



Editorial

Tender for a KFKI-Project pertaining to "Morphodynamics in the German Bight"

1. Statement of intent

The coastal waters along the German North Sea coast underlie constant morphological changes due to the external dynamic forces. Highly detailed knowledge of the natural morphological processes and their future development form an essential basis to secure - on a long-term and ecologically compatible basis - man's living conditions in the region and the coast as a living space, economic zone and nature reserve. A further development of the knowledge and technologies, allowing a reliable prognosis of large-scale transport processes and morphological changes, are an essential basis for meeting future challenges in coastal protection (safeguarding against storm surges and erosion), as well as assuring the usability of waterways and ports along the coast.

The objective is the enhancement of information on large-scale sediment dynamics in the German Bight and its underlying processes through applied research conducted through the German Coastal Engineering Research Council – GCERC (Kuratorium für Forschung im Küsteningenieurwesen – KFKI). Thus, its member authorities and other institutions are provided with an improved knowledge base to facilitate the decision-making process.

2. Legal basis

Projects may be funded according to the directives of the 'Standard BMBF Guidelines for Allocation and Grants on an expenditure or cost basis, and the administrative regulations pertaining to § 44 of the Federal Budget Policy (BHO). A legal claim regarding the allocation of funds does not exist. Funds are granted on the basis of administrative discretion within the context of disposable budgetary resources.

3. Subject of fundable project

The primary objective is the enhancement of information on long-term and large-scale sediment dynamics in the entire German Bight with the aid of computer modelling. Particularly sediment transport paths, directions, volumes and balances are of particular interest. Nearshore areas, foreshores and beaches of the islands, tidal flats and estuaries are to be included in these evaluations.

As a basis for the investigation, plausible and consistent core data regarding bathymetry and sediments are to be established and documented. These will then be available for future GCERC research projects. Relevant factors such as tides and waves as well as surf- and wind-induced currents are to be incorporated into the study.

Additionally, with regard to the effects of impending climate changes, selected scenarios concerning rising mean sea levels and changes in the sea state are to be investigated exemplarily.

Due to the complexity of the modelling task, the utilised technology and quality of the models as well as the range of conclusions derived from core data and simulation series represent an important aspect of the research project. Model development should principally not be conducted for deterministic models; instead, several models should be applied to the same problem in order to evaluate the spread of results due to conceptual differences of various model families. Next to the deployment of deterministic models, empirical models and neuronal nets may be applied and further developed.

The simulation software should possess a modular structure with standardised data interfaces to guarantee utilisation of the simulation results in constructive follow-up research. Documentation of

data and models should be effected according to international quality standards to warrant access by future GCERC research ventures.

Joint projects with several partners from research and administration are intended to support the process of cooperation which is necessary for the realisation of research objectives and for a sustainable safeguarding and continued application of research results.

4. Prerequisites, type, extent and volume of grants

Financial funding of project may be extended up to a duration of three years. As to project funding and the application procedure, we refer to the information available under <http://kfk.baw.de> for third-party projects of the GCERC sector of BMBF.

5. Procedure

As opposed to the usual first level application and evaluation process for third-party projects of the GCERC sector of BMBF, summaries of projects applications in written and electronic form have to be initially submitted to the following address no later than November 10, 2008:

Projektträger Jülich
Geschäftsbereich MGS
Forschungszentrum Jülich GmbH
Seestrasse 15
18119 Rostock-Warnemünde
n.blum@fz-juelich.de

Summaries for joint projects need to be discussed with the Joint Projects Coordinator. Based on the funding guidelines, it is intended to conduct further rounds in the selection process. The deadline for submittal is identical with the exclusion deadline. The length of project summaries (DIN-A4-format, Arial 11 point, 1.5 spaced, double-sided) may not exceed 5 pages for the general concept and 6 pages for each intended project. They are to be submitted as a pdf-format file in addition to 10 hard copies. The received project summaries will be evaluated by GCERC with the assistance of consultants to select suitable and fundable projects. Interested persons will be notified by mail about the result of the selection process.

In the case of positively evaluated project summaries, prospective researchers will be asked to submit a formal funding application as part of the second selection phase, upon which a decision will be made following a concluding examination.

Further questions regarding the application process may be directed to Dr. Blum of the Jülich Project Coordination Office. As regards project content, questions should be addressed to the GCERC Research Coordinator, Frank Thorenz.

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PIANC-COPEDEC VII

Prof. Dr.-Ing. Sören Kohlhasse
University of Rostock, Institute for Environmental Engineering

February 24 to 28, 2008
Report on the conference in Dubai, United Arab Emirates

COPEDEC stands for Coastal and Port Engineering in Developing Countries.

Parallel to the International Conference on Coastal Engineering – ICCE, the first conference of this series was held with the support of Denmark in Colombo, Sri Lanka in 1983. The primary intent of the conference is the involvement of colleagues, especially of young scientists and engineers, from developing and emerging nations in the international exchange of experience in coastal and port engineering.

Based on this fundamental idea, follow-up conferences were successfully held in Beijing (1987), Mombasa (1991), Rio de Janeiro (1995), South Africa

(1999) and, again, in Colombo (2003), each with the support of a European partner country.

Alongside the organisational support for the respective host country, each European partner is primarily tasked with financing a grant programme to enable talented students and young colleagues from colleges and administrative branches to participate in this exchange of experience.

Differing from the ICCE conferences, case studies pertaining to current topics and practical problems of coastal engineering are specifically called for. The COPEDEC series has undergone a continuous development regarding the quality of the papers presented, as well as the number of participants and countries represented. The Dubai conference counted ca. 700 participants from over 40 countries, making it the largest COPEDEC conference yet.

Holding the conference in Dubai, which can in no way be considered a developing country, was caused by an increasing lack of financially supportive partners. A conference of this magnitude, especially its grant programme, cannot be financed through subsidies and registration fees alone.

On the occasion of the Sri Lanka conference of 2003, Dubai spontaneously declared its willingness to cover these costs. A decision was also made at this conference to entrust PIANC with its organisation. PIANC, being an international association, command the best prerequisites for the planning und implementation of an event of this size. This organizational new orientation was yet conducted under the chairmanship of Summa Amarasinghe, the initiator of COPEDEC and tireless champion of ist objectives.

Dubai is not a city to remind one of previous conference locations. Quite the opposite: not only the impressive development projects at the coast witness its unhindered economic power, the civil engineering projects within the city are unimaginable in comparison to the hesitant development here in Germany. Visionary concepts are promptly realised. If mistakes in planning and design should happen, they are effectively corrected. The pace is frightening, especially considering the traffic in the streets. Finding a taxi in Dubai's downtown may take hours. The subway system, now under construction, will barely alleviate this situation, particularly as the city will grow to over

12 million inhabitants within the next few years. Therefore, an urban waterway within the city limits is being planned, to take up a majority of individual traffic. But Dubai City's development is a topic sui generis and not subject of this brief report on the conference.

Conference venue was the newly erected Conference Centre in the Interconti Hotel, a little outside the downtown core. The 5-star-Hotel accommodated the nearly 100 stipend holders, but by no means the majority of paying conference participants.

The facilities and technical equipment were of the highest quality, which also goes for the

snacks, beverages and lunches available during the breaks and recesses. It should be difficult to find a host for a follow-up conference (which will not be decided upon until fall of this year) who will be able to achieve and finance anything similar. The subsidies granted by the city and several large Dubai companies were enormous, but were only discussed in hushed tones. For me, who had attended all but the first conference and, as a member of the Paper Selection Committee, also knew the contents of all the individual papers presented, the Dubai conference by all means raised critical questions. Can there be a developing or emerging nation (several papers used the term Countries in Transition), that will be able to follow in Dubai's footprints? Will there be a European country to co-finance a comparable COPEDEC conference?

On the other hand, major advancements in technical know-how particularly concerning institutions and projects in developing nations are easily recognisable. Sri Lanka's example shows that the stimuli offered through COPEDEC have come to fruition. With the help of the Danish Development Aid Programme (DANIDA) a research institute (LHI) had been established at that time, which – proven by its worthwhile exposition during the conference – is successfully active in the Asian region nowadays. The LHI was able to acquire major projects, which had previously been the sole province of European institutions. Even the winner of the Best-Conference- Paper Award, selected during the conference by the PFC, came from a developing country.

Since papers were presented in four parallel sessions

it is naturally a difficult proposition for an event of this magnitude to evaluate each contribution individually. Moreover, every participant selects those lectures which are of highest importance to him or her personally. At four parallel sessions, one misses out on 75 percent of all available lectures. The Proceedings are, therefore, a substantial source of information, which are regrettably only released at a later date, although abstracts of all papers were available to all participants on CD and in print form at the beginning of the conference.

It was my impression that, aside from a few exceptions, all sessions were very well attended. The participants' interest did not once wane during the entire course of the event. Discussions were lively and extended well into the breaks. I found it commendable, that so many young delegates became involved.

During the course of the sessions only very few breakdowns occurred, few lectures were cancelled and changes in the programme were rare, a marked improvement over previous conferences.

The entire planning and organization can only be described as exemplary. The same applies for the execution of the excursion programme, albeit with a few exceptions. The organizers had employed a travel agency, leading one to expect that the indicated departure times of the busses would be adhered to and registrations for technical tours be processed. However, all problems were eventually resolved satisfactorily.

