

# Potential uses of the GEOSS in the domain of hydrology in Germany

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## **Final Report**

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**BMVI Research Project No. 50.0355/2012 (Duration: 12/2012-09/2015)**

**Realization of the Global Earth Observation System of Systems (GEOSS)**

**Supervision: Carsten Dettmann, BMVI**

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### **Summary**

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The German Federal Ministry of Transport and digital Infrastructure (BMVI) tasked the University of Bonn within the framework of the Research-Project No. 50.0355/2012 “Realization of the Global Earth Observation System of Systems (GEOSS)” (runtime 12/2012 to 09/2015) to conduct a conceptual study on the subject “Use potentials of the GEOSS in the domain of hydrology in Germany”. Goal of the study was to identify and demonstrate potential uses of the Group on Earth Observations (GEO) as international network and cooperation platform and of the Global Earth Observation System of Systems (GEOSS) as geodata infrastructure. For this purpose, based on online searches and expert discussions, the potential uses of GEO and GEOSS were identified and classified. Subsequently, four selected use cases were experimentally implemented and demonstrated in cooperation with national partners. The main cooperation partner was the German Federal Agency of Hydrology (BfG). National datasets and databases of the BfG were connected to the German geodata infrastructure (GDI-DE) during the runtime of this project and thus made freely available as an important contribution to the GEOSS.

To encourage the involvement of national actors within the further development of the GEOSS and as contribution to the GEO resource mobilization task, the document “Guideline on GEO related funding opportunities in the subject area of hydrology” was developed in German, to facilitate the acquisition of GEO related projects. Through the acquisition of a GEO related Horizon 2020 project during the project runtime, together with German and European partners, the resource mobilization capabilities gained through the participation in GEO activities was successfully demonstrated.

The international and national coordination with different GEO actors and entities, participation in GEO events and working groups and the involvement in the development of strategic and conceptual GEO documents and discussions ensured the embedding of the project work within the global framework of GEO. Project results and preliminary results have been presented on the national and international level at GEO events and scientific conferences.

Through the project work and results several GEOSS components in the framework of the GEO Work Plan 2012-2015 have been supported by the University of Bonn. Primarily the areas water, biodiversity, science & technology, user engagement and resource mobilization have been addressed within the project. It was possible to contribute to the design of the future GEO Work Programme and to involve national actors in this process. The contributions to different GEOSS components, the continued involvement of German actors in GEO related activities, and the raised awareness of GEO and GEOSS achieved by this project can be seen as a long-term contribution to GEO and the future development of the GEOSS.

# Potential uses of the GEOSS in the domain of hydrology in Germany

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Within a research and development project (Project-No.: 50.0355/2012), funded by the German Federal Ministry of Transport and digital Infrastructure (BMVI), the University of Bonn developed a conceptual study to identify use potentials of the GEOSS exemplified for the domain of hydrology in Germany. The identified potential uses and exploitation capabilities were demonstrated and experimentally implemented within four use cases in cooperation with the German Federal Institute of Hydrology (BfG<sup>1</sup>).

## 1. Objective

Objective of the conceptual study was to identify different potential uses and exploitation capabilities of the GEOSS and the Group on Earth Observations (GEO) (as community and network). In a second step, selected examples of these uses and capabilities were to be demonstrated together with national cooperation partners. The focus on hydrology was selected to directly support the GEO Water Task. Additionally, this focus allowed building on the existing cooperation with the BfG that was essential for the successful implementation of the use cases.

A further objective of the project was to involve German users in GEO activities by informing them about synergies between their own tasks and work and the GEO Work Plan. Throughout the project work, the University of Bonn was expected to directly contribute to different GEOSS components in the areas of water, science & technology, user engagement and resource mobilization.

## 2. Approach

By means of online search, document analysis and expert discussions with staff members of the BfG and other national institutions, topics within hydrology were identified that were suited for the implementation of a potential use analysis. Within these defined topics and through discussions with experts the actual potential uses and exploitation capabilities of GEO and GEOSS were identified and classified. Within selected use cases, these uses and capabilities were then demonstrated in cooperation with the BfG and other cooperation partners. Besides this study, a guideline on resource mobilization for GEO related projects in the field of hydrology was developed, targeting German researchers, institutions and agencies.

