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Data Management Centre of the Federal Waterways and Shipping Agency, Northern Region Office

Ronny Beyer, Axel Orths and Lothar Neumann

Summary

The Data Management Centre (Zentrales Datenmanagement, ZDM) has been operating the portal system www.kuestendaten.de since 2008 as an information platform for the northern coastal area, including the estuaries, rivers and canals under the competence of the Federal Government. The main task involved is documenting the construction works carried out on federal waterways within the sphere of competence of the Federal Waterways and Shipping Agency, Northern Region Office (GDWS, Northern Region Office). The ZDM is responsible for distributing technical data and information on hydrology, nature conservation, remote sensing technology and any additional environmental data that is commonly available.

In recent years it has been possible to further extend the range of data and information offered. It now also includes plausibility tested time series, complete and consistent digital terrain models, ecological data, data related to the documentation of existing conditions and a database of publications. In addition scoping papers, planning documents and plan approval decisions are provided on an area and project basis on the general entry portal and the five regional portals Tidal Elbe (Tideelbe), Kiel Canal (Nord-Ostsee-Kanal), North Sea Coast (Nordseeküste) and Baltic Sea Coast (Ostseeküste).

The provided data is made available both for manual research and for access through standardised interfaces like Web Mapping Service (WMS), Web Feature Service (WFS) and Sensor Observation Service (SOS).

The user can perform spatial searches using a map tool. For visualising a time series a state-of-the-art Sensor Web Client is available.

Keywords

extension, existing conditions documentation, German coast, data provisioning, Elbe estuary, extension of the River Elbe, deepening of the Elbe, extension of the River Ems, GDWS Northern Region Office, geospatial data, new construction projects, North Sea coast, Baltic Sea coast, planning approval, planning documents, Tidal Elbe, Tidal Ems, WSV, time series, ZDM, German Bight

Zusammenfassung

Das Zentrale Datenmanagement (ZDM) betreibt das Portalsystem www.kuestendaten.de seit 2008 als Informationsplattform für den norddeutschen Küstenbereich, seine Ästuare, Flüsse und Kanäle im Zuständigkeitsbereich des Bundes. Die wesentliche Aufgabe besteht in der Dokumentation von Baumaßnahmen an Bundeswasserstraßen innerhalb des Zuständigkeitsbereichs der Generaldirektion Wasserstraßen und Schifffahrt - Außenstelle Nord (GDWS Ast. Nord). Das ZDM übernimmt die

Verbreitung von Fachdaten und Informationen aus den Bereichen Gewässerkunde, Naturschutz, Fernerkundung und weiterer allgemein verfügbarer Umweltdaten.

Das Angebot an Daten und Informationen konnte in den letzten Jahren immer weiter ausgebaut werden und beinhaltet u.a. plausibilisierte Zeitreihen, komplette konsistente digitale Geländemodelle, ökologische Daten, Beweissicherungsdaten und eine Publikationsdatenbank. Dazu kommen Scopingpapiere, Planunterlagen, genehmigte Planfeststellungsbeschlüsse, die gebiets- und projektbezogen auf dem Einstiegsportal und den fünf regionalen Portalen Tideems, Tideelbe, Nord-Ostsee-Kanal, Nordseeküste, Ostseeküste bereitstehen.

Die angebotenen Daten werden sowohl für die manuelle Recherche als auch über standardisierte Schnittstellen, wie Web Mapping Service (WMS), Web Feature Service (WFS) und Sensor Observation Service (SOS) zur Verfügung gestellt.

Eine räumliche Suche über ein Kartentool ist möglich und zur Visualisierung von Zeitreihen ist ein moderner Sensor Web Client im Einsatz.

Schlagwörter

Ausbau, Beweissicherung, Deutsche Küste, Datenbereitstellung, Elbeästuar, Elbausbau, Elbvertiefung, Emsausbau, GDWS Ast. Nord, Geodaten, Neubauvorhaben, Nordseeküste, Ostseeküste, Planfeststellung, Planunterlagen, Tideelbe, Tideems, WSV, Zeitreihen, ZDM, Deutsche Bucht

Contents

1 Introduction

Since October 2008, all data and digital documents related to the complete range of new and ongoing construction and extension projects falling under the competence of the Federal Waterways and Shipping Agency, Northern Region Office (GDWS Northern Region Office) have been captured and merged by using standardised criteria and made available over the Internet at the Data Management Centre (ZDM). Thus the offices of

the GDWS, Northern Region Office can use the ZDM as a new service facility that takes on an additional role as information centre for external users against the background of freedom of information and environmental information laws.

