National Report 2011/2012

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

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Dear readers

The purpose of this National Report is to show you the diverse range of tasks covered by surveying and mapping and geographic information. In Germany, this field is dominated by the federal structure that poses specific challenges for the collaboration between the federal government and the Laender. The Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV) is squaring up to this challenge.

Following the ever popular AAA®, industry and administrations in particular had a frequently expressed need for a web map service during the period under review. The AdV addressed these requirements, the aim being for the federal government and the Laender to jointly operate and provision an official map service in the geo portals. The first key points were swiftly agreed and unanimously decided by the AdV Plenum. WebAtlasDE, as a nationally standardised product of Germany's official surveying and mapping authority, was born.

The AdV had set a tight schedule for implementing WebAtlasDE during its first realisation phase. The data preparation by the Laender and the provisioning of this data to the BKG was scheduled for completion by December 2011. The service was then to be set up immediately afterwards, to enable WebAtlasDE to be activated alongside Geoportal.DE at CeBIT 2012. All deadlines were met.

Now, WebAtlasDE has to be refined to satisfy the needs of its users – because there's nothing as constant as change – as Heraclitus of Ephesus was aware some 2,500 years ago.

Although Heraclitus' philosophy will always hold water, we currently seem to be in a phase where change is especially prevalent, as we are seeing with the so-called megatrends such as climate change, energy transition and demographic change. For Germany's official surveying and mapping authority, these issues present both a challenge and an opportunity, as change does not take place in isolation. Geospatial reference data provide the fundamental basis and tools for geospatially depicting, analysing and ultimately shaping this change. "Geospatial reference services" are also set to play an increasingly important role in this regard. The real challenge lies in the uniform provisioning of the geospatial data, with simple cost and licence conditions and assured quality. WebAtlasDE has demonstrated that collaborations between the federal government and the Laender, as well as collaborations between the Laender themselves, enable large-scale projects to be realised in the fastest time. This created the basis and is exactly the right approach!

WebAtlasDE, the second realisation phase of which is nearing the end, is just one of many activities in Germany's official surveying and mapping. Information on other activities can be found in this National Report. I hope you enjoy reading this material and gaining interesting insights into the AdV's complex range of activities.

Ulrich Püß
President of AdV

1. Organisation and Performance of Tasks

In the Federal Republic of Germany, the Laender are responsible for the performance of official surveying and mapping tasks. Since 1948, the authorities of the Laender and the Federal Ministries of the Interior, Defence as well as Transport, Building and Urban Development responsible for official surveying and mapping have been cooperating in the Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV) in order to deal with technical issues of fundamental and national importance. The German Geodetic Commission (DGK) as representative of geodetic teaching and research and the Working Committee for Rural Development (ARGE LANDENTWICKLUNG) have guest status in the AdV.

Surveying, mapping and real estate cadastral authorities of the Laender

In recent years, conventional surveying, mapping and real estate cadastral systems have advanced both technically and methodically, the main area of focus being geoinformation management. Over the last decade, this process has been accompanied by comprehensive legislative reforms. The key to modernising the administrative procedures of the surveying, mapping and geoinformation authorities in the Laender is to open up the administrative bodies to adjacent areas to create the foundation in the network cluster for the infrastructural and spatial planning policy.

The surveying, mapping and geoinformation authorities are assigned to various departments, the interior department being most frequently represented. Structural changes have taken place in a number of agencies. In certain Laender, the real estate cadastral authorities and in some cases also the regional development/ farmland consolidation authorities are being integrated into the higher-level authorities of the surveying and mapping authorities. In other Laender, local fields of activity have been expanded by the amalgamation of real estate cadastral authorities.

The key aspects of the geoinformation system – management of the real estate cadastre, geotopography and reference surveys/official reference systems – are the responsibility of the Laender. The original services include:

- The widespread provision of spatial reference data via reference networks in the Authoritative Control Point Information System (AFIS®), comprising both terrestrial control points and their documentation as well as the satellite-supported positioning service SA*POS*®,
- The storage of a widespread image of the earth's surface via geotopographic products in the Authoritative Topographic Cartographic Information System (ATKIS®) using landscape and terrain models, official topographic cartography and orthophotos,
- The widespread digital documentation of buildings and approx. 64 million land parcels in the official real estate cadastre for ownership rights in the land register, currently managed by applying the procedures for the automated real estate map (ALK) and the automated real estate register (ALB), in the future using the Authoritative Real Estate Cadastre Information System (ALKIS®) and
- Integration of real estate cadastre and surveying and mapping.

Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie)

Bundesamt für Kartographie und Geodäsie

The Federal Agency for Cartography and Geodesy (BKG) is a federal authority responsible to the Federal Ministry of the Interior. In cooperation with the Laender, the BKG fulfils the following duties and responsibilities in the field of geoinformation and geodesy:

- Provisioning and mapping up-to-date analogue and digital topographic and cartographic information, as well as the advancement of the procedures and methods required for this purpose;
- Provisioning and updating of geodetic reference networks in the Federal Republic of Germany, including the required
    - Services pertaining to surveying and mapping as well as the theoretical services for the acquisition and preparation of measurement data, and involvement in bilateral and multilateral activities for determining and updating global reference systems,
    - Advancement of the measurement and observation technology employed;
- Representation of the interests of the Federal Republic of Germany in the field of geodesy and geoinformation at international level.

Federal Ministry of Defence (BMVg) Geoinformation service of the Federal Armed Forces

GEOINFORMATIONSDIENST DER BUNDESWEHR

Federal Ministry of Defence (BMVg) is represented in the AdV by the Head of the Federal Armed Forces Geoinformation Service (GeoInfoDBw) and Head of the Federal Armed Forces Geoinformation Authority (AGeoBw).

The AGeoBw is responsible for guaranteeing the military core capability of "Geoinfo support for the Federal Armed Forces" in deployment and basic operations. Under the guiding principle of "Geoinformation from one source", the teams at GeoInfoDBw assume responsibility for both the availability of quality-tested geoinformation in deployment and also for the recognition and assessment of geofactors (including terrain, weather, climate, water) that can impact deployment progress.

The AGeoBw acts as the central department of the GeoInfoDBw which, taking an interdisciplinary, i.e. comprising eighteen geo-sciences (including geodesy, geography, geology, cartography, remote reconnaissance, meteorology), personnel and process approach, develops, trains and deploys the processes of geoinfo data acquisition, geoinfo data management and geoinfo production relevant to geoinfo support. For the Federal Republic of Germany, the reliance is very much on the data and product services of the surveying, mapping and real estate cadastral authorities in the Laender and the BKG.

This guarantees that the federal armed forces deployed on German territory have access to the same maps produced in civil-military cooperation, as well as the civil auxiliary and security forces deployed in parallel where necessary. Another task of the GeoInfoDBw is to ensure that digital information is managed according to standardised structures and up-to-date data models across all German Laender, the data of which can be transmitted to the geoinfo database of the federal armed forces in just one process step, enabling them to be used for military purposes. With the design and successive implementation of the AdV's AAA® concept, considerable progress was achieved in this regard during the period under review.

Federal Ministry of Transport, Building and Urban Development (BMVBS)

WSV.de
Wasser- und Schifffahrtsverwaltung des Bundes

The Federal Ministry of Transport, Building and Urban Development (BMVBS), represented by the Waterways Department, has been a member of the AdV since 1950. For the operation and maintenance of the approx. 7,300 km of Germany's inland waterways and approx. 17,800 km² of navigable waters, the Federal Waterways and Shipping Administration, an authority with its own surveyors, is subordinate to BMVBS. The surveying, mapping and real estate division has approx. 450 employees. Official surveying and mapping tasks are carried out throughout Germany, necessitating close consultation within the AdV. Along its waterways, the WSV has its own reference network (position and elevation marks) and manages a digital map series (1 : 2,000), the content of which is used for the continuance of the ATKIS® Basic DLM.

For the offshore area, the German Maritime and Hydrographic Agency (BSH) conducts marine surveys in Germany's north and Baltic seas as the mostly travelled waters of the world. Marine surveys and cartography provide the requisite foundations for environmental protection, the erection of offshore installations, coastal protection and hydraulic engineering. The survey region of the BSH covers an area of some 57,000 km², equivalent to one sixth of Germany's land area. This is shown in a nautical chart series containing approx. 150 data records for electronic nautical chart systems, as well as 60 nautical charts in hard copy format.

For scientific advice and applied research, the WSV receives support from the Geodesy Department of the Federal Institute of Hydrology (BfG) for the focal points of geodetic reference systems, geokinematics, hydro and object surveying, as well as geotopography. The department collaborates closely with universities and colleges.

All agencies and higher-level authorities work closely with the surveying and mapping authorities of the German Laender and with the AdV working groups. The focal points are the exchange of information about topography, information technology and spatial reference, as well as use of SA*POS*® services, especially in the reception range over sea.

Organisation of the AdV

The graphic below (Figure 1) shows how the AdV is organised. Its bodies are the President and the Plenum. The AdV is supported by the working groups, the Task Force PRM and the management.

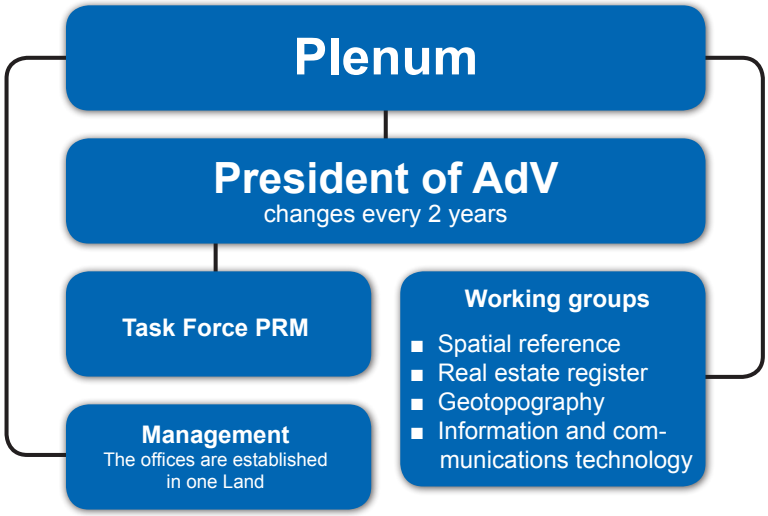

Fig. 1: Organisation of the AdV

Objectives, duties and responsibilities of the AdV

The member authorities collaborate in the AdV

- To regulate technical matters of fundamental and national importance to official surveying and mapping in a standardised manner,
- To create a stock of standardised geospatial reference data geared towards meeting the requirements of the information society and
- To provide the infrastructure for geospatial reference data as an important component for modern eGovernment architectures.

In order to achieve these objectives, the AdV fulfils the following duties and responsibilities:

- Creation and coordination of future-oriented joint concepts for the nationwide standardisation of real estate land cadastre, surveying and mapping and the geospatial reference data information system, to meet the needs of politicians, industry and administrative units,
- Assistance with the joint execution of projects of national importance,
- Facilitating and coordinating normalisation and standardisation procedures for the recording and management of geospatial reference data, as well as methods of access and distribution,
- Support for establishing and refining the national and European spatial data infrastructure and the corresponding electronic services,
- Representation and presentation of official surveying and mapping to the outside world,
- Involvement in international technical organisations for encouraging the transfer of expertise,
- Collaboration with dedicated organisations and authorities, as well as geodetic research and teaching institutions and
- Agreement on technical training issues.

