by global warming, extreme weather events have become increasingly frequent and more intense in recent decades. Heavy rainfall events and their consequences in particular are receiving increasing attention from society, policy makers and public authorities. Within a very short period of time, such high amounts of precipitation can fall that even areas far away from bodies of water can experience catastrophic flooding with a high potential for damage.

As part of its efforts to contribute to optimal heavy rain preparedness, the Federal Agency for Cartography and Geodesy (BKG) is working with the relevant federal and state authorities to develop a Germany-wide map of heavy rain hazards, which provides information on flood depths and flow velocities for every square metre in Germany. A uniform data basis enables comparable assessments of heavy rainfall hazards nationwide – regardless of administrative boundaries – and thus supports coordinated, interregional risk management.

The 2D hydrodynamic modelling is based on geodata from the federal and state governments, in particular the digital terrain model with a grid width of one metre (DGM1) from the state surveying authorities. The water catchment areas derived from this form the hydrological basis. For a realistic runoff simulation, the DGM1 is supplemented by structures such as road culverts and pumping stations and thus adapted hydrologically.

Buildings and roof shapes from the Official Real Estate Cadastre Information System (ALKIS®) are transferred to the DGM as 3D models. Buildings act as flow obstacles, while roof shapes direct the runoff during precipitation. The land cover model (LBM-DE) defines the surface roughness of the terrain, enabling realistic adjustment of the flow velocity.

The heavy rain hazard map shows realistic simulation events for possible flooding scenarios. Flooding depths, flow velocities and directions are shown based on an exceptional 100-year event and an extreme heavy rain event with precipitation of 100 mm/h (Fig. 10). The freely available KOSTRA-DWD data set contains a regionalised evaluation of precipitation levels according to duration and annual frequency and is used in the simulation of the 100-year event.

Geospatial reference data in use:

The BKG provides guidance on heavy rain preparedness

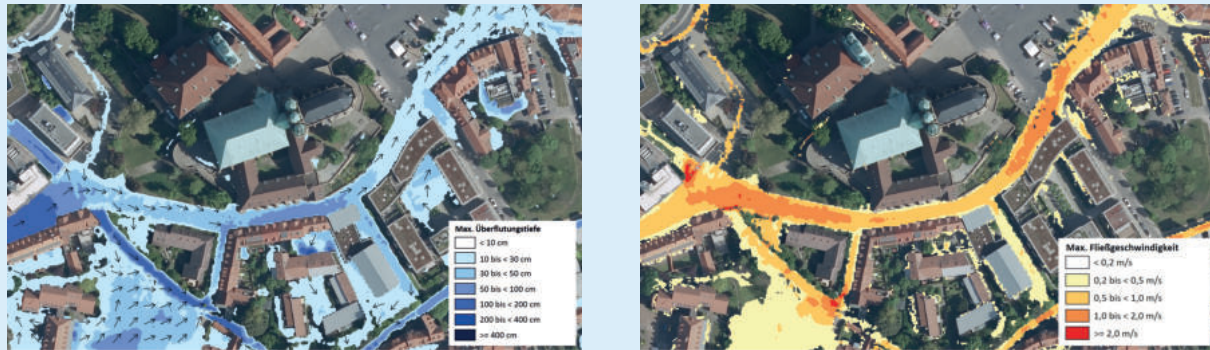


Fig. 32: Flood levels and flow directions (left) and flow velocities (right) for an extreme heavy rainfall event at Erfurt Cathedral. (© GeoBasis-DE/BKG (2025), © GDI-Th)

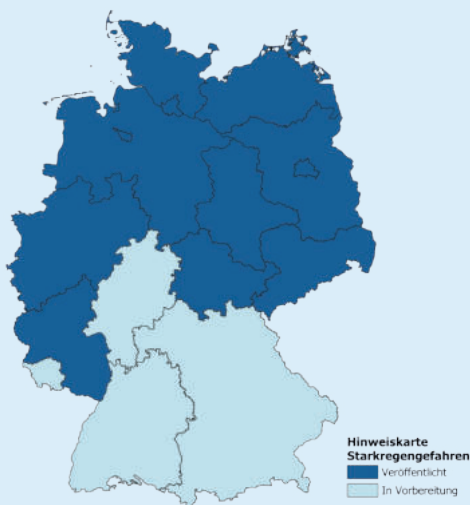


Fig. 33: Availability of the heavy rain hazard map (as of April 2025).