The database of the ZDM is available at www.kuestendaten.de. This is the entry page to the regional portals for the North Sea (www.portalnsk.de), Kiel Canal (www.portalnok.de), Tidal Elbe (www.portal-tideelbe.de) and Baltic Sea (www.portalosk.de), which are also directly accessible through their respective web addresses. The regionally organised portals document specific data and information on construction works carried out by the Waterways and Shipping Offices in that particular region. The Tidal Ems portal (www.tideems.de) is unique in so far as it falls outside the competence of the GDWS, Northern Region Office. The area boundaries (see Fig. 1) are approximate points of reference for the regional portals' study areas; the lines do not represent areas of responsibility within the structures of the Waterways and Shipping Administration.

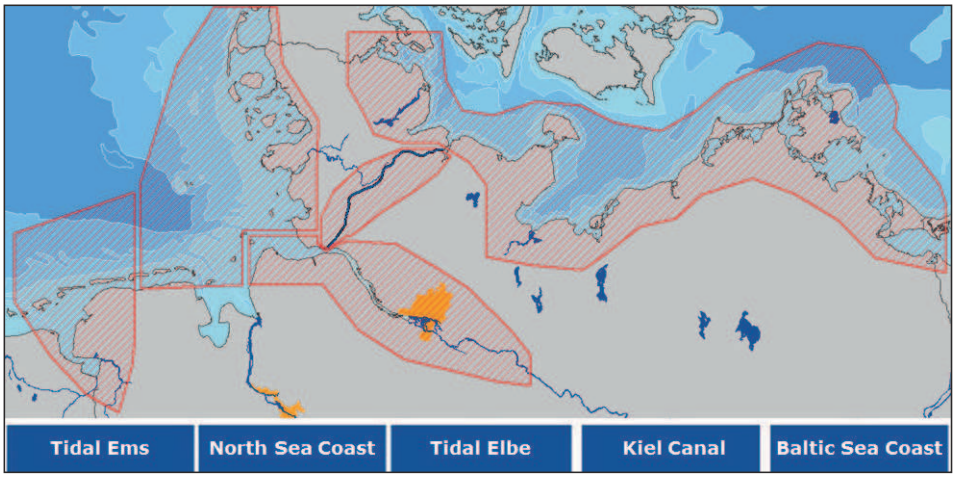

Figure 1: The regional subportals of www.kuestendaten.de.

2 Centre for data provisioning and publishing

The ZDM originated from the data collection centre established for measuring and documenting existing conditions in connection with the adjustment of the Lower and Outer Elbe fairways to the requirements of container ships. The data collection centre was set up in compliance with a provision in the plan approval notice of 02/22/1999 stipulating free access to the database of existing conditions for the regulatory authorities (*Einvernehmensbehörden*) of the federal states. In addition to merging data of new construction projects, the ZDM is now responsible for supporting the authorities in all aspects of specialised IT-supported data storage and visualisation. By pooling specialised and IT knowledge in the GIS, CAD and database areas and by ensuring free access to information and data repositories the requirements of the regulations of both the Environmental Information Act (Umweltinformationsgesetz, UIG) and the Freedom of Information Act (Informationsfreiheitsgesetz, IDF) are met at the same time. The services

provided by the ZDM also include the development and provision of formatting and layout specifications that can serve as templates for tender issuing offices.

3 Collaboration with the Information Technology Service Centre in Ilmenau

In fulfilling its tasks the ZDM is supported by the centralized server hardware and the IT contracting authority of the Information Technology Service Centre (DLZ-IT) in Ilmenau. This collaboration, which is designed as a long-term project, started as early as 2002 with the ZDM's predecessor, the data collection centre, and has been continued successfully since.

The static content is managed using the WSV Content Management System and thus seamlessly fits in with the corporate design of the WSV. The dynamic content is implemented by an external service provider.

The ZDM hardware infrastructure is completely embedded in the local network structure of the DLZ-IT and the intranet of the WSV and can therefore provide general and fast access to the central services offered by the DLZ-IT. This simplifies the integration of central services provided for federal and other waterways by the WSV in the ZDM portals. In future this network will be used, for example, to access data in the water resources management information system KISTERS (WISKI) and to eliminate complex exports and imports of data. If changes are made to data, they can be used directly by the hydrological divisions with no additional efforts by the ZDM and no need for redundant data storage.