All told it was a very successful conference in a very beautiful and relaxed atmosphere. Highlights for me, from a technical/ scientific view, were the visit to the artificial island Jebel Ali off the coast of Dubai, which is presently under construction, and Prof. Kees d'Angremond's lecture on the closing day of the conference. Prof. d'Angremond impressively spanned the gap between the former and current tasks of coastal engineering, also elaborating on the requirements of education and professional qualifications of future coastal engineers.

I was not the only one left with a resounding memory of this particular lecture.

Special mention should also go to the successful social events during the conference and on the closing day, as well as the programme for the accompanying partners.

Report on the workshop "Storm Surge Threats at the Baltic Sea Coast"

University of Rostock on March 4-5, 2008

Univ. Prof. Dr. Jürgen Jensen

Dipl.-Ing. Christoph Mudersbach

University of Siegen

Since February 1962, the North Sea coast has not been affected by any catastrophic storm surges with flooding and severe property damage. Even though heavy or very heavy storm surges have occurred in more or less regular intervals at the Baltic Sea coast, it has been spared any devastating event since the catastrophic storm surge of November 1872. Its coastal protection system, therefore, orientates itself to the peak surge of that storm of November 1872. Henceforth, detailed information regarding the highest possible extreme storm surges and the corresponding wave conditions along the German Baltic coast is of the utmost importance to coastal engineering and disaster management.

On March 4 and 5, 2008, a workshop on "Storm surge threats on the Baltic Sea coast" was held at the University of Rostock. The subject matter was discussed by over 100 specialists and colleagues from the scientific and practical fields, as well as political decision-makers and administrators. Basis for the workshop was the current joint research project "Model supported research into extreme storm surge occurrences at the German Baltic Sea coast (Modell-gestützte Untersuchungen zu extremen Sturmflutereignissen an der Deutschen Ostseeküste - MUSTOK)" (2005 to 2008) of the German Coastal Engineering Research Council GCERC (Kuratorium für Forschung im Küsteningenieurwesen - KFKI), which is funded by the Federal Ministry for Education and Research (BMBF, 03KIS52-54). Aim of the workshop was a broad public discussion of results prior to the conclusion of the research project, particularly regarding its practical relevance.

The MUSTOK Research Project is jointly operated by the Water and Environment Research Institute



Figure 1:
Welcome of the participants by Univ.-Prof. Dr.-Ing. Jürgen Jensen

(Forschungsinstitut Wasser und Umwelt - fwu) of the University of Siegen (coordinator), the German Meteorological Service (Deutscher Wetterdienst - DWD), the Federal Maritime Agency (Bundesanstalt für Seeschifffahrt und Hydrographie - BSH), the GKSS Research Centre Geesthacht, the Universities of Kiel and Rostock, the State Agency for the Environment and Nature Conservation (Staatliches Amt für Umwelt und Natur Rostock), as well as the Federal State Commission for Coastal Protection, National Parks and Marine Protection of the Federal State of Schleswig-Holstein (Landesbetrieb Küstenschutz, nationalpark und Meeresschutz – LKN - SH) in close cooperation.

Following introductory speeches by the representatives of the Federal State of Mecklenburg-Vorpommern and the University of Rostock, Frank Thorenz (research coordinator GCERC) welcomed the participants of the workshop and emphasised the importance of applied storm surge and coastal research for today's practical measures. He stressed, that a large number of researchers had been brought together in GCERC's Joint MUSTOK project and that many synergetic effects of the interdisciplinary investigation of storm surges in the Baltic Sea had thus been achieved. Alongside meteorologists and oceanographers, the research group also included natural scientists and coastal engineers.

At the beginning of the first day of the workshop, fundamental aspects of coastal protection in the federal states of Mecklenburg-Vorpommern and Schleswig-Holstein were discussed. Dr.-Ing. Thomas

Zarncke of the Ministry for Agriculture, Environmental and Consumer Protection of Mecklenburg-Vorpommern described the coastal protection strategies of this state along its roughly 2,000 km of coastline. The importance of this topic was underscored by the fact that ca. 70 percent of the coastline is undergoing erosion processes. Dr. Jacobus Hofstede of the Ministry of Agriculture, Environment and Rural Regions of Schleswig-Holstein concentrated especially on the current endangerment of the almost 600 km of Schleswig-Holstein's Baltic coast and explained how sustainable coastal protection may be achieved on an environmentally compatible level despite intensive tourism. Gudrun Rosenhagen of the Marine Weather Bureau of the German Meteorological Service and Dr. Sylvin Müller-Navarra of the BSH in Hamburg explained the wind and water level forecasts at the German Baltic Sea coast, which take on special significance for the Storm Surge Warning Service.

On the afternoon of the first day, Prof. Dr.-Ing. Jürgen Jensen of the fwu of the University of Siegen, in his function as project coordinator, introduced the research project MUSTOK including its subprojects, partners and objectives. The subproject MUSE Baltic Sea (Analysis of storm surge levels with very low probability factors on the German Baltic Sea Coast, 03KIS052) is concentrates on the assessment of very high storm surge water levels at the German Baltic Sea coast and the determination of the related probability factors. The subproject SEBOK A (03KIS054) and SEBOK B (03KIS053) (Wave Force Impact Baltic Sea Coast), on the other hand, is developing methods for the determination of locally



Figure 2:
from lefthand: Univ.-Prof. Dr.-Ing. Jürgen Jensen, BD Dipl.-Ing. Frank Thorenz, BD Dr.-Ing. Thomas Zarncke, Dr. Jacobus Hofstede

relevant storm surge sea states on the basis of an evaluation of storm surge induced wave action and water levels occurring directly in front of and at coastal protection structures. Data is collected by employing models of various spatial scales of the coastlines of Schleswig-Holsteins and Mecklenburg-Vorpommern. Prof. Dr.-Ing. Jürgen Jensen emphasized the wide spectrum of scientific disciplines within the project ranging from meteorology to coastal engineering, as well as the project's orientation towards practical applications.

Subsequently, he presented the essential results of the MUSE project, for which the catastrophic storm surge of November 12 /13, 1872, was of central significance. This event saw the highest, most reliably recorded water levels along the German Baltic Sea coast, yet. Even today, it is considered the benchmark for the design of coastal protection measures. For the first time, modern simulation models were able to reconstruct this significant event with a high degree of conformity regarding the extreme peak water levels, which may further improve storm surge forecasts. Furthermore, the research group was able to identify roughly 32,000 scenarios from weather simulations which may lead to storm surges along the Baltic Sea coast. Only six of these have the potential to induce extreme water levels. According to preliminary results, storm surge levels markedly exceeding the extreme levels of 1872 are presently very unlikely. Future modifications due to climatic changes have not yet been considered.

Prof. Dr. Roberto Mayerle of the West Coast Research and Technology Centre of the Christian-Albrecht-University at Kiel and Dr.-Ing. Peter Fröhle of the Coastal Engineering Department of the University of Rostock presented the results of the SEBOK A/B subproject. The focus of their analyses is not primarily on the determination of maximum water levels, but rather on the identification of a combined load on coastal protection structures due to water levels, currents and wave action. The results showed, that the forces acting on these structures may differ widely locally. Therefore, site-specific values need to be derived to not only make coastal protection more efficient, but also to conduct it more economically.

The evening's event was enriched by a very entertaining popular scientific lecture by Dr. Schumacher of the University of Greifswald on 'Historic Baltic Sea

Storm Floods From a Geological Viewpoint'.

During the second day of the workshop, the methods and achieved results of the separate subprojects were explained in detail by the project staff:

- Forecast of extreme storms in the Baltic Sea (Dr. R. Schmitz)
- Relevance of cyclone tracks on storm surge levels in the Baltic Sea (Dr. A. Benkel)
- Digital Wind Atlas for the Baltic Sea (Dr. A. Ganske)
- Reconstruction of the storm conditions of November 13, 1872 (Dipl.-Met. G. Rosenhagen, Dipl.-Ozean. I. Bork)
- Storm surge simulations (Dr. S. Müller-Navarra, Dipl.-Ozean. I. Bork)
- Determination of probability factors for extreme storm surge levels on the German Baltic Sea coast (Dipl.-Ing. Ch. Mudersbach)
- Determination of evaluation parameters for coastal protection measures along the German Baltic Sea coast based scenario simulations (Dipl.-Ing. G. Bruss)
- Determination of definitive hydrodynamic evaluation parameters for coastal protection measures at the Baltic Sea coast (Dipl.-Ing. Ch. Schlamkow)

Following this and chaired by Prof. Dr.-Ing. Jensen, these presentations were discussed with the audience. It became clear that the joint research project had provided important contributions to the understanding of the development of storm surges and of the genesis of extreme weather situations in the Baltic Sea. There were valuable technical suggestions from the audience, which will find consideration during the continued work of the project.

The concluding press conference was well received by diverse media, resulting in several news reports, with special interest generated by the first successful reconstruction of the 1872 storm flood.