The heavy rain hazard map can therefore provide an initial assessment of potential risks, which, when combined with existing local expertise, should greatly facilitate measures planning. It serves as an important tool for identifying areas at risk from heavy rain and raises awareness of the dangers posed by heavy rainfall events. It enables local authorities, planners and emergency services throughout the country to derive appropriate measures, both preventive and in the event of an acute disaster.

To date, maps are available for twelve Laender, covering around two-thirds of Germany: Bremen, Brandenburg, Hamburg, Mecklenburg-Western Pomerania, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate (state data), Saxony, Saxony-Anhalt, Schleswig-Holstein and Thuringia. These are freely available as WMS and on Geoportal.de, with data downloads in preparation.

The areas of Baden-Württemberg, Bavaria, Hesse and Saarland will be calculated by the end of 2025 and published in early 2026 (Fig. 11).



Heavy rainfall events do not stop at administrative boundaries. This makes it all the more important to have a map with comparable hazard warnings for the whole of Germany. With its heavy rainfall hazard map, the Federal Agency for Cartography and Geodesy (BKG) provides this information nationwide and in high resolution: for the federal government, the Laender and local authorities, the result is a valuable basis for both preparedness and disaster response. In addition to climate data from the DWD, the mapping is based on official geodata from the Laender. Its availability throughout Germany, as well as its comparable quality and timeliness, made the project possible in the first place.

President and Professor Dr. Paul Becker
Federal Agency for Cartography and Geodesy

7. Involvement in European and international Organisations

EuroGeographics



EuroGeographics (www.eurogeographics.org) is the non-profit association of the national institutions in Europe that are responsible for performing geodesy, cartography, and real estate cadastre-related tasks. For this purpose, EuroGeographics maintains a network and represents the interests of its members at both European and international levels. The objective of EuroGeographics is to facilitate access to the geodata and services of its members. In addition, EuroGeographics members collaborate on the creation of harmonised, cross-national products and in joint working groups and projects.

AdV is an associated member and the BKG a regular member of EuroGeographics. Both are actively involved in the work on products, in expert groups and in projects. Additionally, the BKG holds a permanent seat on the Management Board.

The products EBM, ERM, EGM, EuroDEM, Open Regional Gazetteer and Open Cadastral Maps and High-value large-scale pan European prototype

EuroGeographics bietet die folgenden amtlichen, europäischen Datensätze in einheitlicher Form, über Ländergrenzen hinweg harmonisiert und mit bedarfsgerechtem Aktualitätsstand an:

- **EuroBoundaryMap (EBM)** – EuroBoundaryMap (EBM) – data set in the scale 1:100,000 that contains all the administrative units of all national administrative levels in Europe, with names, unique code numbers and a reference to the statistical classifications NUTS/LAU of Eurostat (Statistical Office of the European Union).

Production management is carried out by the BKG.

- **EuroRegionalMap (ERM)** – the topographic reference data set in the scale 1:250,000. Production management is carried out by the BKG with the support of the regional coordinators.
- **EuroGlobalMap (EGM)** – the topographic reference data set in the scale 1:1,000,000 is automatically being derived from ERM. Production management is carried out by the “Institut national de l’information géographique et forestière (IGN)” France.
- **European Digital Elevation Model (EuroDEM)** – a digital terrain model computed by the BKG in 2008 from the national data sets with a position resolution of 2 arcseconds (approx. 60 m) and a height accuracy of 8 – 10 m. In 2022/23, the product was partially replaced by open MERIT data so that it could be made available as open data.
- **Open Gazetteer** – Open Gazetteer an open European naming service containing geographical names of the EBM and ERM products. The name database is enriched with exonyms (geographical names in other languages) by a name expert is made available by the BKG.
- **Open Cadastral Map** (prototype, as of April 2025: ten Länder) – European cadastral map with information on administrative units, cadastral parcels (and cadastral zones), buildings (and parts of buildings) and addresses.
- **High-value large-scale pan European prototype** (as of April 2025: six Länder, partly with over-sea regions) - Large-scale data set covering the topics of administrative areas, transport and traffic.

EBM, ERM, EGM and “Open Gazetteer” are published once a year.

