



# NATIONAL REPORT

## ON THE GERMAN CARTOGRAPHIC ACTIVITIES

Deutsche Gesellschaft für Kartographie DGfK  
(German Society of Cartography)  
Report Period 2015 – 2019



Compilation:

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# 1 Activities of the Deutsche Gesellschaft für Kartographie DGfK (German Cartographic Society)

## 1.1 Society Organisation and Activities

The *Deutsche Gesellschaft für Kartographie DGfK* is the national professional organisation of the cartographers of the Federal Republic of Germany and of those persons who have an interest in cartography.

The aims of the society are:

- to promote cartography in research, training and practice
- to support all involved in the field of cartography with apprenticeships and further training, especially for entrants
- to cultivate national and international co-operation in cartography and with other specialist fields
- to promote knowledge of cartographic science for geospatial planning and projects
- to support and nurture the cartographic culture in Germany

Executive bodies of the DGfK are the Vorstand (Executive Committee) the Vorstandsrat (Executive Council) and the Mitgliederversammlung (General Assembly). The Society is regionally organised in Regional Branches (Sections), professionally in Commissions. The Sections and Commissions organise professional and social meetings, lectures, seminars, and excursions for their members and guests. At present the Society has about 1500 members.

The DGfK holds an annual "Deutscher Kartographentag" (German Cartographic Conference). The annual general assembly of the society also takes place during this event.

Highly associated to the DGfK is the foundation "Kartographie Stiftung Ravenstein". This foundation is awarding the "Ravenstein Förderpreis" every year, a prize to honour young talented cartographic students and professionals for their qualified work. Before 2019 the foundation gave about 5.000 Euro for the award winners, the organization of the event and the travel costs for participants of the ceremony. This year, this sum could be increased up to 10.000 Euro.

The "Kartographischen Nachrichten", the only cartographic periodical in German, is also published by the DGfK. With the beginning of 2019 the publishing house has been changed. The journal is now published by the Springer Nature Group with the extended title "KN – Journal of Cartography and Geographic Information". Four issues per year are delivered to the DGfK members as part of their membership. In articles, reports, reviews, and other information, also job advertisements, this periodical mirrors cartographic news in Germany and abroad (especially Switzerland and Austria). The change of publishing house was necessary to fulfill international quality standards for scientific publications in the field of cartography and to consider the scientific globalization. Main language for scientific articles is English, the information part for the society members of the journal remains in German.

Apart from the "Kartographischen Nachrichten" members of the DGfK also receive, every couple of years, the "Kartographisches Taschenbuch" (Cartographic Paperback) which contains an extensive list of addresses in the field of cartography. Together with the "Staatsbibliothek Preußischer Kulturbesitz, Kartenabteilung" the "Bibliographia Cartographica" is published annually. It is the only regular documentation of international cartographic literature.

DGfK is a member of the International Cartographic Association (ICA). On a European level DGfK is, since 1999, a founding member of the European Cartographic Union (ECU). Nationally, DGfK contributes to the German GeoUnion. In this way our society is engaged on an international and national level and is involved in the development of cartography.

### *Annual Meetings "Deutscher Kartographie Kongress" (German Cartographic Conference)*

2015 Stuttgart: Joint Conference with INTERGEO, the Conference of the Gesellschaft für Geodäsie, Geoinformation und Landmanagement "DVW" (Society of Geodesy, Geoinformation and Land Management). Conference theme: "Cartographic Solutions for Big and Open Data".

2016 Potsdam: geoinfo.potsdam.2016 Conference theme: "Wissen schafft Praxis"

2017 Berlin: Joint Conference with INTERGEO, the Conference of the Gesellschaft für Geodäsie, Geoinformation und Landmanagement "DVW" (Society of Geodesy, Geoinformation and Land Management). Conference theme: "Smart Cartography".

2018 Munich: The joint conference of three academic societies in Germany – Photogrammetry & Remote Sensing, Geoinformatics, and Cartography "PFGK2018". Conference theme: „Photogrammetrie - Fernerkundung - Geoinformatik - Kartographie – 2018“

## **1.2 Commissions**

### **1.2.1 High Mountain Cartography**

*Chair D, A, CH*  
Karel Kriz

*Chair Germany*

Alexander Klaus (since September 2017, GAF AG) following Manfred Buchroithner (TU Dresden)

#### *Terms of Reference*

Further define the topics of Mountain Cartography and promote the methods and knowledge of mountain cartography among scientists and professionals in cartography and related fields.

Development of new ways of mountain map representations.

1. Provide an updated, attractive web-site with information about Commission activities, links to other events and theme-specific knowledge.
2. Provide an updated web-portal with links to related web-sites and bibliographic information.
3. Emphasize cartographic design issues and map related representations in large scale topographic mapping.
4. Continue the well-established workshop series.
5. Promote publication activities (proceedings, web-proceedings, journal articles and special issues) and common research activities.

#### *Members*

In Germany, the Commission currently only comprehends less than 10 members who are active. They come from TU München, TU Dresden, University of applied sciences Munich and the German Alpine Club (Deutscher Alpenverein).

#### *Activities*

With active participation from the group of TU Dresden, the following workshops and meetings have been attended:

10th Mountain Cartography Workshop 26 - 30 April 2016 in Berchtesgaden, Germany

11th Mountain Cartography Workshop 21-25 May 2018 in Hvar, Croatia

#### *Publications*

##### *Maps:*

Buchroithner, M.F., E. Oleson E., Hemp A. (2017): Treckingkarte, Tansania Kilimanjaro 1:100.000  
Institute for Cartography, Dresden University of Technology

- Monat L., (2017) TK25 Paznaun 1 :25.000 Department of Geoinformatics, University of applied sciences Munich
- Partenhauser V. (2018): Chile 1 :25.000 Department of Geoinformatics, University of applied sciences Munich
- Klaus A. (2019): Treckingkarte, Langtang Himal 1 :50.000 Department of Geoinformatics, University of applied sciences Munich



### 1.2.2 Law and Geodata

#### Chair

Dr. Rita Eggert

#### Terms of Reference

The Commission on Law and Geodata discusses and publishes legal aspects relevant for the processing and use of geodata. Of high priority are copyright issues, rights of database producers, licence models, competition law, data and privacy protection, spatial infrastructure and surveying law, consumer rights in contract law.

Taking up current developments of legislation or jurisdiction, questions from cartographic institutions or topics from the business of its members the Commission holds discussion and suggests solutions.

The Commission on Law and Geodata is a common Commission of DGfK, DGPF and DVW.

#### Members

Currently the Commission comprehends 7 members from business, science and public sector.

#### Projects

The following topics are in the centre of the Commission's activities:



- Which works or geodata are protected either by copyright or by right of database producer?
- Is an orthophoto protected as a database or as a work?
- Which actions may injure these rights? Which actions are allowed by law (esp. for purpose of education and science)? Updating and publishing the short guide “Urheberrecht leicht gemacht” for users.
- What are the characteristics of common licence models? How to understand terms in licences, esp. “commercial use”.
- How to manage different licences when using data from different sources to derive and publish an own product.
- What happens if one’s own geodata are inserted into open geodata bases (e.g. OpenStreetMap) or if OpenStreetMap data are used for one’s own products?
- What are the effects of EU directives and regulations (e.g. INSPIRE, PSI, Copyright, Data protection) for provision, access and re-use of geodata on the national legislation and practice?
- Which are the requirements that companies and public authorities may process private data lawfully?
- How to prepare the mandatory information on data protection for internet visitors, customers or members of an association.
- Which kind of processing geodata have to be considered as private thus protected by the obligation of privacy?

#### *Publications*

- Aringer, K., Rösler-Goy, M.: Freistaat Bayern vor dem EuGH erfolgreich – Topographische Karten als Datenbanken urheberrechtlich geschützt. zfv 2016, 1: 67.
- DGfK (ed.): Urheberrecht leicht gemacht. 2017, [www.dgfk.net/download/Urheberrecht.pdf](http://www.dgfk.net/download/Urheberrecht.pdf).
- Diez, D.: Der Europäische Gerichtshof stärkt den Schutz des Persönlichkeitsrechts und weist Google in die Schranken. KN 2015, 1: 32.
- Diez, D.: Grünes Licht für eine neue Bürokratie. KN 2015, 4: 255.
- Diez, D.: Zwischen Geodaten-Nutzung und Datenschutz: Der Europäische Gerichtshof zeigt einen gangbaren Weg. KN 2017, 1: 27.
- Diez, D.: Neues Urheberrecht: Gesetz zur Angleichung des Urheberrechts an die aktuellen Erfordernisse der Wissensgesellschaft. KN 2018, 1: 30.
- Rösler-Goy, M.: Aktuelle Gesetzgebung und Rechtsprechung für Karten und Geodaten. KN 2015, 5: 317.
- Rösler-Goy, M.: Datenschutz und Nutzungsrechte. Mobile GIS - Hardware, Software, IT-Sicherheit, Indoor-Positionierung, RTGIS 2016, 121.
- Rösler-Goy, M.: Europäischer Gerichtshof schützt Landkarte als Datenbank. KN 2016, 3: 143.
- Rösler-Goy, M.: Bayerns topographische Karte vor Gericht – zur Entscheidung des Europäischen Gerichtshofs vom 29.10.2015. Mitteilungen des DVW Bayern 2016, 3: 231.
- Rösler-Goy, M.: Aktuelle Gesetzgebung und Rechtsprechung für Karten und Geodaten. KN 2017, 5: 291.
- Rösler-Goy, M.: Neues Datenschutzrecht – Informationen aus erster Hand. KN 2018, 2: 107.

