Vom Sensor zum MIKE Modell

Grundhochwasserworkshop in Bremen
27. April 2016

M.Sc. Dominic Spinnreker
Wasser-, Umwelt-, und Küsteningenieur

MIKE Technologies for all Water Environments

MIKE MODELS

MIKE INFO

MIKE PLANNING

MIKE OPERATIONS

MIKE
Powered by DHI

We will enable MIKE software users to build solutions for their clients!

DHI

MIKE OPERATIONS On-line forecasting and operational control

Operational overview

Notifications & Alarms

Emergency response

System Optimisation

System control

Data Integration

One window to all data

Notifications & Alarms

On-line Control (Data driven)

Objective Decision Making

Stakeholder involvement

Robust Decisions

Wise investments

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Project References

Water Resources

Hydrological Forecasting
Piedmonte, Italy (Case story)

Protecting Bangkok from Floods
Chao Phraya River Basin, Thailand (Case story)

Optimised River Operations
Murrumbidgee River, Australia (Case story)

Reservoir Operations
Krishna and Bhima Rivers, India (Case story)

DSS for Pianura Di Ferrara
Canterbury, New Zealand (Case story)

Optimize Irrigation Canal Operation
Canterbury, New Zealand (Case story)

Improving Water Management in North India
North India (Case story)

And many more…..
Africa, India, Europe, USA

LAKE VICTORIA IMS
Lake Victoria Basin, Africa (Case story)

Volta Basin
Burkino Fasso, Africa (on-going)

Zambesi River IMS
Zambesi Basin, Africa (on-going)

Zambia Water Information System
Zambia, Africa (on-going)

National Water Information System
South Africa (on-going)

Client segment
Water & Environment Authorities
Flood Protection Agencies
Mining
Dams
Consultants

Nile Basin DSS
Nile Basin, Africa (Case story)

Managing Increased Water Demands
Southern India (Case story)

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Project References

Urban and Industry

Bathing Water Forecast System
Copenhagen, Denmark (Case story)

Real-Time Irrigation Canal Operation
New Zealand (Case story)

Online Water Distribution Model
ØVRE EIKER, Norway (Case story)

Urban On-line Water modelling system
Zurich, Switzerland (Case story)

And many more…..
Africa, India, Europe, USA

Data Management Made Easy
Cape Town, South Africa (Case story)

Leakage Reduction
Templice, Czech Republic (Case story)

Client segment
Water utilities
Consultants
Industries

Water Management Plan
City of Olomouc, Czech Republic (Case story)

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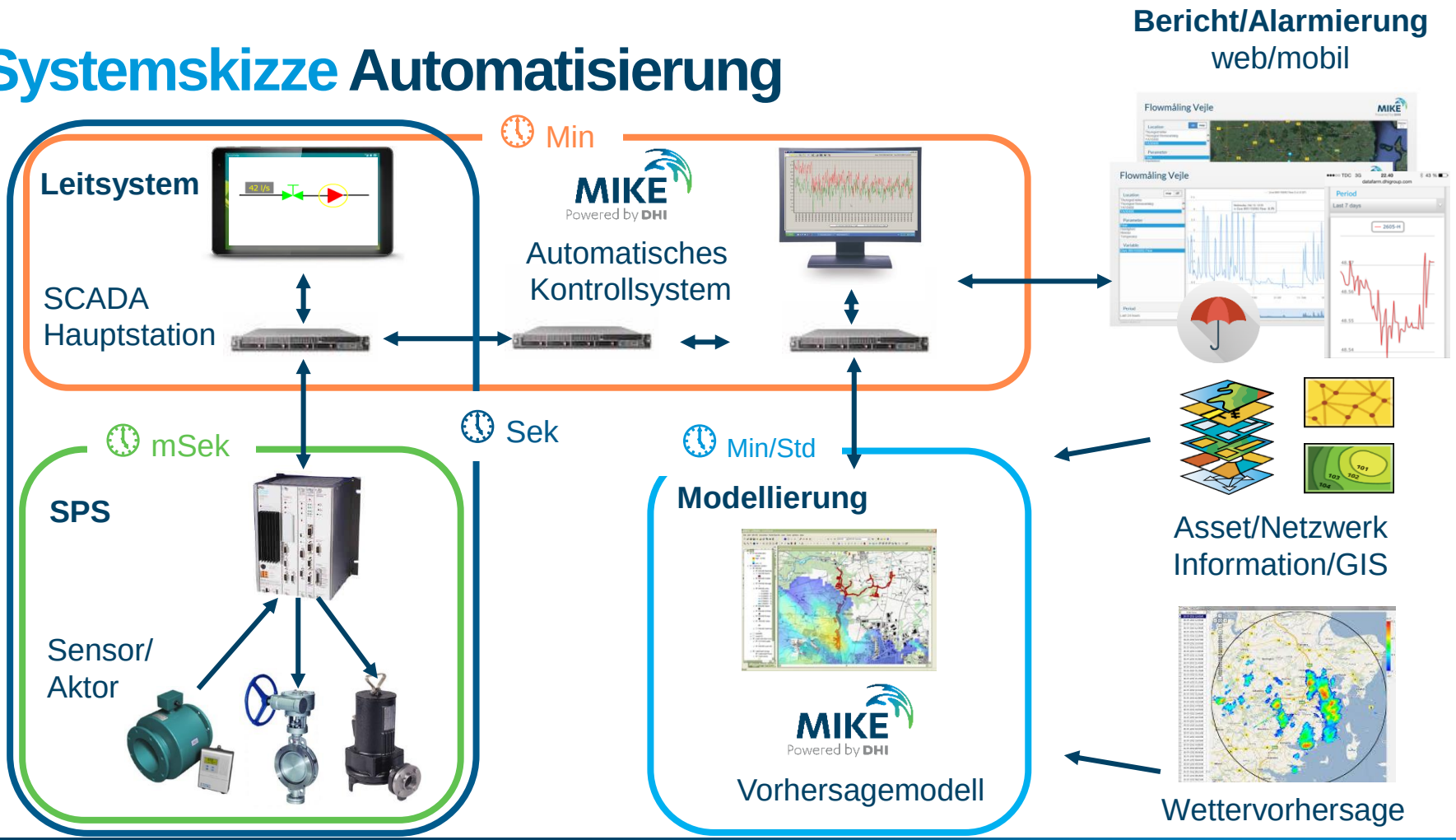
Systemskizze Automatisierung



