NOKIS - Information Infrastructure for the North and Baltic Sea

Carsten Heidmann[1] and Jörn Kohlus[2]

Abstract

NOKIS, the North and Baltic Sea Coastal Information System, establishes an information infrastructure for the German coast. Within two projects (NOKIS 2000-2004 and NOKIS++ 2005-2008) financed by German Federal Ministry of Education and Research (BMBF) and carried out in cooperation with the German Coastal Engineering Research Council (KFKI) the technical development, the process of organisational co-ordination and collection of contend will be done. A coastal metadata profile has been created and services for data access and analysing are in development. NOKIS is basing in international standards and conforming to the German Geodata Infrastructure.

1.   General

The initial motivation for the project NOKIS (German title: Nord- und Ostsee-Küsteninformationssystem) was the absence of an infrastructure for the exchange of geodata across administrative boundaries between the German wadden sea national parks and other governmental administrations (e.g. from water management and administration of waterways and navigation) on federal and state level. Today, within NOKIS around 20 partners from administration, research and industry are cooperating. The focus of the participants moved from the mere goal of an information system towards the shared internet-based use of existing geodata.

The technologies and concepts in NOKIS reflect the common objectives of the participating partners, but they also grew from their different interests, problems and tasks. Some of the frequently discussed topics in the project since its start in the year 2000 are data and privacy protection, criteria for the distribution of data and the handling of the copyright of data. The micro cosmos of federalism in Germany can be seen as a biotope, in which the tasks, problems and their handling of the data exchange across institutional and administrative boundaries can be studied. First steps have been done to establish NOKIS as an institution.

2.   Use of Standards

From the beginning, NOKIS made use of existing and emerging standards. In the field of geodata, the ISO 19100 suite of standards concerning the standardization of metadata is already the de-facto standard for the erection of new geodata infrastructures (GDI). The NOKIS network uses especially the parts IS 19115 (ISO 2003), IS 19119 (ISO 2005) and TS 19139 (ISO 2007). In the developing network of different GDI's, the use of exchange standards is important for the interoperability of systems. NOKIS contributes to the interoperable network by using standards from the Open Geospatial Consortium (OGC) and from the German implementation of the OGC ISO Application Profile for CSW (Catalog-Service for Web); Open Geospatial Consortium 2005) named DE-Profile (Länderübergreifender Arbeitskreis Metadaten 2005).

---

[1] Federal Waterways Engineering and Research Institute, Coastal Division, Wedeler Landstrasse 157, 22559 Hamburg, Germany

[2] Office for the National Park of Schleswig-Holstein Wadden Sea, Schlossgarten 1, 25832 Toenning, Germany

Within NOKIS, a profile of the ISO 19115 has been developed, which meets the needs of the coastal community. To enable the documentation of time series and research projects within the same system, metadata schemas have been developed to include the necessary information.