### **1.2.3 Map Curators**

#### *Chair*

Wolfgang Crom

#### *Terms of Reference*

The Commission of Map Curators is a forum for the exchange of ideas between staff members in map collections of different institutions like archives, libraries, institutes, and museums. It is an open body without a rigid member structure. This means the Commission holds annual meetings at various places. On the one hand, meetings are an information forum for questions about current issues, on the other hand a meeting always has a main topic and according to the subject, external speakers are sometimes

invited to join the conference. Thus, the meetings often are events of continuing professional education.

#### *Members*

Currently the Commission comprises 25 German members plus a number of colleagues from Austria and Switzerland.

#### *Projects*

Introduction of the international guidelines Resource Description and Access (RDA), drafting of national standards and training examples for the implementation of the new cataloging instructions. Further development of the Bibliographia Cartographica towards a better online presentation and visibility, especially regarding electronically available publications. Strengthening of international relations with the aim to improve the data for documenting cartographical literature. A form for external contributors has been put online. The creation of a repository for cartographic material is in preparation.

Improvement of catalogues and search possibilities in map collections. Further standardisation of procedures for the work with cartographic materials, inclusion of geographic coordinates in title information and subject authority files as a basis for graphical search tools.

Exchange of experiences regarding digitisation projects (digitisation, storage, presentation), which frequently are joint projects.

#### *Spreading of Results*

- Publication of the results in journals of the library and archive sectors as well as in the *Kartographische Nachrichten* (KN).
- Participation in congresses (national and international) with oral presentations and/or posters.
- Organising of meetings and events.
- Internal working papers.

#### *Publications*

Bibliographia Cartographica online: <http://bc.staatsbibliothek-berlin.de>

Christoph, Andreas, Michael Ammon, Wolfgang Crom, Holger Przibytzin: Digitalisierung, Verortung, Recherche - Neue Perspektiven für historische Karten.- In: *Kartographische Nachrichten* 66. – 2016, 3, p. 115 – 122

Crom, Wolfgang: DGfK-Kommission Kartenkuratoren. Aus der Arbeit 2013-2017. – In: *Kartographische Nachrichten* 68. – 2018, 1, p. 48-50

### **1.2.4 Cartography and Research**

#### *Chair*

Jochen Schiewe

#### *History*

Since 2010 the Commission on “Cartography and Research” provides a platform within DGfK for persons from universities, public authorities and companies, who are active in cartographic research and want to make this visible to an international community. In order to express the desired networking aspect in German speaking countries, members from Austria and Switzerland are explicitly invited to participate in this Commission..

#### *Terms of Reference*

General goal of the Commission on „Cartography and Research“ is to monitor and to foster cartographic research on an international level, in particular by the following actions:

- Propagating and promoting the scientific positioning of Cartography and its self-conception to be the responsible discipline for the communication of spatial data;
- Promoting the exchange over a huge bandwidth of current research topics and initializing research co-operations;
- Developing and promoting networks with other disciplines;

- Strengthening of international networking and improving the international visibility of Cartography in German speaking countries.

#### *Board*

The activities of this Commission is guided by a group which consists of Prof. Dr. Doris Dransch (Potsdam), Prof. Dr. Sara Fabrikant (Zurich), Prof. Dr. Georg Gartner (Vienna), Prof. Dr. Jochen Schiewe (Hamburg) and Prof. Dr. Monika Sester (Hannover). Prof. Schiewe acts as chair of the Commission.

#### *Activities since ICC 2015*

In 2016 the Priority Programm “Volunteered Geographic Information: Interpretation, Visualization and Social Computing” of the German research Foundation (DFG) started. This programme is an output of prior workshops and structured activities of the Commission.

The Commission organized a junior scientist workshop on the topic "Open (Geo-) Data in Science" in Berlin in 2018.

In addition, in June 2017, a survey was conducted among Commissioners and other university staff to identify issues that are relevant to societal or technical developments and that will require a larger, more focused research initiative in the field of Cartography in the near future. The evaluation of the survey is still ongoing. It is planned, after a necessary focus, to organize a roundtable (possibly financed by the DFG).

Further information: [www.visualisierung.dgfk.net](http://www.visualisierung.dgfk.net)



## 2 Cartographic Activities of Authorities

### 2.1 Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV)

The Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV) is the German umbrella organisation of the authorities of the 16 Laender of the Federal Republic of Germany competent for land surveying and cadaster and of three federal authorities.

The surveying and cadastral administrations of the Länder provide, with the assistance of the other AdV members, the geobase data required for the most diverse tasks from

- real estate transactions and legal relations
- soil and nature conservation
- regional planning and town and country planning
- economy
- administration

The products include Real Estate Cadastre, Integrated Geodetic Spatial Reference, Geotopography, 3D Building Models as well as a Meta Information System.

Within the scope of their legal tasks they keep for the whole area on an up-to-date and uniform basis the necessary base data systems and make them available to the customers on request.

#### *Guidelines for the nationwide uniform archiving of geographic reference data*

For many years surveying and mapping authorities and the archive authorities of the Laender of Germany are working together with regard to the delivery of analogue products, particularly maps. More and more the surveying and mapping authorities produce digital data, and new ways have to be set up for basic uniform regulations for the process of archiving digital geographic reference data.

For this reason, AdV and the Conference of Directors of the Archive Authorities of the Federal Government and the Laender (KLA) appointed a joint working group to develop a document on a harmonised approach to this challenge.

Both AdV and KLA adopted the resulting guidelines at the end of 2015. [The complete document has now been translated into English.](#)

Further information: [www.adv-online.de](http://www.adv-online.de)

AdV publishes a yearly national report about current activities, projects and working groups

- [AdV-National Report 2015/2016](#)
- [AdV-National Report 2016/2017](#)
- [AdV-National Report 2017/2018](#)

## 2.2 Bundesamt für Seeschifffahrt und Hydrographie, BSH (Federal Maritime and Hydrographic Agency)

### 2.2.1 Cartographic Responsibilities and Activities of BSH

BSH is responsible for the production and issuing of official nautical charts. It presently produces about 66 charts covering the German waters of the North and Baltic Sea. The production is based on the cooperation of national hydrographic services under the umbrella of the International Hydrographic Organisation (IHO) and takes advantage of the system of International Charts coordinated by IHO.

In addition, BSH is responsible for producing the so called Electronic Navigational Charts (ENCs) for German waters (155 cells), using the IHO Transfer Standard for Digital Hydrographic Data, referred to as S-57. These official ENCs, and their regular electronic updates, are for the onboard use on an Electronic Chart Display and Information System (ECDIS). They are Germany's contribution to the Worldwide ENC Database (WEND) coordinated by IHO and distributed by Service Providers appointed to the International Centre for ENCs (IC-ENC) based in United Kingdom. Printed nautical charts and ENCs are produced by BSH and other hydrographic services worldwide to satisfy the carriage requirement for ships according to the International Convention "Safety of Life at Sea" (SOLAS) of the International Maritime Organisation (IMO) and are part of a comprehensive nautical information system comprising charts, nautical books and the regular update services "Notice to Mariners".

BSH licenses its cartographic products for commercial reuse by private companies.

### 2.2.2 Important cartographic products and projects

*Products (see above):*

- Official nautical charts for professional shipping and small craft
- Notice to mariners, a printed weekly bulletin for keeping nautical charts and publications up-to-date
- Official Electronic Navigational Charts (ENCs) including weekly electronic up-dates
- Vessel Traffic Services Guide North Sea and Baltic Sea
- WMS chart services based on ENCs as part of the national geodata infrastructure (GDI) accessible via [www.geoseaportal.de](http://www.geoseaportal.de)

*Projects:*

- Electronic Sailing Directions
- Three charts of Antarctic waters according the commitment of Germany within the framework of the international Antarctic Treaty.

### 2.2.3 New Developments

The "Hydrographic Production Database" (HPD) is currently being introduced into the BSH production environment. It is based on the IHO S-57/S-100 standard (see below) and forms the core element of a fully integrated digital work flow from processing of survey data and other relevant sources down to final cartographic products in either printed or digital form..

### 2.2.4 International Cooperation

All hydrographic services cooperate under the International Hydrographic Organisation and its Regional Hydrographic Commissions (RHCs). Relevant for BSH are the North Sea Hydrographic Commission and the Baltic Sea Hydrographic Commission. BSH has also observer status in other RHCs, depending on varying requirements, such as bilateral projects. BSH cooperates also, within the framework of IHO, in the development of standards related to hydrography. A particularly important one is the development of the IHO Universal Hydrographic Data Model, referred to as S-100. S-100 came into force on 1 January 2010. S-100 is the document that explains how the IHO will use and extend the ISO 1900 series of geographic standards for hydrographic, maritime and related issues. S-100 extends the scope of the existing S-57 Hydrographic Transfer standard. Unlike S-57, S-100 is inherently more flexible and makes provision for such things as the use of imagery and gridded data types, enhanced metadata and

multiple encoding formats. It also provides a more flexible and dynamic maintenance regime via a dedicated on-line registry.