Geobasis Steering Committee

The Geobasis Steering Committee, on which all Laender are represented, was established on 8 December 2010 under the Administrative Agreement for cooperation on official surveying and mapping in Germany. The Administrative Agreement aims to continuously improve the operative implementation of the strategies arranged in the AdV and to further optimise cooperation across Germany. The Geobasis Steering Committee is also supposed to ensure that the geospatial reference data are consistently provided to all users in the quality required.

The Geobasis Steering Committee shall perform the following tasks to implement the strategic resolutions adopted by the AdV:

- Monitoring and analysis of work and development situations, including compliance with the defined quality benchmarks and standards,
- Analysis of cooperation potentials and devising suggestions as to how they can be realised,
- Facilitation of the collaboration between individual Laender or several Laender,
- Quality review based on AdV standards regarding content and format consistency.

Official surveying and mapping statistics

Land	Inhabitants in thousands	Territory in km²	Land parcels in thousands	Number of authorities		
				Laender agencies (operations)	Regional agencies	Chartered Surveyors ÖbVI
Baden-Wuerttemberg	10,754	35,751	8,878	1	60	168
Free State of Bavaria	12,539	70,550	10,641	1	51	-
Berlin	3,461	888	393	1	12	46
Brandenburg	2,503	29,483	3,094	1	18	151
Free Hanseatic City of Bremen	661	419	206	1	1	6
Free and Hanseatic City of Hamburg	1,786	755	248	1	-	8
Hesse	6,067	21,115	4,976	1	7	87
Mecklenburg-Western Pomerania	1,642	23,191	1,900	1	7	70
Lower Saxony	7,918	47,613	6,113	1	-	103
North Rhine-Westphalia	17,845	34,092	9,235	1	53	456
Rhineland-Palatinate	4,004	19,854	6,334	1	6	86
Saarland	1,018	2,569	1,291	1	-	11
Free State of Saxony	4,149	18,420	2,604	1	13	113
Saxony-Anhalt	2,335	20,450	2,643	1	-	55
Schleswig-Holstein	2,834	15,799	1,863	1	-	43
Free State of Thuringia	2,235	16,173	3,094	1	-	70
Total for Germany	81,751	357,122	63,513	16	228	1,473

Tab. 1: Statistics: Inhabitants and territory Status 31 December 2010, Source: Statistical Federal Office
Land parcels and ÖbVI Status 1 July 2012
Number of authorities Status 1 September 2012

2. Spatial reference

The global reference systems and the national geodetic spatial reference have a close mathematical correlation and cannot therefore be considered in isolation. This becomes especially clear when the modern measurement systems – especially the global navigation systems – are examined. Changes in the system parameters directly affect the measurement results and must therefore be considered. The further realisation of the international reference system ITRF2005 to ITRF2008 during 2010 brought about systematic changes in the satellite orbits and the coordinates of the global reference stations, which expand to the SA*POS*® *application scope. It is therefore crucial for both the global reference systems and the regional (Europe) and national sections to be monitored and adapted on a regular basis. The various institutions of the Federal Agency for Cartography and Geodesy (BKG) and the German Laender make important contributions here to their respective remits.*

Connection to the global reference systems

The BKG operates, as its contribution to the global networks, three geodetic observatories in Wettzell (Bayerischer Wald, Figure 2), in Concepción (Chile) and O'Higgins (Antarktis, Figure 3). These represent cornerstones of the services offered by the International Association for Geodesy (IAG). The Geodetic Observatory (GO) in Wettzell is operated together with the Satellite Geodesy Research Institute at the Technical University of Munich.

The primary functions of the BKG's geodetic observatories are data acquisition for the ongoing maintenance of the national, European and global reference systems, the operation and advancement of the measurement systems, the development of new measurement systems and the representation of this sector on international committees. Specifically, the following products are developed:

- Data acquisition VLBI: Radiointerferometric measurements to quasars (VLBI),
- Data acquisition SLR: Distance measurements to man made satellites and to the reflectors on the moon (SLR/LLR),
- Data acquisition GNSS: Observations to the satellites of the GPS, GLONASS and Galileo navigation systems.

In addition, location based observations that supply location information for the space techniques are also carried out. This activities are performed in the product "local measurement data and specialist services". Including:

- Time and frequency measurements for the provision of the time scale and reference frequencies,
- Measurements using superconductive gravimeters for the recording of local gravity variations,
- Determination of the variation in the earth's rotation using large ring lasers,
- Recording of environmental parameters (meteorology, hydrology, ground deformations),
- Recording of earthquakes using seismometers and
- Geodetic measurements for determining the connection vectors between the individual measurement systems and for local stability control.

The key operational results during 2011 were:

- Completion of the TWIN radio telescope (without VLBI reception technology),
- Completion of the telescope for the new satellite observation system SOS-W T, first measured pass on 15.11.2011,
- Completion of the overhaul of the Wettzell Laser Ranging Systems (WLRS) telescope,
- Migration of the WLRS control software to SLR 2.0,
- Successful measurement of the Chandler and Annual Wobbles using the ring laser.

Fig. 2: Geodetic Observatory in Wettzell, TWIN radio telescope

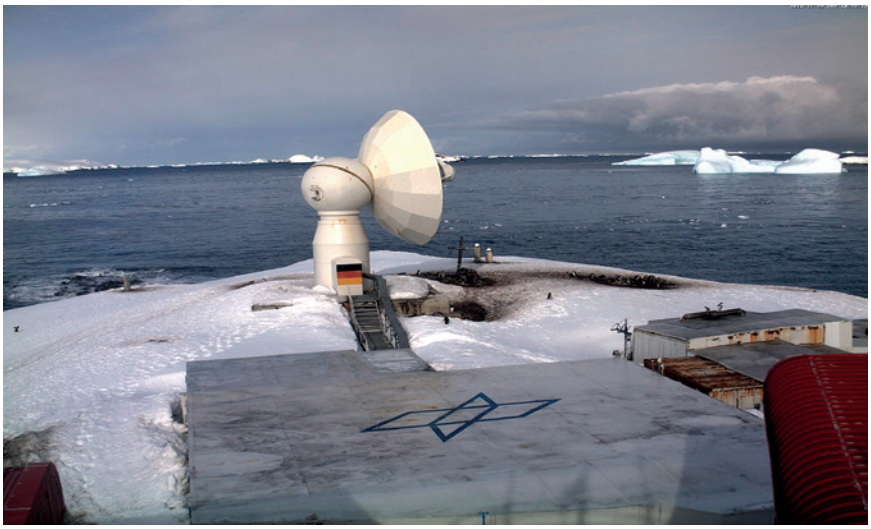

Fig. 3: The GARS O'Higgins

The central office of the International Earth Rotation and Reference Systems Service (IERS) was established in the BKG in 2001. The BKG acts as a data and analysis centre of the International VLBI Service (IVS) (VLBI – Very Long Baseline Interferometry) and as the analysis centre of the International Laser Ranging Service (ILRS). The observation stations and analysis centres of the BKG are part of the global activities for developing space techniques for geodetic use.

In carrying out these activities, the BKG is contributing to the global reference systems which provide the basis for both the European and national position, height and gravity reference systems. Furthermore, modern observation and analysis approaches will be implemented at national level as geodetic technology continues to be advanced.

BKG's GREF stations are analysed in various networks, including a sub-network of the European Reference Network (EPN), which comprises approx. 125 stations, and also as part of the SA*POS*® reference framework under the designation DREF-Online (Project SA*POS*® coordinate monitoring). The GNSS observation data are analysed daily during post processing using Version 5.0 of the Bernese analysis software. The networks are calculated daily in consideration of the precise satellite orbit and satellite clock data of the IGS (International GNSS Service) and the centre for satellite orbit determination in Europe (CODE) and combined every seven days for a weekly solution. Prior to that, the networks are pre-evaluated using the rapid orbits of the IGS.

At the 17th Conference of the Spatial Reference Working Group held on 16/17 June 2009, the decision was taken to implement DREF-Online as a reference framework for SA*POS*® coordinate monitoring in regular operation, and to assign the BKG as the processing centre to conduct regular DREF-Online analyses. An administrative agreement to this effect was signed by the BKG and the German Laender at the end of 2009.

The network currently comprises 30 SA*POS*® stations, 28 BKG GREF stations and 15 other EPN/IGS reference stations both at home and abroad. Network solutions are calculated daily in the post-processing and provided as week combination coordinate time series. Following a workshop held in February 2011 regarding the analysis of the SA*POS*® Laender networks, cumulative multi-year solutions are also being provided and compared with the official coordinates. In April 2011, the reference system was converted from ITRF2005/IGS05 to ITRF2008/IGS08.

The quasigeoid model GCG2011 – the height reference surface of the AdV

In recent years, satellite navigation systems (GPS, GLONASS, in the future Galileo) have become indispensable to surveying operations. However, the heights determined using these systems cannot be used directly, as they are determined purely geometrically and are not relative to sea level. To determine practical physical heights, a height reference surface model is required. In geodesy, this is referred to as a geoid or a quasigeoid.

A new height reference surface model for Germany is set to replace the GCG05 (German Combined Quasigeoid 2005) model that was introduced in 2005. Like its predecessor, the GCG2011 (German Combined Quasigeoid 2011) is a combination of two independent solutions offered by the BKG and the Institute of Geodesy of the Leibniz University, Hanover (IfE).

The essential differences to the 2005 model are:

- Expansion to the region of Germany's exclusive economic zone in the north sea,
- Condensing of the gravity measurements by the German Laender,
- Modification of the GNSS measurements to the SAPOS level by the Laender Baden-Wuerttemberg and Thuringia.

The following modifications were also effective with the BKG solution:

- Use of a new digital terrain model based on the DGM25,
- Introduction of selected, indexed gravity observations to supersede mean values,
- Height reference surface calculated in one step instead of in three parts through the development of a new software solution.

Since the completion of the last version of the quasigeoid in 2005, condensed and updated gravity measurements have been provisioned, in particular by Baden-Wuerttemberg, the Free State of Bavaria, Hesse, Rhineland-Palatinate and Schleswig-Holstein. The ellipsoidal heights of the GNSS/levelling points in Baden-Wuerttemberg and Thuringia have been modified by the Laender to the level of SA*POS*®-diagnostic adjustment (ETRS89/DREF91). This provided, for the re-calculation of the quasigeoid model, a global, heterogeneous database from various sources (data from the Laender, BKG, IfE, the Federal Agency for Maritime Transport and Hydrography (BSH), the natural oil and natural gas industry, Germany's gravity archive and also the DNSC08 model of the 2008 Danish National Space Center derived from altimeter observations). The entire gravity database (approx. 650,000 points) was thoroughly validated, enabling a number of defects to be detected and eliminated.

Despite the previous efforts made by the Laender to close data gaps, the data available in some regions is not adequate for calculating the height reference surface with a resolution of less than 5 km. In these areas, the condensing of the gravity database is to be continued and accelerated. The replacement of older data records (especially the data in Germany's gravity archive) and the systematic metrological examination of these records (the data of the new Laender in particular), would considerably increase the reliability of future models.

The model was computed using the "remove - compute - restore" approached typical or regional gravity modelling. The long wave and short wave portions of the earth's gravity field were computed by the global gravity model EIGEN5C of the German Geo Research Center GFZ Potsdam (Foerste et al., 2008), the digital terrain model of the BKG (Germany: DGM25, Status 2010, resolution 25 m; Europe: EuroDEM, Status 2008, resolution 50 m), as well as the bathymetric data of the Federal Agency for Maritime Transport and Hydrography and the GEBCO model (General Bathymetric Chart of the Oceans, Status 2004, resolution 2 km).

Unlike the previous BKG solution, a gravimetric quasigeoid was initially used for the 2011 model. In a subsequent step, the model was modified to the German height system DHHN92 and the spatial reference system ETRS89/DREF91 (SA*POS*® diagnostic adjustment) was realised by means of an additional correction surface. The correction surface was computed using 924 height anomalies, which were determined at the GNSS/levelling points of the German Laender.

