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The WFD reporting process - a German approach to information management in the coastal zone

THE WFD REPORTING PROCESS – A GERMAN APPROACH TO INFORMATION MANAGEMENT IN THE COASTAL ZONE

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ABSTRACT

A German coastal information system has been established, which applies the international standards for metadata and web services. It provides a user-friendly metadata editor to create and maintain vital information about distributed resources. Using a standardized information infrastructure facilitates the dissemination of information in Integrated Coastal Zone Management and supports the reporting obligations required by the Water Framework Directive of the European Union.

1 INTRODUCTION

The European Union Water Framework Directive (WFD) aims at good ecological and chemical status of all water bodies following the principles of inte-grated water resources management based on river basins, transparency and stakeholder participation (European Parliament 2000). The agreed methods are monitoring networks for status and modeling in relation to making assessment of impact.

Responsible management relies on efficient information infrastructures to facilitate information sharing both horizontally among Federal and State offices and vertically between national and international administrative bodies. The European Union is working on an environmental information structure Reportnet (Saarenmaa et al. 2002), which will support the necessary information flows.

Flexible modeling tools demonstrate the cause and effect chains of physical environmental phenomena of different onshore and offshore domains, which characterize entire coastal regions. They play an important role in the analysis of generally complex coastal systems and their wide spectrum of time scales for various processes. Operational models require detailed information as input data from a variety of sectoral disciplines hosted by different institutions in order to serve as predictive tools in decision support systems.

Meta information, defined as "data about data", provides the background for consistent documentation and efficient search mechanisms to retrieve existing data files, documents, maps, images, research papers etc. It is a central feature of information systems.

Metadata concerning geographical and temporal extent as well as thematic content for each information entity permit precise queries for management purposes, and support automated search engines and discovery services. The next step is online access to selected data and web services (Nebert 2001) for visualization and analysis purposes.

The German North Sea and Baltic Sea Coastal Information System NOKIS provides online means to search and retrieve information from the German coastal zone (Lehfeldt & Heidmann 2003). Initially a project group of German national park authorities in the coastal zone together with Federal and State institutions, responsible for coastal protection and maritime traffic, and the German Coastal Engineering Research Council KFKI joined with the intention to create standardized documentation of the locally available databases in order to share information more efficiently. Cooperation in NOKIS bridges the information gap between sectoral views such as coastal engi-neering and ecology. The common metadata profile provides a basis for finding data and information context, which is an essential requirement in Inte-grated Coastal Zone Management and of the Water Framework Directive.

Development of the NOKIS information infra-structure based on international standards and implementation of web based analysis and reporting tools related to the WFD are in progress since 2000.

An extensive information platform is available for public use. The searchable information relate to data of NOKIS partners, reports of all coastal research projects funded by the German Coastal Engineering Research Council as well as to an index of the German journal "Die Küste" and the recently implemented online open public access catalog (web OPAC) of the KFKI-library.

2 METADATA

2.1 METADATA STANDARDS

Several standards have evolved during recent years and facilitate the documentation and characterization of data, documents, maps etc. in a way that automated search mechanisms can be applied to discover specific resources.

The existing standards differ in their metadata models, which determine the granularity of information units and consequently the comfort or service to be offered in search interfaces. The well-known standards Dublin Core for literature and FGDC for geospatial data (FGDC 2001) have been in use for almost ten years. The recently adopted ISO19115 (ISO 2002) is the most comprehensive metadata standard. Different user communities are expected to create specific profiles of their own from the ISO metadata model.

The principal metadata elements of this standard are abstracts, keywords and thumbnails, where applicable, to characterize the data in storage. Entries concerning temporal and spatial coverage help localize the data. The elements for point of contact and internet addresses support data retrieval. Entries on data quality help assess the usefulness and applicability of resources discovered.

With these categories at hand, automated search procedures can focus on standardized elements to discover relevant and timely resources. The required information commonly consists of data, modeling results and written documents including pictures and maps. These complementary resources are often maintained in distributed archives.

Online discovery and resource retrieval can only be efficient if data provider publish standardized metadata along with their data, which is the prerequisite for potential users to find, understand and share the data. A working implementation of ISO19115 metadata is the North Sea and Baltic Sea Information System NOKIS.

2.2 Creating metadata

A practical metadata editor has been developed to support creation of ISO-compliant metadata according to the NOKIS profile for the coastal zone. Partner institutions use this multi-lingual web tool for comprehensive documentation of their resources.

There are a number of data where thumbnails can characterize the content in a concise way. The quality of time series recordings, for instance, can quickly be estimated by visual inspection. Also, the spatial extent of surveys can easily be recognized when shown as bounding polygons or shaded areas. Figure 1 shows a preview picture of a map as part of the metadata for a map.

Context sensitive help guides the user through the metadata model and provides examples of good practice, which have been collected during the first years of application.

The detailed metadata model supports automated text- and number-based search procedures during the discovery process, which can incorporate pre-selected topics on customized user interfaces for different user groups. The additional preview graphics provide quick overviews of data quality and thus play an important role in data assessment. The NOKIS metadata editor handles both aspects and can serve as graphical index to data holdings.