S-100 provides the data framework for the development of the next generation of ENC products, as well as other related digital products required by the hydrographic, maritime and GIS communities.

## **2.3 Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)**

### **2.3.1 Activities of BGR and its cartographic responsibilities**

The Federal Institute for Geosciences and Natural Resources (BGR) is the central geoscientific authority providing advice to the German Federal Government in all geo-relevant questions. It is subordinate to the Federal Ministry for Economic Affairs and Energy (BMWi).

As a federal institution the BGR is responsible for maps and map products at a scale of 1:250,000 to 1:5,000,000 and smaller. The maps are available as Web Map Services (WMS) via the BGR Geoviewer, as digital data sets in the BGR Produktcenter and several of them still in printed form. Large-scale maps and information can be found at the State Geological Surveys of Germany (SGD) of the respective federal states (see <https://www.infogeo.de>). Geological information made available by the BGR includes a wide range of both national and international geoscience map data. In addition to general geoscience data sets (Germany, Europe, etc.) also data sets of specialized thematic maps and map series are available.

BGR publishes official German maps (online, digital and on paper) on geology, mineral resources, groundwater and soils mainly in the scales 1:250,000 and 1:1,000,000. Thematic map data sets covering Europe and produced in European cooperation are published at scales of 1:1,500,000, 1:2,500,000 and 1:5,000,000 and smaller.

Also in projects of Technical Cooperation (TZ) thematic maps are produced at different scales, financed by the Federal Ministry for Economic Cooperation and Development (BMZ). Also in geoscience research projects BGR participates in producing thematic maps of various scales and subjects.

### **2.3.2 Important official national maps**

#### **2.3.2.1 Maps at the scales of 1:200,000 and 1:250,000**

Until recently the standard medium map scale of BGR was 1:200,000. Due to a new topographical base, this changed in the last couple of years and the maps series of the geological (GÜK200), hydrogeological (HÜK200), soil (BÜK200) and mineral resources (KOR200) maps at a scale of 1:200,000 compiled in close cooperation with the State Geological Surveys of Germany (SGD) were reduced in scale and are published at the scale of 1:250,000. The aim is to offer, online, all map themes seamless and harmonized for the entire German territory.

- *The new Geological Overview Map of Germany, scale 1:250,000*

The new GÜK250 is based on the map series General Geological Map of the Federal Republic of Germany 1:200,000 (GÜK200), the result of long cooperation (since 1964) between the State Geological Surveys of Germany (SGD), neighbouring countries and the BGR.

It presents a web-enabled, seamless and harmonised data set for the entire Germany. Like its predecessor, the GÜK250 maps the surface geology of Germany and contains harmonised and updated information on the age, composition and genesis of rocks. According to these contents the GÜK250 offers three nationwide legends for the representation of geological units: a) Chronostratigraphy, b) Petrography and c) Petrogenesis. The GÜK250 also contains information on lithostratigraphy, the formation process and event and environment of the rocks. In addition, the GÜK250 provides – if available – thickness information on the geological units and contains a layer with tectonic line elements, ice margins and quartz dykes. In general, the term ‘surface geology’ refers to geological formations up to a depth of 2 m. However, there are significant deviations from this concept – especially in the south of Germany – so that rock thicknesses of up

to several 100 m can occur. In addition to the base layer, the GÜK250 also contains an overlay layer, which usually comprises thin Quaternary layers.

Also, the harmonized GÜK250 data are going to be transformed according to the Data Specifications of the European INSPIRE Directive INSPIRE-Guidelines so that INSPIRE-compliant data sets can be downloaded in due time.

For the time being the GÜK250 is digitally accessible via the BGR Geoviewer and available as WMS and in various download formats (e.g. ESRI Shape) via the BGR Produktcenter.

- *General Hydrogeological Map of Germany, scale 1:200,000 and 1:250,000*

In order to support the implementation of the European Water Framework Directive (EU-WFD), the State Geological Surveys of Germany (SGD) and the BGR agreed in 2000 to compile a digital hydrogeological map at the scale of 1:200,000 (HÜK200), providing a harmonised survey of the upper groundwater bodies in Germany. The HÜK200 captures hydrogeologically relevant attributes such as consolidation, type of porosity, permeability, type of rock and geochemical classification to describe the hydrogeological characteristics of the rocks of the uppermost aquifers. The geological information on lithology, stratigraphy and genesis of the General Geological Map of the Federal Republic of Germany 1:200,000 (GÜK200) provided the basic data. This information was evaluated and hydrogeologically interpreted by regional experts of the SGD or replaced and completed by other regional geological and hydrogeological maps and data where necessary. In 2019, HÜK200 was migrated to a scale of 1:250,000 (now HÜK250). All data are available for free download and accessible through an online viewer.

- *The Soil Map of Germany, scale 1:200,000 and 1:250,000*

The 1:200,000 Soil Map of Germany (BÜK200) is a seamless, harmonised data set for the whole of Germany, compiled by BGR and the 16 SGD. Full spatial coverage of the map has been reached in 2018. The sheet-wise explanations are amalgamated to a general legend. A database with representative soil profiles comes along with the soil map, the completion of which is planned until March 2020. Both, map and database, together represent the most important data component of the Soil Information System of the BGR (FISBo BGR).

In addition to the digital and currently updated version, 55 map sheets have been printed after their completion. Although the soil profile database does not yet cover the whole country, derivation of further thematic maps has started. Also the BÜK 200 is offered in the scale 1:250,000 (BÜK250).

- *Map of the Near-Surface Mineral Resources of Germany, scale 1:250,000*

Since 1986 the Map of the Near-Surface Mineral Resources of the Federal Republic of Germany, Scale 1:200,000 (KOR200) is published. The objective is to provide a nationwide documentation, presentation and description of deposits and occurrences of mineral resources according to standard criteria. The map series shows mineral resources that are predominantly extracted from open-pit or from near-surface underground mines. Such resources include industrial minerals, building materials, peat, lignite, oil shale and brine. Each map sheet is accompanied by comprehensive explanatory notes.

By the end of 2018, 47 map sheets are available as printed edition and as digital files in various download formats (e.g. ESRI Shape) via the BGR Produktcenter. Based on the map sheets at a scale of 1:200,000 the new KOR250 at a scale of 1:250,000 was generated. It will be available digitally via the BGR Geoviewer by the end of 2019. The KOR250 data are going to be transformed according to the Data Specifications of the European INSPIRE Directive INSPIRE-Guidelines so that INSPIRE-compliant data sets can be downloaded on time.

### 2.3.2.2 Maps at a scale of 1:1,000,000

- *Geological Map of Germany, scale 1:1,000,000 (GK1000)*

The Geological Map of Germany at the scale of 1:1,000,000 (GK1000) presents the geology of Germany and its adjacent countries on a single map sheet. The geological units are shown as mainly stratigraphical units with additional information on lithology and genesis.

The GK1000 map was first published in 1973; in 1993 the fourth edition, compiled using a geographic information system (GIS), was published as a paper map and also included the area covered by the former German Democratic Republic. Together with the Soil Map of the Federal Republic of Germany, scale 1:1,000,000 (BÜK1000) and the Map of Mineral Resources of Germany, scale 1:1,000,000 (BSK1000), the GK1000 presents the BGR map series at the scale 1:1,000,000. The geological information of the GK1000 is the basis for the German contribution to the EU project OneGeology-Europe and the global OneGeology project.

- *Soil Map of the Federal Republic of Germany, scale 1:1,000,000 (BÜK1000)*  
The national soil map 1:1,000,000 (BÜK1000) has been produced shortly after the reunification of the two German states and thus represents the only complete nationwide soil map. It was compiled on the basis of published soil maps of the former German Democratic Republic and the pre-1990 federal states of Germany. The map contains 72 soil mapping units in 12 soil regions, described in a detailed legend on the basis of the German and FAO soil classification systems. The legend contains typical soil profiles and selected attribute data for the dominating soils of each mapping unit. The map was published in 1995. Its digital version is part of the spatial database integrated into the FISBo BGR Soil Information System. The digital version is also provided through the WMS of BGR. The maps of the soil atlas of Germany, that was published in 2015, have been published as soil atlas web map viewer [www.bodenatlas.de](http://www.bodenatlas.de) on the basis of the BÜK1000.
- *Map of Mineral Resources of Germany, scale 1:1,000,000 (BSK1000)*  
The Map of Mineral Resources of Germany 1:1,000,000 (BSK 1000) provides basic information about the spatial distribution of these commodities in Germany. The mineral resources are summarized in commodity groups, which are depicted in different colours. They comprise energy resources, building materials, industrial minerals and iron ore.  
The map also contains information about the definition, development, use and economic importance of all commodities shown. The BSK1000 was compiled by BGR in cooperation with the State Geological Surveys of Germany (SGD).