Wertschöpfungskette

Eingangsgrößen

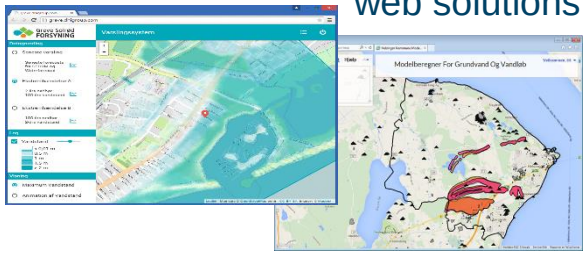
Virtuelle Ebene

Entscheidungs- und Steuerungsebene

Customization Options

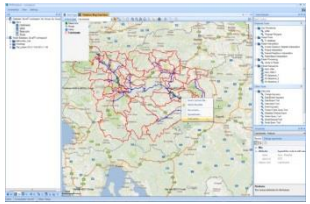
Configure layout and Information

Develop web solutions

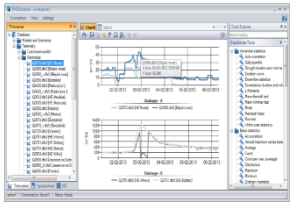


Web Solutions

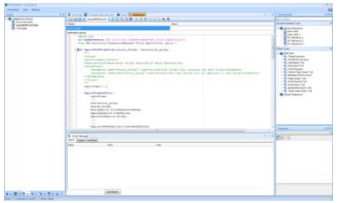
API



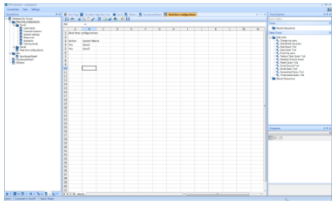
GIS



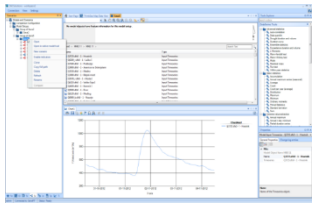
Time-series



Scripting



Spreadsheets



Jobs

Configuration Platform

Extend by Scripts, Data Reports, Tools, New Modules

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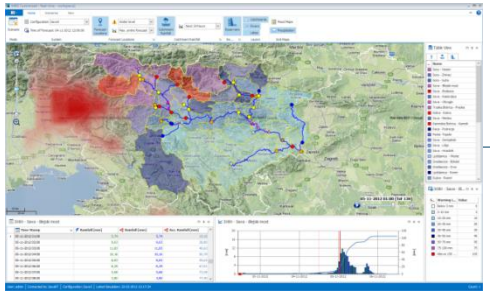
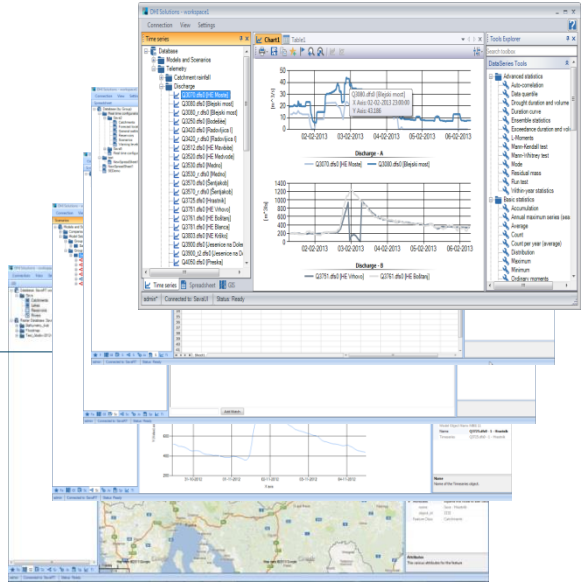
Unterschiedliche Nutzeroberflächen und Darstellungen

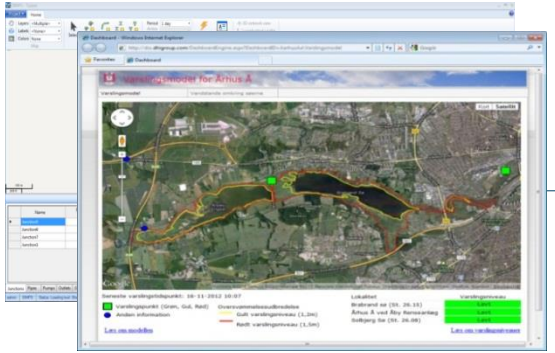
Betreiberansicht (Produkt)



Datenbankansicht (Komponente)



maßgeschneiderte Ansicht (Endnutzerlösung)



Datenbank

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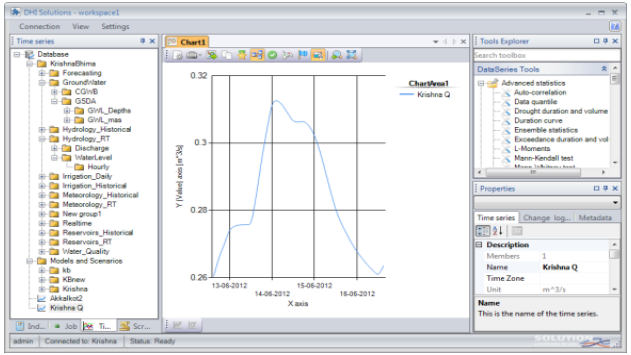
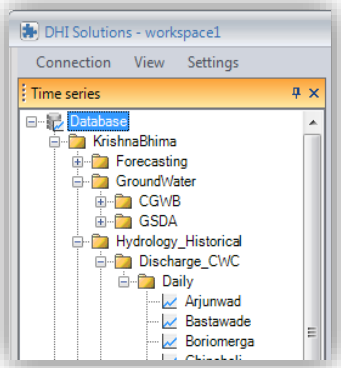
Unterschiedliche Nutzeroberflächen und Darstellungen

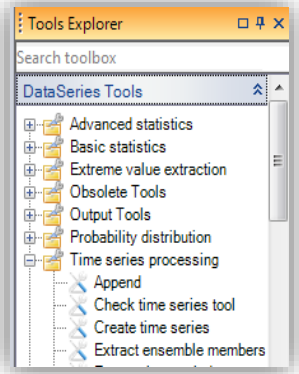
Benutzeroberfläche



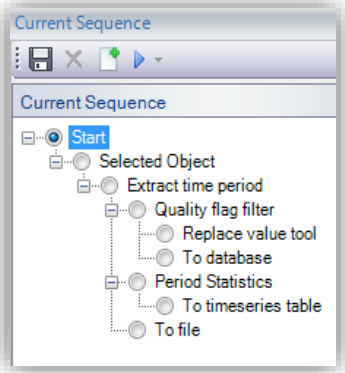
Daten organisieren



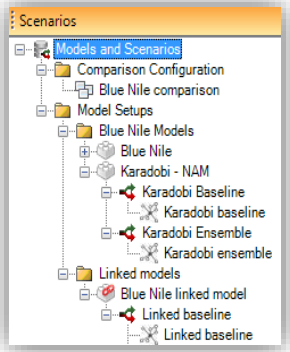
Werkzeugboxen



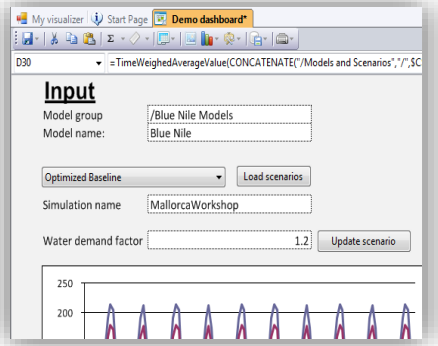
Sequenzen



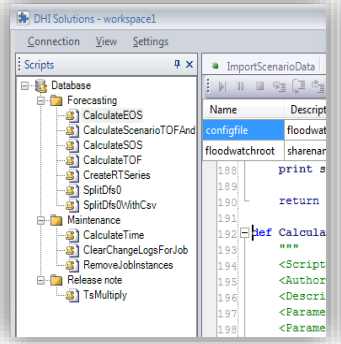
Modelle



Spreadsheets

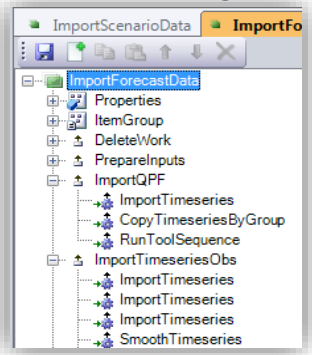


Skripte



Karte

Automatisierung



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Flussgebietsmanagement

New South Wales, Australien

Über 1.600 Gewässerkilometer mit zwei Dämmen und tausenden von Wassernutzern. **Ein** Gewässermanagementsystem.