To ensure the necessary strategic and thematic connection between these activities and the GEO Work Plan, and to identify interfaces and cooperation potentials for national actors, the University of Bonn was active within different GEO Communities of Practice (Water, Biodiversity), the GEO Societal Benefits Implementation Board, and participated in many GEO events, webinars and telephone conferences. Additionally, the University of Bonn cooperated tightly with the international GEO Secretariat and the German Group on Earth Observations (D-GEO<sup>2</sup>) and a regular exchange with Carsten Dettmann, the German GEO Principle Alternate from the Federal Ministry of Transport and digital Infrastructure, was maintained.

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<sup>1</sup> <http://www.bafg.de/EN/>

<sup>2</sup> [http://www.d-geo.de/index\\_en.htm](http://www.d-geo.de/index_en.htm)

### 3. Results

Based on the GEO Work Plan 2012-2015 and the conducted online search potential topics that were suitable for conducting the study were identified. One of the criteria for selection was for example the sufficient incorporation and importance of the topic within the GEO Work Plan. Another important requirement was the relevance of the topic within the national tasks and duties of the BfG. In expert discussions with the BfG and based on the pre selection a final selection of three topics was made to build the thematic frame for the study and the experimental implementation:

1. Sediment and hydromorphology
2. Wetlands
3. Water Surface Temperature

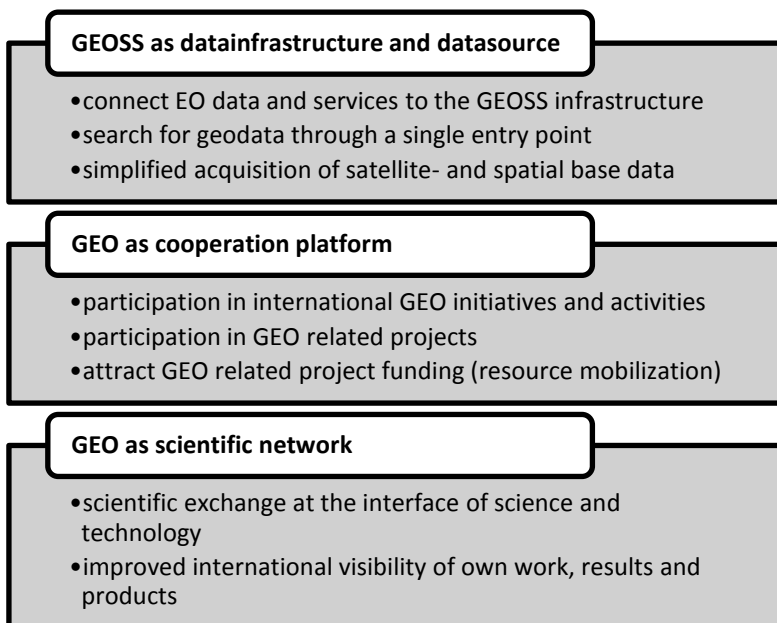


Fig. 1: Classification of identified potential uses of GEO and GEOSS

Primarily within these three topics, a use potential analysis was conducted, based on expert discussions with staff members of the BfG and other national agencies and institutions. Goal of the analysis was to identify different possible uses and exploitation capabilities of GEO and the GEOSS for different national actors. The identified use potentials were summarized into three categories (see Fig. 1).

To demonstrate these use potentials, four use cases were developed together with

cooperation partners, to experimentally implement some of these uses. Two of them are targeting at the use of GEOSS as technical (data) infrastructure for the connection and provision of own Earth observation data. The other two use cases highlight the use of GEO as cooperation platform and scientific network. The following sections summarize the use cases and their results.

#### a) Use case 1 – Connection of national river discharge data to the GEOSS

Based on international standards of the Open Geospatial Consortium (OGC) that were further developed within the EU Project GEOWOW (GEOSS Interoperability for Weather, Oceans and Water), within the framework of this project, the BfG published German river discharge data via the German geodata infrastructure (GDI-DE<sup>3</sup>). For this purpose a server was installed, using the OGC Sensor Observation Service 2.0 to make sensor data available in the WaterML 2.0 format. Fig. 2 schematically shows how the provision of the national river discharge data is implemented via a SOS 2.0 Server. Currently the data can be viewed through a visualization client available on the Geoportal

<sup>3</sup> <http://www.geoportal.de/EN/>

of the BfG<sup>4</sup> and the service is registered in the German geodata catalogue (Geodatenkatalog.de). Basically, the use of the SOS 2.0 technology allows direct access to the server, making it possible for applications to find and use the sensor data through the GEO Discovery and Access Broker (GEO DAB) (see dashed lines in Fig. 2). The consequent use of these new standards is therefore an important step towards enabling future information systems to connect and use different complex data sources.