3. Applications for NOKIS

3.1 Editor

The NOKIS editor is the central tool for the generation and maintenance of metadata records. This software helps the user in creating valid ISO 19115/19119 metadata by indicating missing or wrong elements and by providing aids for the editing of certain elements. It helps the user by providing template mechanisms for the generation of metadata for similar data sets and through the possibility to import metadata from other applications (e.g. ESRI ArcGIS Metadata).
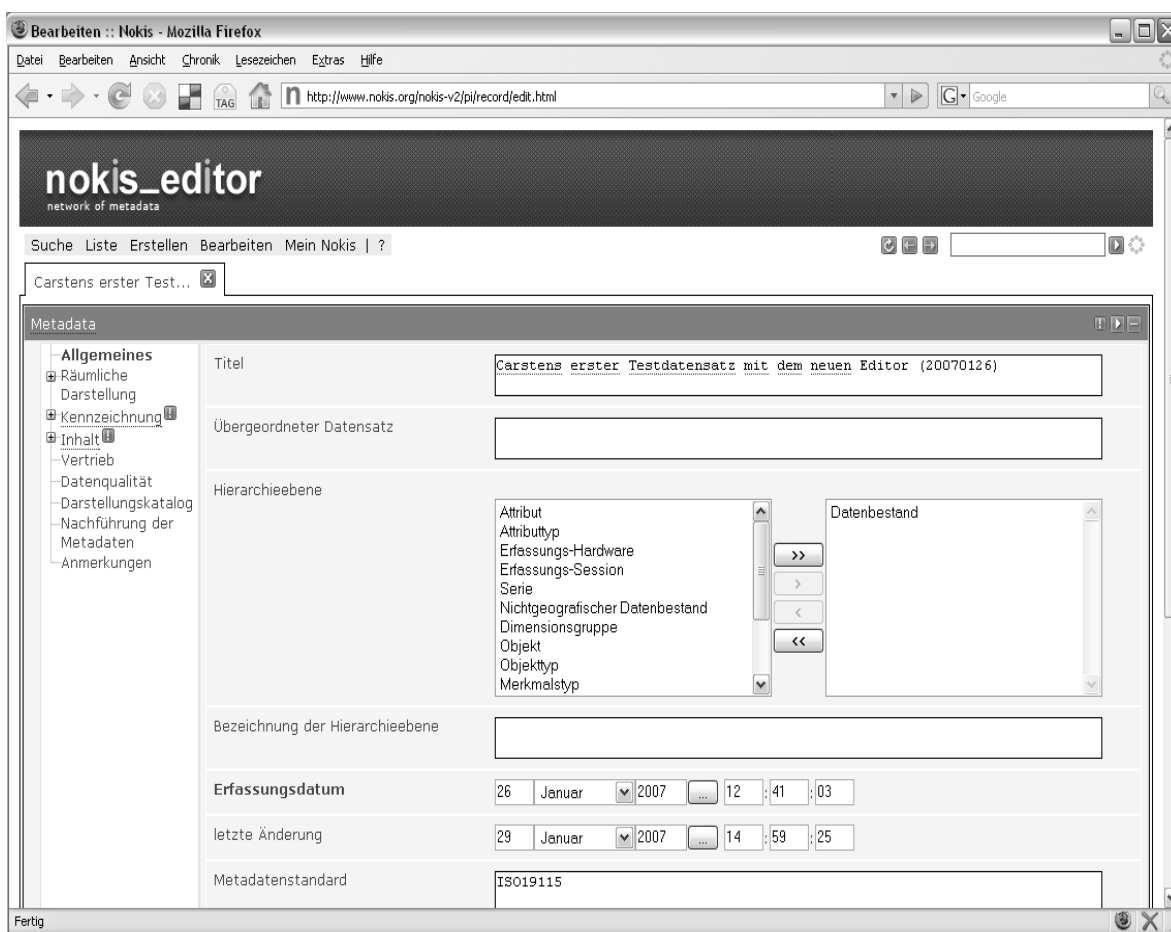

Figure 1: The NOKIS Editor

In order to make the software usable in a context of greater institutions, a workflow mechanism is included. It allows for the restriction of the visibility and of the editing functions by the administrator.