Computer Aided River Management system (CARM)

"CARM is a world class development designed to maximise the efficiency of the Murrumbidgee River system."

Brett Tucker, Chief Executive Officer, State Water Corporation, New South Wales, Australia

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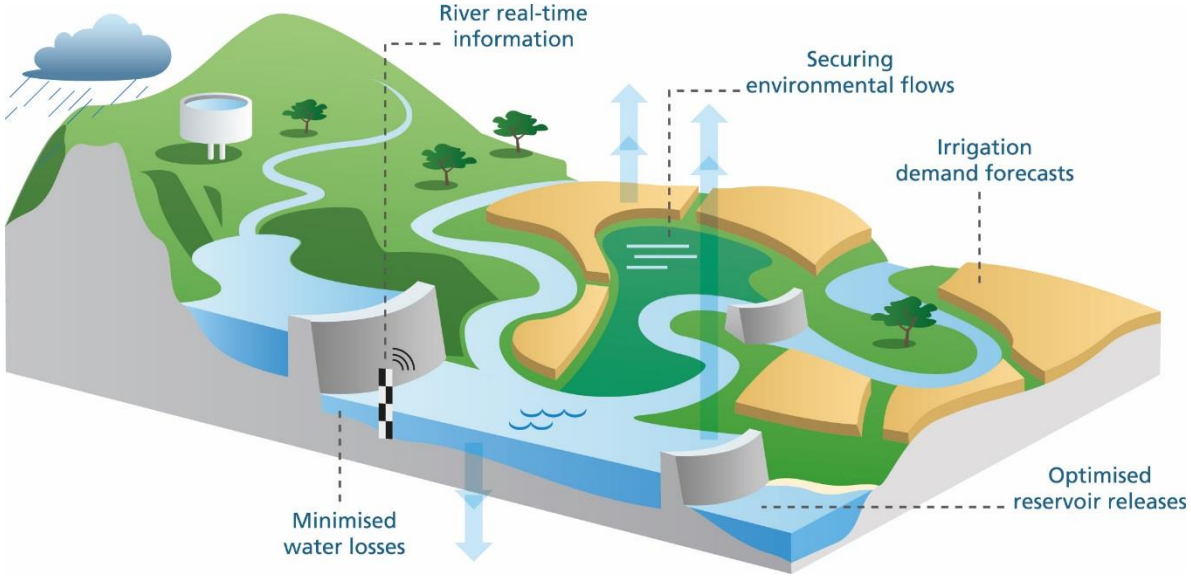
Gewässerbetrieb

New South Wales, Australien



“The CARM project will make control of water flows more responsive and more precise.”
State Water Corporation

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Wasserentsorgungssystem

Kapstadt, Südafrika

17.600 km Haltungen. 700 Pumpen. 130 Reservoirs. 13 Kläranlagen. **Ein** Datenmanagementsystem.

Dynamic Integrated Monitoring System (DIMS) Kapstadt

"We expect to save a considerable amount of water, time and money every year."

Jaco de Bruyn, Head, Integrated Planning, Strategy and Information Management - City of Cape Town's Water and Sanitation Department

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Wasserversorgungssystem

Kapstadt, Südafrika

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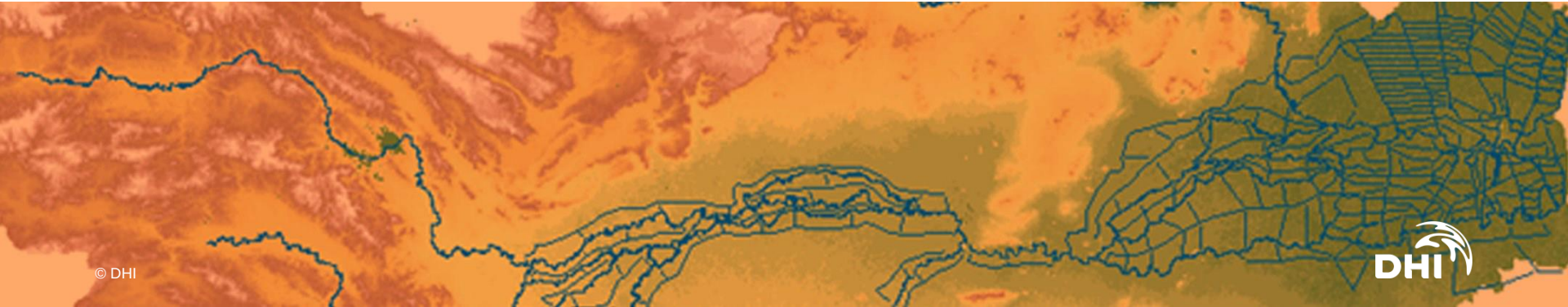
Frühwarn- und Vorhersagesystem

Chao Phraya, Thailand

Das **Chao Phraya** Flusseinzugsgebiet. 160.000km^2. **Ein** Entscheidungshilfesystem zum Schutz vor verheerenden Überschwemmungen.

"HAII highly appreciates DHI for their excellent job, especially on the close collaboration and hands on experience that made us become a good partner."

Dr. Piyamarn Sisomphon, Project Leader, Hydro and Agro Informatics Institute



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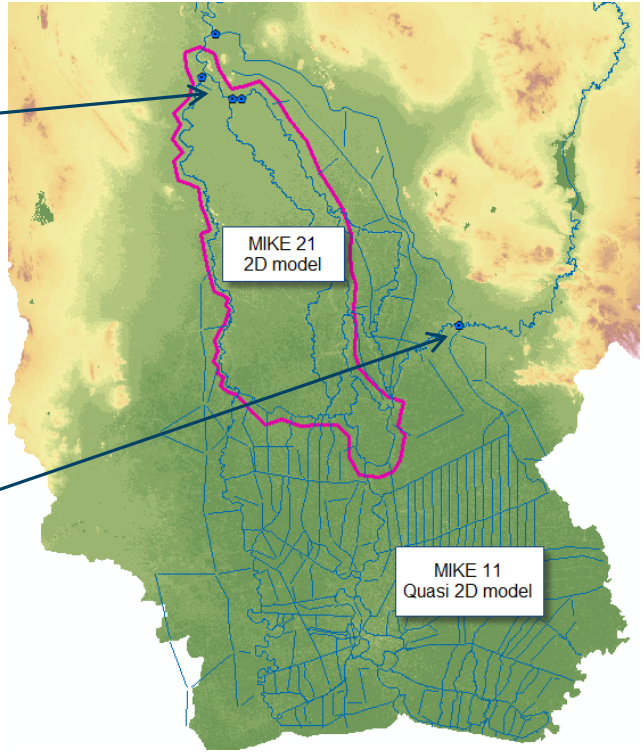
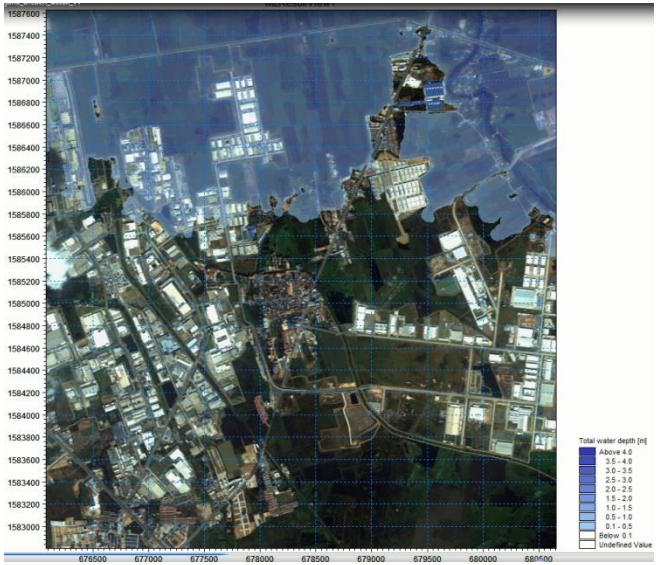
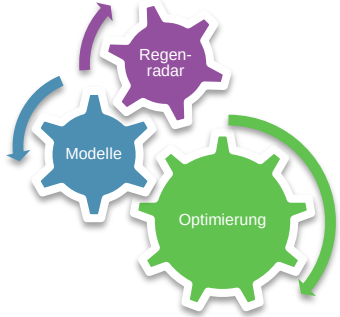
Frühwarn- und Vorhersagesystem