### 2.3.2.3 Maps at other scales

- *Soil Map of the Federal Republic of Germany, scale 1:2,000,000 (BÜK2000)*  
The soil map 1:2,000,000 of Germany (BÜK2000) is based on the General Soil Map of the Federal Republic of Germany 1:1,000,000 (BÜK1000). The map contains 61 soil mapping units which are derived based on aggregation principles. This map is published in the Hydrogeological Atlas of Germany (HAD). Based on BÜK2000, a comprehensive soil atlas of Germany with maps at a scale of 1:3,000,000 and smaller on soil forming factors, soil properties, potentials and threats have been published by the end of 2015 as a printed version with 48 maps and a digital version on the web with more than 100 maps ([www.bodenatlas.de](http://www.bodenatlas.de)).
- *Map of Mining and Storage Operations of the Federal Republic of Germany, scale 1:2,000,000*  
Since 1967 the Map of Mining and Storage Operations of the Federal Republic of Germany 1:2,000,000 is released annually by the BGR in cooperation with the mining authorities of the states of Germany. The map contains information to the extracted material, amount, and number of sites in operation. Since 2002 the map is released exclusively via Internet.
- *Maps for the Hydrological Atlas of Germany (HAD)*  
The Hydrological Atlas of Germany (HAD) is the work of cooperation between the major German institutions in the fields of hydrology, meteorology, geoscience and environmental protection and the federal states of Germany. BGR is contributing to this project since 1995 and provides geological, hydrogeological and soil maps and expertise. The atlas is published both as a conventional graphic atlas and as a digital version.  
The following thematic maps at the scale of 1:2,000,000 have already been realised by BGR:
  - Soils
  - Lithology

- Hydrogeology
  - Depth of the Effective Root Zone
  - Field Capacity up to 1 m Soil Profile Depth
  - Available Water Capacity in the Effective Root Zone
  - Air Capacity in the Effective Root Zone
  - Mean Annual Rate of Percolation from the Soil
  - Hydrogeological Regions
  - Groundwater Yields
  - Mean Annual Groundwater Recharge
  - Geogenic Groundwater Quality
  - Mineral Water, Thermal Water and Medical Water
- *Map of Soils in Germany 1:5,000,000 (BGL5000)*  
The map of Soils in Germany 1:5,000,000 (BGL5000) has been collated during the preparation of the Soil map of Germany 1:200,000. Soil regions were defined based on geology and relief, while great soils were delineated using soil material information, water regime, relief and macroclimate.
  - *Map of Groups of Soil Parent Material in Germany 1:5,000,000 (BAG5000)*  
The map Soil Parent Material of Germany 1:5,000,000 (BAG5000) provides the basis for maps on heavy metal background values (natural and diffuse contamination). It has been derived from the General Soil Map of Germany 1:1,000,000 (BÜK1000) and statistical analyses based on analytical values from soil profiles from the whole country.

### 2.3.3 Maps in European and international cooperation

- *International Geological Map of Europe and the Mediterranean Regions, scale 1:1,500,000 (IGK1500)*  
The International Geological Map of Europe and the Mediterranean Regions, scale 1:1,500,000 (IGK1500) consists of 45 map sheets covering Europe and neighbouring countries in Africa and Asia. The map was published partially as 2nd and 3rd edition and was completed in the period between 1964 and 2000. The map is the product of close cooperation between BGR and the Geological Surveys of the concerned countries with support by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The decision to compile this map was done on the occasion of the 2nd International Geological Congress in 1981 in Bologna/Italy.  
The map series can be downloaded sheet-wise or completely as georeferenced TIFF via the BGR Produktcenter.
- *International Hydrogeological Map of Europe, scale 1:1,500,000 (IHME1500)*  
The International Hydrogeological Map of Europe, scale 1:1,500,000 (IHME1500) consists now of 30 map sheets including explanatory notes for 25 sheets, covering the European continent and parts of the Near East. The data set was extended for five unpublished, digitised IHME1500 map sheets to achieve full map coverage. The map depicts aquifer type/productivity, lithology, seawater intrusion, lineament. The IHME1500 v1.2 includes a correction of inconsistencies of the printed map sheets and was spatially adjusted to an up-to-date topographic base. The BGR and the UNESCO are the project coordinators, supported by the International Association of Hydrogeologists (IAH) and the Commission for the Geological Map of the World (CGMW). Each sheet consists of contributions by the respective countries represented in the map, which were harmonised across borders. Together with the accompanying explanatory notes, the map series can be used for scientific purposes, for large-scale regional planning and as a framework for detailed hydrogeological mapping.
- *International Quaternary Map of Europe, scale 1:2,500,000 (IQUAME 2500)*  
The International Quaternary Map of Europe, scale 1:2,500,000, was published on paper during the period 1967 to 1995 by BGR in cooperation with the UNESCO and International Union for



Quaternary Research (INQUA). The map shows the Quaternary landform features, including end moraines, ground moraine hillocks, kames, drumlins, eskers and ice limits, and also those resulting from ice movement, limits of marine transgressions and tectonic faults. Important key localities for Quaternary research, bathymetric lines and sea-floor deposits, are also indicated. The Quaternary geological units are represented by a combination of age, genesis and lithology. The map consists of 14 map sheets that cover Europe, together with a special legend sheet (explanations given in German, English, French and Russian).

- *Review and new edition – International Quaternary Map of Europe 1:2,500,000 (IQUAME 2500)*  
BGR began reviewing, reworking and digitising the paper map in order to build a GIS of the Quaternary geology of Europe in 2011, through international cooperation, and under the umbrella of the Commission of the Geological Map of the World (CGMW) and supported by INQUA. The Quaternary information is planned to be compatible with the already existing GIS of the 1 : 5 Million International (pre-Quaternary) Geological Map of Europe and Adjacent Areas (IGME 5000, see below) so that the information in each layer can be combined, selected and cross-referenced. The IQUAME 2500 GIS and map will contain digital information concerning:
  - the geological boundaries and classifications of the Quaternary rocks (unconsolidated and consolidated sediments, volcanic rocks, peat),
  - extension and boundaries of permafrost,
  - last glacial maxima,
  - active faults,
  - geomorphology/landforms,
  - submarine currents and their impact on the ocean floor etc.,
  - key locations, e.g. palaeolithic sites, stratigraphic, significant stratotype sections and points.
 To facilitate the review, all contributors received guidelines with complete instructions on how to undertake the review and digitally contribute the update of their data. The work is carried out in cooperation by over 30 geological surveys and similar organizations throughout Europe, with support of an advisory board of leading international scientists. An international consultation workshop will be held at the INQUA Congress, Dublin/Ireland, July 2019.
- *The 1:5 Million International Geological Map of Europe and Adjacent Areas (IGME 5000)*  
The International Geological Map of Europe and Adjacent Areas was published 2006 as paper map and web mapping application. It is a result of the IGME 5000 GIS-project of the BGR under the umbrella of the Commission of the Geological Map of the World (CGMW). Its aims were to build a GIS on Europe's pre-Quaternary geology, to print a map in consideration of high standards in scientific and cartographical aspects, and to implement a web mapping application. In this project 48 active European and non-European geological services have been involved. It was supported by a network of academic advisors from European and northern American universities and scientific institutes. The IGME 5000 displays the pre-Quaternary geology of Europe onshore and also offshore – for the first time at this scale. In addition to the geology – attributed by age, petrography and genesis – also magnetic anomalies, tectonic structures, the continent-ocean boundary, metamorphism, oceanic crust information and bathymetric lines are being provided. The GIS IGME 5000 allows manifold cross-national queries over whole Europe. The data are downloadable via the BGR Produktcenter and visible via the BGR Geoviewer.
- *European Marine Observation and Data Network (EMODnet)*  
The European Marine Observation and Data Network (EMODnet) consists of more than 150 organisations assembling marine data, products and metadata to make these fragmented resources more available to public and private users relying on quality-assured, standardised and harmonised marine data which are interoperable and free of restrictions on use. EMODnet is currently in its third development phase with the target to be fully deployed by 2020. EMODnet is subdivided into

7 projects, the “Lots” and one of them is the Geology Lot. EMODnet Geology focusses on producing open, high-quality harmonized spatial geoscience data of the European Seas that is interoperable and available free of charge. Within EMODnet Geology, BGR is leading the workpackage “Seafloor Geology” to compile and harmonize the European marine geology map data as detailed as possible for the themes:

- pre-Quaternary and
- Quaternary geology;
- geomorphology.

Essential instrument for interoperability and harmonization of those data across the EEZ-boundaries is an agreement to use common standards, in particular existing international standards. Thus, the European Directive INSPIRE data specifications and portrayal rules for geology based on the global vocabularies of Commission for the Management and Application of Geoscience Information of the IUGS have been used and additional vocabularies specific for the off-shore areas were developed.

These data are available at the EMODnet Geology portal <https://www.emodnet-geology.eu/>.

- *Soil Regions of the European Union and Adjacent Countries 1:5,000,000 (EUSR5000 Version 2.0)*  
The Soil Regions Map of the European Union and Adjacent Countries is a joint project of the European Soil Bureau Network (ESBN) and the Joint Research Centre (Ispra/Italy), coordinated and realized by the BGR. As a basic component of the project ‘Georeferenced Soil Database for Europe’ it is part of the Manual of Procedures intended to support better harmonized soil mapping at the scale 1:250,000.