Based on the same gravity measurements and height anomalies at GNSS levelling points, the Institute of Geodesy at the University of Hanover (IfE) performed a second, independent calculation according to a different procedure. The ultimate model was created by averaging the two solutions. Figure 4 shows the differences between the IfE and the BKG solutions.

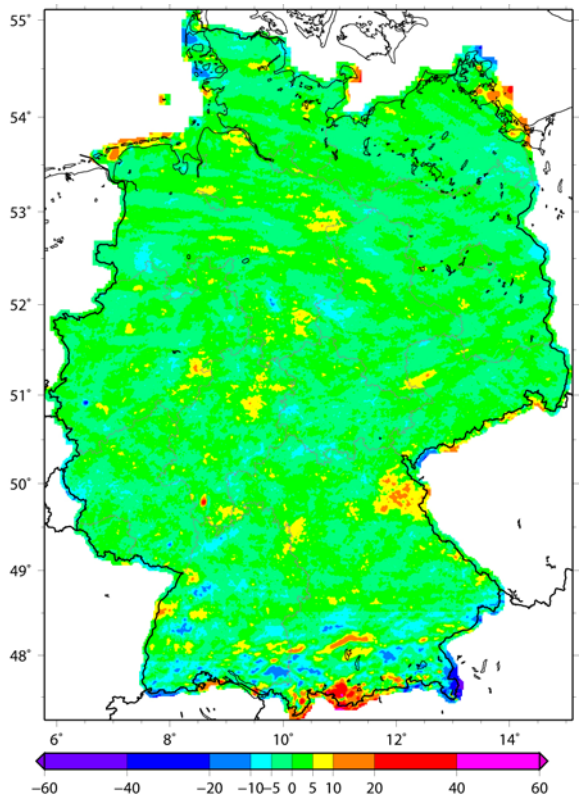

Fig. 4: Differences between the BKG and IfE 2011 models (mm)

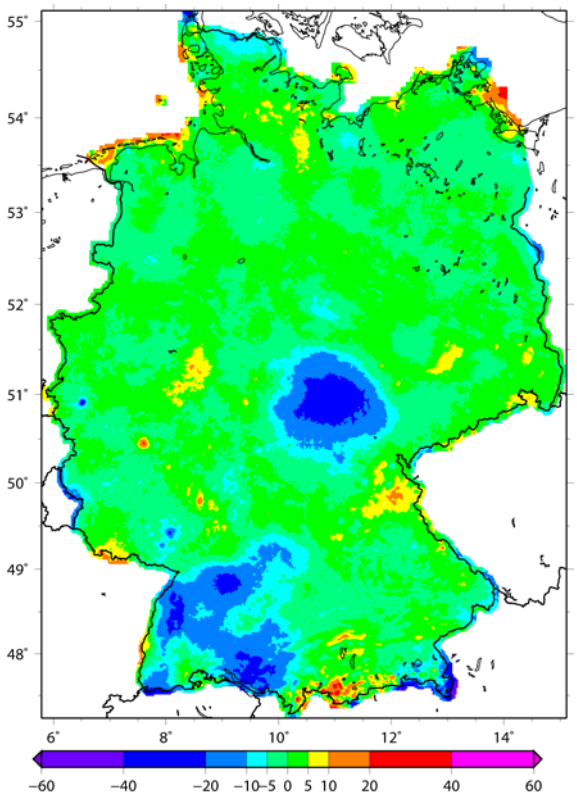

Fig. 5: Differences in the model solutions of 2005 and 2011 (mm)

In most areas, the two models concur to better than 1 cm (98 % of the region). For 88 % of the region, the differences between the two models are even less than 5 mm. While in the land area, the differences between the two models were significantly reduced, major uncertainties are still reported in the maritime area. Here, the models differ by up to 10 cm.

Figure 5 shows the difference between the 2005 and 2011 solutions. These differences (up to 2.5 cm) are primarily down to the GNSS levelling measurements from Thuringia and Baden-Wuerttemberg that have been modified to the SA*POS*® level. Further differences of up to 2 cm are due to condensed and rectified gravity measurements, and also the new DGM. Figure 6 (next page) shows the final model GCG2011. In the north sea area, it encompasses Germany's entire exclusive economic zone (AWZ).

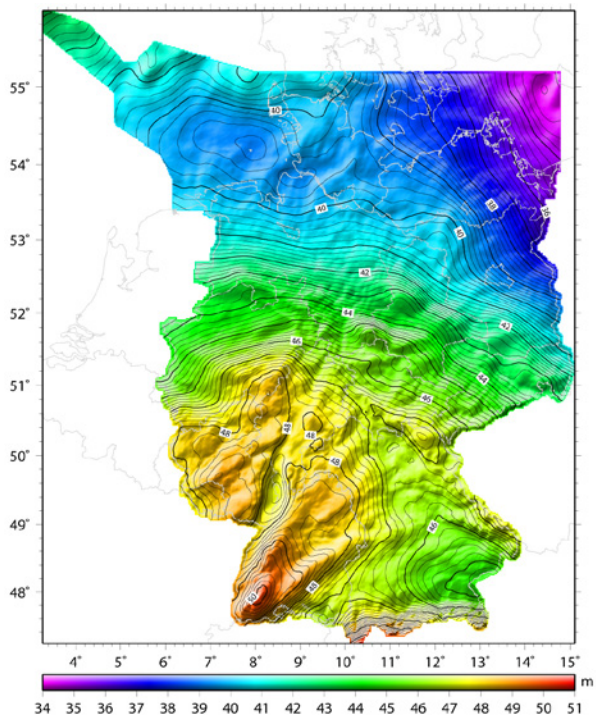

Fig. 6: Quasigeoid model GCG2011 (m)

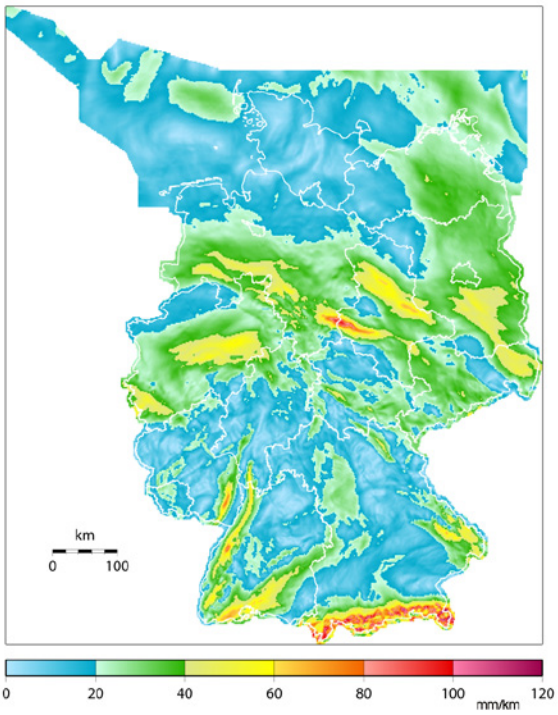

Fig. 7: Gradients of the GCG2011 in mm/km

The horizontal gradients of the quasigeoid (Figure 7) can assume amounts of up to 10 cm/km. The quasigeoid variations must therefore also be considered for local height determinations using GPS and GALILEO.

The model's accuracy can be independently assessed by comparing it with the height anomalies at 272 points distributed throughout Germany (geodetic fundamental network points and GREF stations). For these points, ellipsoidal heights of a provisional solution used in the GNSS 2008 campaign, and also heights in the DHHN92 were available. At 8.6 mm, the standard deviation of the differences at these independent points is only marginally above the standard deviation at the 924 points, which were used to position the model (6.5 mm). The model's internal accuracy is therefore between one and two centimetres. In the centre, however, the points deviate by 8 mm. This discrepancy clearly reflects the importance of the standardised spatial reference system and the need for consistently accurate realisations for the C-network points, the geodetic fundamental network points and the SA*POS*® reference stations.

The model has been distributed by the geodata centre of the BKG and the surveying and mapping agencies since early 2012. In addition to the previous supply scope, the model is also provisioned in special formats for LEICA and SOKKIA-GNSS receivers.

National geodetic spatial reference – renewal of the DHHN

One of the large projects of the national geodetic spatial reference in recent years is the renewal of the German first order levelling network 1992 (DHH929). This project, the aim of which is a nationwide re-measurement of the amalgamated German first order levelling network introduced as part of the country's reunification, is nearing its end in terms of the levelling measurements. GNSS measurements were taken at 250 selected geodetic fundamental network points (GGP) in the same epoch in 2008. For 100 of these GGP, absolute gravity

values were measured in 2009 and 2010 using the BKG's absolute gravimeter A10 – enabling for the first time throughout Germany, a high number of earth-marked points to be determined within one measurement epoch using standard geodetic measurement procedures (geometric and physical part).

In September 2011, the Plenum of the AdV approved the application made the Spatial Reference Working Group to extend the levelling measurements up to 2012. This took account of the fact that height changes in the first order network were detected through the extensive analyses of the measured data material from the participating institutions (analyses of the revealed earth movements, areas of known raw material extraction, network configuration improvement...), resulting in a real need to increase measurement performance.

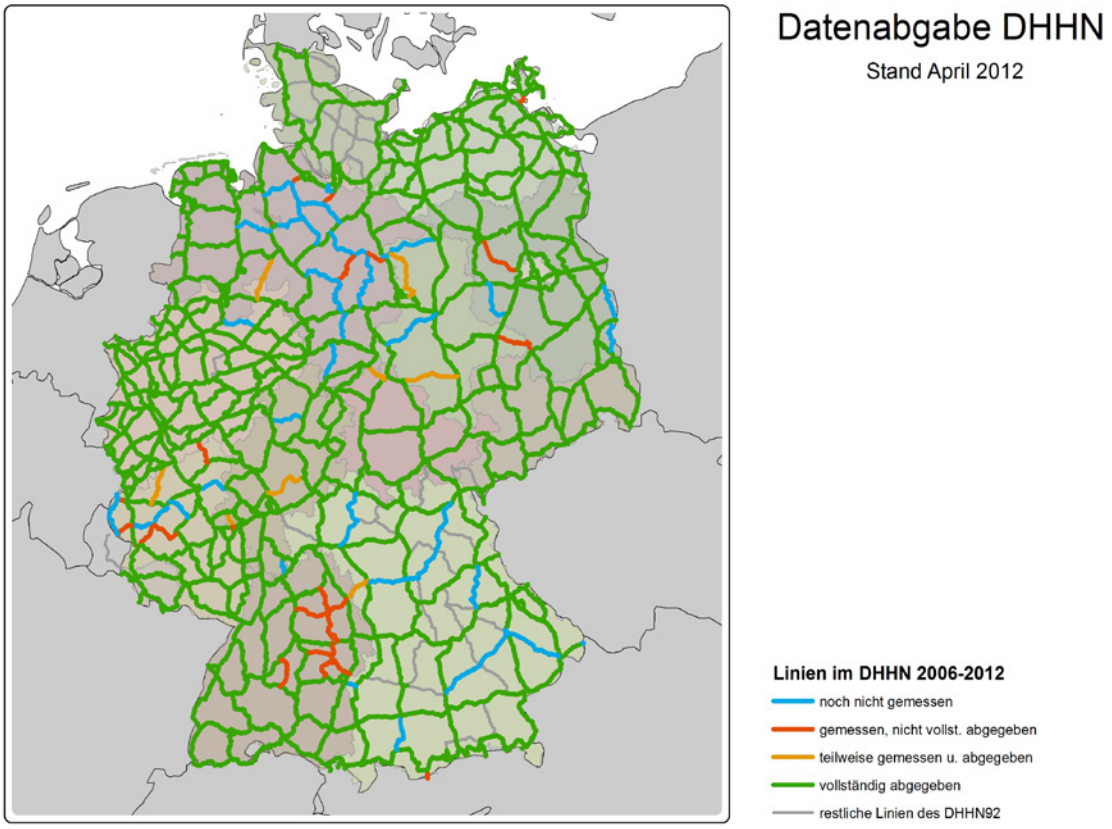

Fig. 8: Data submission to the processing centres in the DHHN project, Status April 2012

When the measurements are complete at the end of 2012, just under 90% of all lines of the DHHN92 will have been re-measured (see Figure 8). The measurement data will be prepared in the German Laender (crude error search, creation of output formats) and then submitted to the processing centres at the Cologne district government and the BKG. These centres perform various examinations on data quality and consistency, as well as error analysis and calculations of the range of results.