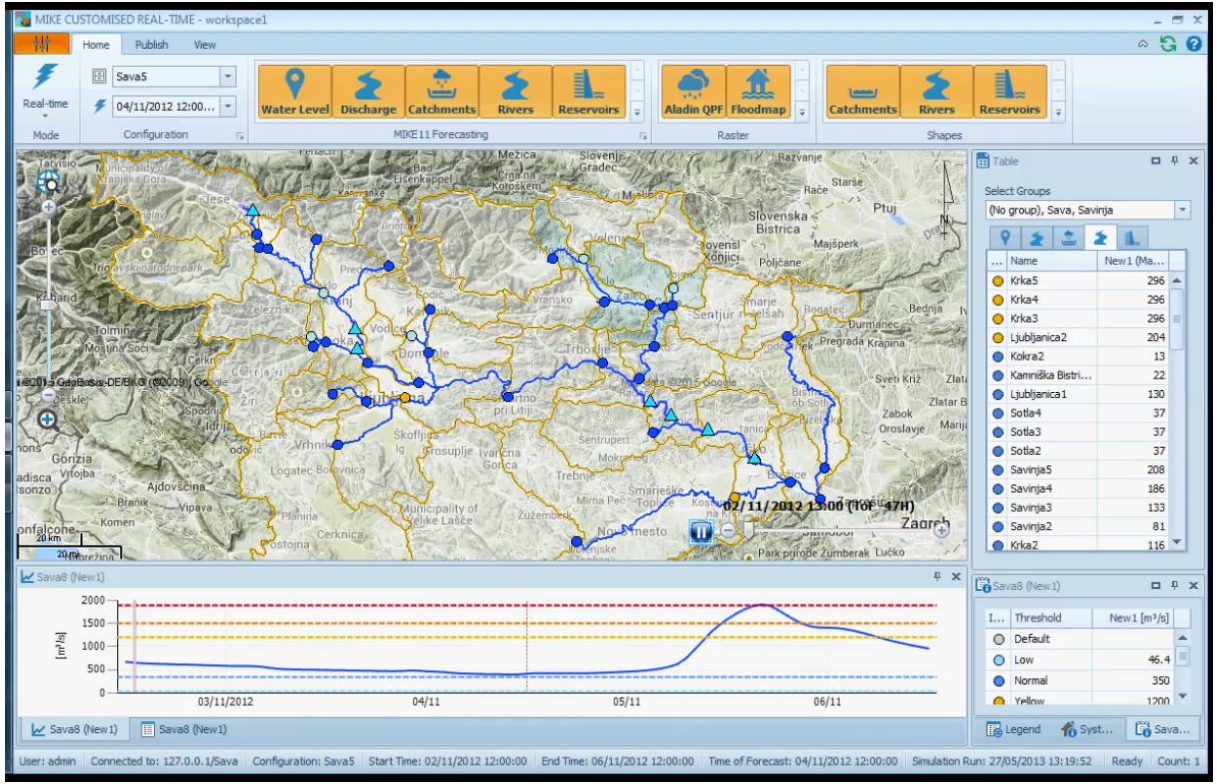
Chao Phraya, Thailand

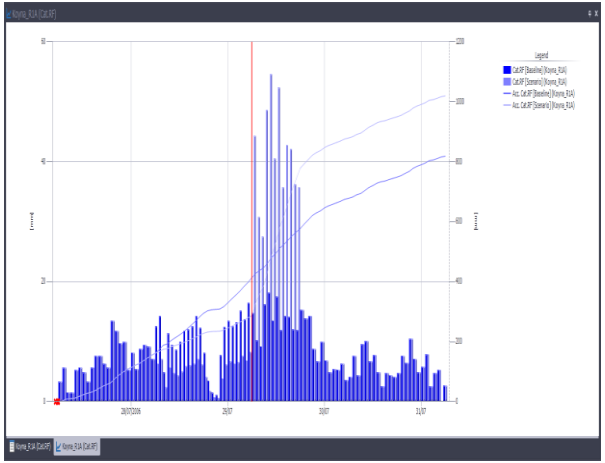




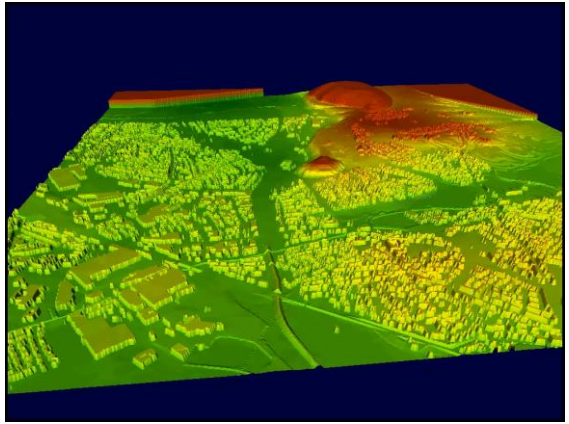
Szenarienanalyse

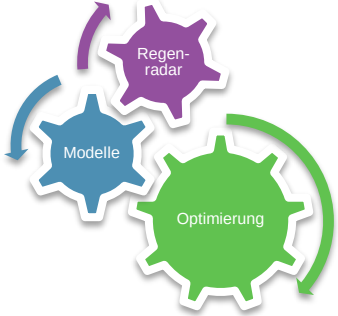


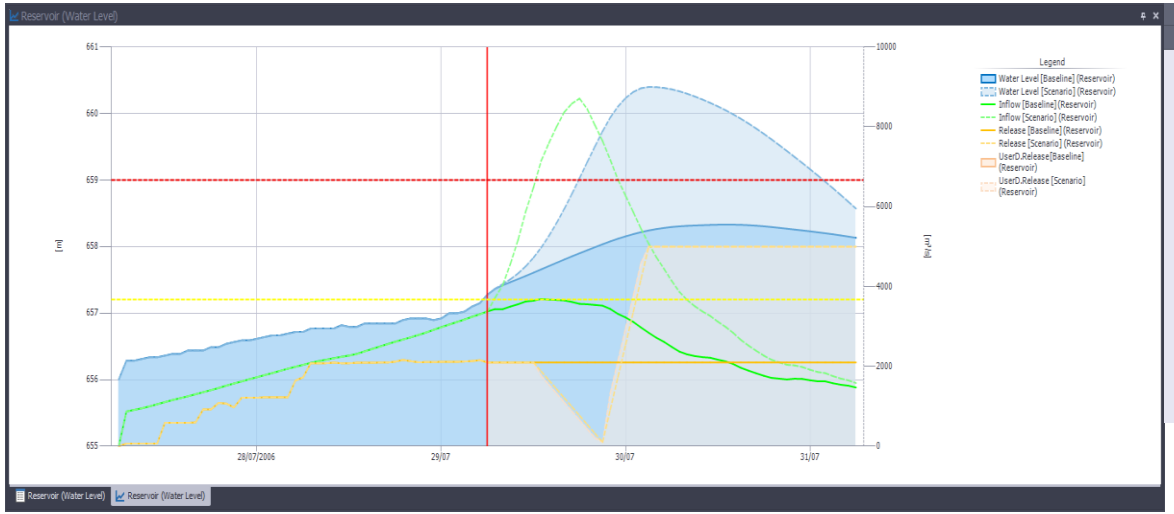




Optimierung

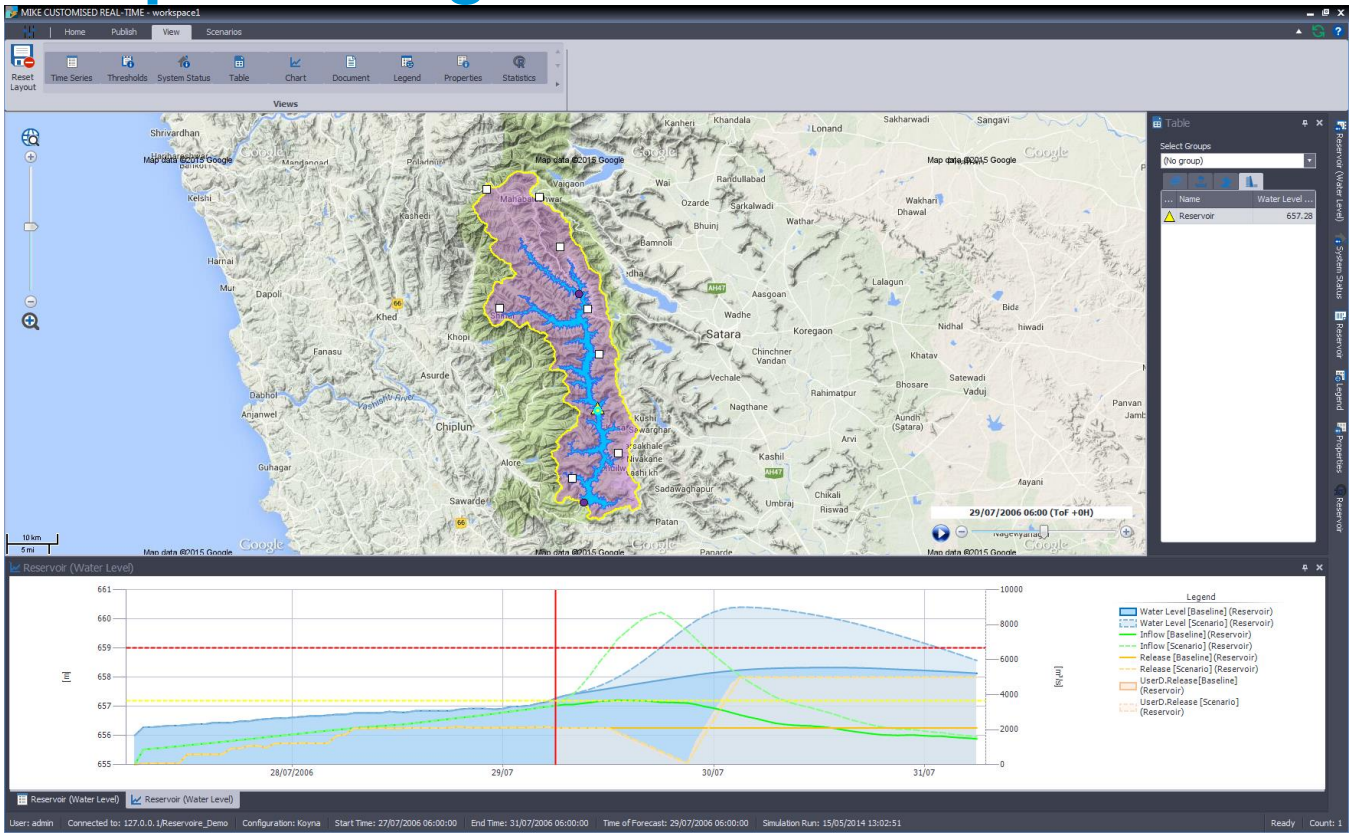


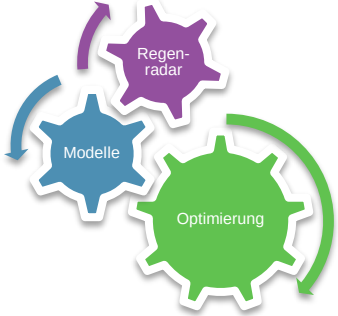




Reservoir	Time Series			UserD.Release	
Time	Water Level [m]	Inflow [m³/s]	Release [m³/s]	Baseline [m³/s]	Scenario [m³/s]
28/07/2006 21:00	656.92	2,786.63	2,104.56		
29/07/2006 00:00	656.92	2,982.61	2,116.88		
29/07/2006 03:00	657.02	3,173.03	2,123.73		
29/07/2006 06:00	657.28	3,376.18	2,100.00		2,100.00
29/07/2006 09:00	657.47	3,498.71	2,100.00		
