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The Profile of the Fraunhofer-Gesellschaft

Largest society for applied research in Europe

- 60 Institutes
- 18,000 employees
- Budget 1.7 Billion € in 2010
- **Fraunhofer IOSB** (Karlsruhe)
  - 400 employees

- 7 Groups:
  - Information and Communication Technology
  - Life Sciences
  - Microelectronics
  - Light & Surfaces
  - Production
  - Materials and Components
  - Defense and Security
Energy and environment sector: Context

1. Future market water
2. Ground water
3. Surface water
4. Water management
5. Demand forecast
6. Wastewater treatment
7. Information systems
Energy and environment sector: Core competences

Operational management systems

Information Systems

Energy
- Energy networks
- Smart grids
- Smart metering
- E-mobility

Water
- Water resource management
- Water systems management
- Wastewater treatment
- Groundwater

Environment
- Environmental information systems
- Environmental risk management
- Early warning systems
Tasks/Motivation:
Water – the issue of the future

- Billions of people with no access to water supply
  - 2.4 billion people with no sanitary facilities
  - 1.1 billion people with no access to clean water
  - 4 billion people are not connected to functioning sewage treatment facilities
- Since 1950: worldwide water usage has tripled
- Water losses of up to 25 % due to leakage even in industrialised nations
- Wastage of water resource (Dubai: 500 litres per person/day; Germany: 127 litres)
- Climate change (steppification/desertification e.g. in southern Europe)
- EU Water Framework Directive creates a framework for action
Project Beijing Water

Water Resources Management System for Beijing

- Model-based decision support system for Beijing
- Takes into account entire water cycle
  - Catchment areas, reservoirs, water courses
  - Large-scale groundwater model (6300 km²)
- Assistance for strategic planning of water management
- Graphic user interface
- Comprehensive data management
Groundwater Modeling

- Small and large-scale models
  - Optimal management of groundwater resources
  - Model reduction for fast calculations

- Transport of water ingredients
  - Risk assessment
  - Remediation methods
  - Strategies for countermeasures

Example:
Prediction of salination in Beijing province

- after 4 years
- after 8 years
- after 12 years
- after 16 years
Project Beijing Water
Surface water Modeling

- Modelling and dynamic simulation of water flow and water ingredients in lakes, rivers, channels, pipes

- Example:
  Surface water system of Beijing province
Project Beijing Water
Software Implementation

Our software is easy to handle for the end users!
Project
Optimal Water Management – Beijiang River

- Challange: Management of barrage cascades and reservoirs
  - Navigability of waterways
  - Power generation
  - Drinking water availability
  - Flood protection

- Beijiang River - facts:
  - 180 miles wide river section
  - 30 million inhabitants
  - 4 hydropower plants with 350 MWp
  - Salinization at the estuary of the Beijiang River

- Solution: Optimized water management using decision support systems
  - Planning of long-term extensions of the water infrastructure
  - Increase of energy production
Project Idea
Model based Eutrophication early warning system

- Harmful algae blooms (e.g. red tides)
  - Toxicity
  - bad touristic impact
  - overturning of water bodies

- Idea: Model based early warning system

- Approach: Combining Flow Model and biological Expert Knowledge by means of Fuzzy Logic

- Project partners?
Simulation Study
Modelling of algae growth of Orbotello Lake (Italy)

Profile of Biomass and Nutrients

Biomass profile

\[ c_B \left[ \frac{g}{m^3} \right] \]

Max: 7.787
Min: -0.429

Nutrients profile

\[ c_N \left[ \frac{g}{m^3} \right] \text{ mit } R_N = -k \cdot R_B \]

Max: 1.184
Min: -0.0617
Thanks for your attention!
Discussion ... ?