Product production management includes the organisation of the entire manufacturing process as well as its strategic planning and technical implementation. Another key task for the product managers is the communication with the data producers and regional coordinators. In cooperation with them, the manufacturing process is continuously reviewed and optimised if needed.

Knowledge Exchange Networks (KENs)

The Knowledge Exchange Networks (KENs) are platforms for an exchange of experiences on various topics between experts from the EuroGeographics members. One example is the QKEN, in which members deal with data quality and quality management issues as well as follow international standards in this area. Further KENs deal with the implementation of the INSPIRE Directive, the real estate cadastre or European strategies, directives and regulations.

Once or twice a month, members of EuroGeographics present successful projects as part of the Thursday online events.

In addition, EuroGeographics collaborates with partner organisations such as EuroSDR to offer workshops on current topics, e.g. artificial intelligence and the retrievability of geodata and metadata.

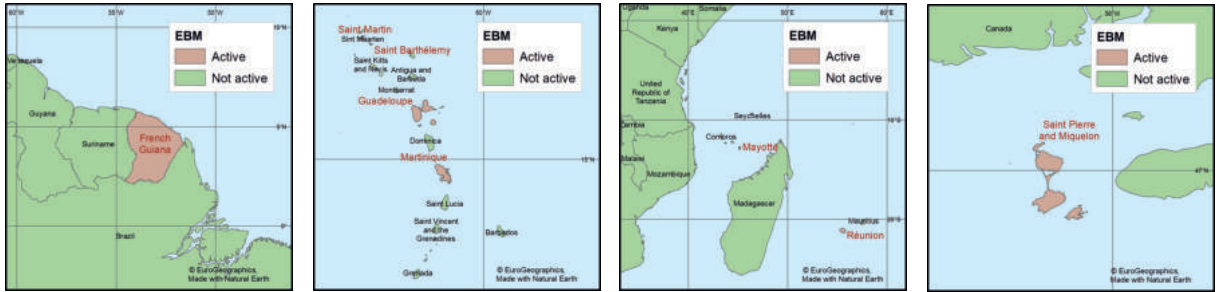
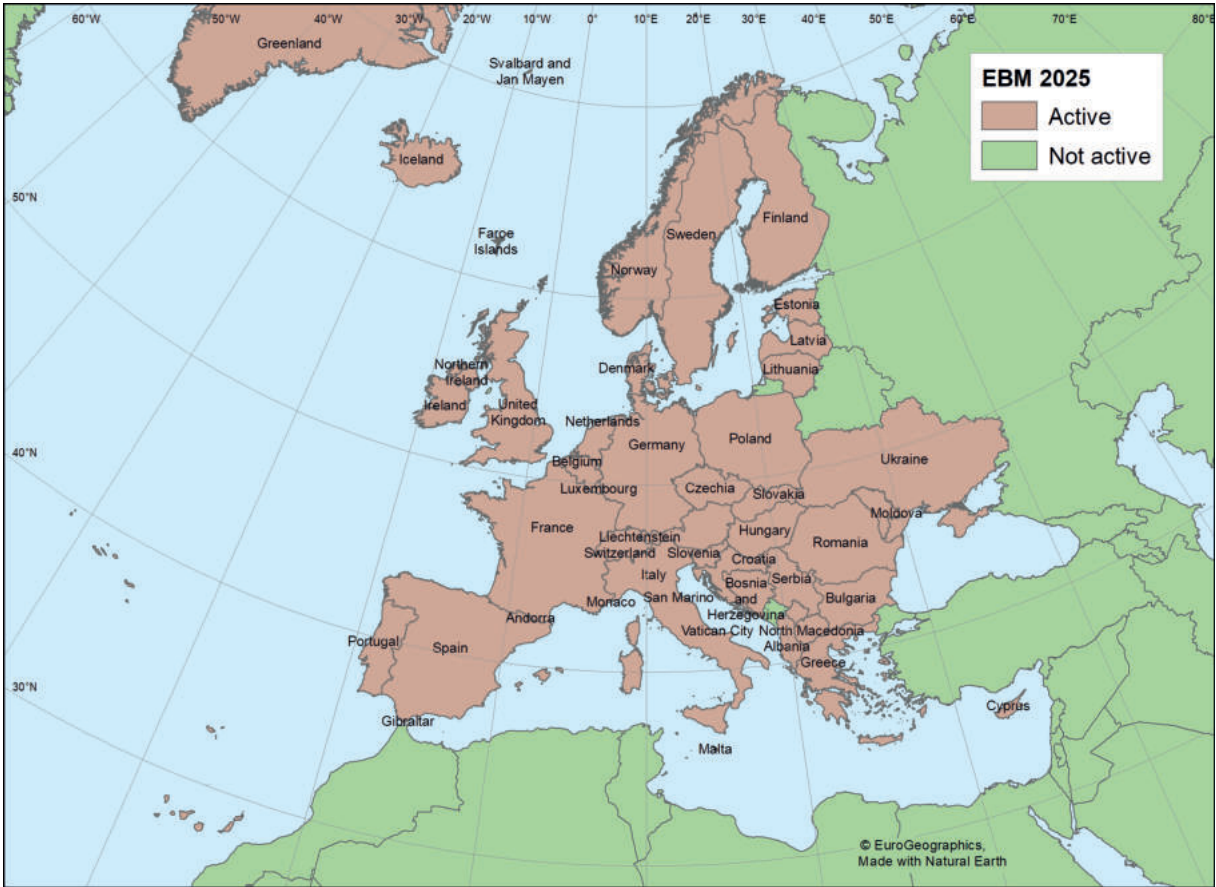