29/07/2006 12:00	657.61	3,644.47	2,100.00		2,100.00
29/07/2006 15:00	657.76	3,662.37	2,100.00		
29/07/2006 18:00	657.90	3,566.29	2,100.00		
29/07/2006 21:00	658.04	3,520.98	2,100.00		100.00
30/07/2006 00:00	658.15	3,225.93	2,100.00		
30/07/2006 03:00	658.24	2,842.31	2,100.00		5,000.00
30/07/2006 06:00	658.30	2,488.50	2,100.00		
30/07/2006 09:00	658.32	2,258.84	2,100.00		
30/07/2006 12:00	658.33	2,167.99	2,100.00		
30/07/2006 15:00	658.33	1,965.06	2,100.00		
30/07/2006 18:00	658.31	1,764.22	2,100.00		
30/07/2006 21:00	658.27	1,671.94	2,100.00		

Optimierung

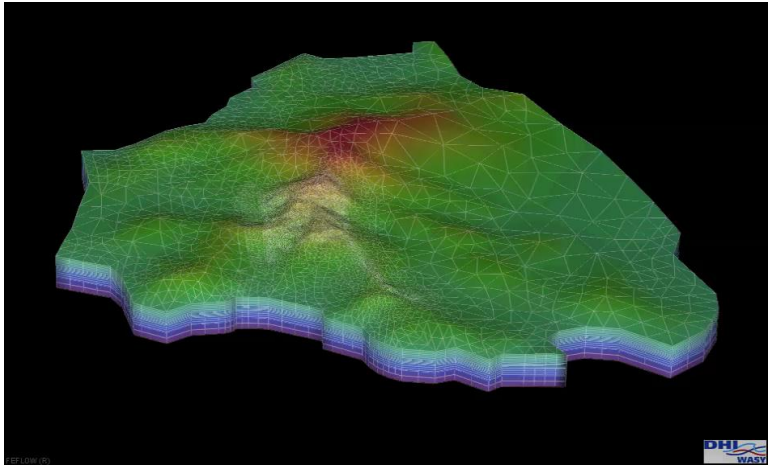




Integrierte Echtzeitsteuerung

Automatisierter Betrieb von:

- Datenerfassung
- Datenaufbereitung
- Modellausführung
- Optimale Strategiefindung
- Steuerungsanweisung und -ausführung
- Auslösen von Alarmen



Integriertes Echtzeitsteuerungs- und Frühwarnsystem auf Basis hydraulischer Modellierung

Beispiel Aarhus

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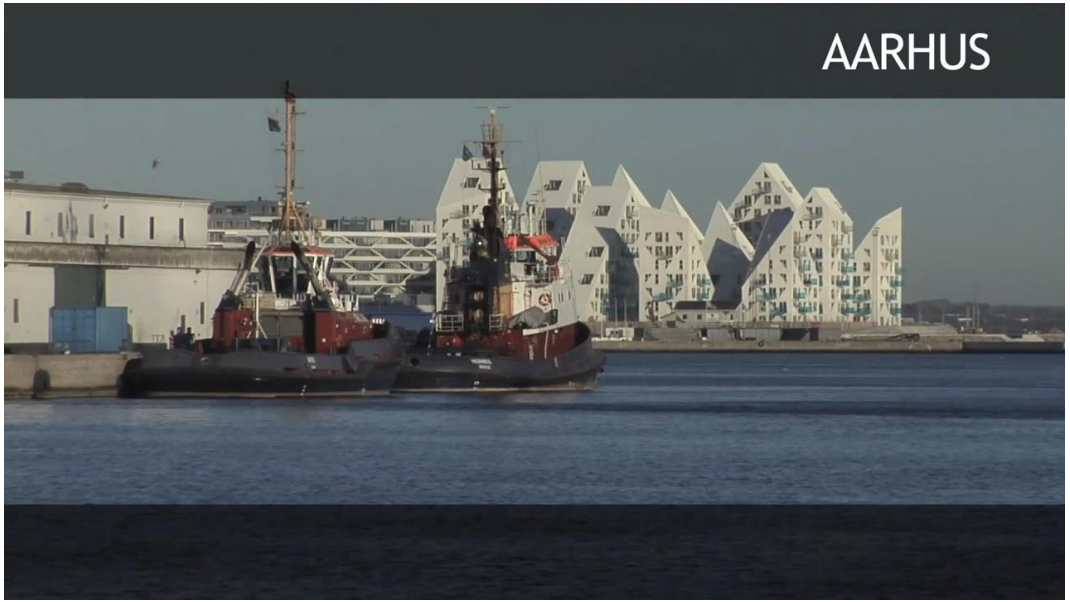
Aarhus – Dänemark

…an der See gelegen, zweitgrößte Stadt in Dänemarks



…Erholungsgebiet und aktive Nutzung der Umgebung

… Geschäfte und Industrie

Aarhus – Dänisch für Fortschritt

…Aarhus Universität

… Architektur und Kunst

…Naherholung und aktive Nutzung der Umgebung

… Geschäfte und Industrie

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Projektgebiet

beschleunigende Faktoren

…rasches Wachstum der Stadt

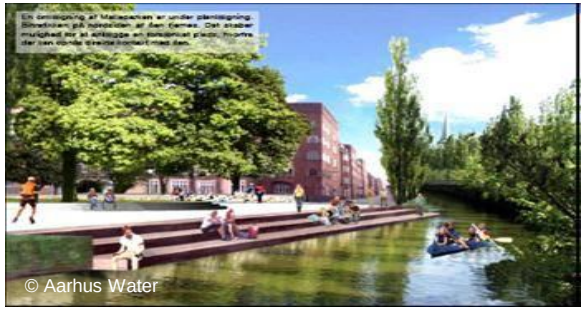
… Wasser in das städtische Umfeld integrieren

…Wohngebiete am Hafen ermöglichen

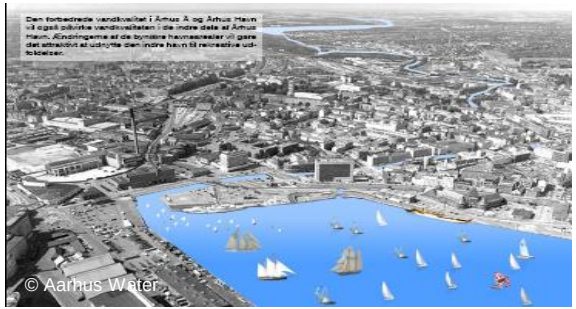
… Wasser als Element der Naherholung nutzen

Projektziele

…Badewasserqualität in Lake Brabrand (hygienisch)

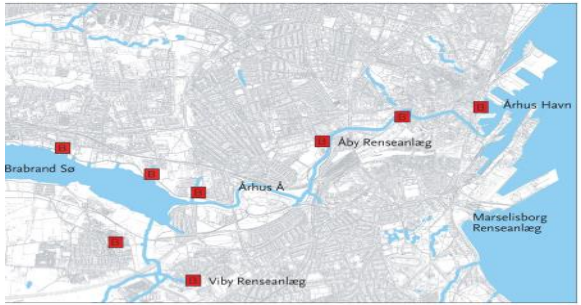


…verbesserte Wasserqualität & periodische Badetauglichkeit in River Aarhus

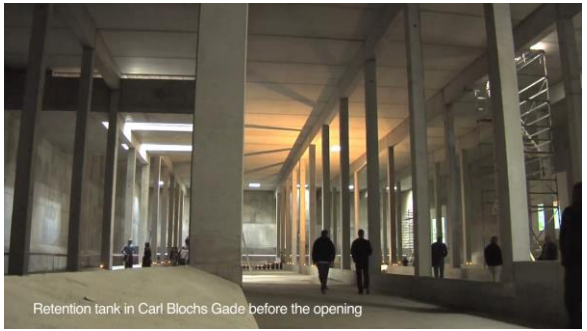


… Badewasserqualität im Hafen (hygienisch)