Further information regarding the workshop, the joint research project and its results may be obtained from the following web site:

www.fwu.uni-siegen.de/wb/veranstaltungen/
→ MUSTOK-Workshop

kfkiGIS

Dr.-Ing. Rainer Lehfeldt

Kuratorium für Forschung im Küsteningenieurwesen

Dr.-Ing. Frank Sellerhoff

BSc. Trong-Nhan Vo

smile consult GmbH

Einleitung

Mit dem kfkiGIS (03KIS073) soll ein synoptisches Verzeichnis über hydrologische Datenbestände wie Seegang, Wasserstand, Salzgehalt, Temperatur, Geschwindigkeit, Trübung, SPM bei den Küstenbehörden und Forschungsstätten als Bestandteil der KFKI-Website aufgebaut werden. Der Nachweis dieser Daten erfolgt durch eine GIS-Anwendung, die Positionen von Messungen in Karten markiert und geeignete Darstellungen für den Mess-Zeitraum und weitere Begleitinformationen anbietet. Dabei wird die NOKIS Informationsinfrastruktur als Basistechnologie eingesetzt, die eine durchgängige Nutzungsmöglichkeit gewährleistet. Die notwendigen Anpassungen und Erweiterungen der Software wurden durch die Firmen disy (Metadatenbank, Metadaten-Editor) und smile (Services) realisiert. Eine Daten-Suche, die Auswahlkriterien wie physikalische Parameter, Gebiet, Zeitraum, Provider oder Messmethode berücksichtigt, erfolgt dabei anhand von NOKIS Metadaten. Der Zugriff auf die verteilt archivierten Daten erfolgt mit Hilfe von standardisier-

ten Internet-Diensten und Datenwrappern, die proprietäre Datenformate vor Ort lesen und in einheitliche Formate transformieren. Damit wird eine gemeinsame Nutzung unterschiedlicher Quellen in Web-basierten Werkzeugen wie z.B. dem Planungsinstrument möglich.

Die Komponenten von kfkiGIS

Das System kfkiGIS setzt sich aus einer Reihe von Komponenten zur Beschaffung und Darstellung von Informationen zusammen. Die Komponenten orientieren sich allesamt an den internationalen Standards vom Open GIS Consortium (OGC) und gehen bisweilen deutlich darüber hinaus. Der WMS-Klient dient der Anbindung von Kartenservern (Web-Mapping-Server), die beispielsweise Satellitenbilder bereitstellen oder das Portals Tideelbe ansprechen. Der WFS-Klient erfüllt die gleiche Aufgabe wie der WMS-Klient, richtet seine Anfragen jedoch an sogenannte Web-Feature-Server und stellt Informationen als Vektordaten zur Verfügung. Zu den Besonderheiten eines WFS gehört, dass an ihn komplexe Anfragen gerichtet werden können, die beispielsweise den Raumbezug oder Schlüsselworte definieren. Damit lassen sich gezielte Informationsrecherchen durchführen. Eine direkte Anwendung für den WFS-Klienten ist die Anbindung des NOKIS-Gazetteers, der die seeseitigen Geometrien und Namen von Orten entlang der deutschen Küste in einem OGC-konformen WFS-Service zur Verfügung stellt. Die CSW-Schnittstelle (Catalogue Service Web) dient zur Suche nach Metadaten. In kfkiGIS können hierzu der

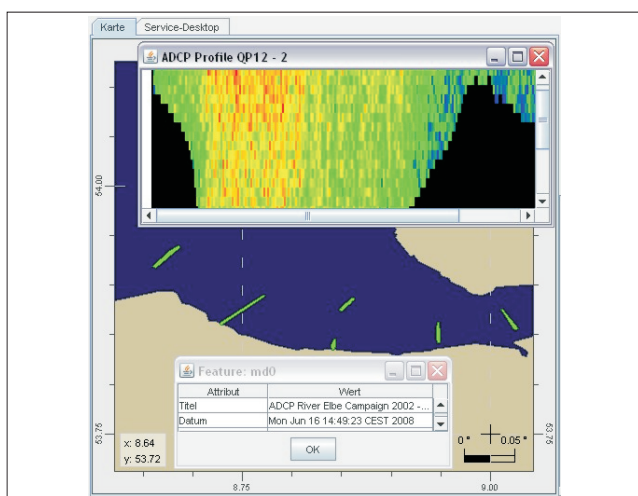


Abbildung 1:
Darstellung und Auswertung einer ADCP-Messkampagne der BAW in kfkiGIS

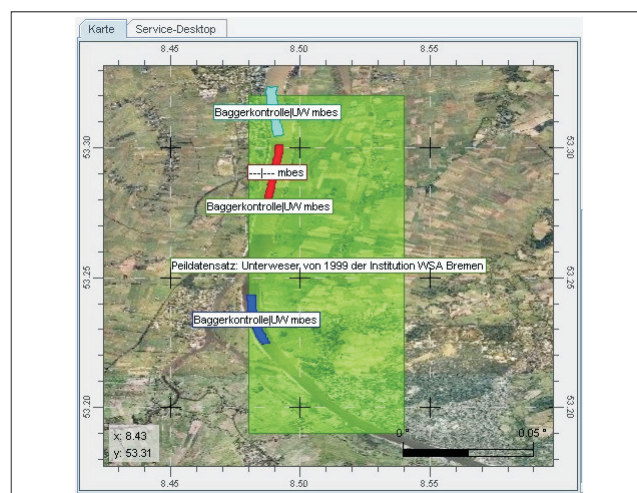


Abbildung 2:
Ansicht von Peilungs-Dokumentationen an der Weser aus dem WSV-Datenkatalog (Bounding Box) und NOKIS (Polygone)

NOKIS- und auch der WSV-Datenkatalog durchsucht werden. Die Ergebnisse einer solchen Anfrage werden mit Ihrem Raumbezug auf der Karte dargestellt und können dort selektiert und näher untersucht werden. Die Metadaten der NOKIS-Infrastruktur zeichnen sich dadurch aus, dass neben dem umschreibenden Rechteck auch komplexe Polygone verwendet werden können, um die räumliche Ausdehnung von Daten zu beschreiben. Das Planungstool für Seevermessung und Monitoring (Sellerhoff, Reimers, 2006) ist ebenfalls Bestandteil von kfkigIS.

Über den Service-Desktop werden Konzepte erfahrbar, die in NOKIS entwickelt und prototypisch umgesetzt wurden. Für eine Reihe von Metadaten ist die Verknüpfung mit den eigentlichen Daten realisiert. Ein solcher Metadatenatz kann auf den Service-Desktop übertragen und zum Ausführen weiterer Aktionen herangezogen werden. So lassen sich beispielsweise nach einer erfolgreichen Metadatenrecherche auch die Daten visualisieren oder mit einfachen Mitteln analysieren.

In der Abschlussarbeit von Trong-Nhan Vo, 2008, im Master-Studiengang EuroAqua wurde die Eignung des OGC-Standards WFS hinsichtlich der Verwendung für nicht traditionelle GIS-Daten erprobt. Am Beispiel einer ADCP-Messkampagne in der Elbe aus dem Jahre 2002 (Maushake, 2007) wurde ein Szenario entworfen und implementiert, das von der Speicherung der in einem proprietären Format vorliegenden Basisdaten in einer Datenbank, über deren Beschreibung mit ISO 19115-konformen Metadaten bis hin zur Bereitstellung über einen Web-Feature-Server einschließlich einer geeigneten Klient-

Anwendung zur Darstellung der Daten reicht. Damit wurde erfolgreich gezeigt, dass unter ausschließlicher Verwendung von Standards auch GIS-untypische georeferenzierte Daten aus dem Küsteningenieurwesen verarbeitet und publiziert werden können. Die technische Realisierung von kfkigIS erfolgte auf der Basis von Java-Web-start. Die Ausführung ist performant und sicher. Sie erfordert keinerlei administrativen Aufwand.

kfkigIS - mehr als Karten

kfkigIS ist mehr als ein kostenfreies Informationssystem. Seine Kernaufgabe besteht darin, die Verknüpfung von unterschiedlichen Informationen zu realisieren. Mit kfkigIS ist es gelungen, bereits offen verfügbare Informationsquellen aus dem Küsteningenieurwesen gemeinsam nutzbar zu machen. Darüber hinaus macht kfkigIS die in NOKIS entwickelten Technologien einem breiten Anwenderkreis verfügbar.

Literatur

Maushake, C. (2007): Untersuchungen zur Schwebstoffdynamik im Elbeästuar auf Basis von ADCP – Messungen. Die Küste, 72.

Trong-Nhan Vo (2008): Metadata and services for field data - River Elbe Campaigne 2002. MSc dissertation at EuroAqua.

Sellerhoff, F., Reimers, H.-C. (2006): Planning tool for integrated coastal hydrography and the monitoring of coastal waters. In: KFKI aktuell - News of the German Coastal Engineering Research Council, 6 (2) 2006, pp 6-7.