A context-sensitive help system is included, which supports the editor in the creation of the necessary metadata elements. The experience in the first project NOKIS (2001-2004) showed, that the modern metadata standards are far from being intuitively comprehensible.
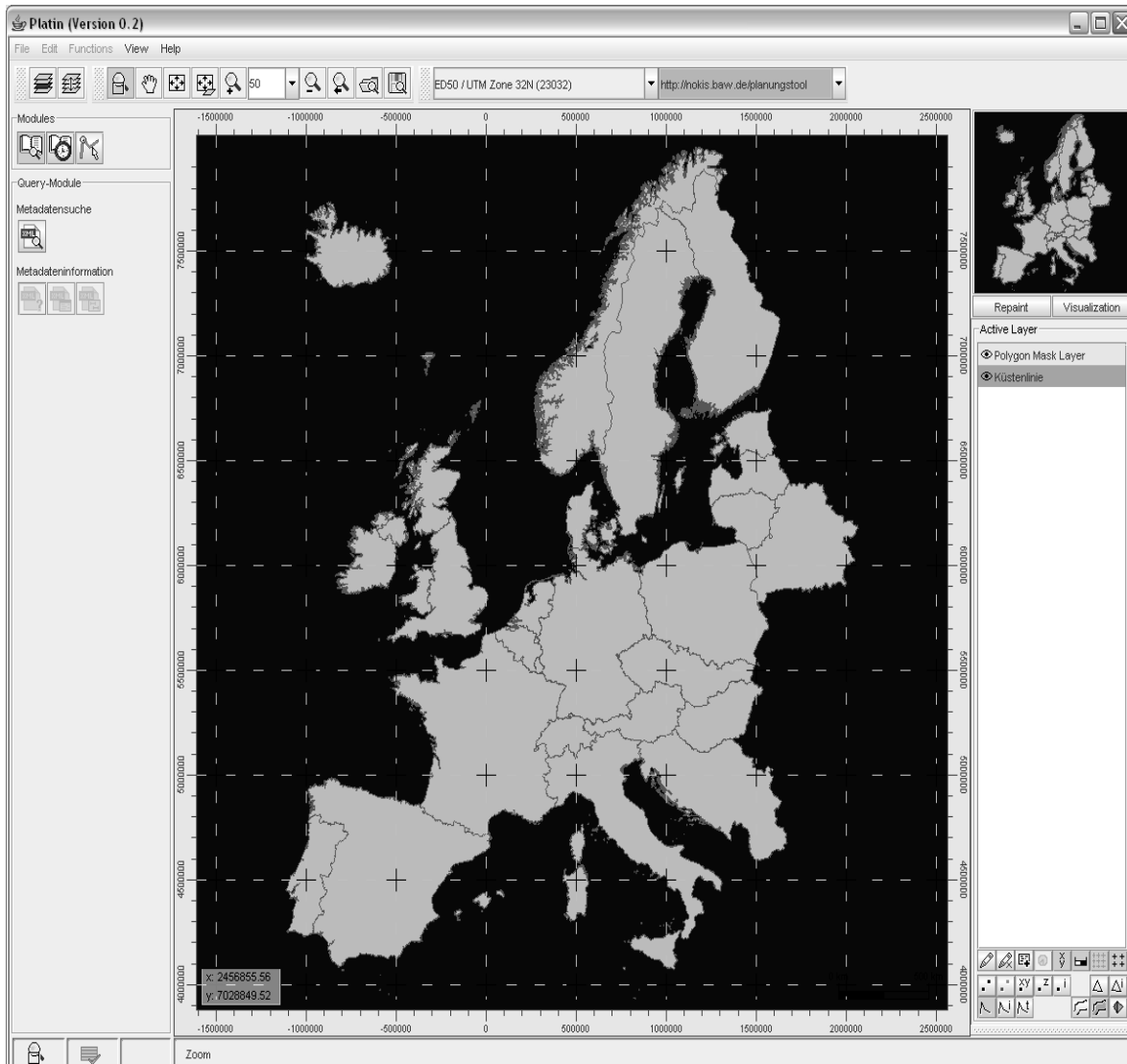
The software is implemented as a 3-tier Java application, which uses a browser as frontend. Any modern graphical web browser should be working, it is tested with Mozilla Firefox 2.0.* and Internet Explorer 6.0 upward. The server-side implementation is based on the Spring-Framework for web applications (Spring 2007), which provides a flexible basis for the integration of different components for the persistency, application logic and the view generation. The data model is mainly defined by the XML-Schemas for the

metadata. Using a combination of JAXB (Sun 2007) and Hibernate (Hibernate 2007), the model content is stored in a relational database. Almost any database supported by Hibernate is useable as backend. The view is generated using the Apache MyFaces library (Apache 2007) and different other libraries which provide special implementations for the Java Server Faces specification (Burns 2006). In order to minimize page submits and to improve usability, the view makes strong use of Ajax technology (Garrett 2005), resulting in a more desktop-like application.

3.2 Planning Tool

One of the applications within NOKIS which draws a lot of attention is the planning tool. It exists in different customizations: as a planning tool for the German coastal survey planning and as a monitoring network planning tool for the Water Framework Directive (European Community 2000).

Within coastal survey planning, the coordination today happens in yearly meetings, where all participating institutions declare which surveys they are planning for the following year. The result of this meetings is a (hand-drawn) map, on which further coordination can be based on. The usage of a online accessible tool makes it possible to adjust the planned surveys during the whole year and it makes it easy to include the surveys from past years into the consideration.