The "Renewal of the DHHN" project is being managed by the Spatial Reference Working Group of the AdV and the "Coordination of DHHN measurements" Project Group employed by it. The activities of this project group range from organisational tasks (controlling; managing processing centres; workshops) through to technical refinements and overall documentation.

At the end of 2011, the Spatial Reference Working Group advised on further procedure within the project. The focus was on evaluating the previous results in relation to the aims of the projects. The absolute gravity measurements from the three procedures are completed and evaluated. The GNSS analyses, apart from the final decisions on positioning, are also complete. The working group has argued for two fundamental solu-

tions. The coordinates of the ground marks from the combined LGLN/BKG processing centre solution are to be transformed into both the official system ETRS89/DREF91 and into the system of the measurement epoch ITRF2005, the aim being to maintain the homogeneity of the user system, while at the same time guaranteeing an optimised reference epoch in the sense of "technical coordinates".

The adjustment results of the precision levelling are also to be defined in two fundamental solutions, which relate to an "old parametrisation" as per DHHN92 (Wallenhorst data point) and to a new solution, which are to be rated for the current status of science and the requirements of future use. As well as the datum point (LNH) Wallenhorst, further datum points are therefore also to be used to provide data (selected LNH and GGP, GREF stations and SA*POS*® reference stations).

In summary, the accuracy assessments for all measurement procedures were not only met, they were exceeded and therefore justify the high expenditure for planning, field measurements and analysis. The project is therefore the best way for setting a milestone for German spatial reference and thus attaining a very high status at international level.

The latest in SA*POS*® development

Alongside AFIS® SA*POS*® is an infrastructural remit of the government for provisioning spatial reference information for positioning purposes. The satellite positioning service of Germany's surveying and mapping (SA*POS*®) makes use of two realtime and one post-processing service (EPS, HEPS, GPPS). In the German Laender, SA*POS*® was established and developed for production over ten years ago. The service employs various communication media to transfer GNSS correction data (Global Navigation Satellite System) and is not dependent upon any one company due to using international standards. AdV's main customer segment for the realtime service is mandatory surveying and mapping. All sectors have other customers with positioning remits. SA*POS*® data are also used for computing national weather models.

The SA*POS*® service has been continuously refined to keep abreast of technical progress in recent years. As widespread geo-sensors, the reference stations are not only used today by the surveying and mapping agencies, they also offer private service providers (Leica Geosystems and Axio-Net) with a reliable basis for their own nationwide positioning services. Positioning service customers enjoy not only the benefit of being supplied by expert providers in various remits, they can base their work on a standardised, quality-assured national infrastructure.

Today, SA*POS*® is at the cutting edge of technology. An extensive quality assurance concept guarantees integrated monitoring of all components, enabling swift intervention should individual components fail. For this concept to be reliably offered in future, it must be continuously modified to keep abreast of technical developments. Following the successful integration of GLONASS data in previous years, the data of Galileo, the European satellite navigation system, will in future be incorporated into SA*POS*® services.

The introduction of Galileo into SA*POS*® calls for new strategies in processing and transmitting data from reference stations. These advancements will impact both the evaluation procedures in the software packages of the service operators, the terminal devices at the user (Rover), and also the interfaces (RTCM; RINEX; NTRIP) and transmission media (GSM; GPRS; radio; Internet). The current procedures for representing the networking results (area correction parameters, FKP, virtual reference station, VRS; Master Auxiliary Concept, MAC) will be used in their existing form to only a limited extent. This is because these procedures will not cope with the much broader transmission bandwidths necessitated by the increasing number of satellites and signals.

Especially notable today is the advancement of the established absolute positioning procedure "Precise Point Positioning" (PPT) that is able to globally position an individual receiver (or its antenna). If it is possible to determine the entire error balance of code and phase measurements for the area of an individual receiver, there will be no need for a direct connection to a particular reference station (relative point positioning). To realise this concept, the reference station as a data supplier for complex modelling will still need to be widely available. Likewise, a precise GNSS error balance for this particular reference station area has to be calculated and transferred to the user.

A procedure, referred to as PPP-SSR (State Space Representation) is currently under discussion and being examined by the Spatial Reference Working Group as part of the first prototypical applications. Similar to the conventional post-processing approach, the entire error balance of an area of reference stations is determined in the form of a functional and random model (state representation) and amalgamated with the data for a point to be defined in a single point determination. The first tests are showing very promising results and creating new potentials for a further development of the SA*POS*® service.

As well as technical solutions that have to be managed over the next few years, intense work will also be required on the standardisation committees to enable these new approaches to be integrated into the practical use of SA*POS*®. The AdV is very well positioned with the SA*POS*®, as the Head of the Cedtral Bureau SA*POS*® is also the AdV representative on the RTCM Committee.

3. Real estate cadastre

ALKIS® continues to be the dominant topic when it comes to real estate cadastre. While in the Laender, ALKIS® continues to be implemented, the modelling experts in the AdV are currently revising the ALKIS® revision list for the update of GeoInfoDok.

With the ALKIS® WFS, a product specification is currently being devised as the basis for the standardised provision of ALKIS®-data throughout Germany via geodata services.

Close ties continue to exist with other administrative areas. These include the judiciary, given the development of a national land register database and the data interchange with ALKIS®. Together with the fiscal authorities, the effects on the ALKIS® object type catalogue are being examined in connection with the enforcement of the amended land valuation legislation. Alongside the management of the land valuation results in ALKIS®, the management of the legal classification data according to the evaluation law is also an issue. The working group has also been looking at the development of the recreational area as part of the relocation and traffic areas that has been addressed up by the Federal Statistical Office. Rules have been defined that are to improve the comparability of the results from the official area statistics in the Laender.

In the field of land evaluation, the AdV has updated the VBORIS model to take account of the changed legal requirements and the potentials offered by today's information and communication technology.

ALKIS® introduction

ALKIS® is currently being implemented in the Laender at full pace. Following Hamburg, Hesse, Rhineland-Palatinate, Schleswig-Holstein, Lower Saxony and many of the cadastre authorities in North Rhine Westphalia, which already manage ALKIS® in realtime, Baden-Wuerttemberg, Brandenburg and other local authorities in North Rhine Westphalia are expected to follow the migration this year. The nationwide introduction of ALKIS® is expected to take another two to three years (Figure 9).

The status of the AAA® migration in the Laender and the synopsis to the ALKIS® master database and to Laender-specific contents have been updated and posted on the website www.adv-online.de.

ALKIS® geodata services

On the back of an ALKIS® WMS specification (Web Map Service) being decided last year by the AdV committees, a project group of the Real Estate Cadastre Working Group is now developing a product specification for an ALKIS® WFS (Web Feature Service).

The specification is to create the initial basis for the nationally standardised provision of ALKIS® data via geodata services.

The specifications relate to AdV-WMS/WFS profiles, which are based essentially on INSPIRE and GDI-DE standards.

The ALKIS® object type catalogue in the GeoInfoDok 6.0.1 version and the architecture concept of GDI-DE 2.0 form the basis for the product specification of ALKIS®-WFS. The content of the specification comes from the ALKIS® master database. In addition to the NAS-compliant variants, simplified variants that the user is able to process in a "Standard GIS" are also being discussed. The concept for an ALKIS® WFS specification will be presented by the end of 2012.

Fig. 9: Status of ALKIS® implementation

Official area statistics

In accordance with the German law on agricultural statistics, the data on actual usage carried in the real estate cadastre are presented every year, for each local authority, to the statistics authorities for the preparation of the official area statistics. The development of the recreational area as part of the relocation and traffic area is an important indicator for the goal being pursued by the federal government, as part of the national sustainability strategy, to reduce area usage to 30 ha/day by the year 2020.

The Real Estate Cadastre Working Group is currently consulting closely with the Federal Statistical Office with a view to optimising the development of the relocation and traffic areas derived from the data on actual usage carried in the real estate cadastre. Attention is focussing on consistency and nationwide comparability of the official area statistics with regard to area monitoring as defined by the federal government's sustainability strategy.

Development of the digital land registry database

In connection with the introduction of the nationally consistent land register database, the Real Estate Cadastre Working Group is supporting a redundance-free data maintenance in the real estate cadastre and in the land register. The deliberations being made by the administration of justice to convert the systems of “land register page”and “inventory”, currently established in the land register, to the identifier “land parcel” carried in the real estate cadastre have been rejected by the Real Estate Cadastre Working Group and reasons have been given. The AdV's disapproval of these deliberations has been communicated to the Federal Ministry of Justice.

One reason for updating GeoInfoDok is to incorporate the new concept for the commercial types into the ALKIS® revision list. The commercial types currently carried in the land register no longer match the usage type classification in ALKIS®. A project group of the AK real estate cadastre is currently devising a solution.

Land valuation

The German Laender are under a legal obligation to carry the results of land valuations in the real estate cadastre. Currently, these results are carried in the real estate cadastre in digital format for around 75 % of the country's area. Following the AdV's recommendation, migration to the digital format should be completed by 2015, except in those Laender that do not yet carry the land valuation results in their ALB. The Real Estate Cadastre Working Group evaluates the progress annually. Furthermore, to meet the requirements of the fiscal authorities, land valuations will be collated for the master database in ALKIS®.

As part of enforcing the amended land valuation law, the impact on the ALKIS® object type catalogue is being examined in collaboration with the fiscal authorities. The fiscal authorities submitted the requisite modifications for the GeoInfoDok update to the AdV in form of revision requests.

As well as the results of land valuations, the Federal Ministry of Finance has also pronounced the mandatory requirement to carry data on the legal classification in compliance with the valuation law (previous code 32) in ALKIS®. The Real Estate Cadastre Working Group is addressing the request of the fiscal authorities. The fact that no legal basis exists, however, must be considered.

Networked Standard Ground Values Information System (VBORIS)

The network of standard ground values information system is essential to Germany's geodata infrastructure. The AdV developed the VBORIS model some years ago and advised the Laender to use it as a procedural basis when realising a standard ground values information system.

The AdV model VBORIS was updated and presented in Version VBORIS 2 based on the guidelines for determining standard ground values (BRW-RL), which were used to revise and rewrite the previous master guideline of the Bund for standard ground values. VBORIS 2 takes account of both the changed legal requirements, and in particular the potentials currently offered by information and communication technology (Figure 10). An AdV decision to convert to the VBORIS 2 model is planned for 2012.