4 Regional portal Tidal Elbe

The regional portal Tidal Elbe was the first web portal to start operation. It was set up together with the data collection centre which was used in the survey of existing conditions during the last fairway adjustment in 1999/2000. The data and content provided on this portal therefore exceed what is available on the other regional portals. The functionality and content of the portal Tidal Elbe is representative of the other four regional portals of the ZDM.

The area under observation in this portal (see Fig. 1) roughly follows the regime of the Elbe estuary, extending from the weir at Geesthacht (Elbe km 588) to the mouth of the Elbe (Elbe km 760) (BOEHLICH and STROTMANN, 2008). In addition, the subareas of the tributaries at the Lower Elbe and the Binnenelbe as far as Neu Darchau are included.

The web site is divided into four areas (see Fig. 2) where the following information and data is available, as described below:

- Project information ("Projekte" (projects))
- Map ("Kartentool" (map tool))
- Time series ("Messwertassistent" (measurement wizard))
- Downloads ("Datendownload")

The closely interlinked pages can each serve as an entry point for navigating to the information and data on the individual portals. The user can easily and conveniently navigate from a map view of an oxygen monitoring network to a time series presentation and a

page where data on the oxygen parameter can be downloaded. The reverse path is just as easy. If the user enters the web page via the data download section, the map retrieval from there is equally simple.

Figure 2: Homepage of www.Portal-Tideelbe.de.

4.1 Project information

This page holds static content of projects organised in new constructions and extensions. The static content comprises scoping papers, planning documents and plan approvals presented systematically in a repetitive pattern and in a manner which is easy to follow. For larger projects a short project profile is followed by further technical content, sorted by project phase:

- Preliminary studies
- Planning
- Planning approval
- Existing conditions documentation
- Measures of compensation

On providing this information the ZDM seeks to offer the static content with the highest possible standards of accessibility and hereby ensuring that it complies with the ordinance on barrier-free information technology pursuant to the Act on Equal Opportunities for Disabled Persons (Behindertengleichstellungsgesetz (BITV 2.0)) which is applicable to the federal authorities.

There are many links leading from the areas with static content to the portals' dynamic areas, (e.g. the map tool, the data download pane, the database of publications or the presentation of time series), for example to complement a planning document with a corresponding map presentation.

4.2 Map

The display of maps is always an essential part of data portals. The ZDM portals use the map server of the Open Source Geospatial Foundation (OSGeo) which offers a variety of general functionalities. One of the most noteworthy features is the permalink which allows for permanent storage of map views and a free text search in all existing map topics.

Unlike many other geo portals the ZDM portals offer a wide spectrum of data, ranging from base geospatial data to data taken from hydrological and meteorological stations (point information) to the documentation of longitudinal and cross profiles (line data) and to large biotope type collections from High Resolution Stereo Camera (HRSC) data and comprehensive topographic models created from aerial laser scanning and hydrographical surveys (surface data).

The map topics cover the following subject areas:

- Base geospatial data
- Observational networks
- Topography
- Vegetation
- Sediment distribution
- Compensation areas
- Photo documentation
- Port documentation
- Estuary dams

4.2.1 Web Map Service and Web Feature Service

All map-related topics are freely available as a Web Map Service (WMS) and can be conveniently embedded in the user's own local GIS applications.

Each regional portal has its own separate WMS web address following the pattern set on the Tidal Elbe Portal:

http://www.portal-tideelbe.de/cgi-bin/bs

To improve the indexing capability of our maps for external and internal search engines a Web Feature Service (WFS) is used. With the WFS a description of all map topics is available so that the monitoring networks in particular can be found and presented in a better manner.

http://www.portal-tideelbe.de/cgi-bin/wfs

The standardised connection of the WISKI system (see section 3 Collaboration with the DLZ-IT Ilmenau) will use a Web Processing Service (WPS) in future to derive water level values, since this data is not stored in the WISKI database.

4.3 Time series

Among the topics dealt with in existing condition documentation great significance is attached to plausibility tested time series data related to parameters such as water level, current, electrical conductivity and oxygen. The principal focus of the portal is on

plausibility tested time series. They provide a sound basis for analyses regarding all river regime-related topics. Regular requests from research and industry prove their high value.