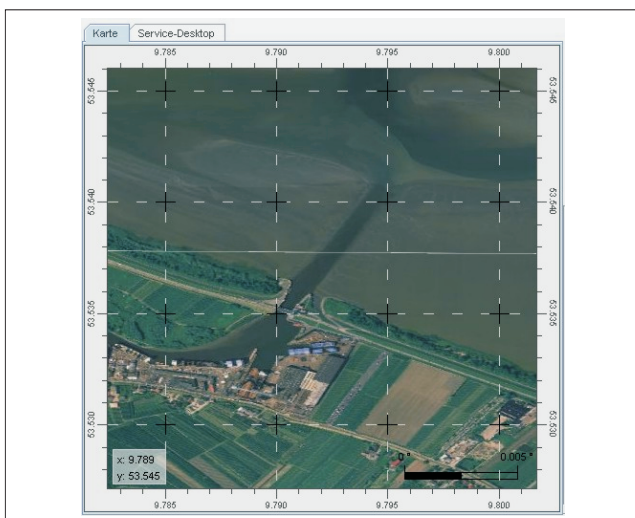


Abbildung 3:
Einbindung von Luftbildern

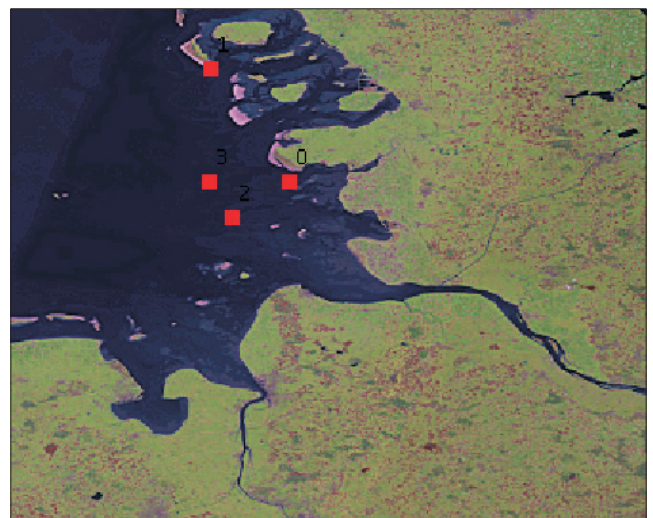


Abbildung 4:
Überlagerung von Messstellen, Satellitenbild und Küstenlinie

ICCE 2008

31st International Conference on Coastal Engineering August 31 to September 5, 2008

Prof. Dr.-Ing. Holger Schüttrumpf

Institute of Hydraulic Engineering and Water
Resources Management Aachen University

The 31st International Conference on Coastal Engineering takes place from August 31 to September 5, 2008 in the Congress Center Hamburg (CCH). The call for papers has been well accepted. More than 850 delegates have already registered and more than 30 exhibitors from the building industry, consulting, academia, administrations, measurement equipment manufacturers and scientific publishers have registered for the exhibition during the conference. Due to the favourable response it was necessary to extend and complete the conference program.

Key elements of the conference are, among others, the Icebreaker Party on August 31, the Opening Ceremony on September 1 with a keynote lecture given by Dr. Wolfgang Kron, Munich Re Group, titling "Coasts, the riskiest places on earth".

Five technical excursions are scheduled on September 3 with focus on these topics:

- Modern port logistics in an open tidal harbour
- Heavy loads on silty soils – extension of Airbus industries into the river Elbe
- Experience storm surges firsthand at Büsum's Blanker Hans
- Hydraulic infrastructures around Hamburg
- Storm surge barrier at Eider estuary and revetment construction at Holm Gröde

as well as the Closing Banquet on September 5. Main focus of the conference is, of course, on the more than 450 scientific papers presented in five parallel sessions and the poster session. Papers will be presented to the five conference topics:

- Coastal Oceanography and Meteorology
- Coastal Sediment Processes

- Coastal, Shore and Estuarine Structures
- Ports, Harbours and Waterways
- Coastal Environment
- Coastal Risks
- Coastal Development

The program and all abstracts can be accessed on the conference homepage icce2008.hamburg.baw.de and are ready for download by interested colleagues. More information concerning the exhibition during the conference, the Short Courses and the technical excursions are available.

The event makes optimum use of the spacious venue at CCH. The coffee breaks take place in the exhibition hall where refreshments during coffee breaks will be served. This arrangement will permit easy contact to the exhibitors. The posters are also presented in this room and can be discussed in addition to the presentation scheduled in the poster session.

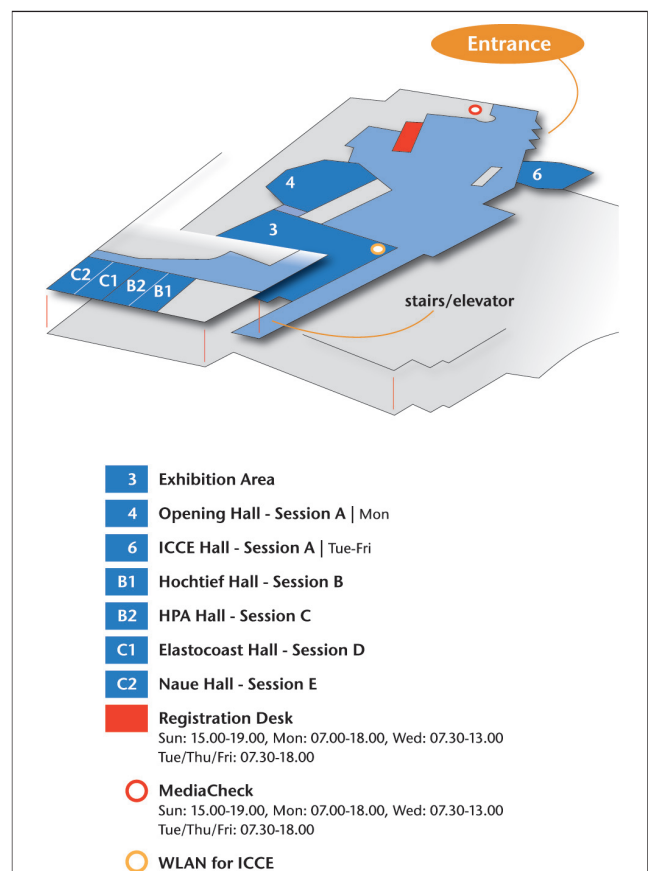


Figure 1:
Venue CCH - Congress Center Hamburg
Am Dammtor/Marseiller Straße
20355 Hamburg, Germany

ICCE 2008 – Short Course 1 European Overtopping Manual

Dr.-Ing. Holger Schüttrumpf

Institute of Hydraulic Engineering and Water
Resources Management Aachen University

Considerable advances in understanding the overtopping processes have recently been made in several European research projects. Research at HR Wallingford has provided techniques for predicting the mean overtopping discharge, and the consequent flood volumes and drainage requirements, for a range of seawall types. In the Netherlands and Germany, there has been continuous research on overtopping at embankments and dikes. Within the European CLASH project hazards arising from wave overtopping have been studied. In 2005, the Environmental Agency (United Kingdom), Rijkswaterstaat (Netherlands) and the Coastal Engineering Research Council (Germany) agreed to integrate the latest research results in a joint European Overtopping Manual, with the following aims in mind:

- Synthesis of the current know-how in wave run-up and wave overtopping, and elaborating recommendations for practical implementation
- Standard, harmonized manual on wave run-up and wave overtopping for various coastal structures "dikes, breakwaters, seawalls, etc."
- Direct implementation of the manual in a web based software, with release of further computing programs "Neuronal Network, CLASH Database, PC Overtop" as part of a calculation tool.

This state-of-the-art description of available methods for assessing overtopping and its consequences has been published as "European Overtopping Manual" Die Küste 73, 2007 and will be presented by

Dr. Tim Pullen «HR Wallingford»

Prof. William Allsop «HR Wallingford»

Dr. Tom Bruce «University of Edinburgh»

Dr. Andreas Kortenhaus «Universität Braunschweig»

Prof. Holger Schüttrumpf «Rheinisch-Westfälische Technische Hochschule Aachen, Lehrstuhl und Institut für Wasserbau und Wasserwirtschaft»

Dr. Jentsje van der Meer «Van der Meer Consulting»

ICCE 2008 – Short Course 2 Morphodynamic Processes and Modeling

Dr.-Ing. Rainer Lehfeldt

German Coastal Engineering and Research Council (KFKI)

This course focuses on the processes that determine the morphodynamic behaviour of coastal systems. The current issues of sea-level rise and coastal response to climate change are closely related to morphodynamic studies, which involve increasingly more complex modeling systems and extensive data bases. In this context, new conceptual and technical modeling approaches are pursued. Experts in morphodynamics present state-of-the-art material on:

- Large scale coastal behaviour processes and modeling
- Field observations and modeling of tidal inlets
- Effects of coastal structures
- Siltation studies
- Modeling of geological processes
- Small-scale morphological processes
- Morphodynamics of estuaries
- Community modeling

Based on these talks of 30-35 minutes plus short discussion each, breakout groups carry on with discussion sessions on topics of interest put forward by the more than 60 participants.