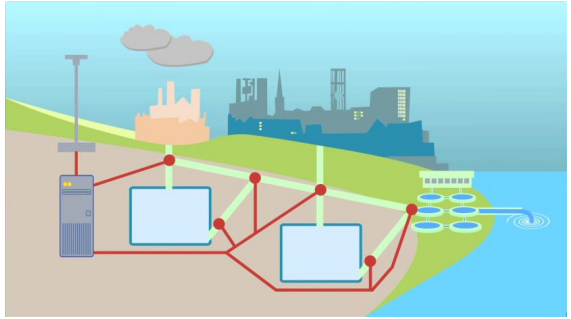
3 Projekte - 1 Lösung



…Analyse und Design
2006-2007



…Infrastrukturmaßnahmen
2007-2012



…modelbasierte integrierte Steuerung und Warnung
2009-2013

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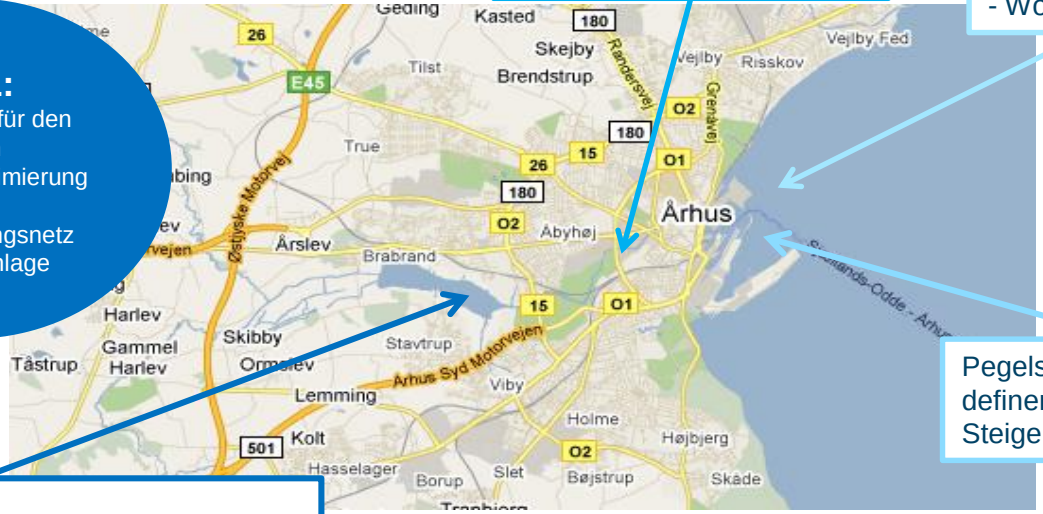
Randbedingungen

- Fluß durch die Stadt
- Zufluß aus Kanalnetz
- Beeinflusst durch Überstau aus Kanalnetz

Wasser Qualität
- Badeanstalt
- Wohngebiet

ZIEL:
Vorhersage für den Hafen
Kapazitätsoptimierung von Entwässerungsnetz und Kläranlage



Pegelstand im Hafen definert Flußgradient
Steigender Meeresspiegel

- Hochwassergefährung
- Beeinflust durch Meereswasserspiegel
- Zunehmender Zufluß durch Klimawandeleffekte

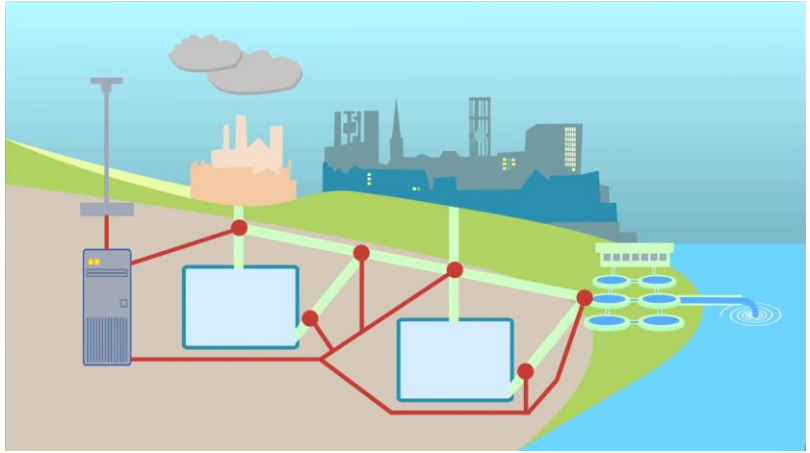
Herausforderung

Naherholungsgebiet = Vorfluter

3 Kläranlagen
75 Mischwasserentlastungen
58 Regeneinläufe
50% des Flußwassers stammt aus der Kläranlage

Lösung - 50 Mio. EUR Projekt 2006-2013

- Investment in Infrastruktur
  - 9 Rückhaltebecken
  - Nachgeschaltete Desinfektion an Kläranlage und Becken
  - Erhöhung der hydraulischen Kapazität der Kläranlage
- Steuerungssystem
  - Integrierte Echtzeitsteuerung und Modellierung von Kanalnetz und Kläranlage
  - Frühwarnsystem

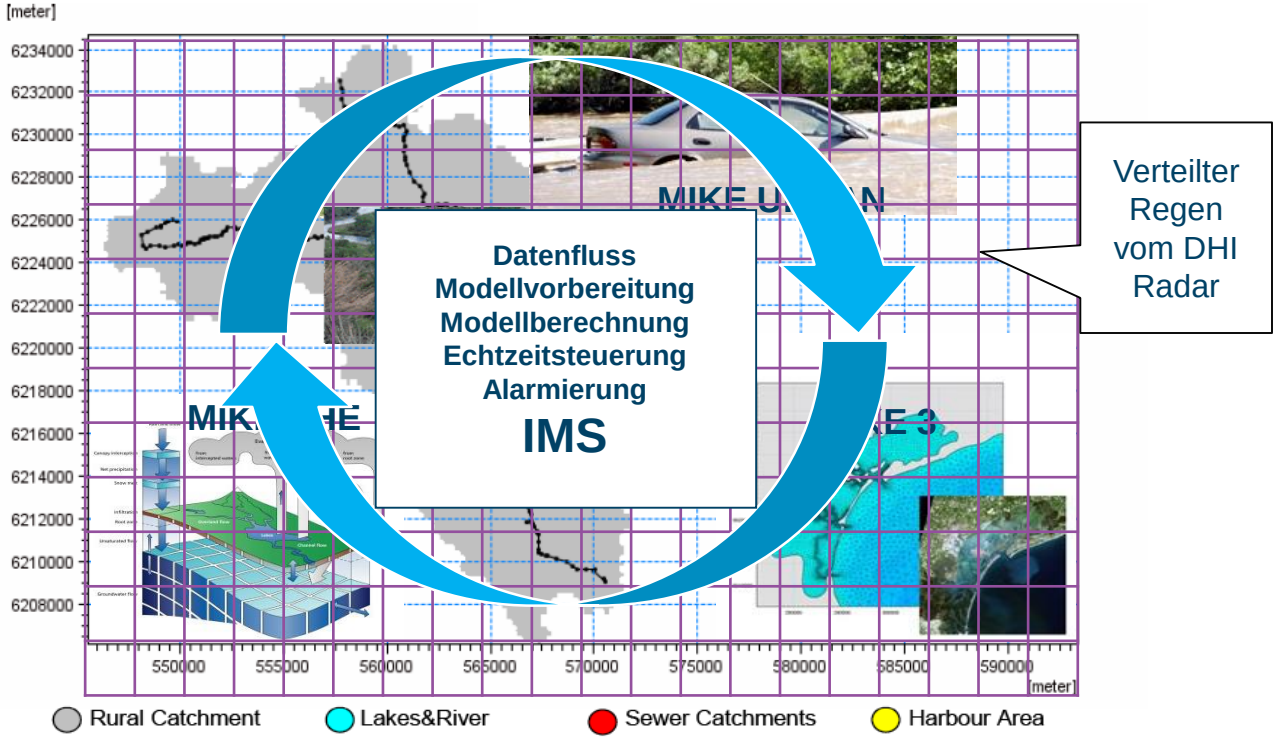


DHI Local Area Weather Radar (LAWR)