Existing maps as well as soil information provided by the European partners were interpreted by using uniform delineation criteria (WRB classification). In the map 285 soil regions and 35 climate areas are distinguished, as well as undifferentiated Fluvisols, Anthrosols and urban soils. The map units are stratified using combinations of about 120 different soil associations and eighteen different parent material associations. Whereas in the map legend only dominant soil and parent material is presented, an explanatory text offers more information also about the co-dominant and associated soils.

To enhance the geomorphographic aspects, e.g. the mountainous climate areas, a shaded relief is drawn in the background of the map. It is based on the GTOPO30 global digital elevation model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometre), provided by the U.S. Geological Survey (USGS).

Additionally to the map and the explanatory text an auxiliary database has been developed which contains information about all relevant parameters (climate, soil type, parent material, elevation, slope, land use, geographical position etc.) in query mode.

### **2.3.3.1 Maps at the scale 1:25,000,000**

- *Groundwater Resources Map of the World, Scale 1:25,000,000*

The World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) is a joint activity of the UNESCO, the Commission for the Geological Map of the World (CGMW), the International Association of Hydrogeologists (IAH), the International Atomic Energy Agency (IAEA), the International Groundwater Resources Assessment Center (IGRAC) and the BGR. It aims at collecting, collating and visualising hydrogeological information at the global scale, to convey groundwater related information in an appropriate way for global discussion on water issues and to give recognition to the invisible underground water resources. WHYMAP brings together the huge efforts in hydrogeological mapping, at regional, national and continental levels. BGR has built up a geographic information system (WHYMAP GIS) in which the groundwater data are managed and visualised.

An important milestone of the WHYMAP Programme has been the publication of the Groundwater Resources Map of the World at the scale of 1:25,000,000 in 2008. Since then, the following global maps have been compiled and published:

- Map 'River and Groundwater Basins of the World 1:50,000,000' (special edition for the 6th World Water Forum, Marseille/France, March 2012),
- Map 'Global Groundwater Vulnerability to Floods and Droughts 1:40,000,000' (special edition for the 7th World Water Forum, Daegu & Gyeongbuk/Republic of Korea, April 2015),
- World Karst Aquifer Map 1:25,000,000 (WOKAM, September 2017).

The latest edition is the Groundwater Resources Map of Africa 1:12,500,000 (special edition for the 7th Africa Water Week, Libreville/Gabon, October 2018).

#### **2.3.4 Maps in Projects of Technical Cooperation for Development in Partner Countries**

Via the Federal Ministry for Economic Cooperation and Development (BMZ) the Federal Government commissions a number of executing agencies for Technical Cooperation projects – including BGR in the geology and mining sector – to plan and implement Technical Cooperation projects and programmes (TZ) in Latin America, Africa and Asia. Key elements are combating poverty and protecting natural resources. BGR supports state institutions, e.g. Geological Surveys and other public sector organisations in developing countries in the following areas:

- management and resource-optimised utilisation of water and soil,
- mineral and renewable energy resources (exploration, potential and evaluation of deposits, geothermal energy),
- environmental and resource protection/mining environment,
- geological principles of regional planning and policy (e.g. for the location of suitable sites for landfills),
- geo risks, climate and disaster protection (e.g. for water vulnerability and disease response management).

In order to the mission geological and thematic derivative maps are produced in various scales to be used as overview maps or detailed for specific purposes like regional and urban planning and also as base map for further geological research. Most of the maps are based on GIS-techniques and are disseminated as digital maps using the Internet or CD.

#### **2.3.5 BGR Produktcenter**

All maps are also digitally available (mostly for free) within the BGR product centre (Produktcenter) which provides an overview about editorial and technical information.

Here all maps are referenced in a meta database and can be researched based on regional and technical aspects. They are available in a variety of resolutions and formats (PDF, TIFF, JPG, PNG and as ESRI Shape and e00 files). The research results are provided as detailed information for the map/map series including coordinates, technical descriptions, contact persons and ordering options (online or through bookshops). The maps are also included in the Geoviewer (see below).

<https://produktcenter.bgr.de>

#### **2.3.6 BGR Geoviewer**

The BGR Geoviewer allows the user to visualize and to combine BGR's WMS based on data of various disciplines. The information for every map contains a link to the BGR Produktcenter where the relevant geodata are available for download. The offered map data cover whole Germany and are generalized for different scale intervals between 1:200,000 and 1:5,000,000. Thus, some of the map services are displayed only for fixed scale ranges depending on data sources.

The layout will automatically adjust itself for display on smartphones and tablets.

<https://geoviewer.bgr.de>

### 3 Cartographic Activities of Private Enterprises

No report submitted.

### 4 Cartographic Training and Research at Institutions of Higher Education

#### 4.1 Hochschule für Technik und Wirtschaft Dresden (Dresden University of Applied Sciences), Faculty of Spatial Information

##### *Research*

The Faculty of Spatial Information is a competent partner for economy, government and administration. Research activities mainly focused on the development of GIS applications and Web-GIS components, information systems, and multimedia applications for the public and private sector. In projects and theses, research was conducted to make historical maps and data available on the internet. 3D subsurface city models and 3D city models for defensive measures in case of high water were developed. Further fields of research were Atlas Cartography, 3D Laser Scanning and 3D Modelling (including virtual reality and augmented reality), Building Information Modeling (BIM), Unmanned Aerial System (UAS) as well as Aerial Photography.

##### *Selected international projects*

- Integrated water resource management in central Asia - model region Mongolia (MoMo III); partners: Helmholtz-Centre for Environmental Research – UFZ (project lead), Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Mongolian Academy of Sciences
- Survey of aqueducts in the Region of Nasca /Peru; partners: CVUT Prag, Faculty Geomatics (photogrammetry), Agencia Agraria and Autoridad Nacional del Agua Nasca/Peru, Asociación “Maria Reiche” Lima/Peru
- Road maps of Namibia for tourists developed in collaboration with the Namibian authorities (Roads Authority of Namibia, TASA)
- Bohemian-Saxon literary landscape. Multi-use interactive map; partners: TU Dresden, TU Liberec

##### *Selected national and regional projects and products*

- GPS-measurements and stereo analysis of satellite data as a basis for archaeological research in Erbil/Iraq in collaboration with German Archaeological Institute (DAI)
- Project “Geodatabase - Boundaries of Parishes”: development and design of a map series 1:10000 or 1:25000 for the Diocese of Dresden-Meißen (episcopal ordinariate) and data processing for the “Atlas of Dioceses” of the Federal Republic of Germany (<https://www.bistum-satlas.de/>)
- Cartography for museums: 2D and 3D items for exhibitions, multimedia applications and VR-applications; partners: Europäisches Kultur- und Informationszentrum Via Regia e.V., Archaeological Heritage Office in Saxony
- Participation in private publishing projects (“Sächsische Heimatblätter”, “afrikapost”).
- Building Information Modeling (BIM) in the context of urban planning – Integration of BIM and GIS

##### *Organised Symposia*

- FOSSGIS Conference 13 -16 March 2019 in Dresden  
The FOSSGIS conference is the leading conference for free and open source software Geo-Software and OpenStreetMap. It was organized by the non-profit organization FOSSGIS e.V., the OpenStreetMap Community, and the Dresden University of Applied Sciences, Faculty of Spatial Information.

### Education

Beginning with the winter semester 2017/2018 the first Bachelor students in Geomatics – Surveying/Cartography/Geoinformatics have been pursuing their studies. This new programme substitutes the Bachelor degree programmes Cartography/Geoinformatics and Surveying/ Geoinformatics.

The following modules are integrated in this programme:

- Natural sciences/applied sciences: Mathematics, Computer Science
- Geodatabase Systems, Geographic Information Systems and Programming
- Photogrammetry and Remote Sensing, 3D Modelling and Virtual Reality
- Soft skills: foreign languages and rhetoric skills, academic skills
- Law including copyright law

Before the start of the second semester students choose between two field of studies: Cartography or Surveying.

The course programme Cartography comprises the following modules and contents:

- Geography, Map Projections and Coordinate Reference Systems (CRS)
- Theoretical Cartography with Map Design, Graphic Design, Thematic Cartography
- Practical Cartography with Map Technologies, Printing and Media Production
- Geoprocessing, Computer Graphics, Application Development in Geoinformatics

In the 5th semester, an external work placement takes place for at least 18 weeks. The 6th and 7th semesters aim to improve specialist knowledge in Cartography and Geoinformatics or Surveying. Each student works on a complex cartographic project.