Autoren:

Dr. Ida Brøker «DHI Water Environment Health»

Dr. Tim Cheshier «HR Wallingford»

Prof. Jørgen Fredsøe «Danish Technical University, Lyngby»

Prof. Andreas Malcherek «Universität der Bundeswehr München, Institut für Wasserwesen»

Dr. Peter Mewis «TU Darmstadt»

Hanz D. Niemeier «NLWKN, Norderney»

Prof. Dano Roelvink «UNESCO-IHE, Delft»

Christopher R. Sherwood «USGS, Woods Hole»

Prof. Marcel J.F. Stive «TU Delft»

Dr. John C. Warner «USGS, Woods Hole»

Die Küste - Book 74

Dr.-Ing. Rainer Lehfeldt

German Coastal Engineering Research Council (KFKI)

Dr.-Ing. Holger Schüttrumpf

Institute of Hydraulic Engineering and Water
Resources Management Aachen University

This volume of "Die Küste" gives a comprehensive overview of the coastal zone along the German coastlines of the North Sea and Baltic Sea from a coastal engineering perspective. The volume provides background information on integrated management processes as well as on related matters concerning communication and public participation. Details of up-to-date facts and figures as well as references for further reading are also listed at the end of each article.

All authors, who are either actively involved in coastal research or hold responsible positions in public administrations or harbour management, have been invited to outline topics relevant to the German coastal zone by way of short articles. With the assistance of guest editors, these contributions have been grouped according to the following key themes:

- natural environment (Rainer Lehfeldt)
- coastal protection (Bernd Probst)
- coastal protection works (Holger Schüttrumpf)
- estuaries and fairways (Harro Heyer)
- ports (Birgitt Brinkmann).

This collection has been published to mark the occasion of the 31st International Conference on Coastal Engineering from August 31 to September 5, 2008 in Hamburg, where more than 850 participants from Germany and abroad will discuss their latest scientific findings in the field of coastal engineering.

Introduction (RAINER LEHFELDT)

KLAUS SCHWARZER, KLAUS RICKLEFS, ALEXANDER
BARTHOLOMÄ and MANFRED ZEILER

Geological Development of the North Sea and
the Baltic Sea

DIRK MEIER

The Historical Geography of the German North
Sea Coast: a Changing Landscape

MANFRED ZEILER, KLAUS SCHWARZER and KLAUS
RICKLEFS

Seabed Morphology and Sediment Dynamics

CHRISTIANA LEFEBVRE and GUDRUN ROSENHAGEN

The Climate in the North and Baltic Sea Region

HOLGER KLEIN and ALEXANDER FROHSE

Oceanographic Processes in the German Bight

WOLFGANG FENNEL and TORSTEN SEIFERT

Oceanographic Processes in the Baltic Sea

JÜRGEN JENSEN and SYLVIN H. MÜLLER-NAVARRA

Storm Surges on the German Coast

BERND PROBST and FRANK THORENZ

Allocation of Administrative Responsibilities and
Legal Framework Conditions

Coastal Protection (BERND PROBST)

BERND PROBST

Coastal Protection along the North Sea and
Baltic Sea Coasts

JACOBUS HOFSTEDE

Coastal Flood Defence and Coastal Protection
along the North Sea Coast of Schleswig-Holstein

KLAUS BEDNARCZYK, ANNE HEELING, DETLEF SCHALLER
and ULRICH VIERFUSS

Coastal Protection at the North and Baltic Sea:
Helgoland Island

FRANK THORENZ

Coastal Flood Defence and Coastal Protection
along the North Sea Coast of Niedersachsen

JACOBUS HOFSTEDE

Coastal Flood Defence and Coastal Protection
along the Baltic Sea Coast of Schleswig-Holstein

BIRGER GURWELL

Coastal Protection along the Baltic Sea Coast –
Mecklenburg-Vorpommern

Coastal Protection Works (HOLGER SCHÜTTRUMPF)

HOLGER SCHÜTTRUMPF

Sea Dikes in Germany

ANDREAS KORTENHAUS, THOMAS BUSS, OLIVER SULZ, JEFF
MARENGWA and HANS-ANDREAS LEHMANN

Storm Surge Protection Walls in Germany

HANS-ANDREAS LEHMANN and HEINZ JASPER

Tidal Barriers at the North and Baltic Sea Coast

PETER FRÖHLE

Detached Breakwaters

FRANK WEICHBRODT

Coastal Groynes in Germany

Estuaries and Fairways (HARRO HEYER)

MARTIN KREBS and HOLGER WEILBEER

Ems-Dollart Estuary

AXEL GÖTSCHENBERG and Andreas Kahlfeld

The Jade

DIETRICH LANGE, HELMUT MÜLLER, FRIEDERIKE PIECHOTTA
and REINER SCHUBERT

The Weser Estuary

MARCUS J. BOEHLICH and THOMAS STROTMANN

The Elbe Estuary

KLAUS BEDNARCZYK, DETLEF SCHALLER and ULRICH
VIERFUSS

The Eider Estuary

JÖRG BROCKMANN, ANNE HEELING, MARTIN POHL and
KLEMENS ULICZKA

The Kiel Canal (Nord-Ostsee-Kanal)

ANNETTE ERNST, HERWIG NÖTHEL and HOLGER RAHLF

Access Routes to Baltic Sea Ports

Ports (BIRGITT BRINKMANN)

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Ports in Lower Saxony

STEFAN WOLTERING and IVEN KRÄMER

Bremen and Bremerhaven

MICHAEL BÖLTING

The Port of Hamburg

GESAMTVERBAND SCHLESWIG-HOLSTEINISCHER HÄFEN

The Ports of Schleswig-Holstein

ULRICH BAUERMEISTER

Ports in Mecklenburg-Vorpommern

PETER FRÖHLE

Marinas in German Coastal Areas

JADEWESERPORT REALISIERUNGSGESELLSCHAFT

The Construction of JadeWeserPort

A Deepwater Container Terminal in Wilhelms-
haven

Symposium on the, protection of dams, dikes and barrages ("Sicherung von Dämmen, Deichen und Stauanlagen") at the University of Siegen, March 12 and 13, 2009

Univ. Prof. Dr. Jürgen Jensen

University of Siegen

3. Symposium on the ,protection of dams, dikes and barrages ("Sicherung von Dämmen, Deichen und Stauanlagen") at the University of Siegen, March 12 and 13, 2009

On March 12 and 13, 2009, the Geotechnical Institute (Institut für Geotechnik – IfG) and the Research Institute for Water and Environment (Forschungsinstitut für Wasser und Umwelt – fwu) of the Faculty of Civil Engineering, University of Siegen, will hold the third Symposium on the "Protection of Dams, Dikes and Barrages". This symposium will be chaired by Profs. Dr.-Ing. Richard Herrmann and Dr.-Ing. Jürgen Jensen.

For the third event of this series of symposia topics with emphasis on the following areas have been chosen:

- Design principles and models
- New construction and renovation measures
- Materials, e.g. geo-textiles
- River and sea dikes
- Dams, storage reservoirs and barrages
- Indirect investigation methods, e.g. geo-physical techniques

Personnel from construction companies, administrations, engineering consulting firms, construction material manufacturers and research institutions are invited to participate in the symposium. Abstracts of papers to be presented can be submitted to the University of Siegen (fwu@fb10.uni-siegen.de, geo@fb10.uni-siegen.de) until September 08, 2008. Extensive investigations into the safety of dams and barrages based on interdisciplinary cooperation between fwu and IfG form the basis for the symposium series "Protection of dams, dikes and barrages". The severe floods of summer and fall of the year 2000 in the South and East of Germany and its bordering countries served to emphasize the topicality of the problems at that time. In 2003, the 1. symposium was aimed at introducing new as well as established

methods, structures and materials for the emergency protection of dams and dikes. Furthermore, selected topics, focussed on the safety of dams and dikes, such as design criteria, geo-textiles, geo-membranes, soil solidification, computer forecast models as well as the reconstruction of existing dams and dikes were made part of the program. Results of this first symposium have been published in the manual and reference book "1. Handbuch – Sicherung von Dämmen und Deichen" which was introduced on the "AQUA-alt" and on the "Geotechnical Symposium" of the DGGT (Deutsche Gesellschaft für Geotechnik e.V.) in 2004.

Following the success of the first symposium, the second event of the series focussed on the catastrophic events of the Tsunami in South-east Asia, the flooding of new Orleans and, in particular, on the flood events in the alpine regions of Austria, Switzerland, Southern Germany (Bavaria, Baden-Württemberg) and in Eastern Europe in 2005 and 2006, respectively. Again, this symposium was to represent a forum for the compilation of scientific results, for documentation but primarily for identifying new roads towards flood protection. In order to obtain a balanced mixture of theoretical and practical approaches, the following focal topics were included:

Field reports concerning flooding events (structural damage, Elbe 2002, Tsunami 2004, hurricane New Orleans 2005)

- Basic design principles (erosion, soft spot analysis, simulation, field measurements, overtopping, design water levels)
- New construction and renovation (analysis, compaction machinery, boosting efficiency, protection)
- Concepts for stability and structural integrity (national and international comparison and verification of safety, MSD 2005)
- Construction materials – geo-synthetics (clay sealing sheeting, applications, RC material)

The specific importance of this symposium series for the University of Siegen became already evident at the opening of the second symposium in February of 2006. The solidarity between the City of Siegen and the university as well as the hospitable reception of the visiting scientists in the "City of Rubens" was expressed by Mayor Ulf Stötzel in his welcome address.

The symposium was inaugurated with a lecture by

Prof. Dipl.-Ing. Dr. techn. Dr. h.c. Dieter Gutknecht, chairman of the Institute for Water Engineering and Engineering Hydrology of the Technical University of Vienna. The topic was "About the Detection of Risks of Flooding – New Developments in Hydrology". In spite of the diversity of papers presented during the symposium, each presentation was accompanied by a professionally well-founded discussion.