The Planning Tool offers the user a Rich Client Frontend implemented in Java for the generation of planning information. It allows data import from a variety of spatial formats and stores its information in a configurable NOKIS metadata repository, making it searchable for other applications. Storing and retrieving the planning information occurs using the CSW-specification (OGC 2005) of the Open Geospatial Consortium, which offers a HTTP-based interface for the search and retrieval of XML-formatted data as well as storing this data via the same interface.

4. Services

4.1 Catalogue Services

The NOKIS infrastructure uses OGC Catalogue Services (OGC 2005) for the data exchange between different NOKIS metadata nodes or with other GDIs. The CSW interfaces delivers DE-Profile and NOKIS conformant metadata (as of May 2007). Through the use of this standardized interface, all services can operate with the same technology. When available (planned: summer/fall 2007), NOKIS will also implement the new ISO Application Profile (OGC in prep.), which will be the successor for the DE-Profile.

Within Europe, the spatial infrastructures rely on CSW interfaces to exchange their informations. The common format used for this purpose is the OGC ISO Application profile with some minor changes in the national profiles like the DE-Profil.

4.2 Coordinate Transformation Service

NOKIS provides a web service for the transformation of coordinates between different systems. It is based on the freely available projection library PROJ.4 (PROJ.4 2007). It provides the possibility to transform point coordinates between known and describable cartographic projections.

A web service for the transformation of complete ESRI shape files is planned for summer 2007. It also uses the projection library PROJ.4 and will be accessible for the partners of the NOKIS project.
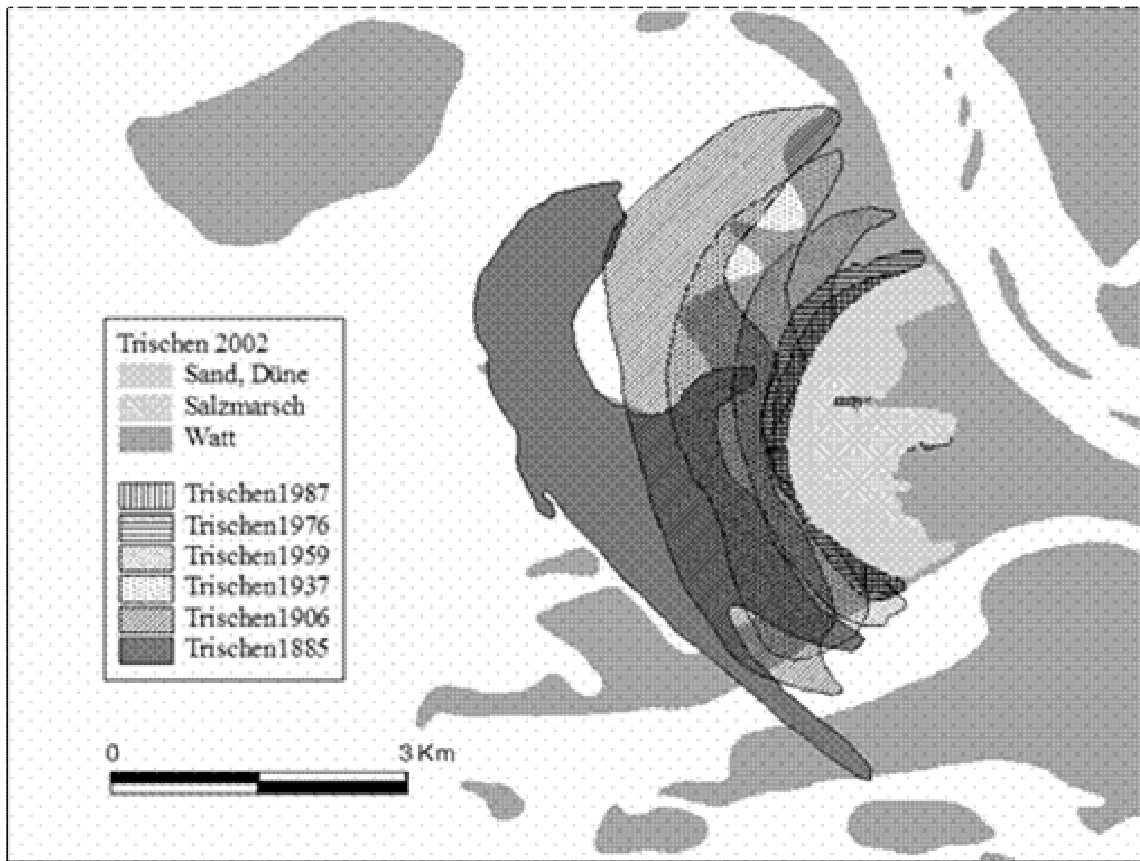
Figure 3: The "wandering island" Trischen. Due to the east shift (about 30 m/a), the relationship between the named dynamic object and the location in absolute geographic coordinates exist only in an episodic context (after WIELAND 2000 and a sea chart of the BSH 2002).