The following study programmes are currently offered at HTW Dresden, Faculty of Spatial Information

Programme	Degree	Duration	Numbers of students per year	Accredited
<b>Geomatics – Surveying/Cartography/Geoinformatics (Geomatik – Vermessung, Kartographie, Geoinformatik)</b>	<b>Bachelor</b>	<b>7 semesters <sup>1)</sup></b>	<b>60</b>	<b>yes</b>
Geoinformatics/Management (Geoinformatik/Management)	Master	3 semesters (consecutive) <sup>2)</sup>	30 <sup>3)</sup>	Yes
Geoinformatics/Management (Geoinformatik/Management)	Master	4 semesters (not consecutive) <sup>2)</sup>		yes
Surveying (Vermessungswesen)	Diplomingenieur (FH)	10 semesters (correspondence course)	35	no

<sup>1)</sup> beginning: every winter semester

<sup>2)</sup> beginning: every winter semester and summer semester

<sup>3)</sup> numerus clausus

Further Information: <http://www.htw-dresden.de/fakultaet-geoinformation.html>

## 4.2 Hochschule Karlsruhe – Technik und Wirtschaft (Karlsruhe University of Applied Sciences) Faculty of Information Management and Media

### *Research*

For the 300-year anniversary of Karlsruhe in 2015, students had helped to generate 3D-city models of the city's development for five time steps. Animated fly-throughs along prominent streets were integrated into the city's official exhibition for the festivities. In the meanwhile, additional efforts have targeted the development of VR/AR-applications. Based on the high accuracy of the city models accommodating either good texture resolution or construction in LoD 3, VR-applications for different output devices, from HTC Vive to VR-cardboards with smartphone integration, were developed for scales up to natural size. AR-applications were also generated to augment historical map exhibitions. Another research ambition connected with Hochschule Karlsruhe (HsKA) are the floodplains of German rivers. Here, the Federal Agency for Nature Conservation (BfN) funded a second study on their areas and states to update the first evaluation of ten years ago. The survey is based on up-to-date geodata of the Federal Agency of Cartography and Geodesy as well as on data of the European Flood Risk Management Directive in combination with local information (e.g. from planning documents). More than 10.000 km of rivers will be evaluated for a scale as detailed as 1:25.000. The 3-year project will be finalized by end of 2019.

In Kenya the NGO ACK is supported to enhance its capacities in digital workflows when monitoring cheetahs at regional and national level. Native mobile map apps were developed to serve the specific needs of the NGO. In combination with satellite image analysis and species distribution modelling, we thus contribute to efforts aiming at the protecting of the predators. Besides, preliminary studies of distinguishing vegetation units on Sentinel-2 satellite imagery of the Afroalpine zone on Mt. Elgon were conducted. HsKA is also involved in establishing a training centre for environmental research in Western Kenya.

A new cooperation was started with the University of Pretoria (UP) in 2015. A summer and a winter school on Participatory Sensing helped to promote the two universities and their study programmes among students. For UP students an exchange semester within the International Geomatics Master programme at HsKA is particularly attractive, while HsKA students opted to work on their Master theses at UP. The cooperation, funded by the Baden-Württemberg Stiftung (BWS) until 2019, resulted in several joint papers related to thematic cartography/geovisualization.

### *Education*

The Bachelor degree programme "Geo-Information Management" (GIM) with its three options for specialization (Geobusiness, Web-cartography and Geomedia, and Environment) was restructured. We opted for more cartography-related courses being mandatory for all students (e.g. Web mapping, mobile map apps). Consequently, the number of elective courses per specialization option reduced. This made it easier to offer a Master programme which covers modules of interest for all five current fields of specialization within the two Bachelor programmes GIM and 'Geodesy and Navigation' (GUN). The Bachelor PLUS study offer is still available. By extending their studies by one semester, students can spend a full year abroad (e.g. at Edinburgh Napier University, Universidad Politécnica de Valencia, or Minnesota State University), although scholarships by DAAD are not available anymore.

The International Geomatics Master programme received a major realignment. We are now offering project modules on modern topics where students can select three out of five electives per semester and work in groups to achieve a certain target. At the same time, the geoinformatics aspects were strengthened within the mandatory courses to enhance the students' capacities in ICT technologies and programming. All courses are taught in English and due to maintaining the structure established over many years now, students mix from diverse backgrounds and cultures. When from abroad or having spent a semester abroad, the degree of an International Master is awarded.

Due to funds within the 'campusWELTBewerb', in 2018 workshops on the topic 'Fremdsein 4.0' took place, which aimed at addressing students from across the study programmes offered at the Faculty of Information Management and Media. By jointly reflecting on "Fremdsein" und "Heimat", the students used their various media skills to elaborate artefacts for an exhibition which also included



two interactive map apps. Its virtual exhibition can be visited on <http://www.iaf.hs-karlsruhe.de/gvisr/project/fremdsein40.html>.

#### 4.3 Hochschule München (Munich University of Applied Sciences)

##### *Education*

The Department of Geoinformatics at Munich University of Applied Sciences offers a broad spectrum of education in the field of geoinformation sciences, combined with specific research activities. This means students benefit from an interdisciplinary academic environment where active applied research is ongoing.

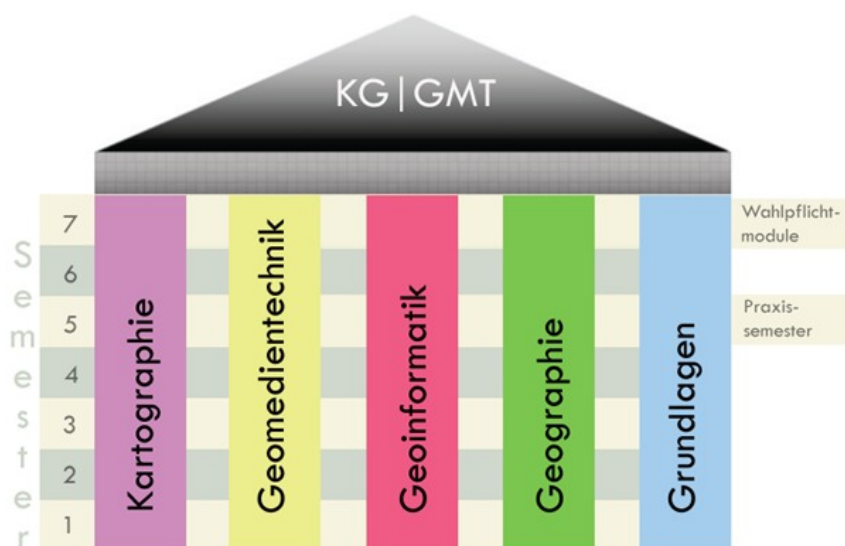
Currently there are 500 students enrolled at the Department of Geoinformatics divided into four degree courses. Moreover, our relationships with universities and corporate partners in Germany and abroad give students access to unique learning and research opportunities beyond the campus of Munich University of Applied Sciences. Munich is Germany's leading research hub in the field of geoinformation sciences. The thriving regional economy ensures a wide range of work opportunities both during and after the studies.

The Department of Geoinformatics offers the following Bachelor degree programs:

- Cartography | Geomedia
- Applied Geodesy and Geoinformatics
- Geoinformatics and Navigation

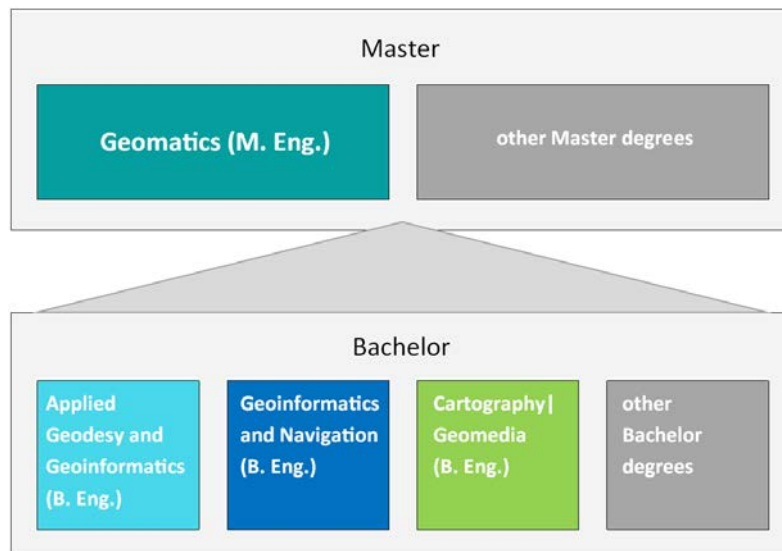
The Bachelor degree program Cartography | Geomedia (Bachelor of Engineering) covers seven semester and includes an internship semester in the 5th semester. The concept of the Bachelor degree program is based on five pillars (see Figure below) and is run by all students in the same way until the 6th semester. In the 7th semester the education is completed by three selectable modules from the four pillars. With this option the students can deepen their knowledge according to their own interests.

The combination of cartography and geomedia techniques is the necessary consequence of the current cartographic development, which offers the Bachelor's degree program Cartography | Geomedia an outstanding position in German-speaking countries for the field of cartographic education opened for the new trends of our digital world.



Five pillars of the Bachelor degree program Cartography | Geomedia

The Master program Geomatics is designed for students with a Bachelor degree in Cartography, Computer Science, Geoinformatics, Geography or similar. This program teaches how to use modern technologies to collect, analyze and visualize spatial data and processes. This program enables students to deepen and extend their knowledge in the fields of Cartography | Geomedia, Applied Geodesy and Navigation. It prepares the students for leadership positions in companies and public authorities as well as for scientific activities at universities and research institutions. The broad education and the interdisciplinary approach distinguish this master.



The degree programs offered by the Faculty of Geoinformation

### Research

Cartographic research activities at the Department of Geoinformatics are mainly focused on key topics such as user-oriented geovisualization, web mapping, topographic and thematic cartography and 3D-visualization and cognition. Many research objectives are based on a close connection between cartography and geomedia techniques, according our concepts of the Bachelor's degree program Cartography | Geomedia and the Master program Geomatics. The interdisciplinary nature is one of the key characteristics of our activities.