Examples of centred topics and results of presentations and discussions showed

- that climate change takes place and we have to adapt to the consequences, e.g. by better counteracting the dangers of flooding,
- that controllable polders can contribute to the capping of flood peaks more effectively than relocated dikes,
- that dikes, improved and strengthened by various well-proven construction methods, remain the backbone of a technical flood protection,
- that by using geo-synthetics, dikes can be built that can take overtopping, thus making the unrulable design criteria "overtopping" controllable. This will trigger a "new design" of dikes the directives of which have to be drafted, yet, and
- that an adequate risk management with suitable design methods is required.

The results of the second symposium have also been published in an add-on volume (no. 2) of the manual "Handbuch – Sicherung von Dämmen und Deichen" in 2006. These books can be purchased at the University of Siegen.

The patronage of the symposium series for the "Protection of dams, dikes and barrages" is assumed by the DGGT. Future symposia of this series will be organized in cooperation with the Working Group on "Sealing Systems in Water Engineering" (Dichtungssysteme im Wasserbau). This is a study group of the "German Association for Water Management, Waste Water and Wastage" (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (DWA)), the DGGT and the "German Port Technology Association" (Hafenbautechnische Gesellschaft – HTG), thus working towards and offering an event with European background.

Identification of morphological trends and process velocities in the nearshore zone

Dr. Peter Milbradt

Catrin Dorow

Leibniz University of Hannover, Institute for Computer Science in Civil Engineering

Introduction

The evaluation of long-term morphological changes and their forming processes at the German North and Baltic Sea coast is an essential prerequisite for planning, design and realization of sustainable concepts for coastal protection and development. The newly defined "digital terrain model" consists of a multitude of sets of basic data and the associated guidelines for interpretation in space and time. This opens up new possibilities to derive sophisticated information about morphological changes in the nearshore zone from the available survey data.

Methods

Bathymetric and topographical surveys carried out on

a regular basis by several institutions and with various measurement methods and objectives form the basis for the evaluation of morphological changes in the nearshore zone. Even though measurement techniques are being improved continuously, the synoptic bathymetric survey of large areas of the sea bottom will not be possible in the near future. The idealized concept of a digital terrain model in time and space is used for the evaluation of temporal and spatial changes of the bathymetry. Thus, the "digital terrain model" incorporates a multitude of sets of basic data and their associated interpretation guidelines. The single set of basic data contains all survey data recorded under equal conditions. They can be utilized to describe a partial area of the topography.

In order to guarantee the temporal allocation, all measurements recorded by one and the same device during one day are assigned to one basic data set. The interpretation guidelines include all additional information concerning elevation the depth at any points in space and time, which have not been surveyed, yet. This initially includes the applied interpolation and approximation methods in space as well as the associated confidence area. The confidence area describe all locations for which terrain elevat-

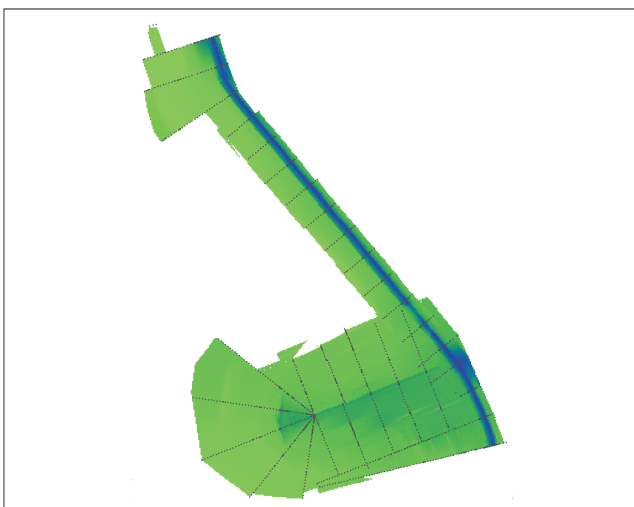


Figure 1:
Interpolation on profiles within the non-convex range of assertion of a data set

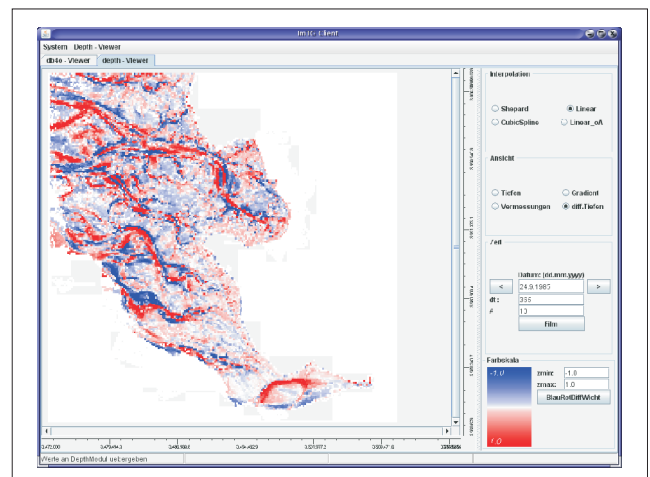


Figure 2:
Regions of sedimentation and erosion derived from the depth difference of the years 1985 and 1984 in the region of Dithmarscher Bucht (Schleswig-Holstein)

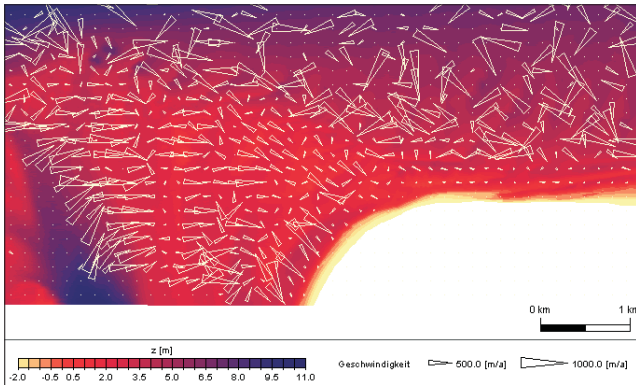


Figure 3:
Derived velocities of morphological processes with depth distributions of the island of Langeoog in 2002

ions can be derived from the survey points by applying the interpretation guidelines. This definition enables the application of the suitable approximation or interpolation method for each basis data set, thereby accounting for data sets of different character obtained similarly by various methods (e.g. line and area surveys, fan-type soundings as well as laser-scanning).

If no explicit assumptions concerning the interpolation and approximation methods can be made, it may be possible to apply the survey data to train artificial neuronal networks (ANN) for the representation of the topography. Particularly for the transition to a temporally variable terrain model, artificial neuronal networks can be trained to yield unknown interrelationships.

For the determination of quasi-synoptic terrain models at arbitrary times, temporal interpolation and interpretation methods have to be additionally introduced, and temporal ranges of confidence have to be defined. Thus, a quasi-synoptic digital terrain model at a point of time can be considered as a horizontal intersection in the spatial and temporal range of confidence.

Based on such a quasi-continuous terrain model, which is variable in space and time, multifaceted

conclusions, in particular non-classical analyses such as the calculation of derivations and iso-planes and their derivatives are possible.

Intermediate results

Bathymetric data sets, which have been made available by the project partners NLWKN, LKN-SH, StAUN Rostock and BAW-DH, can be archived using an object-oriented data base. This includes also meta data and methods used.

For this purpose, the attached meta data, which had been delivered in various formats, had to be harmonized and complemented by project-relevant meta information such as confidence region and reliability. Identification and reconstruction of structures in survey data, which resulted from the measurement method and determined a suitable interpolation method, have led to a significant improvement of the quality of the ensuing terrain models.

The amount of data sets required a problem-specific efficient administration with an especially fast access to survey points which had to be interpolated. For this, an indexing process based on additional internal meta data was realized.

Future prospects

For the continuous improvement of the coupled spatial and temporal interpolation and approximation methods more information has to be called in. This includes e.g. the consideration of spatial and temporal discontinuities such as encroachments by man as well as derived morphological process velocities and resulting sediment transport directions. The further optimization of the object-oriented administration of data and methods in the bathymetrical data base and their integration into engineering applications are yet another challenge in this project.

Elevation levels of gauge reference datums, recent vertical crustal movements, and water level variations of long periodicity on the German North Sea coast

Dr.-Ing. Astrid Sudau

Dipl.-Ing. Robert Weiß

Federal Institute of Hydrology (bfg)

The variation of the mean sea level (MSL) is considered by many scientific institutions to be an indicator of global climate change. Particularly, rising water levels are interpreted as a consequence of global warming. Nowadays, water level variations of long periodicity are derived from satellite altimetry and analyses of long series of observations from water level gauges.

