# WADI: Datamanagement Of Hydrographic Information

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*Rijkswaterstaat is the Dutch government agency, which is responsible for the maintenance of the water infrastructure, the protection against floods and the quality of the main water systems. To perform these tasks a lot of information is needed and therefore many measurements are performed in the fields of physics, hydrography and ecology. Of all data types the hydrographic data represent the largest volume. To manage this huge amount of data Rijkswaterstaat has developed the WADI (WAter Data Infrastructure) database.*

### Introduction

Hydrographic data is used for many purposes, for instance the data are used for safety of the land against floods, for navigational purposes and for the planning and realisation of dredging projects. Rijkswaterstaat is responsible for these tasks and therefore collects hydrographic data on a daily basis using various single beam and multibeam systems. Rijkswaterstaat is a government agency with about 8000 employees, of which at the start of 2006 101 people were involved in hydrography, located at different parts of the country. A total of 18 ships are used to perform the hydrographic surveys of Rijkswaterstaat. For hydrography Rijkswaterstaat needs a yearly budget of over 20 million euros. These figures illustrate, that hydrographic information is a costly investment and should be managed accordingly.

Rijkswaterstaat has decided to make all measurement data centrally available in a uniform format and accessible through internet. Through international co-operation in projects like SeaDataNet the exchange of data with colleague organisations is facilitated. The WADI database plays a central role in the storage and management of information by Rijkswaterstaat. Of all the measurements stored in WADI in this paper the emphasis will be on the hydrographic data.

### Work Flow

In order to organise the datamanagement the work flow around these data is essential. Previously the storage and archiving of information was a task to be performed at the end of each project. In the work flow of the information services of Rijkswaterstaat (see diagram in Figure 1) WADI has a central position. By using the central database local data storage can be avoided. This decreases the total costs for the organisation as well as the risks.

In the work flow a major distinction between the various stages of the process can be recognised. The scheme is demand driven, which means that for all data acquisition the information need of one or more end-users within the Rijkswaterstaat organisation is required. The data acquisition and validation results in data with a well defined quality level and format. Thus the need reconcile this phase later in the process in minimised. Data storage is now an integral parts of the work flow. Through the meta-data stored together with the measurement data a complete data set is stored and archived. Data processing and presentation is a separate part of the scheme, thus emphasizing the special skills needed for this work.

This description of the work flow has several advantages:
- There is a logical distinction in data acquisition and data processing.
- A better control of the data quality can be reached. The quality management system (QMS) ensures good data quality for WADI.
- Re-use of data is facilitated by this scheme. The database contains the validated data as well as processed data (e.g. after gridding).
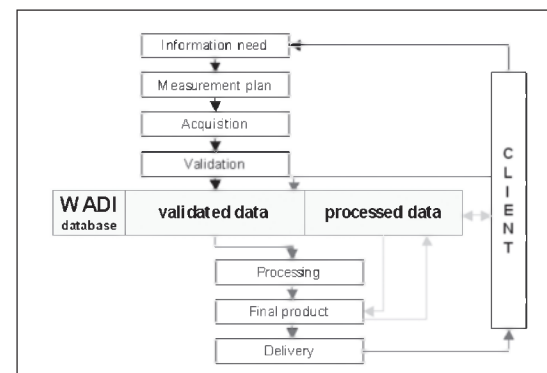


*Figure 1: WADI's central position in the work flow of Rijkswaterstaat.*

### Technical Design of WADI

It is beyond the scope of this paper to give a detailed technical description of WADI. All documentation can be found through the WADI-website (www.wadi.nl). In Figure 2 the structure of the WADI database is outlined.
Applications communicate with WADI through the web-api using SOAP (Simple Object Access Protocol). In this way the application is totally separated from the storage. WADI will provide a general application to search the database and retrieve data.

It is expected, that various specialised applications will connect to WADI in the coming years.