### Special research projects:

- Research project CORSSNAV (Head: Prof. Dr. Peter Krzystek): Funded by Bavarian State Ministry of Sciences, Research and the Arts. A team consisting of the Professors Thomas Abmayr, Peter Krzystek and Carola Tiede (Faculty of Geoinformation) and Professor Claudius Schnörr (Faculty Computer Science and Mathematics) is working on the environmental issues such as the biomass mapping of forest and non-forest tree populations, the thermal mapping of buildings and the efficient provision of geothermal and solar sites, industry-related topics of image processing such as the fast 3D tomography. CORSSNAV is thereby allow early active participation and skills development in research and development projects, in particular students, e.g. on research funded part-time positions in Master's programs and attractive internal university theses.
- Prof. Dr. Peter Kammerer: Creation of 3D visualization of the former Celtic Oppidum Bibracte in France; Collaboration with the Center Archéologique Européen
- Prof. Dr. Peter Kammerer: Creation of web mapping applications for the evacuation of the population in the vicinity of chemical plants; Cooperation Bavarian State Ministry of Interior.
- Prof. Dr. Markus Oster: Inventory of monuments and fountains in Munich with image based 3D-modeling techniques; Collaboration with Professor Silke Langenberg (Department of Architecture) and the City of Munich.

Prof. Dr. Sabine Kirschenbauer: Empirical Studies of Cartographic Prosumer. Cooperative PhD of Dr. Natalia Ipatow. With Prof. Dr. Francis Harvey. Leibniz-Institut für Länderkunde

- Prof. Dr. Wilfried Hagg: Observation of glacier changes in Bavaria by repeated geodetic surveying; Collaboration with the Bavarian Academy of Sciences and Humanities (Geodesy and Glaciology).

#### *Organized Academic Event*

Raum - Zeit – Risiko: Interdisciplinary conference together with ‘Deutsche Gesellschaft für Kartographie’, Commission ‘Risiken, Katastrophen, Sicherheit’ (Oct. 2017)

TEDGeoX: Talks on Geomarketing. (June 2018). By Prof. Dr.-Ing. Sabine Kirschenbauer.

#### *Further information:*

<http://www.geo.hm.edu> (German version)

<https://www.geo.hm.edu/en/index.en.html> (English version)

## **4.5 Technische Universität Dresden (Dresden University of Technology)**

### *Research*

Research at the Institute of Cartography deals with concepts and implementation of space-related visualisations for analogue and digital media. Major research topics are Geovisualisation of user-generated spatial data, Web- and mobile cartography, Automated generalisation, Environmental monitoring and 3D Visualisation. Here, a series of national and international cooperation projects funded by various funding entities – mainly the German Research Council (DFG), the Federal Ministry of Transport and Digital Infrastructure and the German Academic Exchange Service (DAAD) – have been carried out and are still ongoing for several years. The Institute of Cartography is coordinator of DFG-priority program Volunteered Geographic Information – Interpretation, Visualisation and Social Computing.

### *Education*

The four semester *International M.Sc. Cartography*, is organised successfully together with the Munich University of Technology, the Vienna University of Technology and University of Twente. The Cartography M.Sc. has been selected as Erasmus+ program from the European Union, which offers around 12 scholarships per intake. The highly competitive application process has so far every year resulted in a group of 20 – 30 highly motivated students from all over the world.

### *Organised Symposia*

- Honorary colloquium on the occasion of the 65<sup>th</sup> Birthday of Prof. Dr. Manfred F. Buchroithner, 16. Sep. 2016
- International VGIScience Summer School, 11.-15. Sep. 2017, TU Dresden
- Co-organisation of VGIScience Geovisual Analytics Workshop, 19. Oct. 2018, Konstanz, associated with 4th International Symposium on Big Data Visual and Immersive Analytics (BDVA)

## **4.6 Technische Universität München (Munich University of Technology)**

### *Research*

Current research fields of the [Department of Cartography](#) are

- Mobile cartography with emphasis on (a) the attention-guiding visualization methods and non-photorealistic 3D city models for mobile display devices based on the analysis of eye-movement patterns, and (b) navigation maps for different target groups and mobile tasks;
- Geospatial data integration with emphasis on (a) fast matching algorithms for multiple data sources from national mapping agencies, private enterprises and VGI, and (b) development of a human-machine collaborative visual analytical platform;
- Acquisition and visualization of geo-events with the emphasis on (a) dashboard and storytelling of spatiotemporal events, (b) development of an open event portal with collecting, crawling, editing,

visual storytelling and querying functions, and (c) event detection from imagery, GPS trajectories and social media data based on deep learning methods.

Main collaboration partners and sponsors are: German Natural Science Foundation (DFG), Bavarian State Government, China Scholarship Council, other R&D institutions and industry partners from Germany and China.

On-going research projects and projects accomplished in the recent two years:

- Labeling spatial trajectories in road network using probabilistic graphical models
- Visualizing uncertainty in reasoning based on Bayesian Networks with the classification of global land cover and citizen security as case studies
- Place recognition from street-view imagery by means of deep convolutional neural networks
- Detection of transportation catchment areas from the bike-sharing data
- Space time cube and its usability study
- A visual computing platform for the industrial innovation environment in Yangtze River Delta
- Geospatial information services for smart cities driven by big data
- A Bavarian climate event portal for knowledge exploration
- Impacts of augmented reality on the spatial cognition
- Detection of emotions and their life cycles in social media data

#### *Education*

The Department of Cartography has been jointly running the International Master's Program "Cartography" with TU Vienna, TU Dresden and University of Twente since 2010.

In addition, it is one of the essential components in the bachelor / master program of "Geodesy and Geoinformation" at TU Munich. Furthermore, it is involved in the following international master courses:

- (1) Land tenure and land management
- (2) Earth-oriented space science and technology
- (3) Transportation systems
- (4) Environmental engineering

#### *Organised Academic Event*

The joint conference of three academic societies in Germany – Photogrammetry & Remote Sensing, Geoinformatics, and Cartography "PFGK", March 07-09, 2018.

### **4.9 Ruhr-Universität Bochum (Ruhr University Bochum)**

Cartography is part of the Geomatics Group within the Institute of Geography at the Ruhr-University Bochum. The Geomatics Group teaches in various geography bachelor and master study programmes (more than 1400 students) available in Bochum. In these programmes cartography, remote sensing, GIS and modelling are integral parts in the teaching. A specific M.Sc. programme offers students to specialise in geomatics (<https://www.geographie.ruhr-uni-bochum.de/forschung/geomatik/home-news/>).

#### *Research*

During the report period the research topics included digital cartography, geo-information systems, web mapping, 3D cartography, satellite cartography and user-oriented cartography. In addition to research, relevant aspects of practical cartography were also considered. The main topics in cartographic research are summarised as follows:

- Volunteered Geographic Information
- VR / AR techniques for visualization of spatial information
- Experimental user-studies on map use in a research-based learning environment
- efficiency analysis of thematic maps (empiric cartography)

- 3D-Geovisualisation / photorealistic 3D-modelling of buildings
- 2D and 3D visualization
- satellite-based maps
- multimedia representation and communication
- web mapping / web gis
- thermal mapping
- lenticular foil techniques for thematic cartography
- cognitive mapping.

#### *Education*

In addition to the regular teaching, the geomatics group offers courses for professionals to update and supplement their professional skills. These courses focus on the following topics:

- 
- geographic information systems (open source)
- GIS, web gis, remote sensing
- Visual programming languages
- Open Source Software
- use of open source data
- 3D-data capture from aerial photographs
- map updating techniques from aerial photographs
- cartographic presentation with GIS.

#### *Further information:*

<http://www.geographie.ruhr-uni-bochum.de/forschung/geomatik/home-news>

### **4.10 HafenCity University Hamburg**

#### *Research*

Cartography at the HafenCity University Hamburg is conducted at the Lab for Geoinformatics and Geovisualization (g2lab), headed by Prof. Dr. Jochen Schiewe. The lab focuses on the development of methods and applications which are positioned at the interface between Geovisualization, Remote Sensing and Geoinformatics. Main projects in the report period were concerned with

- developing new algorithms for data classification and aggregation considering the spatial context;
- developing concepts and prototype implementations for the consideration of uncertainties in geodata and derived products for decision making purposes;
- investigating user behaviour in the context of media maps and optimizing the generation process;
- developing concepts and methods for adapted smartphone visualizations for pedestrian navigation purposes considering cognitive processes;
- developing a semiological methodology on the comparability of current and historical maps;
- developing web-based cartographic visualizations for presenting and exploring data and information in the context of a “Geographical Heat Information and Simulation System”.

#### *Education*

Education in Cartography at HafenCity University Hamburg is embedded in the study programs on “Geodesy and Geoinformatics”. While there is only little consideration in the Bachelor of Science course (with only one larger course on Cartography, besides other lectures in GIS, Remote Sensing, etc.), the Master of Science program offers a specialization area in “Geoinformation Technologies” with a strong emphasis on (geo-)visualization topics which are taught in various formats (lectures, seminars, projects).