The following data is available in form of plausibility tested time series:

- Discharge
- Chloride content
- Electrical conductivity
- PH value
- Salinity
- Oxygen
- Flow velocity
- Flow direction
- Water temperature
- Water level data
- Meteorological data

Moreover, to ensure that the appropriate decisions are taken regarding water sampling in the *Alte Land* area, a system with near real-time capability is operated. It provides updated measurement data on electrical conductivity and temperature at currently 12 stations. Upon its completion it will enable the retrieval of data from 18 stations. The notification functionality of the Sensor Web Client used here (see section 4.3.2 Display of time series – Sensor Web Client) facilitates sending a notification via email if certain limits are exceeded.

4.3.1 Provision of time series - Sensor Observation Service

The Sensor Observation Service (SOS) is a web service interface maintained by the Open Geospatial Consortium (OGC) for accessing time series data in real time or for data archiving. The OGC SOS interface enables interoperable (pull-based) access to measurement and observation data. Analogous to the functions of other OGC services it offers operations for retrieving (or publishing, where appropriate) spatial measurement data and associated metadata (JIRKA et al. 2014).

The evaluation across applications of hydrological data from different sources is becoming increasingly important. In this field the ZDM has long been a pioneer in provisioning data from different providers. In the context of fairway extension at the Lower Elbe an essential task of the ZDM is the merging of time series data collected from the different authorities of the federal government and the federal states. Due to the fact that data producers like the Elbe River Basin Community (Flussgebietsgemeinschaft (FGG) Elbe) have not been using standardised interfaces such as the SOS interface for data provisioning, it is first of all necessary to transfer the data manually to the ZDM's database.

The Sensor Observation Service (SOS) serves as an abstraction layer to ensure data independence from specific databases. It publishes the time series data in a standardised format and deploys them on the web. Fig. 3 shows a typical configuration for the use of a SOS server. If other data providers use this interface in the future, time series data may be exchanged easily and without data duplication.

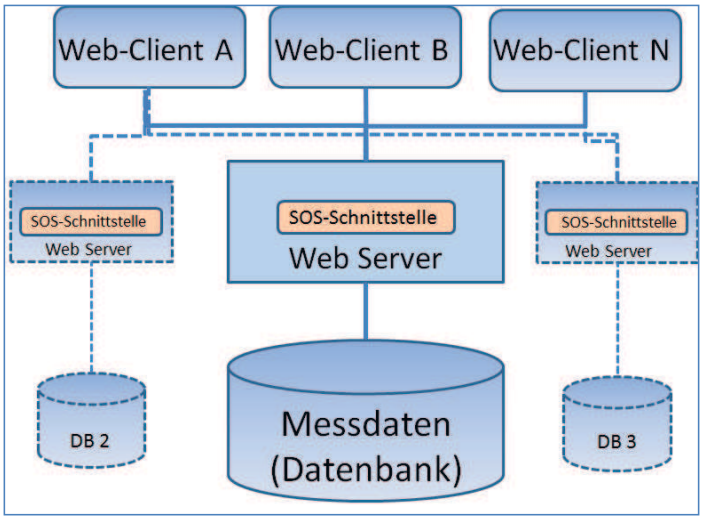

Figure 3: Typical SOS configuration.

4.3.2 Display of time series - Sensor Web Client

With the use of the Sensor Web Client (SWE Client) the ZDM aims at a user friendly presentation of different time series. The SWE Client enables a combined display of hydrographs (see Fig. 4) in an efficient and elegant manner. The version used by the ZDM is a customized version of the Open Source Client developed by the company 52 North. All changes made by the ZDM have been transferred back to the Open Source Community and are therefore openly available.

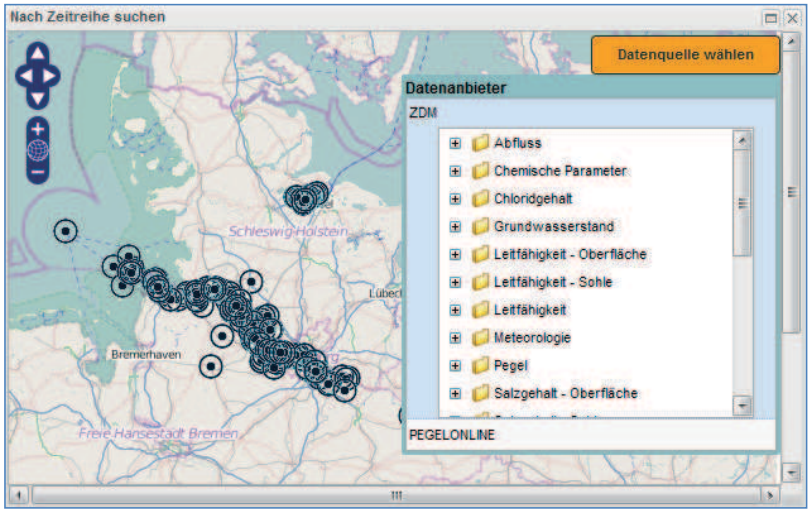

Figure 4: Sensor Web Client time series selected by measurement parameter.