It is important to note that the editor was developed aiming at simplicity, economical use and user-friendliness. There are no license fees since NOKIS is to a large extent based on open source software, and each declared partner is granted the right of use for the metadata editor.

Java, JavaServerPages, XML, PostgreSQL and the map server of the University of Minnesota (UMM 2003) within an Apache Tomcat web server make up the software technology applied in NOKIS.

The metadata are stored locally in distributed databases, and XML-files are used for export to the central repository on the NOKIS server. There are import filters in order to make use of ArcGIS metadata. Export filters can produce different and selective views on the metadata base in order to provide metadata, which is required by other information systems such as the German Environmental Data Catalogue (UDK 2004).

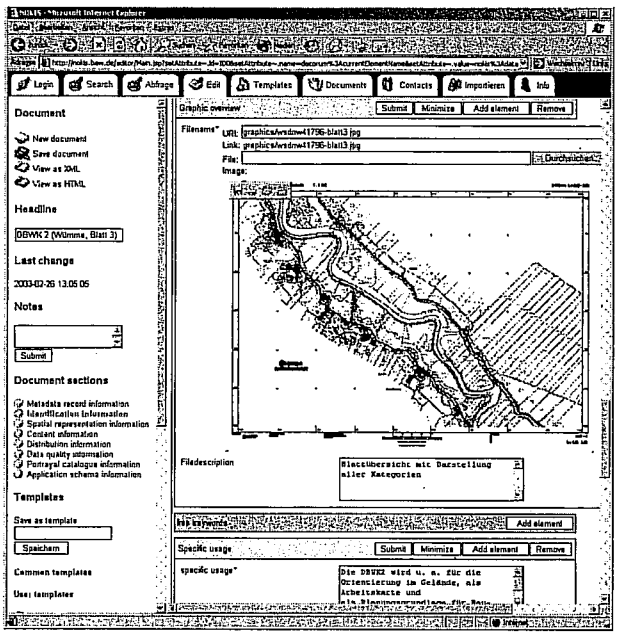

Figure 1. NOKIS Metadata editor with text and preview elements for standardized documentation.

Since all metadata contain spatial information, the NOKIS web portal provides a map server to support the searching process by geographical pre-selection and additional topics.

3 WEB SERVICES

A functioning Water Framework Directive reporting process depends on information infrastructures that allow online enquiry of geo-information and monitoring data in combination with access to further relevant resources.

The publication of standardized metadata describing data and services is one major component of web portals to support automated data discovery. The second component is the provision of common ways to access distributed data with visualization and analysis methods. These allow different views for individual user groups to gain understanding of available data sets. They also facilitate reporting obligations of Federal and State agencies within Integrated Coastal Zone Management.

3.1 Implementing web services

In addition to the standardized meta-information to locate distributed data sources according to ISO 19115, there is the ISO19119 standard, Geographic Information Services, to ensure the interoperability of web services. Within this framework, metadata relating to server based methods come into play, which customize the performance of online visualization and analysis tools. The reporting obligations related to the WFD are a new challenge for data and information management to be met by application of these standards.

The underlying implementation concept is shown in Figure 2. Data collections from monitoring and field surveys are maintained by coastal and environmental institutions as distributed resources (acronyms explained on the NOKIS web site). All data providers create metadata according to the NOKIS coastal zone metadata profile and publish them on the central web portal to support efficient searching.

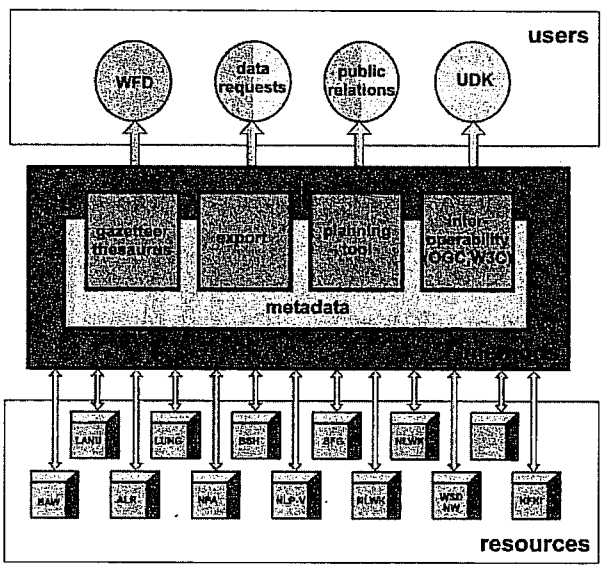

Figure 2. NOKIS++concept. Distributed resources share metadata and appropriate web services to serve user requirements.