Data structures and services related to a gazetteer have been established during realization of the information system NOKIS. The investigation area of the gazetteer is the water zone of Germany's sovereign territory extending 50 km landsite from the coast. In this hinterland only a coarse net of settlement names and administrative units are generated. Compared to the land, in the offshore area westward from the wadden only a few toponyms might be found. For NOKIS mainly the names within the range of the wadden-sea, coastal waters according to the Water Framework Directive and of a ten kilometres zone along the coast will be processed.

In some testing areas also micro-toponyms of specific aspects will be collected and historical records and maps are evaluated (Kohlus 2007). It is used for critical examination of the present gazetteer concept and also to assess the deviation from the data-model and services.

4.3 Tools to analyze and present data

NOKIS contains metadata about coastal data. Since one of the main objectives of high-quality metadata is the easy access and visualization of data, NOKIS also wants to provide methods for this aim. The link between data and metadata is one of the critical elements in this chain. In a basic version it is possible to access unprotected data via a URL which is contained in the distribution information. This method is not

very satisfying, since it allows only a basic access control and is not applicable for datasets stored in relational databases. For those cases it will be necessary to use web services to access the data. The OGC and the W3C provide different means to access data through a web service interface. W3C compliant web services can be accessed through a well described interface (through WSDL) and allow authentification. The OGC provides the WFS specification (OGC 2005) to exchange data, which has the disadvantage of not being W3C compliant and thus not being accessible by generic WSDL clients. For the mere display of spatial data, the OGC provides the WMS standard (OGC 2006), which returns an image of a map with a given extent.

For some of the NOKIS data sources web services will be implemented, which can be described in a standardized way by IS 19119 metadata, so that is possible to couple metadata and data. The aim of this interoperability experiment is to allow the combination of data from different sources on a web based platform, making strongly use of the metadata for retrieving, accessing, visualizing and analyzing this data.

If this attempt turns out to be working, other services will be added to this toolbox after an examination of the primary requirements of the partners community.

5. NOKIS and the GDI.DE

NOKIS participates in the German Geodata Infrastructure (Geodateninfrastruktur Deutschland - GDI.DE) by providing metadata through its catalogue service. NOKIS is one of the first nodes in the Geoportal-BUND (since 2005), providing metadata in a relevant amount. Members of the NOKIS project actively contribute to different working groups within GDI.DE and NOKIS propagates the German translation of the elements and code lists of the ISO 19115 standard.

The ongoing work to translate the ISO standard shows the need for more efforts in the field of metadata instruction and in the development of tutorials and cookbooks for the creation of high-quality metadata. The ISO 19100 series consists of abstract standards with insufficient documentation in the application of the metadata model. For the ongoing work of a European spatial data and metadata infrastructure, it is necessary to generate a common understanding of the elements of these standards.

6. Conclusions and Outlook

With its bottom-up approach towards the generation of metadata, NOKIS has met the requirements of the German coastal community. The inclusion of the actual stakeholders showed many difficulties of the prevailing attempts to implement metadata infrastructures without considering the needs of the data originating institutions. Technically, the application has benefited from the use of freely available web frameworks, allowing the combination of multiple techniques. A large part of the application is driven by the underlying XML schemas, which define the data model and the persistency layer through JAXB and Hibernate.