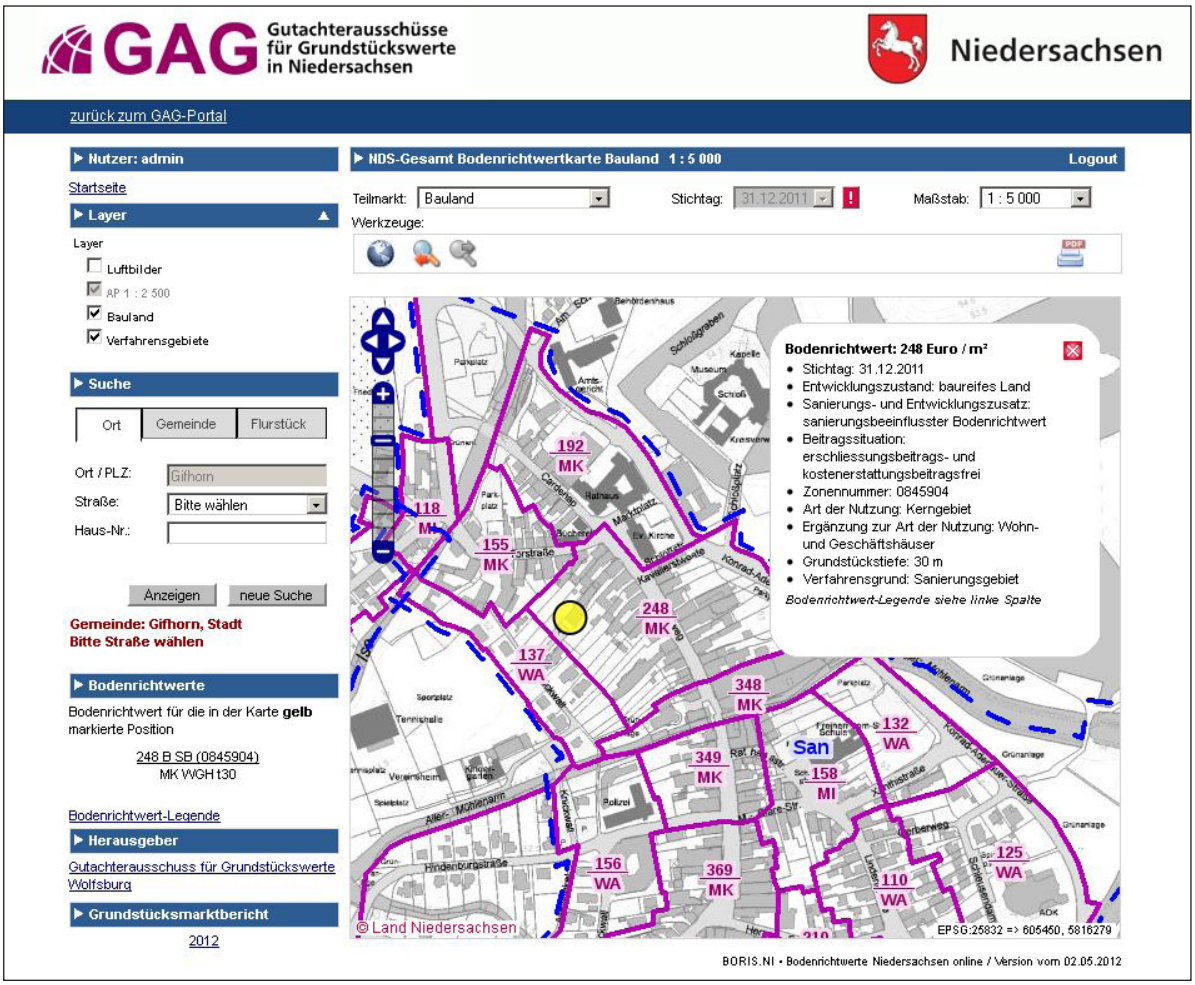

Fig. 10: Presentation of standard ground values via Pop-Up windows

In a future step, VBORIS 2 is to be refined to become a comprehensive online service for land parcel market information. As well as standard ground values, it will offer land parcel market reports and data on land parcel valuations. These include real estate interest rates, comparison factors, real estate reports and purchase price data in this land parcel market information system.

4. Geotopography

Using the Authoritative Topographic-Cartographic Information System (ATKIS®), the surveying and mapping agencies of the Laender are managing landscape-describing geospatial reference data in the Digital Landscape Models, Digital Terrain Models, Digital Topographic Maps and Digital Orthophotos product groups. The individual products in these product groups are kept current with regular updates. For key topographic objects in the digital landscape models, the updates take no more than a few months. Once the migration from ATKIS® to the AFIS®-ALKIS®-ATKIS® data model was on the right track, a key task during the period under review was to realise a joint web-based map service of the Bund and its Laender (WebAtlasDE).

Digital Landscape Models

One of the key tasks for geotopography of the surveying and mapping agencies is to manage and update the digital basic landscape model (Basic DLM) as the basis for establishing various technical information systems in administration and businesses. The ATKIS® Basic DLM database also provides the foundation for deriving small scale ATKIS® DLM50, DLM250 and DLM1000 digital landscape models and for producing official digital topographic maps.

The need to be able to derive the DLM50.1 from the Basic DLM via a fully-automatic model generalisation process has been met in the form of the "ATKIS® Generalisation" joint project. The DLM50.1 exhibits a simpler form of structuring and a lower data volume than the Basic DLM. The DLM50.2 can be derived from this landscape model via automatic cartographic generalisation. To complete the digital topographic maps 1:50000 (DTK50) and 1:100000 (DTK100), the corresponding automated, interactive processes were developed and are now ready for use. Given the increasingly tough user requirements for up-to-date information and shrinking human resources in all surveying and mapping agencies this marked an important milestone in the effective and efficient provision of ATKIS® products.

The DLM250 and the DLM1000 processed in the BKG are widely available and updated on an annual basis. The content is being continuously expanded to create the EuroGeographics products EuroRegionalMap (1:250000) and EuroGlobalMap (1:1000000) and also to link technical data and for reporting at European level (main user: European Commission). The requirements of the users continue to increase also in this area.

The digital landscape models of the ATKIS® class diagram must be continuously adapted to the changing requirements for geotopographical core data. The updating of the joint AFIS®-ALKIS®-ATKIS® data model thus

improves harmonisation of the data in the real estate cadastre and in geotopography, so that data is captured only once and can then be provided for as many products as possible. Requirements ensuing from European projects GMES and CORINE Land Cover (CLC), as well as INSPIRE, for Germany's geotopographical core data database are being discussed and will be addressed with a view to accomplishing the task in the most efficient manner possible.

The migration to the AFIS®-ALKIS®-ATKIS® data model is well advanced in the Laender. A first national database of the Basic DLM in this data model is expected to be available by the end of 2012.

Digital Terrain Models

In addition to the position-describing digital landscape models, the surveying and mapping agencies are managing, to represent height as the third dimension, digital terrain models (ATKIS®-DGM) with varying levels of accuracy. These models will be available to administration and businesses as part of the geographical core data for establishing geographic information systems (GIS). Digital terrain models describe the terrain surface as the interface between the fixed terrestrial body and water on the one hand and air on the other hand. The terrain surface is modelled using a typical three-dimensional number of points. As well as regularly distributed geodetic points (DGM grids), DGM can contain structural elements in the form of terrain lines and specific terrain points. The object type catalogue DGM is available in GeoInfoDok for the ATKIS® concept.

Currently, national DGM databases with a grid width of 10 m (DGM10), 25 m (DGM25), 50 m (DGM50), 200 m (DGM200) and 1 000 m (DGM1000) can be provided. The data quality is documented in the ATKIS® product standard for digital terrain models. For the DGM10, this envisages a terrain type-dependent height accuracy of the grid points of ± 0.5 m to 2 m with a confidence level of 95 % (2 σ). This data quality will be achieved by the surveying and mapping agencies by the end of 2012. The DGM10 is now available with a terrain type-dependent height accuracy of the grid points of ± 2 m. DGMs with larger grid widths are derived from the DGM with the smallest grid width upon request.

In the period under review, the set-up or completion of high-accuracy DGM with grid widths of 5 m (DGM5), 2 m (DGM2) or even 1 m (DGM1) are being expedited in almost all the German Laender. The figures (11, 12 and 13 on the next page) show examples of the different terrain structure resolutions attained with the various DGM grid widths. The geodata centre at the BKG offers the DGM to customers jointly with the Laender.

In the surveying and mapping agencies, digital surface models (DOM) are created in addition to DGM. DOM are based on the method employed by airborne laser scanning and digital image matching. An increasing demand for these DOM among users is being observed. The digital quality can be documented using the ATKIS® standard for digital surface models.

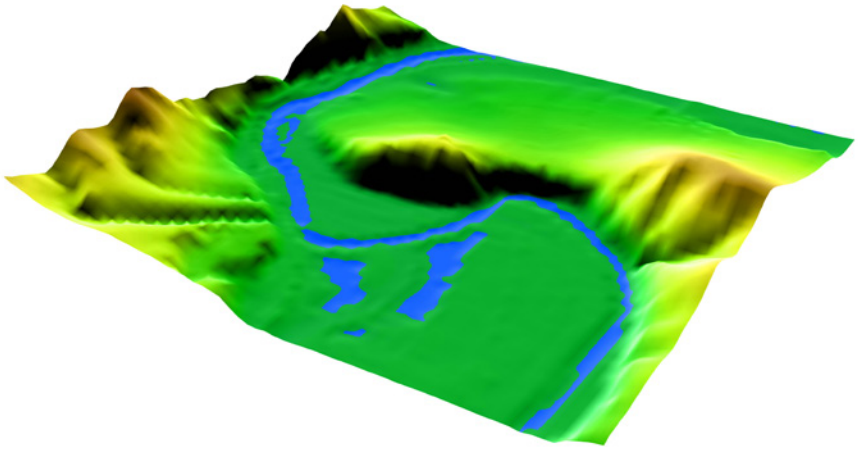

Fig. 11: Digital terrain model in 25m grid (DGM25), Werratal terrain section

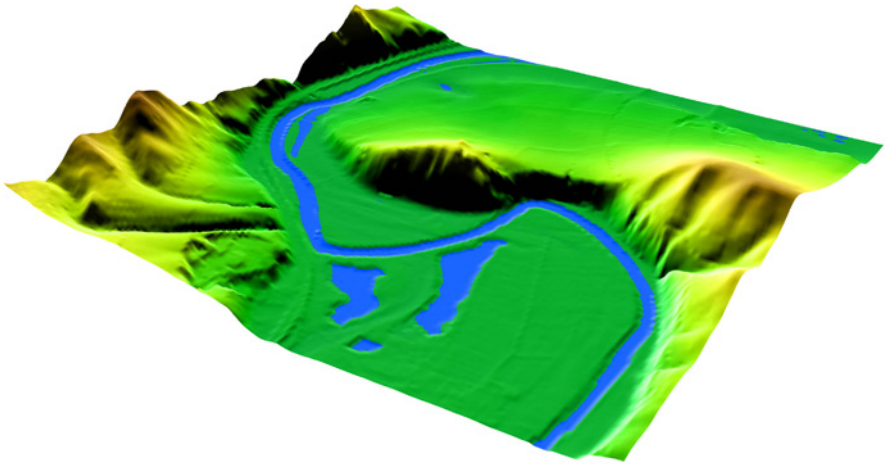

Fig. 12: Digital terrain model in 10 m grid (DGM10), Werratal terrain section

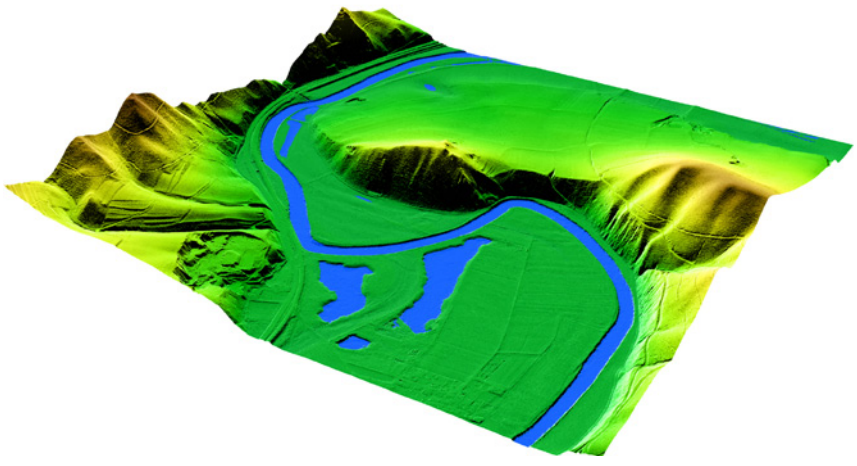

Fig. 13: Digital terrain model in 1 m grid (DGM1), Werratal terrain section

Digital Topographic Maps

Based on the digital landscape and terrain models, the surveying and mapping agencies are creating the topographic map series from modern map graphics, documented in the ATKIS® signature catalogues and published in the GeoInfoDok of the AFIS®-ALKIS®-ATKIS® project. Digital Topographic Maps (ATKIS®-DTK) are already available in numerous Laender. The DTK1000, published by the BKG, is also available. Procedures for a largely automated cartographic generalisation of various map series are available and in use in the first German Laender. These procedures enable a much more efficient derivation from digital landscape and terrain models. For the DTK50 and DTK100, the surveying and mapping agencies have agreed with the Federal Ministry of Defence that these topographic map series will be managed and published as joint civil/military map series. By mid-2012, the DTK100 will be widespread and hence available to the Federal Republic in a standardised format.