Fig 34: Members of EBM (EuroBoundaryMap).

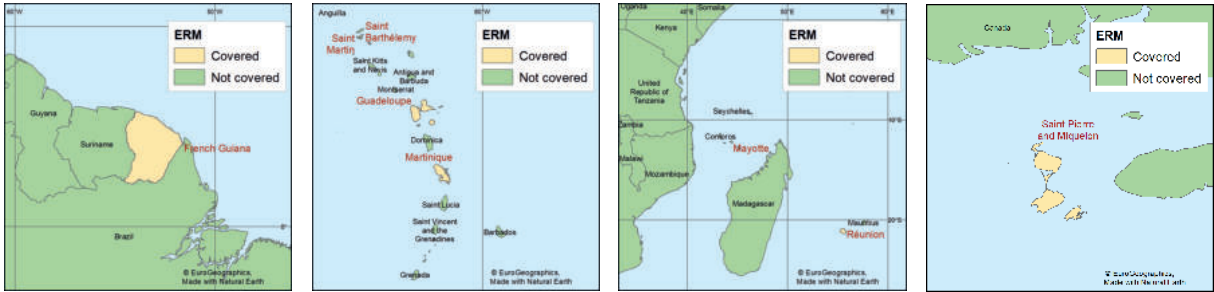
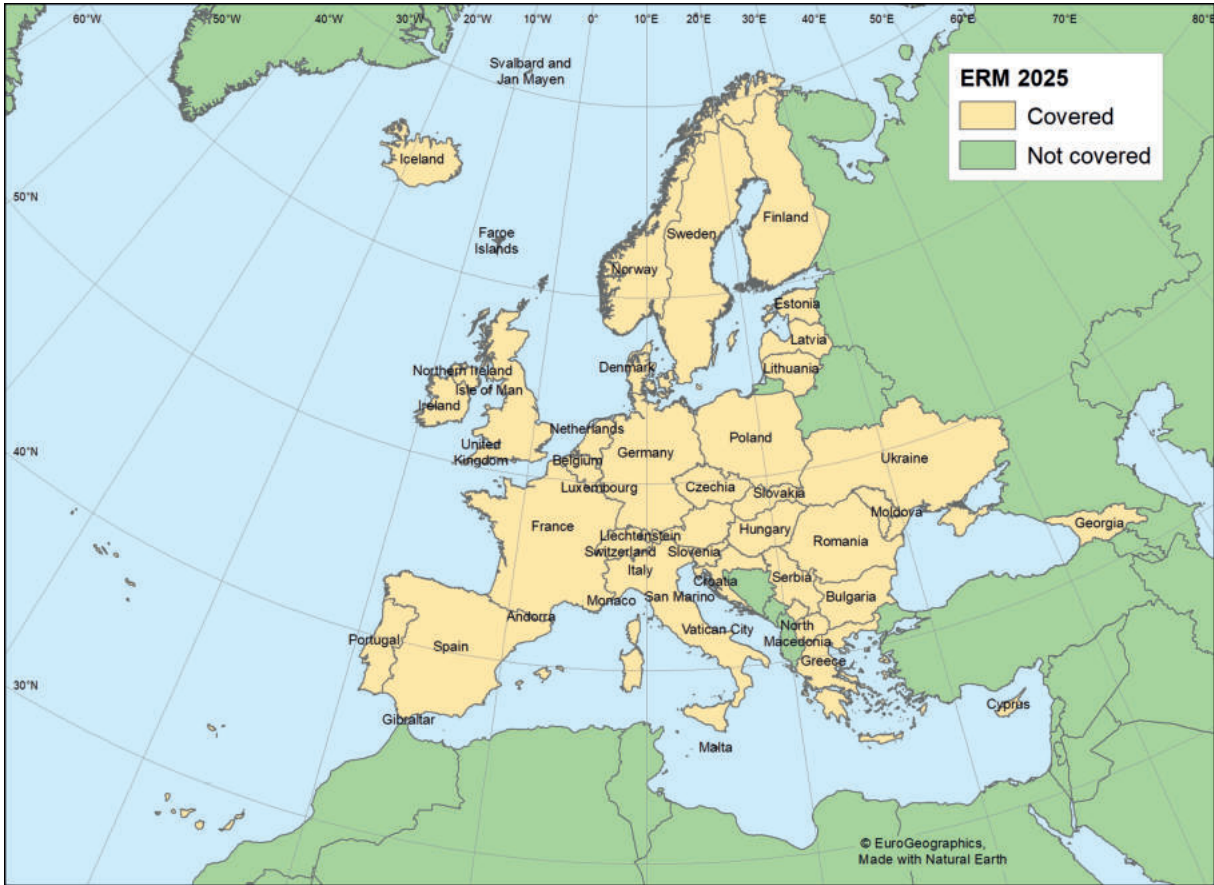