The acceptance of long-term water level time series as indicators of climatic changes implies that the elevation of gauges and their reference datums remain constant or are known over the entire observation period. According to the German Manual for Water Level Gauging and Discharge Measurements ("Gauge Specification", Pegelvorschrift), the decisive part of any conventional gauging station is the staff gauge consisting of the staff with the scale and at least three benchmark points (Pegelfestpunkte PFP). The origin (Nullpunkt) of the gauge staff scale is called the gauge datum (Pegelnullpunkt PNP). The benchmark points (PFPs) are used to monitor the height of the gauge staff and serve to check the immediate surroundings of the gauge station for vertical land movements. The height differences between PFPs and the PNP that were registered when the gauge was established are called the height setpoint differences (Sollhöhenunterschied (hsoll)). In order to be able to compare water levels at various locations, the observations have to be referred to a consistent height reference system. For this reason, the "Gauge Specification" requires the height alignment of PFPs, and thus also of PNPs to the official height reference system. In reality, PFPs are sometimes subject to vertical movements. Based on experience and with view to the local conditions, at least one of the PFPs has then to be defined as the representative one.

Tectonic and anthropogene influences (e.g. extraction of natural gas) may cause vertical movements of the earth's surface (recent crust movement), and the installed water level sensors (gauges) follow these movements. Frequently, true variations of the water level and recent crust movement superimpose. Unidentified or neglected vertical movements of the gauges can be mistaken for water level variations, while those due to hydrological or climate-related causes cannot be identified.

For historical reasons, there are now in Germany several official height reference systems in existence that deviate by up to several centimetres and cannot be combined among each other. Because water level gauges are referred to different respectively valid height reference systems, their heights differ. Currently, for the first time a revision of the German Main Level Network (Deutsches Haupthöhennetz) is being performed according to uniform criteria throughout the reunified Germany. As a consequence, updated heights of all gauges will be available around 2011. Temporal and spatial comparisons or analyses of time series are possible only when all gauge heights can be referenced to one common datum. This is not the case for the time being. The correct evaluation of water level series presupposes the transfer of historical and present-day reference heights into one system that is homogenous in space and time.

The "Gauge Specification" stipulates that with the initial installation of a gauge in coastal waters the gauge datum (PNP) must be fixed at an elevation of NN - 5.00 m. Furthermore, the height setpoint differences and, consequently, the inner geometry of the gauges should be kept unchanged during the service-life of the gauge, if possible. However, when the heights of the benchmark points (PFPs) change, inevitably a contradiction arises that leads to different interpretations of the "Gauge Specification" concerning the preservation of the PNP heights and the handling of transitions between height-reference systems. There are to-date two methods to respond to changes in gauge elevation: On the one hand, a mechanical shift of the gauge staff and respective corrections in the height setpoint differences (Sollhöhenunterschied - hsoll) are made. On the other hand, the height of the gauge datum (PNP) is changed, while the height setpoint differences (Sollhöhenunterschied (hsoll)) are retained. In the course of time, both

methods have been practised at one and the same gauge. Changes between height reference systems have not been taken into account often. The consequences are inhomogeneous data inventories. From a geodetical viewpoint, these data are inadequate to serve as a basis for the verification of climate-induced water level changes.

Within the GCERC-project IKÜS the effects of the above-mentioned practices have been studied at selected gauges. In the following, these effects will be presented exemplarily:

1. Recent crust movement, the example of the island of Norderney

In the course of time, the gauge of Norderney had two different locations and several benchmark points (PFPs) as reference (Fig.1). Some PFPs are in the immediate vicinity of the gauge staff (e.g. PFP 55/56) while the PFP 1 is located in some distance and is pegged as a deep-foundation pipe benchmark. The latter has been chosen to be the representative benchmark for the gauging station.

The official heights of PFP 1 and of the gauge datum (PNP) of the gauge Norderney are compiled in Table 1. At this gauge, the gauge staff have been shifted and the height of the PNP have been changed.

The reason for the need to modify the fixing height of the staff may be changes in the elevation of the location of the gauge such as land subsidence. The shift of the gauge staff by the amount of this subsidence constitutes a "mechanical compensation" of the discovered height changes (e.g. caused by a vertical crust movement). Thus, these movements are not reflected in the measured water levels.

At the gauge Norderney, the benchmark points PFPs

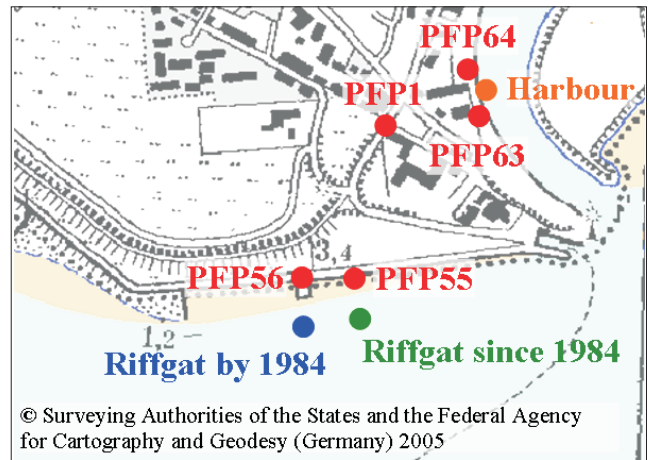


Figure 1:
Location of the PFPs for the gauge Norderney

55/56 and 63/64 are more affected by subsidence than PFP 1. The increased subsidence of the land was positively verified by regular levellings between PFP 1 and the other PFPs.

From 1957 to 1984, PFP 1 experienced a vertical movement of 1.1 mm/a, while the PFPs 55/56 and 63/64 that are located directly at the gauge, subsided by 2.6 and 2.7 mm, respectively.

Relative to PFPs 55/56 and 63/64, the water levels increased faster due to the stronger land subsidence at their sites. Consequently, in addition to the changed water level with relation to PFP 1, this subsidence of the PFPs 55/56 and 63/64 should be accounted for when designing and dimensioning coastal structures.

2. Change of the height reference system a. Height reference system change at the gauge Norderney

Starting in 1912, the introduction of the height system DHHN12 (Deutsches Haupthöhennetz 1912)

| Datum | Standort Pegellatte | Pegelfestpunkt 1 | | PNP H [m] | |
|------------|------------------------|------------------|------------------------------|--------------|--|
| | | H [m] | Δh_{soll} [m] | | |
| 01.11.1935 | Hafen | 5,014 | 10,014 | -5,000 | |
| 16.12.1957 | Hafen | 4,999 | 10,014 | -5,015 | Änderung PNP |
| 16.12.1957 | Riffgatt | 4,999 | 9,999 | -5,000 | Änderung Pegellatte / Δh_{soll} |
| 25.04.1984 | Riffgatt | 4,968 | 9,968 | -5,000 | Änderung Pegellatte / Δh_{soll} |
| 30.11.1994 | Riffgatt | 4,981 | 9,968 | -4,987 | Änderung PNP |

Table1:
Elevations and level setpoint differences h_{soll} of PFP 1 at the gauge Norderney

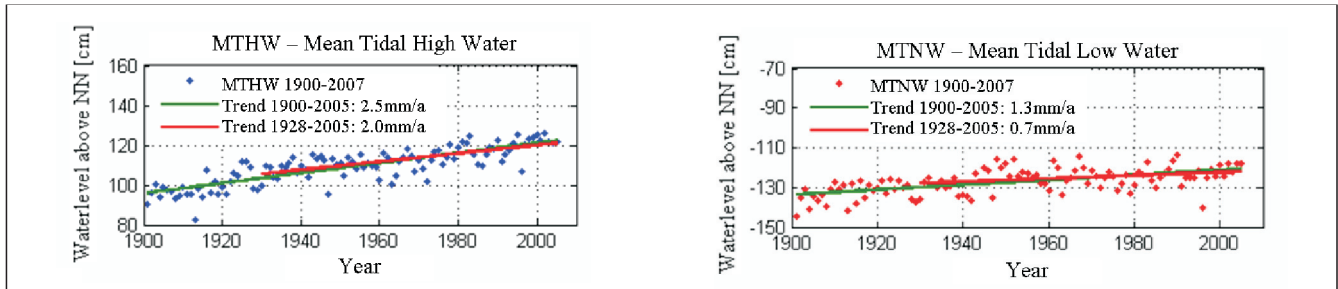


Figure 2:
Water level trends at the gauge Norderney

for the first time took the gravity field of the earth into account. This made it suitable for applications in hydrology (NN - new system). The preceding system "NN - old system", did not meet this requirement, and it is not compatible with DHHN12. The island of Norderney was aligned to the "NN - old system" in 1907; the connection to "NN - new system" followed in 1928. Due to the incompatibility of these two reference systems, their data cannot be combined, that means level data from the two systems cannot be used conjointly for water level trend analyses. Therefore, over the entire period between 1900 and 2005 water level trend analyses are not acceptable with data from this gauge. A correct evaluation requires the transfer of the data obtained before 1928 into the height reference system "NN - new system".

Additionally, in 1935, 1957, 1984, and 2011 new updates of the official height systems were established in large-area measurement campaigns. Each campaign is based on its own network reference (height datum) and calculation approaches. First approaches towards a homogeneous evaluation for all levelling campaigns have been defined within the framework of IKÜS. These efforts, however, have not yet become operational.

b. Change of height reference system at the gauge Helgoland

Because of Helgoland's location in the open sea, it had not been possible until a few years ago to transfer the height reference system from the mainland to the island. Consequently, the so-called "Helgoland ordinance datum" (Helgoländer Null – HN) had been introduced as a special solution, and the gauge datum PNP Helgoland was set at HN – 5.00 m. Some years ago, a satellite-based transfer of the official ordinance height system NN to Helgoland was accomplished, followed by the allocation of new NN heights to all benchmarks and PNPs of the island. The competent federal authority, the Waterways and Shipping Office (Wasser- und Schifffahrtsamt - WSA) Tönning, changed the height of the Helgoland gauge datum from HN – 5.00 m to NN – 5.00 m in 2001. The Helgoland reference height system HN is 0.27 m above the height reference system NN, what necessitated a downward shift of the gauge staff by 0.27 m. Water levels recorded at this tide gauge show a jump of 0.27 m since the date of this modification.