As DTK are not yet being created from the ATKIS® signatures catalogues, the government and the Laender will continue the conventional topographic map series to the extent required and hold them for printing and as grid data records. The CD ROM series Top50 and Top200 are widely available for the whole of Germany. However, there are no plans for a new edition, as increased use is to be made of the potentials of web-based presentations for meeting customer requirements.

WebAtlasDE

The need for official map services among various kinds of user has risen dramatically in recent years. In addition to good performance, "infinite" zooming, high availability, provision in the viewer and as a service, font and signature adjustment at every scale level, a simple, standardised map style and a provision throughout Germany and across the Laender are expected.

DLM and DTK were unable to fully meet these requirements. Based on the activities of some member agencies, a decision was taken to realise a joint web-based map service by the federal government and the Laender under the name of "WebAtlasDE". This is to be integrated in particular into the geoportals of the government and the Laender. From the digital landscape models, grid map tiles of various scale are created and provisioned via a Web Map Tile Service (WMTS) with good performance and high reliability.

An initial application of WebAtlasDE was presented in March 2012 when the Geoportal.DE was activated at the CeBIT exhibition. An improved version based on a newly designed signature catalogue (ATKIS®-Web-SK) is planned for autumn 2012. The figures (14, 15 and 16 on the next page) show, on this very basis, the sections created from zoom levels 10 (scale approx. 1:2 000), 7 (scale approx. 1:18 500) and 4 (scale approx. 1:250 000) of WebAtlasDE.

Fig. 14: WebAtlasDE, zoom level 10
scale approx. 1:2000
Pfaffenhofen an der Ilm section

Fig. 15: WebAtlasDE, zoom level 7
scale approx. 1:18500
Pfaffenhofen an der Ilm section

Fig. 16: WebAtlasDE, zoom level 4
scale approx. 1:250000
Pfaffenhofen an der Ilm section

Digital Orthophotos

The surveying and mapping agencies of the German Laender periodically commission aerial photography flights in order to provide the latest aerial photographs to external customers, and also for internal use for updating digital landscape models and digital topographic maps. These aerial photos are oriented and orthophotos are calculated from them.

The Digital Orthophotos product group (ATKIS® DOP) therefore rounds out the ATKIS® concept. Thanks to the image-based documentation of the landscape, DOPs are suitable for observation-based applications. DOPs with a ground resolution of 20 cm (DOP20) and in colour are available throughout Germany.

Because the results of aerial photography flight are crucial to the realtime updating of the geotopographical core data from ATKIS®, the high resolution DOP20 will be subject to an updating cycle of no more than three years. The specification for the product standard and the technical rules and regulations for DOP data exchange effectively meet the requirements for pooling the data of the Laender at the geodata centre of the BKG. The BKG offers DOP with the Laender and visualises them jointly in a DOP viewer available online. The DOP20 is now a standard product for practically all technical applications with a spatial reference inside and outside the surveying and mapping agencies.

The introduction of digital aerial photograph camera systems places new requirements on the surveying and mapping agencies, but also creates new potentials. The high efficiency of multichannel acquisition permits the simultaneous use of black/white, colour and infrared aerial photograph data. The addition of the infrared channel meets the criterion for pooling the requirements ensuing from the surveying and mapping, forestry and environmental authorities into the aerial photography flight projects of the Laender.

As well as questions regarding the quality requirements for digital photography flights, data transmission and analysis, the surveying and mapping agencies are focussing on the problems of long-term security and history management, as series of aerial photographs are becoming an indispensable tool for the work of more and more users. The security of aerial photograph databases should therefore also meet consistent minimum standards in the future.

The surveying and mapping agencies are providing oriented digital aerial photographs which are the basis for deriving ATKIS®-DOP to specialist users with increasing regularity. Oriented aerial photographs are aerial photographs that contain all the parameters required for stereoscopic analysis. Rapid IT developments and the cost-efficient provision of user software are making stereoscopic aerial photograph analysis and presentation an affordable option for users.

Toponymy

In collaboration with the permanent committee for geographic names (StAGN), the BKG provides a standardised (gazetteer) service which provides the toponymy (GN-DE) from the vector data of the DLM250, VG250 and GN250 products. GN250 (Geographic name 1:250000) is available for the first time in a classification with the same name as the object types of ATKIS® in the AFIS®-ALKIS®-ATKIS® data model. The database comprises around 134000 entries of geographic names, including local authorities, local authority sections, landscapes, mountain ranges, mountains, islands, rivers, canals, lakes and oceans. The GN-DE database is available as a standardised Web Feature Service (WFS) according to the specification of the Open Geospatial Consortium (OGC) at the geodata centre of the BKG.

5. Information and Communications Technology

Information and communications technology forms the technical interface between activities in the fields of spatial reference, real estate cadastre and geotopography. It helps to establish the spatial data infrastructure (GDI) based on official geospatial reference data using networks and geoservices. Activities focus on the maintenance and advancement of the AFIS®-ALKIS®-ATKIS® (AAA®)concept for modelling the geoinformation of the official surveying and mapping as well as information technology coordination of the GDI activities for the AdV at national level.

AAA® model

With its work on the AAA® model, the AdV devised an integrated and harmonised modelling of all geospatial reference data of the surveying and mapping authorities – split into a basic schema and three technical schemas AFIS®, ALKIS® and ATKIS® – and realised such modelling through its member authorities. The AAA® basic schema (Figure 17) forms the basis for the technical application schema for modelling the AFIS®, ALKIS® and ATKIS® objects and for data interchange via the standard-based data interchange interface NAS. The observance and application of the international norms and standards consistently implemented in the AAA® project should be emphasised. The

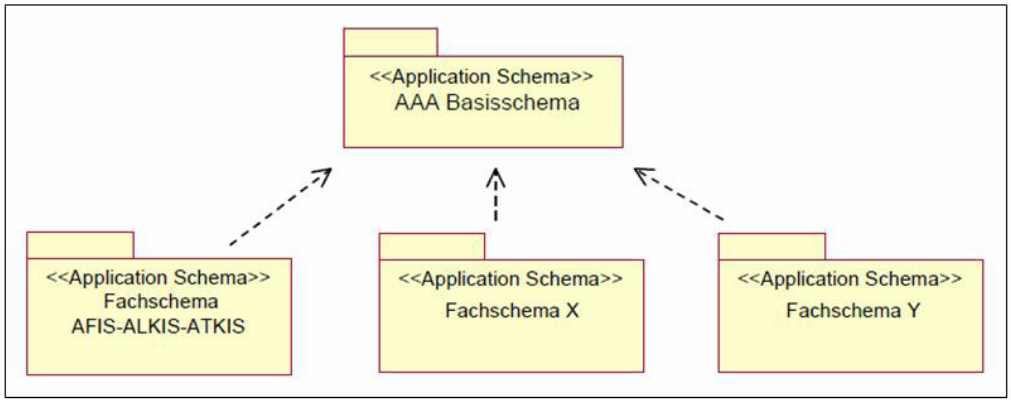

Fig. 17: The neutral AAA® basic schema as a basis for modelling application-specific technical schema (e.g. AFIS®, ALKIS® und ATKIS®)

technically completely neutral modelling of the AAA® basic schema enables other technical information to use the classes defined in the AAA® basic schema for their own modelling. To support an extensive use of the AAA® model in technical information systems, the software scripts forming the modelling basis are available to third parties free of charge.

All the documentation on AAA® modelling is published in "Documentation on modelling the geoinformation of official surveying and mapping (GeoInfoDok)". Version 6.0 of GeoInfoDok, declared by the AdV as the reference version, is also available in English.

In order to meet the requirements of users and GIS manufacturers, work has started on the new Version 7.0 of GeoInfoDok. All submitted revision notifications have now been completely processed. As well as aspects regarding the harmonisation of ALKIS® and ATKIS®, the modelling of 3D objects has also been considered. The new Version 7.0 will only be declared the new reference version when all member authorities of the AdV manage their geospatial reference data in compliance with Version 6.0 of GeoInfoDok.

Spatial data infrastructure

The AAA® data model's compliance with the requirements ensuing from the INSPIRE Directive and the implementation of these requirements in the geospatial reference data access laws and spatial reference data infrastructure laws of the government and the Laender is of central importance. Accordingly, the AdV's INSPIRE technical network is taking a close look at INSPIRE data specifications and their effects on the AAA® model. The INSPIRE data specifications for Annex I topics, created a basic transferability to the INSPIRE data structures, which meant that the AAA® application schema did not have to be adapted to meet INSPIRE specifications. During the review process for the INSPIRE data specifications for Annexes II and III topics, the activities of the INSPIRE network of the AdV brought about a largely united opinion of the AdV member authorities. When the complete data specifications for Annex II and III topics are adopted, the compliance of the AAA® data model for these must still be verified. Beyond the INSPIRE network of the AdV, AdV experts on European committees represent the interest and involvement of the AdV in the European geodata infrastructure process of INSPIRE.

Provision of geospatial reference data via web technologies

In light of the developments in the provision of geodata via web technologies and the requirements ensuing from the INSPIRE process, the AdV is currently creating a series of technical web profiles for viewing and download services (Web Map Service – WMS, Web Map Tile Service – WMTS, Web Feature Service – WFS). The aim, for the widespread provision of geospatial reference data as the basis for spatial data infrastructures in Germany and in Europe, is to harmonise and further expand the services produced by the AdV member authorities. These technical profiles form the basis of the technical character for the data to be provisioned, which is currently realised with WebAtlasDE, the joint web-based map service being realised by the federal government and the Laender, based on a WMTS (see Figure 18). To keep abreast of the advancements and updates occurring with standardisation and the INSPIRE process, these AdV web profiles are also being regularly updated in order to guarantee the interoperability of the web services of the AdV member authorities.