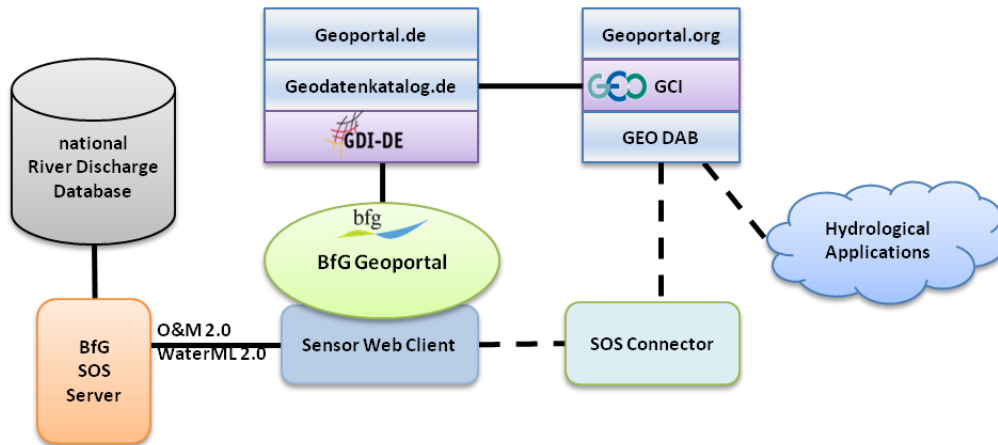


Fig. 2: Use of the SOS 2.0 for provision of national river discharge data.

## b) Use case 2 – Connection of national sediment data to the GEOSS

In a second, similar case example that was developed together with the BfG, the goal was to improve the discoverability of the sediment database of the BfG (SedDB). Up to now, these datasets were only available for staff of the BfG and the German Water and Shipping Administration through a database interface (see Fig. 3).

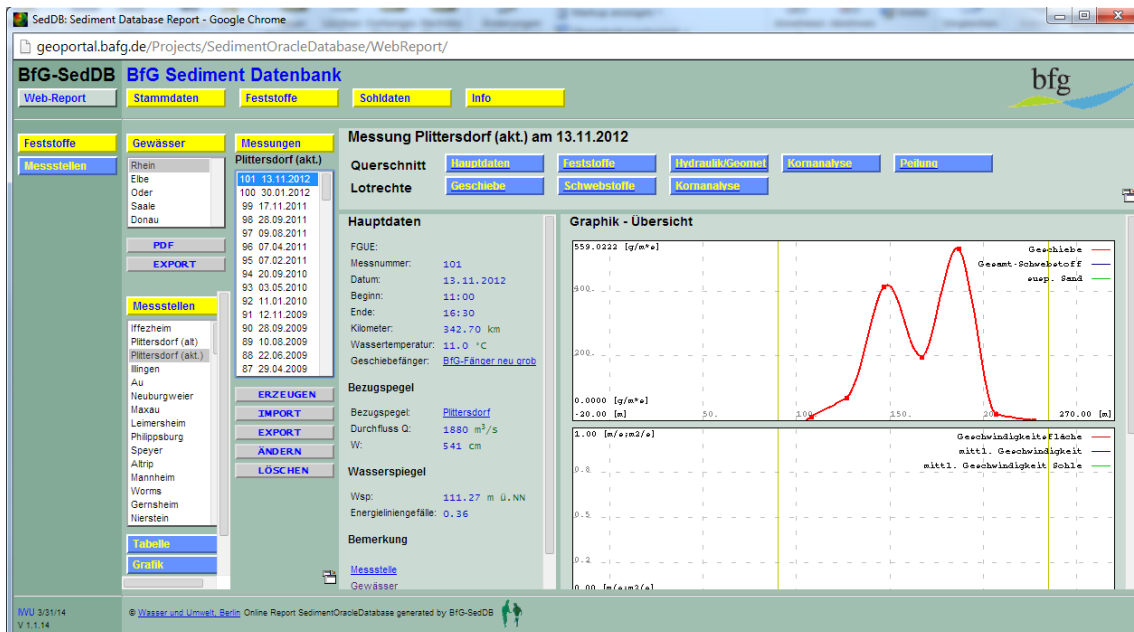


Fig. 3: SedDB database interface available through the BfG Geoportal.