*Further information:* [www.g2lab.net](http://www.g2lab.net)

#### 4.11 University of Applied Sciences Würzburg-Schweinfurt

##### *Education*

Cartography plays a big role in the Bachelor study programme “Geovisualisation”. Within the fields of Virtual and Augmented Reality teaching of cartographic principals is part of the lectures. GIS, spatial modelling, remote sensing is also integrated in the study programme.

##### *Research*

How to realise modern wayfinding and visualisation in 3D-Maps, combined with virtual and augmented reality, together with hotorealistic 3D-modelling of buildings and landscapes is part of our research.

#### 4.12 Leibniz Institute for Regional Geography Leipzig

The Leibniz Institute for Regional Geography (IfL) is the only non-university research institute for geography in Germany including one department with a sole focus on cartography, atlas research and production and visual communication.

##### *Research*

The IfL research on cartography and geovisualization focuses on the understanding and use of mapping by experts and prosumers, interactions, animation and the visualization of dynamic processes, e.g. of commuters or migration. We concentrate on researching and implementing concepts and techniques for atlas compilation, atlas production and the analysis of atlases. Diverse approaches to map production and multi-perspective map use are central in this research. We develop methodologies for the synchronous and diachronic comparative analysis of atlases. Using multi-perspective approaches, we also provide geovisual support for Citizen Science initiatives such as ornithological observations by developing appropriate cartographic evaluation modules and empirically investigating their use. A regularly updated digital base map provides the cartographic basis for many mapping products created by the institute. Geovisualization and its research support the main research objectives of the institute.

More information about our research and developments can be found here:

- Moser, Jana; Koslitz, Sebastian (2016) Pins or Points?—Challenges in Producing Cartographically Appealing Webmaps Within an Editorial Environment for LiD Online. In: Georg F. Gartner, Markus Jobst und Haosheng Huang (Hg.): Progress in Cartography. EuroCarto 2015: Springer International Publishing (Lecture Notes in Geoinformation and Cartography): 83–98.
- Bode, Volker; Lentz, Sebastian; Moser, Jana (eds.) (2017) Deutschland aktuell 2. Leibniz-Institut für Länderkunde. Leipzig: Leibniz-Institut für Länderkunde e.V. (IfL).
- Moser, Jana (2018) Neogeographie - Über Chancen und Herausforderungen für die kartographische Forschung. KN (Kartographische Nachrichten: Journal of Cartography and Geographic Information) 68 (3): 113–119.
- Harvey, F. (2018) “Considerations of graphical proximity and geographical nearness” In Winter, S., Sester, M., & Griffin, A. Proceedings 10th International Conference on Geographic Information Science (GIScience 2018), Berlin:Springer Verlag, 4:1-18.
- Harvey, F. & Losang, E. (2019) Bertin’s matrix concepts reconsidered: transformations of semantics and semiotics to support geovisualization use Cartography and Geographic Information Science, 46 (2). 152-162.

##### *Products*

In addition to many maps produced for in-house publications, journals and research partners the institute is specialized in atlas production and different forms of animated and interactive maps. Following on the National Atlas of Germany (NAD) – published between 2000 and 2007 – the institute provides the following products either in print or as online products:

- **www.nationalatlas.de** (started in 2011) is an atlas portal, an information platform and archive on regional, national and thematic atlases. The portal also provides the user the opportunity to



connect with other IfL-visualizations like “Europe in Maps” or “Kleiner Atlas der Siedlungsnamen”.

- **Nationalatlas aktuell** (launch in 2007) is an online journal that brings a new theme of current interest every month such as natural hazards, the education situation, health or demographic development in continuation of NAD. The themes and maps focus on Germany and Europe.
- **hin&weg**. (2019) A new version of the software will help city planners, statisticians and also the public gain a better understanding of migration in communities of Germany. The software is currently in a first round of development with several German cities.
- **Landschaften in Deutschland online** (started in 2015) extends a rich print regional geography series of nearly 80 monographs, through an online portal to supplemental information and excursions.

#### **4.13 Beuth Hochschule für Technik Berlin (Beuth University of Applied Sciences Berlin)**

No report submitted.

#### **4.14 Leibniz University Hannover**

No report submitted.

#### **4.15 Helmholtz Centre Potsdam German Research Centre for Geosciences**

No report submitted.

## 5 Major Map Collections in Libraries

### 5.1 State Library Berlin, Map Department

[sbb.berlin/karten](http://sbb.berlin/karten)

The map department holds the largest map collection in the German speaking area. With around 1,200,000 maps (print) and more than 200,000 maps as electronic images, 155,000 views, 35,500 atlases, 38,000 volumes of cartographic literature, 2,900 CD-ROMs / DVDs and about 1.000 globes and reliefs the collection covers a very broad spectrum. The focus is on the acquisition of topographic map series from all periods and countries, city plans around the world and old maps, especially from the 19th century. In the last two years – and particularly in the subject field topographic maps – it was possible to complement our collections by numerous additions, as the selection of large scale map series clearly shows:

Afghanistan 1:50,000  
Armenia: 1:50,000  
Belize: 1:50,000  
Bosnia and Herzegovina: 1:25,000  
Bulgaria: 1:50,000  
Israel: 1:25,000 and 1:50,000  
Morocco: 1:25,000  
North Macedonia: 1:50,000  
Mexico: 1:50,000  
Slovenia: 1:50,000  
Togo: 1:50,000  
Tunisia: 1:25,000 and 1:50,000  
USA: all scales

A synopsis of modern topographic map series in the holdings of the map department is accessible online, countries are arranged in an alphabetical list. The listing contains 2,066 map series. A number of entries provide additional information like, e.g., index sheets, geoportals or information on grids and datums: <http://sbb.berlin/k04uq1>

The acquired cartographic literature is systematically catalogued in the Bibliographia Cartographica, the search of publications published from 1989 onwards are accessible online free of charge: <http://bc.staatsbibliothek-berlin.de/index.php?lang=en>. The database directly links to more than 8,500 free documents. The international journal exchange of the journal Kartographische Nachrichten which is organised on behalf of the German Cartographic Society (DGfK) provides a major support for the collection of data for this international bibliography. Bibliographic details for all titles (maps, atlases, cartographic literature) published from 1940 onwards are searchable online in the electronic catalogue of the Staatsbibliothek zu Berlin (StaBiKat: <http://stabikat.staatsbibliothek-berlin.de/>), the integration of older titles into this is ongoing, the conversion will finish in 2023. Old printed maps and atlases published before 1851 are listed in the IKAR-Database of old maps: <http://ikar.staatsbibliothek-berlin.de/>. It is an online database free of charge which records the holdings of 16 map collections. Antiquarian acquisitions especially those of the 19th century are made in the framework of the Collection of German Prints. Digitised maps are made available via the digital collections portal of the Staatsbibliothek as well as via the World Digital Library and similar projects. Various exhibitions will be supplied and reprints are produced. The Map Department closely cooperates with various scientific partners. Special emphasis is put on the georeferencing and transformation of old land surveys for their integration into WebMapServices. Since 2016 the Deutsche Forschungsgemeinschaft has supported

the setup of the Specialised Information Service Cartography and Geodata (SIS Maps): <https://kartographie.staatsbibliothek-berlin.de/en/>

*Publications:*

- Crom, Wolfgang ; Heinz, Markus: Karten, Kartographiegeschichte, Geschichtskarten. – In: Clio Guide – Ein Handbuch zu digitalen Ressourcen für die Geschichtswissenschaften hrsg. von Laura Busse, Wilfried Enderle, Rüdiger Hohls, Gregor Horstkemper, Thomas Meyer, Jens Prellwitz, Annette Schuhmann, Berlin 2016 (=Historisches Forum ; 19). Online version see: <http://www.clio-online.de/guides/sammlungen/karten-kartographiegeschichte-geschichtskarten/2016>
- Crom, Wolfgang: Der Fachinformationsdienst Kartographie und Geobasisdaten. – In: Kartographische Nachrichten 66. – 2016, H. 2. – S. 89 - 92
- Crom, Wolfgang: Kartendigitalisierung – Bunttes Bild oder Mehrwert. – In: Kartographische Nachrichten 66. – 2016, H. 5. – S. 243 - 248
- Crom, Wolfgang: Ausstellung Landkarten seit dem 18. Jahrhundert : 275 Jahre Schropp. – In: Kartographische Nachrichten 67. – 2017, H. 6, S. 339-342
- Bertelmann, Roland, Wolfgang Crom u.a.: Fachinformationsdienste für die Wissenschaft. – In: Rundbrief Geographie 265. – 2017. – S. 12 - 14
- Crom, Wolfgang und Anja Rieckert: Nutzung von Geodaten im Forschungsbereich. Ergebnisse einer Umfrage. – In: Kartographische Nachrichten 68. – 2018 H. 4, S. 208-210
- Atlas des Zisterzienserstifts Neuzelle : General-Plan Neu-Zellischen Stifts-Territorii in verschiedenen Abteilungen, oder Grund Risse sämtlicher unter des Fürstll. Freye Stifft und Closter Neu Zelle gehöriger Vorwerker und Dorfschaften / herausgegeben von der Stiftung Stift Neuzelle ; Wolfgang Crom und Egon Klemp. Berlin : Verlag für Berlin-Brandenburg, 2018

## **5.2 State and University Library Goettingen, Map Collection**

No report submitted.

## **5.3 Saxon State- and University Library, Map Collection**

No report submitted.