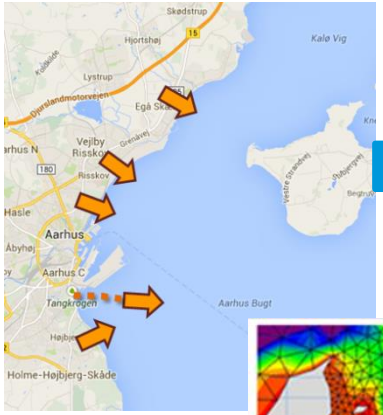
- Hochauflösendes lokales Wetterradar
  - X-band
- Reichweite
  - 60 km Radius für Vorhersagen
  - 20 km Radius für quantit. Analysen
- Räumliche Auflösung
  - 500x500, 250x250, 100x100 m
- Zeitliche Auflösung
  - 1 bis 5 Minuten

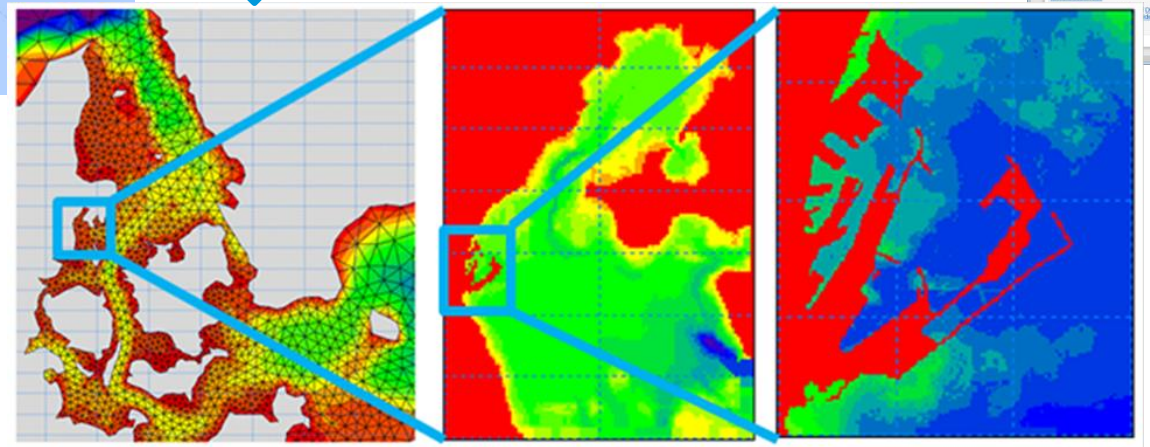
LAWR installation in Aarhus Denmark.

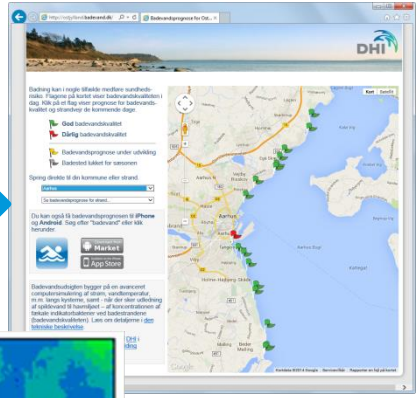
Automatisierte Integrierte Modellierung



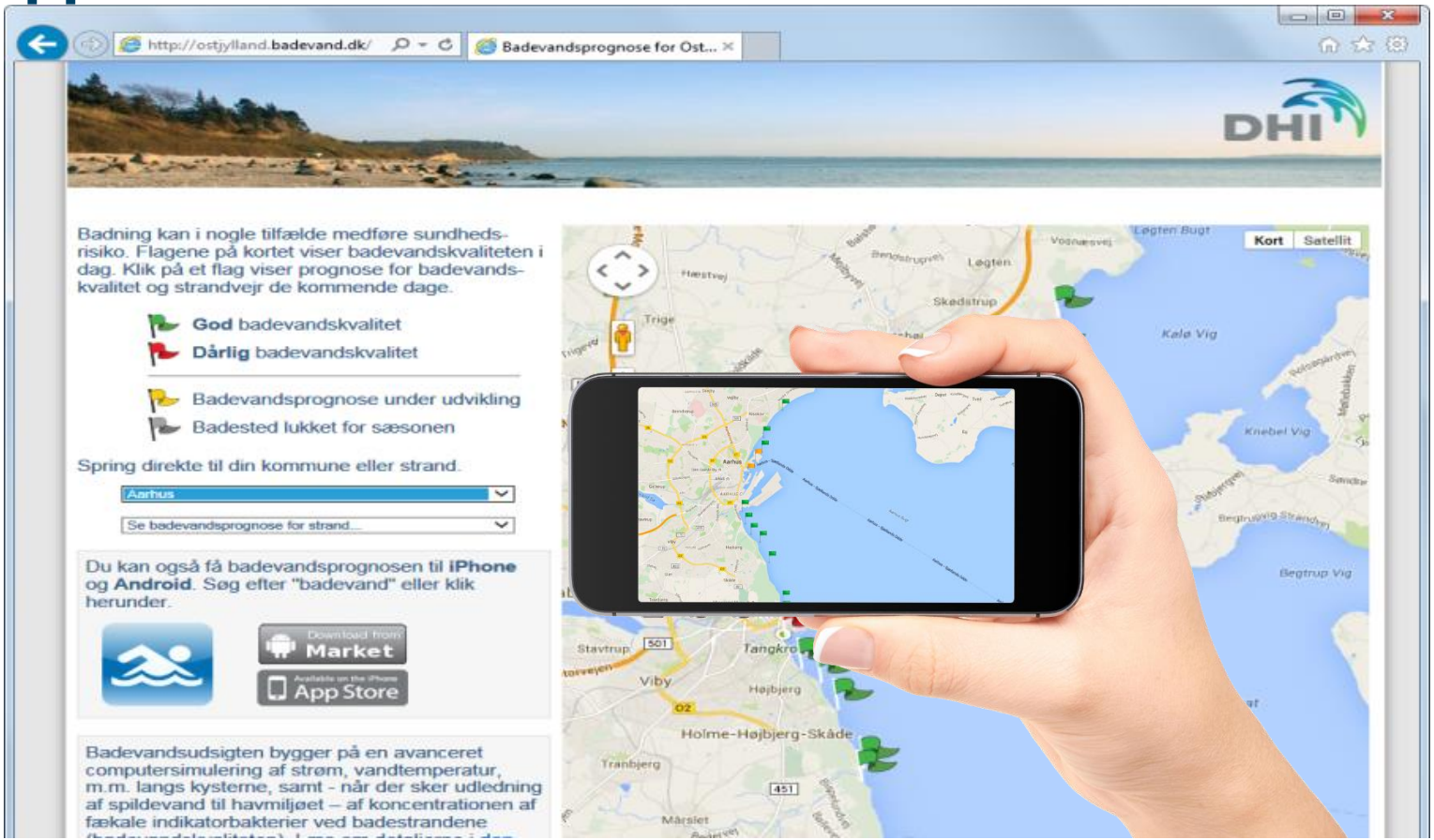
DHI Badewasservorhersage







App- und webbasierte - Öffentlichkeitsarbeit



Frühwarn- und Vorhersagesystem

Slovenia

Das nutzerfreundliche Vorhersage-system gibt den Entscheidungs-trägern einen Überblick des gesamten Systems. Das Modell berechnet dabei automatisch 6 Tages Vorhersagen an 74 Pegelstandorten und das jede Stunde, 365 Tage im Jahr.

“With the new system we expect to reduce costs caused by flooding by 20-30%.”

Janez Polajnar, Head, Flood Forecasting Department, ARSO

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Vielen Dank für Ihre Aufmerksamkeit.

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