The integration in the daily workflow of data-processing and analysing in the partners institutions will decide about the acceptance of NOKIS tools. Instruments for metadata, the key-information to identify data, have to be combined with services for data access and presentation. NATURA2000, the water framework and the high water directive and the directive on public access to environmental information (European Community 2003) could only be fulfilled in co-operated work across the borders of stately or regional administration and structural organisation. The autonomy and the rights of participants in this process have to be respected as well as their different institutional organization and equipment. NOKIS as a scaleable concept, with capsulated instances at the partner's institutions, working with highly standardized components and transparent interfaces has been developed to react on this challenge (Kohlus & Heidmann 2006). Concept and techniques could be adapted from the coast to land, a successfully adaptation to Portuguese language and the use of harbour planning has already been done (Lehfeldt et al. 2006).

But the work in the project has also shown, that further efforts have to be made to achieve syntactical and semantically interoperability between different metadata systems. NOKIS proposes the development of tutorials and handbooks for the different user communities.

In order to enable the further spread and development of the NOKIS system, a consortium will be established to fund and coordinate future action.

Bibliography

Apache (2007): The Apache MyFaces Project. URL: http://myfaces.apache.org/, last visited: 20070510

Burns, E., Kitain, R. (2006): JavaServer Faces Specification. Version 1.2 - Rev A.

European Community (2000): Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Official Journal L 327, 22/12/2000 (2000), pp 0001-0073.

European Community (2003): Directive 2003/4/EC of the European Parliament and of the council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC, Official Journal L 41, 14/02/2003, pp 26-32.

Garrett, J. J. (2005): Ajax: A New Approach to Web Applications. Adaptive Path – Essay Archives. URL: http://www.adaptivepath.com/publications/essays/archives/000385.php, last visited: 20070510

Hibernate (2007): Hibernate - Relational Persistence for Java and .NET. URL: http://www.hibernate.org/, last visited: 20070510

International Organization for Standardization (2003): IS 19115:2003. Geographic information – Metadata.

International Organization for Standardization (2005): IS 19119:2005. Geographic information – Services.

International Organization for Standardization (in prep. 2007): TS 19139:2006. Geographic information - Metadata - XML schema implementation.

Kohlus, J., Heidmann C. (2006): Data Retrieval and Usage - The North- and Baltic Sea Information System (NOKIS). In: Karrasch, P. & E. Csaplovics (Ed.): Proc. Nature Protection GIS. International Symposium of Geoinformatics in European Nature Protection Regions. 13th to 14th Nov. 2006, Dresden.

Kohlus, J (2007): Aufbau eines Gazetteers für die deutsche Küste. In: Traub, K.-P. & J. Kohlus (Ed.): Geoinformationen für die Küstenzone. Beiträge des 1. Hamburger Symposiums zur Küstenzone. p. 152-163, Heidelberg.

Lehfeldt, R., Reimers, H.-C., Simmering, F., Sellerhoff, F. (2006): The use of metadata in coastal engineering and the protection of coastal waters. In: German Coastal Engineering Research Council - GCERC newsletter, 6th year Edition, 2/2006, p. 4 - 5, Hamburg.

Länderübergreifender Arbeitskreis Metadaten (2005): DE-Profil des ISO19115/ISO19119 Anwendungsprofils für OGC Web Catalogue Services (CSW-2.0).

Open Geospatial Consortium (2005): ISO19115/ISO19119 Application Profile for CSW 2.0. OGC Recommendation Paper Version 0.9.3.

Open Geospatial Consortium (2005): OGC Catalogue Services Specification. OGC Implementation Specification. Version 2.0.1.

Open Geospatial Consortium (2005): Web Feature Service Implementation Specification. Version 1.1.0.

Open Geospatial Consortium (2006): Web Map Server Implementation Specification. Version 1.3.0.

Open Geospatial Consortium (in prep.): OGC Catalogue Services Specification 2.0 - ISO19115/ISO19119 Application Profile for CSW 2.0. Version 1.0.0.

PROJ.4 (2007): PROJ.4 - Cartographic Projections Library. URL: http://www.remotesensing.org/proj/, last visited: 20070510

Spring (2007): Spring Framework. URL: http://www.springframework.org/, last visited: 20070510

Sun (2007): Java Architecture for XML Binding (JAXB). URL: https://jaxb.dev.java.net/, last visited: 20070510

Wieland, P. (2000): Trischen - die Geschichte einer alluvialen Insel im Dithmarscher Wattenmeer. Die Küste, H. 62.