Fig 35: Members of ERM (EuroRegionalMap).

The Open Maps for Europe 2.0 project

The aim of the project “Open Maps for Europe 2.0” is to build a productive system for large-scale (1:10,000 and larger) topographic data of the members of EuroGeographics and to make it available under a free licence. For this purpose, the administrative units, the road and water network for ten European countries are to be prepared and made available. OME2 is intended to demonstrate that the user requirements of the European Commission (large scale, key topics, incremental updating, harmonised and border-adapted official data from all over Europe) can be met by the national surveying and cadastral authorities. Furthermore, the project involves the development of a Europe-wide cadastral map using data provided by the members. OME2 is also intended to contribute to the knowledge exchange between EuroGeographics members.

A central role is played by the platform developed in the previous project “Open Maps for Europe” (www.maps-foreurope.org), on which the following data is made available in a user-friendly way (viewing and downloading): topographic maps (High-value large-scale pan European prototype, ERM, EGM), the European name service Open Gazetteer, the digital elevation model EuroDEM, the cadastral map Open Cadastral Map and the European mosaic Pan-European Imagery, produced by the BKG from satellite image data.

EuroGeographics is coordinating the OME2 project, which is divided into six work packages, with the support of a consortium of five surveying and cadastral authorities in Europe (France, Belgium, the Netherlands, Spain, Greece). The BKG is responsible for the production management of several products as a subcontractor. The technical implementation of the platform will be carried out by the French company IDOX.

The project will run from 1 January 2023 to 31 December 2025 and is co-financed by the European Union’s “Digital Europe” funding programme.

OME2 will promote the re-use of open public data in the European Union and contribute to the development of information products and services through the use of high-quality datasets from EuroGeographics members.

UN-GGIM: Europe – Establishing efficient geodata management

The United Nations Global Geospatial Information Management (UN-GGIM) initiative of the United Nations has existed since 2011 and has set out to coordinate global geospatial information management. Important topics at UN-GGIM are the integration of statistical and geographic information, especially in regards to their significance for the 17 UN Sustainable Development Goals.

At the European political level, UN-GGIM: Europe, a regional body that deals with geodesy and geoinformation issues across the board, has been in existence since September 2014.

The work agenda for 2022–2025 comprises five lines of work (LoW):

- Data Integration (DI);
- Integrated Geospatial Information Framework (IGIF);
- Geodetic Reference Frame (GRF);
- Sustainable Development Goals (SDG);
- Data Strategy and Policy (DS&P).

The BKG actively participates in the LoWs Data Integration and SDGs. The LoW Data Integration is now led by colleagues at the national surveying authorities of Belgium and Austria, while the LoW SDG is coordinated by the Portuguese Statistics Authority.