Within WADI a clear distinctions has been made between data and metadata. The user can find data in the database through the metadata only. A data model has been designed too describe the measurement data of Rijkswaterstaat. Metadata on e.g. location, parameter type, measurement time is stored. Furthermore user interface components are available to search and retrieve datasets. To structure the metadata WADI uses the RDF-technology (Resource Description Framework), one of the standards in Internet technology. By RDF the searching of the metadata is much more flexible than in standard database methods, where queries must be programmed for all possible searches.
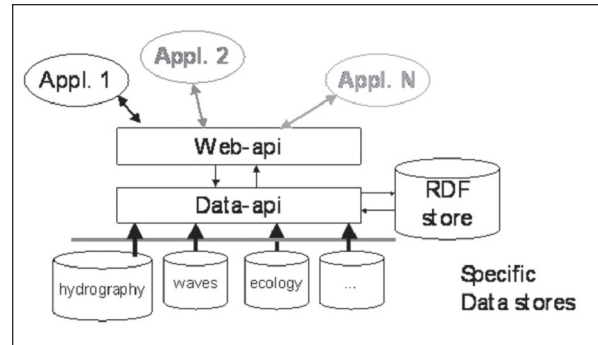


*Figure 2: Structure of the WADI database.*

The data itself can be stored in separate data stores, which can be tuned to the specific data characteristics. At this moment just one data store is implemented.

### Example of Coastal Zone Management

One of the major tasks of Rijkswaterstaat is the protection of the Dutch territory against the North Sea. By law it is stated, that the coastline must be maintained at the position of 1990. Every year sand suppletions are performed at critical zones of the coast to compensate for the erosion processes taking place. Each year the suppletion volume is about 6 million $m^3$ of sand. In order to plan these suppletions accurately a lot of knowledge is necessary of the morphological behaviour of the sea bottom near the coast up to about 20 meter depth. The yearly measurements of the coastal zone are stored in the WADI system.

In Figure 3 the user interface is shown for retrieving grid-data from the WADI database. On the left the various elements of the metadata are shown, on which the search is done (location, time and data type) and on the right the possible locations are shown on the map of The Netherlands.
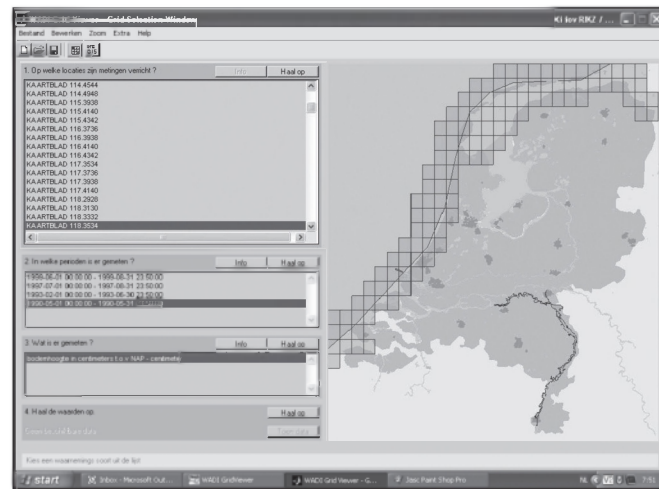


*Figure 3: User interface for retrieving griddata from the WADI database.*

In WADI coastal measurements over a long period in time are available. As an example in Figure 4 the sea bottom measurements for the same locations are shown for the years 1926 and 2001.

### Conclusions

WADI offers a new data infrastructure for storage of all measurement data of Rijkswaterstaat. The system is built using leading edge technology in database development and web based programming. Thus a flexible system has been made, that can be easily connected to other databases. WADI is open to all users through public data portals and through dedicated applications.
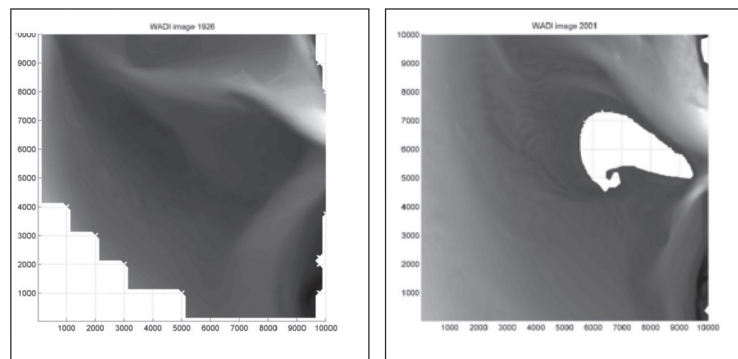


*Figure 4: Examples of long term monitoring for morphological analysis of the coastal zone (same location for 1926 and 2001).*

### References

Information and documentation on the WADI system can be found at the website www.wadi.nl. Information on coastal zone management at Rijkswaterstaat can be found at www.rikz.nl.

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