<sup>4</sup> BfG Geoportal: [geoportal.bafg.de](http://geoportal.bafg.de)

Throughout the project runtime, the metadata of the datasets and of the service have been adjusted, and an additional information sheet about the data quality and used measurement methods was created. The metadata was then published via the Geodatenkatalog.de. The datasets and service can now be found on the Geoportal.de and the Database can be directly viewed through the BfG Geoportal.

For both Use Case 1 and 2 the connection to the German Geodata Infrastructure (GDI-DE) could be realized. But it became obvious, that the connection between the Geoportal.de and the international GEOSS Portal is not functioning as intended, so that that the GEOSS Portal currently is not able to find all the data that is registered via the Geodatenkatalog.de. A solution for this problem is being worked out.

### **c) Use case 3 – International cooperation in the framework of GEO**

At the example of the Global Wetland Observation System (GWOS) it was demonstrated how national actors can benefit from contributing to, and participating in, international GEO initiatives and activities. The GWOS is currently in a conceptual phase and planned and coordinated by the GEO Biodiversity Observation Network (GEO BON) together with the Ramsar Convention on Wetlands and other partners. It was shown how the participation in such international frameworks can provide cooperation opportunities and ways for raising international funding. Thus, participation of national organizations, institutions and individual researchers can help to mobilize longer term resources. Such resources are very important to ensure that national actors are able to stay involved in GEO activities and hereby contribute to the further development of the GEOSS.

Within the project it was possible to directly demonstrate this potential use of GEO by successfully launching the strongly GEO related “Satellite-Based Wetland Observation Service” (SWOS) Horizon 2020 project together with a team of German and European partners. The project has a total budget of almost 5 Mio. Euro and provides the necessary funding to keep four German and nine European institutions involved in the further development of the GEOSS over the course of three years.

### **d) Use case 4 – International scientific networking through GEO**

Within the topic “surface water temperature” the capabilities of GEO as scientific network have been demonstrated by identifying the different means and tools GEO offers for communication, information exchange, presentation and cooperation. The GEO Communities of Practice, GEO Events (conferences and workshops) as well as GEO Webinars offer many opportunities for networking, presenting own work results and discussing ideas with international colleagues. Additionally GEO and the Communities of Practice provide different newsletters and websites that inform about recent and upcoming activities, events etc. A very important feature is the multidisciplinary character of GEO that allows to work across disciplinary borders and to develop ideas together with colleagues from other thematic areas.

### **e) Use of GEOSS as data source**

In parallel to the development of the four use cases the usability of the GEOSS Portal as a data source has been preliminarily tested. As already mentioned under use case 2, these tests have identified problems regarding the connection of the German metadata catalogue to the GEOSS infrastructure. Further, as a résumé of the experiences made with the GEOSS portal, it can be said that at least for

the example of river discharge data it is rather difficult to identify useful data and directly access it through the portal. The search results list makes it difficult to evaluate the contents of the different entries, some entries were listed that were not thematically connected to the used keyword and finding out how to access the actual data through the metadata sheet is not very intuitive or user friendly. Because of the very small scale of the conducted tests this can only be seen as use experience of the GEOSS Portal and not as a representative test. In other thematic areas and with a bigger sample size, a test may deliver different results.

#### **f) Involving national actors in the further GEOSS development**

The involvement of national actors within GEO and the development of the GEOSS have been supported by the project through identifying thematic synergies and opportunities for participation. Additionally, based on an extensive online search and the cooperation with national contact points of funding organizations, a guideline has been developed about possibilities for funding of GEO related projects. And, as mentioned in use case 3, the successful acquisition of the SWOS Horizon 2020 project provides the opportunity for four German institutions and companies to contribute to the development of the GEOSS until 2018 within the framework of the new GEO Strategic Plan (2016-2025), together with 9 European partners.

#### **4. Conclusions**

The described results show that all the set targets of the projects have been fulfilled within the project runtime. A very positive result was the provision of national datasets and services to the GEOSS via the national Geodata Infrastructure of Germany. Use cases 1 and 2 were able to demonstrate how the connection of national datasets can be realized. On the long term, making data globally available and accessible in such a way will improve the capabilities for developing Earth observation applications and services to support decision making processes on different levels. Further, it was possible to involve national actors in GEO activities within the framework of the new GEO Strategic Plan (2016-2025) through the participation in a successful Horizon 2020 project proposal.

The use cases and documents developed within the project contribute to improving the visibility and awareness of GEO and the GEOSS and support the active participation of national actors. Although, the project has been implemented in the thematic area of hydrology, basically most of the results and experiences are transferable to other societal benefit areas of GEO.