In 2023, the various LoWs held online events on knowledge infrastructures, geodata integration, Earth observation for calculating SDG indicators and many other topics. During a meeting in Lisbon in 2024, new tasks were defined for the remaining work phase.

LoW Data Integration has set itself the following goals:

- to produce an evaluation and assessment report with recommendations for data integration, including a list of obstacles hindering implementation, and
- to develop storyboards on pragmatic examples of data integration applications (using prominent articles or videos from the media on topics such as health, migration or climate resilience).

At the LoW SDG, it was decided to accelerate the calculation of further indicators (6.6.1, 11.7.1 and 15.3.1). To this end, various sub-working groups were formed, each dealing with one indicator.

Further information on the LoW (including recordings of the online events) from UN-GGIM:Europe can be found at <https://un-ggim-europe.org/working-groups/>.

Current trends at OGC and ISO/TC 211



The programme to modernise OGC web services for easier implementation of open API standards is in full swing. OGC API – Features, OGC API – Tiles, OGC, API – Processes and other API standards are progressively being implemented in major commercial and open-source geospatial technologies. Therefore, broad adoption of this new generation of web standards is clearly underway.

In particular, the OGC APIs for features and tiles (vector and raster) help to make geospatial data interoperable with the latest technology, thereby making data easily available to all types of users, from geoinformatics specialists to end users. And they do so in a flexible way that was not possible with the previous generation of standards. The approach enables better access to geographic information and thus better decision-making for all users, regardless of their level of technological development.

An alternative to the XML encoding standard previously used in NAS is GeoJSON, a widely used standard from the Internet Engineering Task Force (IETF). This standard enables the simple use of basic object-based geodata in 'Lat-Lon' geographical coordinates, thus avoiding the complexity of using geodetic coordinate reference systems (CRS). For more complex geometric representations of data, OGC is therefore developing the 'Features and Geometries JSON' (JSON-FG) standard to enable these additional functions, which are necessary for the correct use of official geodata.

OGC continues to develop CityGML and related technical application extensions, such as IndoorGML and the Indoor Mapping Data Format (IMDF). These standards enable the creation of detailed 3D city models, Digital Twins and indoor navigation functions. This supports sustainable urban planning, energy efficiency, public safety, accessibility, urban service provision and other applications. These standards have been implemented in commercial and open-source products and are actively used in many municipalities.

As part of the conformance testing and certification programme from OGC, conformity tests for standards are often published immediately after new standards are released. These tests are open source software and allow developers to test their own results before developing software. OGC also offers a certification programme that formally conducts the tests and OGC evaluation of the test results and certifies software that has been proven to properly implement OGC standards. For users such as AdV, this means that appropriately certified software reliably complies with all relevant interoperability requirements and that there is no need to implement their own test cases within the AdV test suite.

ISO/TC 211 currently consists of 37 active and 34 observer members (nations), represented by national standards committees (Germany by DIN). Jamaica was welcomed as a new member in 2023. ISO/TC 211 works with numerous organisations within the framework of so-called 'liaisons', including other GIS-related ISO committees and external organisations. The most important internal ISO liaisons include committees in the areas of integrated transport, Digital Twins and Smart Cities. Further information can be found in the strategic business plan on the ISO/TC 211 website. Freely available resources such as UML models and XML schemas to support the implementation of standards are also published on the ISO/TC 211 website. AdV uses and references these resources directly in its own application schemas (AAA®, LB, LN, VBORIS...).

ISO/TC 211 is also a partner and member of the Committee on Geodesy (SCoG) of UN GGIM and cooperates in particular with the Nations Global Geodetic Centre of Excellence (UN-GGCE).

ISO/TC 211 is also working with OGC, IHO, FIG and other organisations on a comprehensive revision of ISO 19152:2012 'Land Administration Domain Model (LADM)' with the objective of meeting additional requirements of various disciplines related to cadastral and land registry systems with new content. The result of this revision will be a multi-part standard with the following content:

- General conceptual model
- Property protection
- Marine geospatial regulation
- Land valuation information
- Spatial planning
- Implementation aspects.

Currently, intensive work is being carried out on all parts. AdV is contributing its own expertise and, where appropriate, incorporating aspects of this standard into its own specialist models.