Fig. 18: Section from WebAtlasDE

6. Task Force PRM

All spatial planning and decision processes require geospatial reference data to link the relevant technical information to the corresponding location on the earth's surface. This geospatial reference data come in the form of descriptions, which are not specific to any particular interest or application, of the topography of the earth's surface (surveying and mapping) and of real estate (real estate cadastre). In order to ensure the availability of geospatial reference data and services for the government, for business, for science and society, the surveying and mapping agencies of all German Laender are under a legal obligation to collect, manage and provision geospatial reference data.

Requirements

The constitutional and legal responsibility for official surveying and mapping is assigned to the German Laender. However, because the need for many spatial applications goes beyond the provisioning of geospatial reference data within a German Land, a nationally standardised, current and high-quality database must be stored and made accessible to the "geomarket" and to the interested public. The use of digital geospatial reference data in industry and administrative units is continually increasing. The surveying and mapping authorities are taking account of this development with application-based changes in the way data is provisioned: In addition to output on data carriers, web-based data provision has become standard. The surveying and mapping authorities provide digital databases with different characteristics for searching, viewing and for downloading, as well as technical aids, via geoportals, geoservices and geoviewers. The metainformation system provides data on availability, characteristics and points of contact for the products.

To enable a nationally standardised product range, the distribution points are networked and provision is standardised. Currently, certain product groups are being provisioned across the Laender in a harmonised manner at three central distribution agencies: the central agency for house coordinates and building polygons, the central agency SA*POS*® and the geodata centre of the Federal Agency for Cartography and Geodesy (BKG), which also supplies the institutions of the federal government with geospatial reference data (Figure 19).

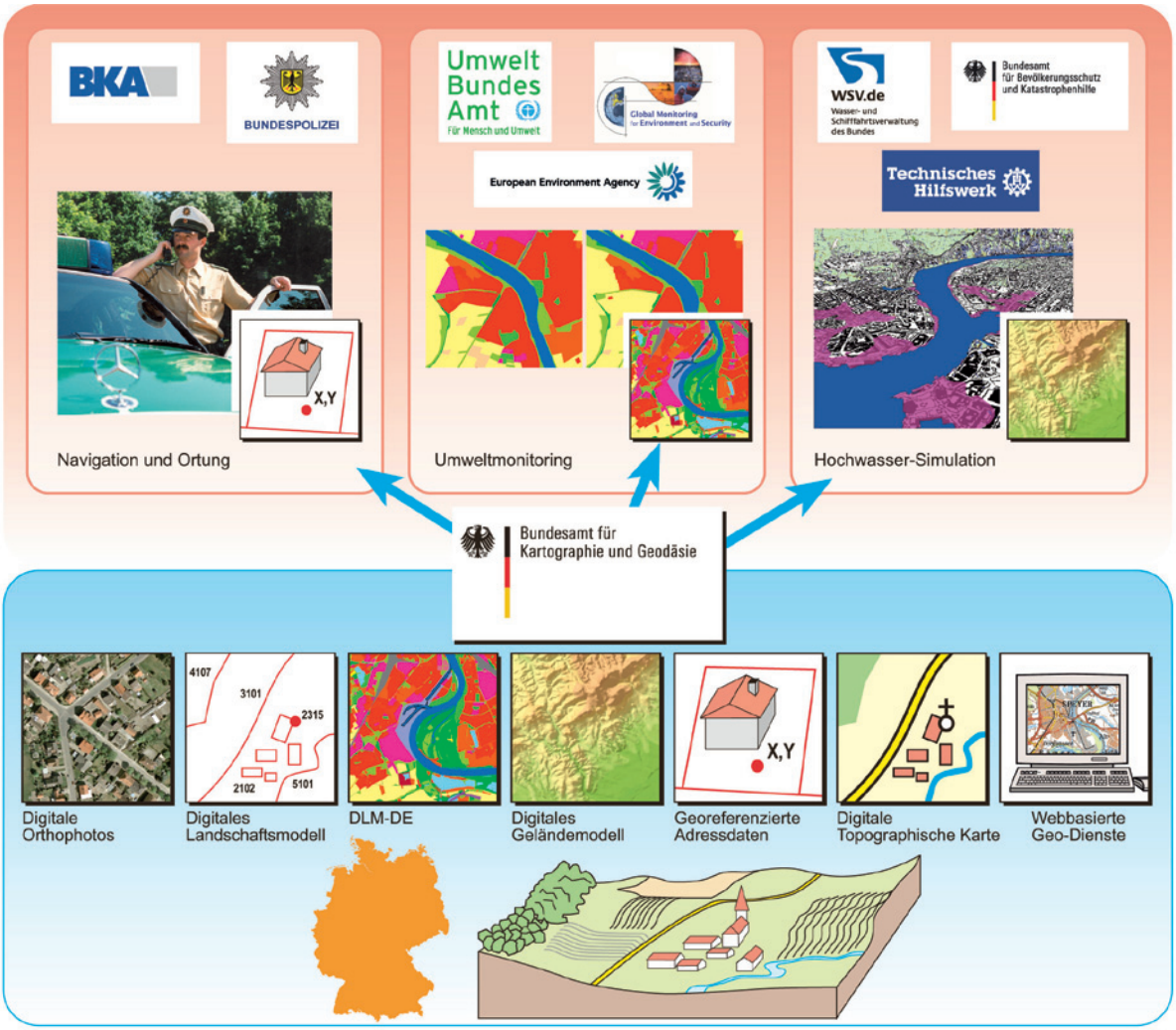

Fig. 19: Central supply of government institutions with geospatial reference data by the BKG geodata centre

To achieve the goals of optimally satisfying the national requirement over the long term and standardising the provisioning of products for Germany's official surveying and mapping, the Public Relations and Marketing Task Force (TF PRM) of the AdV performs, in cooperation with the member authorities and the working groups of the AdV, the operative PRM tasks to ensure that geospatial reference data is available throughout the country. In doing so, the following subject areas must be covered:

- Surveying and recording governmental and social requirements for the collaboration and matching these requirements to the geospatial reference data product range (needs survey and needs analysis),
- Maintenance of the licence and fees models and model licence agreements, as well as execution of model-based licensing for the use of the geospatial reference data and services (conditions and distribution policy),
- Supporting activities for achieving a strategic and technical infrastructure for the provision and use of geospatial reference data and services,
- Implementing measures for information on the availability and usability of the geospatial reference data and services (product information) and
- Implementing measures for the (positive) perception of Germany's official surveying and mapping and its national geospatial reference data product range (image maintenance).

Services

Needs survey and needs analysis

To achieve optimum distribution of the geospatial reference data products, user and purpose oriented geospatial reference data products must be produced and provisioned as part of the official activities of the surveying and mapping agencies. In order to obtain the requisite information about users' needs and requirements for the geospatial reference data (product, intended use, product satisfaction), for the provisioning conditions and product information (information and contact channels to the surveying and mapping agencies), the central distribution agencies conducted a user survey based on a standardised questionnaire and analysed the results jointly with the TF PRM. Currently, the needs analysis is being converted to an online questionnaire.

Licence and Fee Model

To regulate rights of use in connection with the provision of the geospatial reference data and services, there is a need for a clear and simple, nationally standardised licence and fee model that satisfies current requirements and regulates the use of all currently offered geospatial reference data products. Germany's official surveying and mapping authorities has approved the guideline for fees for the provision and usage of geospatial reference data of the surveying and mapping agencies of the German Laender (AdV fees guideline) that meets these requirements, and published it at www.adv-online.de. It is used by the central distribution agencies and implemented in the individual German Laender. To guarantee a standardised and proper design of the AdV fees guideline, the TF PRM has developed a series of recommended actions. The TF PRM updates the licence and fee model according to AdV's requirements and in consultation with the working groups, if the AdV fee guideline has to be adapted to keep abreast of technical advancements and in line with user requirements. The TF PRM is currently investigating how the fee tariffs can be simplified for external use by applying transparent and flat rate regulations, and also how area and time-based flat rate models for download services can be developed.

Furthermore, the TF PRM sees itself as communications platform for the distribution units of all surveying and mapping authorities and for the joint distribution agencies. It also supports the sharing of knowledge regarding the application of the AdV fee guideline.

Model Licence Agreements

Given that the nationwide provision of geospatial reference data and services continues to be standardised and that the surveying and mapping authorities community, with its nationwide provision of geospatial reference data, is being increasingly perceived as a supplier community, the TF PRM has updated the standardised model licence agreements for complex applications, the small contract template for a geoproduct license and the General Terms and Conditions of Business and Use (AGNB). In addition, online sample text modules on licensing for geospatial reference data services are being developed. These sample agreements are used in the central distribution agencies and are recommended for licensing within the Laender. The interested public can view and download them from www.adv-online.de and use them for its own purposes. Currently, the TF PRM is developing simple, click-on model texts for the licensing of geospatial reference services.

Information Documents and Corporate Design

To ensure that Germany's official surveying and mapping has a standardised appearance in both words and image, the AdV adopted a Corporate Design (AdV-CD) in 2009 and made it available to all member authorities. The AdV CD was optimised in accordance with practical requirements and released for use by the AdV President in March 2011. The updated version introduces the three new logos for AFIS®, ALKIS® and ATKIS® (Figure 20).

Fig. 20: Logos for AFIS®, ALKIS® and ATKIS®

AdV's information documents are created according to the design rules defined by Corporate Design. The purpose of the materials is to provide the interested public with information on the applicability and availability of the geospatial reference data products in the language of the geomarket concerned. The TF PRM is publishing the AdV product folder with the title "Basis for your decisions" (Figure 21), which focuses on the geospatial reference data product range of the surveying and mapping authorities and its potential use.

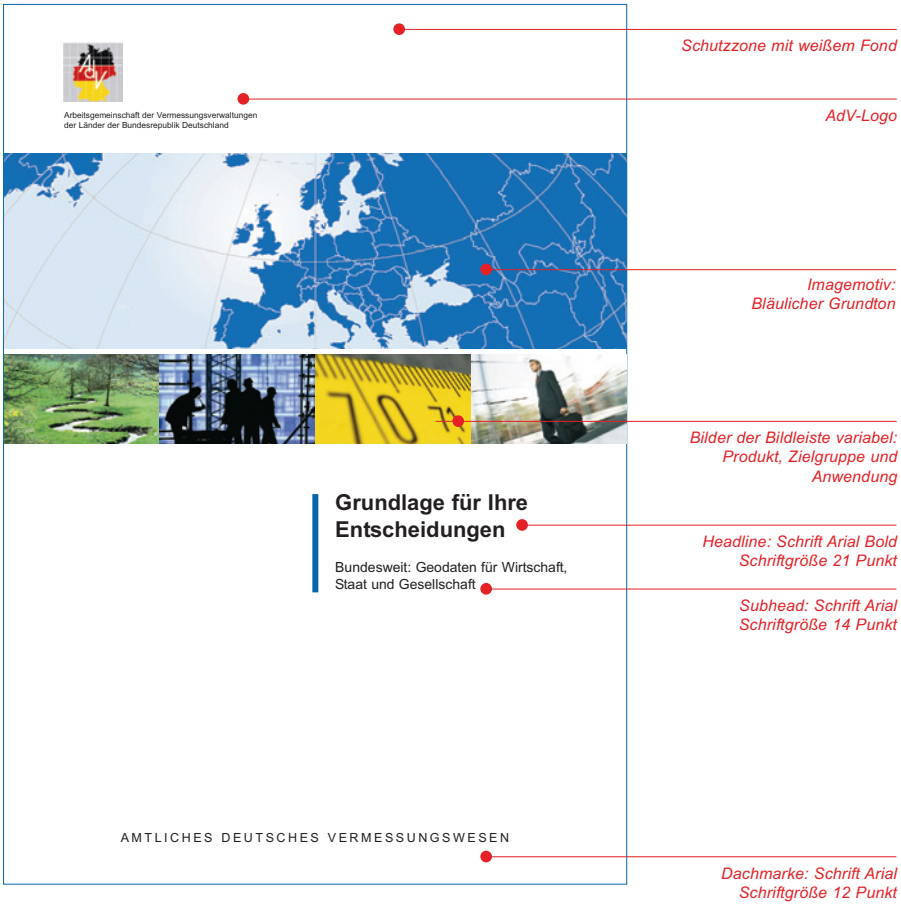

Fig. 21: Design requirements for information documents

Further product brochures and leaflets containing detailed information on the nationally available products are published in consultation with the AdV's working groups on this basis (Figure 22).