3. Recent crust movement at Knock-Emden

The region Groningen (The Netherlands) is an example of vertical crust movement induced by the

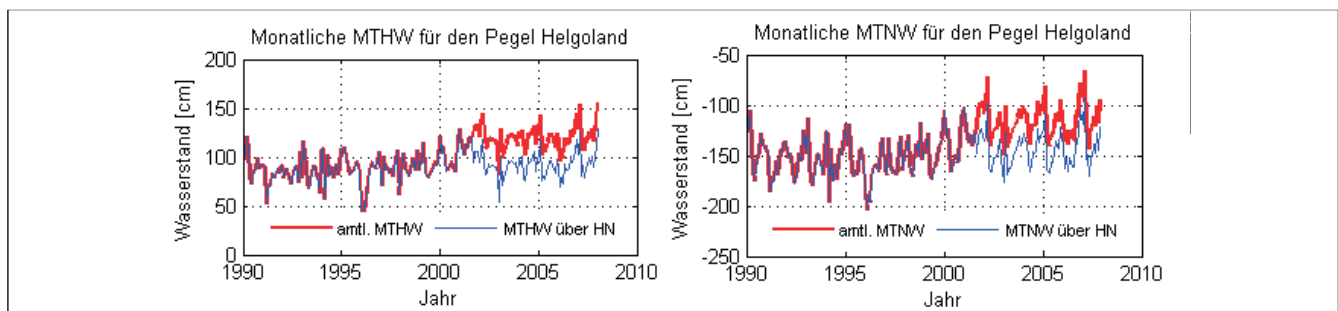


Figure 3:
Effect of the system change from the Helgoland ordinance datum HN to NN on the water level records

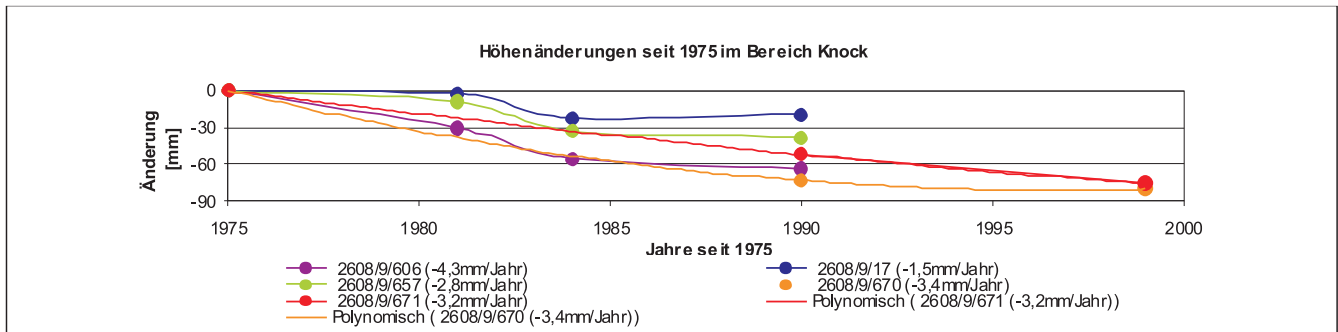


Figure 4:
Subsidence rates of the official reference points in the immediate vicinity of the gauge Knock

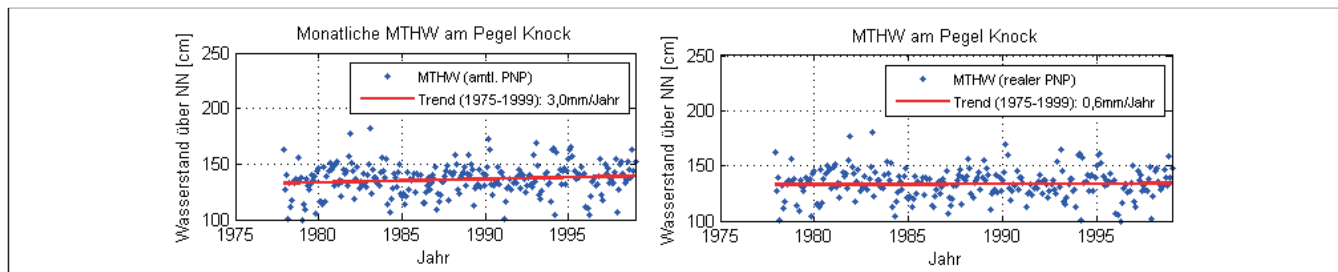


Figure 5:
Gauge Knock

extraction of natural gas that has been practiced there since 1957. The effects of these movements with a subsidence rate of more than 3 mm/a reach as far as the region between the island of Borkum and the town of Emden, where also the water level gauges are affected (e.g. gauge Knock). Figure 4 illustrates the land-subsidence values at the gauge Knock. At this gauge, the elevation was adjusted twice, in 1975 and in 1999, the height of the gauge datum (PNP) differs by 5.3 cm. The linear trends of the monthly averaged MTHW using the official PNP are 3mm/a and with a more realistic PNP, when the land subsidence was accounted for by interpolation, 0.6 mm/a.

The trends after 1999 were not derived, because no updates of the gauge-datum elevation since then are available. The apparent water level rise is obviously correlated with the subsidence rates. These phenomena can be found elsewhere in Germany too, also in inland regions. Recent tectonic crustal movements can be determined (and used for water level analyses) only by evaluation of large-scale levellings beyond national borders or in the context of GNSS-supported height monitoring.

4. Summary and conclusions

Analyses of long-periodicity water level variations have to take the above-mentioned geodetic aspects into account. Moreover, the “mechanical” shifting of gauge staffs resulting from a misinterpretation of the “Gauging Manual” must be corrected. Only then, meaningful statements can be made about climate-induced water level changes. In order to avoid misinterpretations, it is necessary to transfer the existing gauge-datum points (PNPs) and benchmark points (PFPs) into one height reference system that is homogeneous in terms of space and time. For several years now, the use of GNSS-methods has made it possible to monitor elevation changes and to feed the results into a globally compatible reference system. Although this method needs further development, transboundary monitoring of long-periodicity water level variations and combination with data from other sensor systems (e.g. satellite altimetry) have already become possible. Cooperation between administrative and scientific institutions can make the information about long-periodicity water level variations so reliable that it may be used as an indicator of climatic changes.

Events

- August 31 to September 5, 2008 **ICCE 2008: 31st International Conference on Coastal Engineering**, CCH (Congress Centre Hamburg), Hamburg
info: icce2008.hamburg.baw.de
- September 8-12, 2008 **ICHE-2008: 8th International Conference on Hydro-Science and Engineering**, Nagoya, Japan
contact: ttsujimoto@genv.nagoya-u.ac.jp
- September 10-12, 2008 **Enviroinfo 2008: Environmental Informatics and Industrial Ecology**, Leuphana University of Lüneburg
info: enviroinfo2008.org/index.php
- September 11, 2008 **Planung und Durchführung von Erd- und Nassbaggerarbeiten an Wasserstraßen**, Federal Waterways Engineering and Research Institute (BAW), Hamburg
info: www.baw.de/vip/veranstaltungen1.php.html
- October 7-9, 2008 **PIANC Mediterranean Days of Coastal and Port Engineering**, Palermo, Italien
info: www.ric.unibo.it/SiteData/Files/Eventi/PIANC_Mediterranean_Days.pdf
- October 10, 2008 **2. Hamburger Symposium Geoinformationen für die Küstenzone**, HafenCity University, City Nord, Hamburg
info: www.gis-kueste.de/2008/syinfo08.html
- October 16, 2008 **Wasserstraßen: Verkehrsweg und Lebensraum in der Kulturlandschaft**, Federal Waterways Engineering and Research Institute (BAW), Karlsruhe
info: www.baw.de/vip/veranstaltungen1.php.html
- October 30, 2008 **Neue Konzepte, Entwicklungen und Ergebnisse im Küstenwasserbau**, Federal Waterways Engineering and Research Institute (BAW), Hamburg
info: www.baw.de/vip/veranstaltungen1.php.html
- November 5, 2008 **KFKI-Seminar**, Deutsches Schiffahrtsmuseum (DSM) Bremerhaven
info: kfki.baw.de/KFKI-Seminare.41.0.html
- November 6, 2008 **Zukunft Küste - Wandel verstehen, planen, nutzen**, FTZ Büsum
info: iczm.ecology.uni-kiel.de/servlet/is/13082/
- January 12, 2009 **8. HIC Hydro-Informatics Conference**, Concepción, Chile
info: www.hydroinformatics-community.org/conferences/2009-hic
- March 12-13, 2009 **3. Symposium Sicherung von Dämmen, Deichen und Stauanlagen**, University of Siegen
info: fwu.fb10.uni-siegen.de/geo/CfP%202009_Siegen.pdf

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