A map component allows choosing a data provider (SOS interface) and one of the available parameters. A short profile of specifications presents the master data of the measuring station. If the data is of interest it can be included in the hydrographs displayed. Further time series can be loaded and combined provided the data extends over the same temporal range. As illustrated in the example of an extreme flood scenario (see Fig. 5) several different parameters can be considered in a particular period of time.

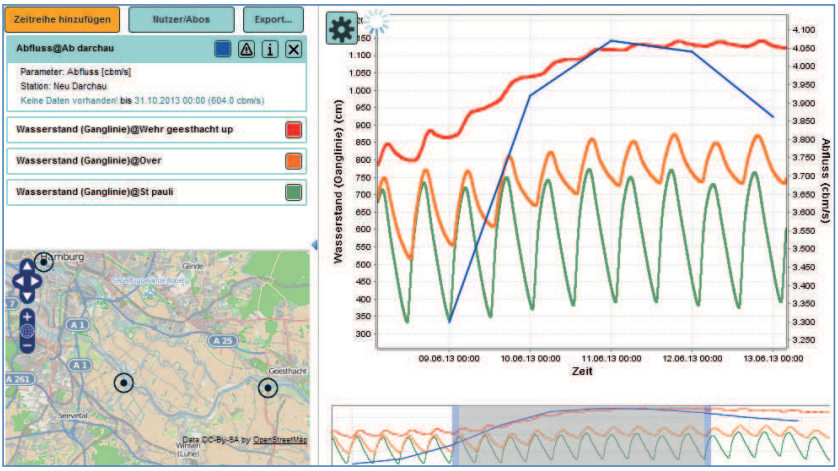

Figure 5: Sensor Web Client time series display – extreme flood event in Geesthacht on the River Elbe – water level and discharge parameters.

The following functions are available for the generation of an analytical visual display:

- Manual scaling of timeline
- Manual scaling of data axis for each parameter separately
- Customising of colours and line thickness in all hydrographs

The permalink feature enables permanent reproduction of user settings. The user only needs to save one link which contains the information required for restoring all the comprehensive adjustments made for a representation. The ZDM Web Client is available at: http://www.portaltideelbe.de/SWC/

4.4 Data download - available data

All the maps and plausibility tested time series are freely downloadable. The maps are offered in Esri shape file format and the time series in ASCII file format. In addition the user can download large data collections like a port or construction database.

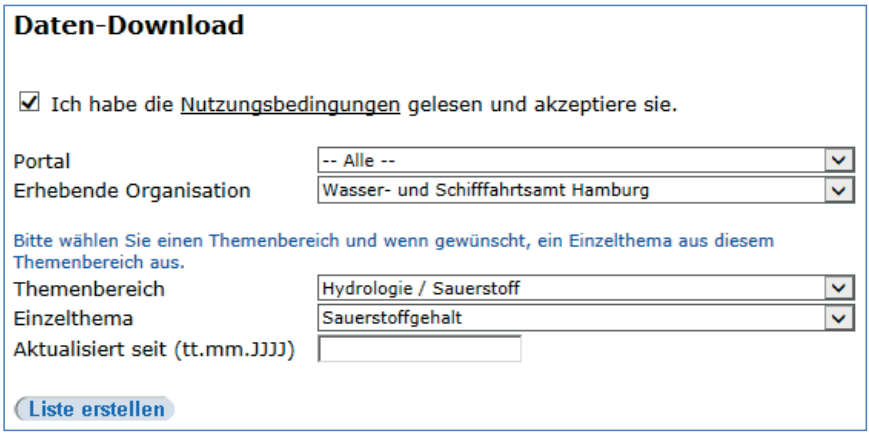

Figure 6: Data download – choices for portal, organisation and subject areas.

5 Metadata

Metadata about the available geospatial data and measuring stations of the ZDM portals are published in the German Portal for geospatial data Geoportal.de. Metadata are maintained in the WSV central metadata information system GeoKatalog.WSV and are transferred to Geoportal.de using the Catalogue Service Web (CSW) interface.

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