Fig. 22: Product brochure for DOP

Web portals and works of reference

The website of the AdV (www.adv-online.de) provides information about tasks, product range and developments with a user-friendly interface. In a further step, the various product-related websites will be merged and adapted accordingly. AdV's presence in online works of reference is important because its role, tasks and product range can be widely communicated via this medium. The websites are being revamped to enable the interested public to easily call up information on AdV with just a few clicks.

Image Maintenance

For the surveying and mapping agencies to be perceived in a positive light, public relations activities must be actively pursued, with appropriate media and effective public images being created for this purpose. The TF PRM has produced a geofilm describing the organisation, role and product range of Germany's official surveying and mapping authorities in a form suitable for a wide audience. To make its use effective for the public, the film is published on the AdV website (www.adv-online.de) and has German and English subtitles. It also carries sign language. The interested public can also profit from information events. There are plans to hold a "Geo Day" on the same date every year, on which all surveying and mapping agencies provide information about the various geospatial reference data topics at the same time.

Public relations and trade fair appearances

As part of establishing spatial data infrastructures in the Federal Republic of Germany, the AdV endeavours to increase the awareness of the products (geospatial reference data) of the surveying and mapping agencies in the Laender. As in previous years, the official surveying and mapping authorities – represented by the AdV – took stands at INTERGEO® 2011 in Nuremberg (Figure 23), the world's leading fair for surveying and mapping, and also at other trade fairs. Alongside the presentation of the products and services of the official German surveying and mapping authorities, accompanying presentations and discussion forums were also held.

Fig. 23: Joint stand of the AdV at INTERGEO® 2011 in Nuremberg

7. Involvement in national 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 cadastre tasks. The collaboration for EuroGraphics comprises the development of cross-border harmonised products, as well as joint working groups and projects. EuroGeographics members are wanting in particular to support the European Commission in establishing the European Spatial Data Infrastructure (ESDI) in connection with the INSPIRE framework guideline and the "Global Monitoring for Environment and Security" (GMES) project. EuroGeographics is registered at the European Commission as the largest "Spatial Data Interest Community" (SDIC), providing through its experts extensive support in devising the INSPIRE implementation rules.

The AdV is an associated member, the Federal Agency for Cartography and Geodesy (BKF) a regular member of EuroGeographics. Both organisations are actively involved in projects and expert groups. The President of the BKG is also a permanent member of the Management Board. As product coordinator, BKG is responsible for the continuance and advancement of EuroBoundaryMap (EBM) and for the European digital terrain model (EuroDEM). Furthermore, the experts at BKG make contributions to the topographic products EuroRegionalMap (ERM) and EuroGlobalMap (EGM), on the web service for geographic names (EuroGeoNames), and on the State Boundaries of Europe (SBE) project. The GeoData Centre in the BKG is the distribution centre for EuroGraphics and delivers European data records to both German and international customers.

EBM, ERM, EGM and EuroDEM60

EuroGeographics offers, in a harmonised manner and beyond the Laender borders, the following pan-European data records based on standardised specifications and with the data currency required:

- EuroBoundaryMap (EBM) – a data record of the administrative units at all national administrative levels in Europe, coordinated and processed by the BKG, with names, unique code numbers and a reference to classifications NUTS (Nomenclature des Unités Territoriales Statistiques) and LAU (Local Administrative Unit) of Eurostat, the Statistical Office of the European Union. The data record on a scale of 1 : 100 000 currently covers 41 European countries.

- EuroRegionalMap (ERM) – a topographic data record coordinated and processed by the Institute Géographique National Belgique (IGN Belgium) on a scale of 1:250 000. ERM covers a region of 31 European countries.
- EuroGlobalMap (EGM) – a topographical data record coordinated and processed since early 2011 by the Institute national de l'information géographique et forestière (IGN France) on a scale of 1:1 000 000. EGM covers a region of 33 European countries.
- European Digital Elevation Model (EuroDEM60) – a digital terrain model computed by the BKG from the national data records with a position resolution of 2" (approx. 60 m) and a height accuracy of 8–10 m.

In addition to making the national contributions for the EuroGeographics products, experts at the BKG are very actively integrated into the technical teams for these projects. These teams are working intensely on sustainably maintaining and advancing the products, particular attention being paid to the EBM and ERM projects. On the EGM project, the BKG also acts as the regional coordinator for ten countries. It is responsible for organisation, technical support and for the quality control and integration of data supply to these partner countries.

In December 2010, a new agreement was concluded between EuroGeographics and Eurostat for the continued supply of new versions of EBM, ERM and EGM. The agreement will run for four years, stipulates annual updates, the incorporation of further countries and several new object types and attributes. Another aim is to derive EGM largely automatically from ERM through generalisation. All products were delivered to Eurostat at the beginning of 2011.

ESDIN

The ESDIN (European Spatial Data Infrastructure Network, www.esdin.eu/about) project, supported by the EU as part of its eContentplus programme, was successfully concluded in March 2011 after a 30-month term. The project illustrated how the national topographic reference data can be more effectively amalgamated to create European data records and be made more easily accessible through web services.

The BKG contributed its expertise to many of the twelve sub-projects. The BKG is also heading the „ExM Data Specification (medium/small scale)" project, is involved in supplying data, testing the specifications and implementing web-based access services.

A specification for topographic data with various levels of resolution was developed from the data specifications for the topics of INSPIRE Annex I and also for the existing EuroGeographics products EBM, ERM and EGM.

Other results included the development of a quality model for reference data and of metadata guidelines. A web-based, semi-automatic evaluation system was developed to enable more cost-efficient reviews of national contributions to the pan-European databases. Principles for boundary adjustment and generalisation rules were also devised. ESDIN also describes how European identifiers can be created based on national identifiers.

On conclusion of the project, the EuroGeographics internal European Location Framework Task Force (E.L.F. Task Force) was established. Its role is to take up and develop findings and developments from ESDIN.

Knowledge Exchange Networks KEN

The Knowledge Exchange Networks (KEN) at EuroGeographics bring together the members' experts and provide a form for exchanging "best practice" applications and discussing ongoing issues.

INSPIRE KEN was established in 2011. The aim is to set up a network of INSPIRE experts to pursue the development of INSPIRE guidelines. The countries will also be able to share best practice for implementation of the guidelines.

The Quality KEN conducts a quality audit for ERM. The audit serves to review ERM quality management, the aim being to identify general problems and demonstrate potential improvements for organisation, procedures and documentation. This system audit therefore contributes to the further improvement of the product.

GMES

The BKG is integrated into the development and establishment of GMES (Global Monitoring for Environment and Security) in Europe and its implementation in Germany. GMES is a joint initiative of the European Union and of the European Space Agency), established to create an independent European earth observation system. GMES uses satellite data from existing missions, while building its own capacities with the Sentinel missions. The satellite data are integrated into the GMES information services together with the technical and reference data. These information services are split into the six topics of land monitoring, marine environment monitoring, catastrophe and crisis management, atmosphere monitoring, climate change monitoring and security. The Federal Government nominated a technical coordinator for most topics at the beginning of 2011. For land monitoring, the BKG is providing the technical coordinator. This function comprises the technical support for the land service, and the provision of information on this topic for German users. The technical coordinator is also the point of contact and the Federal Republic of Germany's representative at the GMES User Forum of the European Commission on land monitoring.

The GMES User Form was established as a new committee at the end of 2010. It advises the commission on the specification and validation of user requirements and on coordinating the GMES programme with users from the public sector. The User Forum, then, has the important task of submitting the requirements and needs of national users to the European Commission and demand that they are met. To expedite the use of GMES also at national level, the Federal Ministry for Transport, Building and Urban Development (BMVBS) and the technical coordinators jointly organised on 24/25.11.2011, the GMES Theme Days Germany 2011 in Munich. The BKG oversaw the land monitoring workshop.

The European Commission will provision satellite image analyses as so-called High Resolution Layers for five land coverage topics by 2013. The layers to be created – forest areas, soil sealing, grass land, wetlands and water bodies – were put out for tender and awarded in 2011 by the European Environmental Agency (EEA). The BKG will, in collaboration with the Federal Environmental Agency (UBA), look after the verification of this data created by companies. The BKG and UBA will also derive the data record CORINE Land Cover (CLC) from satellite image data and geospatial reference data from the German surveying and mapping authorities and make it available to the European Commission.

European Infrastructure for Geographic Toponymy – EuroGeoNames (EGN)

Since 2009, EuroGeographics and the BKG, in collaboration with the European surveying and mapping institutes, have been pushing ahead with the web-based infrastructure for official geographic toponymy in Europe as the "EuroGeoNames" project. The BKG acts as a "Service Center", maintaining the software components as part of this function. The BKG also offered technical support to the national surveying and mapping agencies. The BKG and the EuroGeographics Head Office have agreed that these tasks will be handed over to the Finnish Geodetic Institute (FGI) by mid 2012. The BKG is retaining the continuance of the European exonym and variant name database, one of the central components of the EGN infrastructure.

The main goal for 2012 continues to be EU27 coverage. EuroGeographics will also prepare a new architecture and a business model for sustainability and identify financing potentials.

Further information about the EuroGeoNames project as a whole can be found at:
www.eurogeonames.com.

Open Geospatial Consortium (OGC)

The AdV is supporting the advancement of the description language GML (Geography Markup Language: GML 3.3 will become, as ISO 19136-2, a new part of the existing standard), with a view to safeguarding the compatibility of this description language from the perspective of AAA® modelling (AFIS®-ALKIS®-ATKIS®). The medium-term aim is the qualitative development to GML 4.0 and to derive from the specifications on the OGC-Web-Services a profile for AdV (Web Mapping Service – WMS, Web Mapping Tile Services – WMTS and Web Feature Service – WFS), in order to guarantee compatibility with INSPIRE over the long term.

ISO/TC 211

The AdV is supporting the revision of Standard 19135 – Procedures for item registration in order to

- Guarantee the conformity of the XML encoding section (ISO 19135-2 – XML Schema Implementation – RegML – Registry Markup Language) and
- Contribute the experiences from the registry activities for coordinate reference systems.

Permanent Committee on Cadastre in the European Union (PCC)

On 1 July 2011, Poland took over the EU presidency and hence also the presidency of the PCC for the second half year of 2011. The General Assembly of PCC to conclude the presidency was held in Warsaw. The agenda included a discussion on the role of the cadastral land register in managing the global financial crisis, as well as a sharing of knowledge on the numerous potentials for using cadastral land register data for environmental and catastrophe protection and for managing cultural heritage. The opportunities for cooperating with non-EU states in Eastern Europe and the Middle East were addressed and, not least, the potentials for a closer collaboration between PCC and EuroGeographics were discussed.

The Secretary General represents the AdV in the PCC.

On 1 January 2012, Denmark took over the presidency for the first half year of 2012. The general assembly was held at the beginning of June in Copenhagen to conclude Denmark's presidency. On 1 July, the presidency of the EU and hence of PCC will be transferred to Cyprus for the 2nd half of 2012.

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