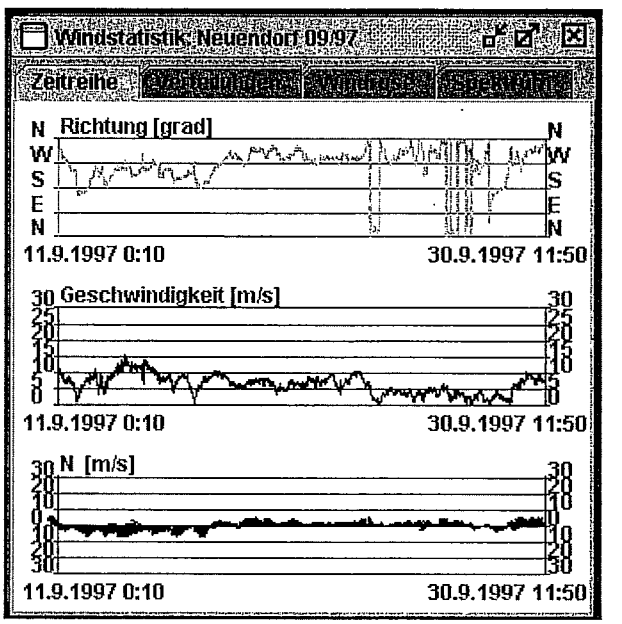

Figure 3. NOKIS Web services. Simple Visualization of wind time series.

A pool of software methods, which have been re-engineered from former stand-alone tools to web services in keeping with ISO 19119 are available to carry out simple recurrent tasks (Lehfeldt & Heidmann 2004). There are many tedious conversion tasks due to different coordinate and reference systems, which need to be handled with great care when data from different sources are used in combined presentations. Automated procedures in standardized information flows can help eliminating sources of error and improve the quality of data products.

By using these methods, more complex web services can be established, which create dedicated working environments. The "planning tool" in Figure 2, for instance, which is currently under development will be used by all coastal agencies to coordinate future surveys and data collection efforts.

Figures 3-4 are examples of simple services. They present wind data as time series including the typical stick diagram. Statistical analysis with directional and speed classifications and the resulting frequency of occurrence matrix is also carried out.

Figure 5 is another example of information integration from distributed data sources to be automated with standardized web services.

3.2 WATER FRAMEWORK DIRECTIVE REPORTING

Starting with the Surface Water Directive of 1975, reporting obligations have a long tradition in EU water legislation. Procedures have been developed to provide the Commission with information relating to the implementation of legislation to protect water resources. The Water Framework Directive presents a new approach to data and information collection and reporting, which provides a clear distinction between the information needs of different actors at different levels.

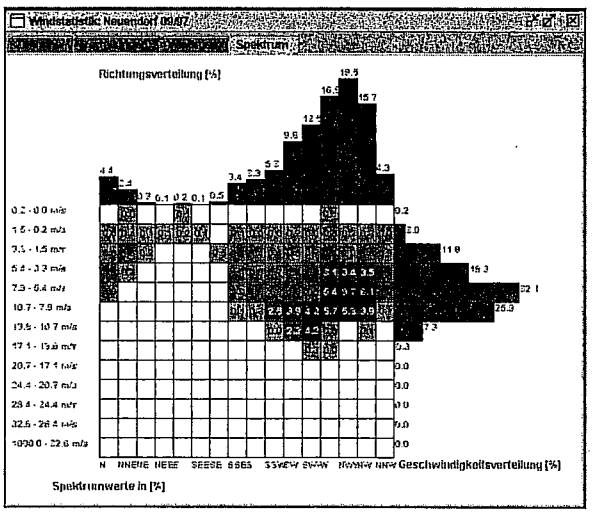

Figure 4. NOKIS Web services. Statistical analysis of wind data.

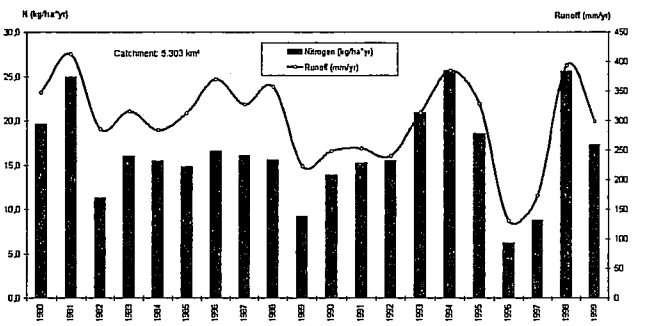

Figure 5. Baltic Sea catchment of Schleswig-Holstein: annual runoff and nitrogen load 1980 - 1999

4 CONCLUSIONS

Information requirements of the European Water Framework Directive call for more harmonization and standardization to facilitate data exchange between data providers and data users for interoperable systems.

Standardized metadata help different user communities to find and share relevant and timely information from distributed data sources. Structured metadata describe contents, spatial and temporal coverage, quality and accessibility of data. This comprehensive documentation is suitable for automated search tools and for quality assessment.

A user-friendly editor supports the creation of metadata at distributed data archives for local application. XML-files export this information to a central repository, which can be searched through a web portal.

Web services in keeping with ISO 19119 complement the metadata and provide standardized presentations and analysis of data, which are used in reporting obligations.

The German North Sea and Baltic Sea Coastal Information System NOKIS depicts a successful bottom-up approach to a coastal metadata profile based on the ISO 19115 metadata standard, and to web services related to presentation of environmental data sets and planning tasks, which is applied in Federal and State institutions charged with coastal and WFD responsibilities.

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