Land cover and land use (LCLU) are further topics for which ISO/TC211 develops technical standards. LCLU are essential and fundamental data topics which are relevant to millions of professional users worldwide in a wide range of applications. There is a growing need for a generally accepted LCLU meta-language to facilitate international analysis. AdV has already taken these developments into account in the creation of its own LB and LN application schemas and, conversely, has also contributed its own proposals.

Permanent Committee on Cadastre in the European Union



On 1 January 2024 Belgium assumed the EU Council Presidency and thus also the Presidency of the Permanent Committee on Cadastre in the European Union (PCC) for the first half of 2024. The members of this committee are those organisations in the EU Member States that are responsible for the real estate cadastre. The highlight of the Presidency was the PCC Conference and General Assembly, which took place in Bruges from 17 to 19 June 2024 in a hybrid format (while most of the speakers spoke on site in Bruges, additional accredited participants were able to join virtually). The key topic of the conference was 'Strengthening the cadastre's competitiveness whilst protecting people and borders'. It essentially dealt with questions such as the open data status of cadastral data in terms of data protection regulations, valuation issues for taxation purposes, etc., and the use of artificial intelligence in cadastral systems.

As of 1 July 2024, Belgium handed over the PCC presidency to Hungary. Usually, the chairing country invites participants to the biannual PCC conference and general assembly. Hungary, however, announced in advance that it would not be possible to hold this event in Hungary due to internal administrative reforms; Latvia stepped in as a replacement. Their conference, also organised as a hybrid event in Riga on 20 and 21 November 2024, dealt with the topics of valuation, developments in national cadastral information systems and developments at European level.

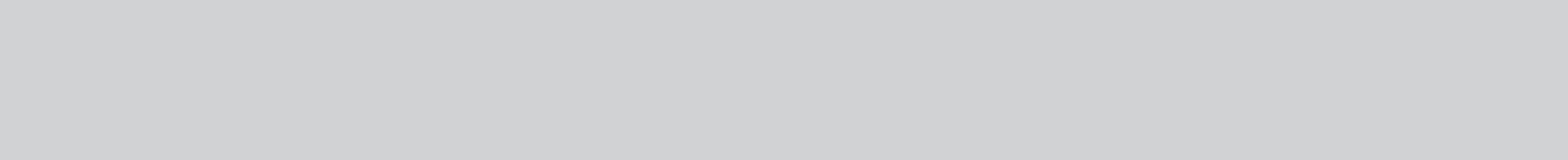
On 1 January 2025, Poland took over the EU Council Presidency and thus the PCC Presidency for the first half of 2025. With the motto 'New technologies in cadastre and future trends', the conference, held in Warsaw on 5 and 6 May 2025, continued the themes of previous years.

In the second half of 2025, Denmark held the chairmanship of the PCC and hosted the conference and general assembly in Aalborg on 4 and 5 November 2025. The theme of the Danish Presidency was 'Climate-smart land consolidation', where the adaption of agriculture to climate change should be combined with the reduction of greenhouse gas emissions in agriculture.

Further information can be found at www.eurocadastre.org.

Explanation of frequently used abbreviations

AdV	Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany
AAA®	AFIS® – ALKIS® – ATKIS®
AFIS®	Authorative Control Point Information System
ALKIS®	Authorative Real Estate Cadastre Information System
ATKIS®	Authorative Topographic Cartographic Information System
BKG	Federal Agency for Cartography and Geodesy
BMI	Federal Ministry of the Interior
BMVg	Federal Ministry of Defence
BMV	Federal Ministry for Transport
DGK	German Geodetic Commission
DGM	Digital Terrain Model
DLM	Digital Landscape Model
DOP	Digital Orthophoto
DTK	Digital Topographic Map
GDI-DE	Spatial Data Infrastructure Germany
GeoInfoDok	Documentation on the Modelling of Geoinformation of Official Surveying and Mapping
GEPOS™	German Satellite Positioning Service
INSPIRE	Infrastructure for Spatial Information in Europe
NAS	Norm-based Exchange Interface
ÖbVI	Publicly Appointed Surveyors
OGC	Open Geospatial Consortium
SA ^{POS} ®	Satellite Positioning Service of the Official German Surveying and Mapping
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service
ZSGT	Central Office Geotopography
ZSHH	Central Office for House Coordinates and Building Polygons
ZSS	Central Office SA ^{POS} ®



Handwriting practice area with 20 horizontal lines.



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