

# BMBF Joint Project: Integrated Water Resources Management in Gunung Kidul, Java, Indonesia

## Technological Solutions for Karst Regions in South East Asia

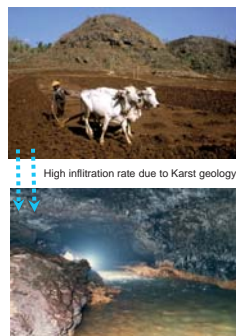
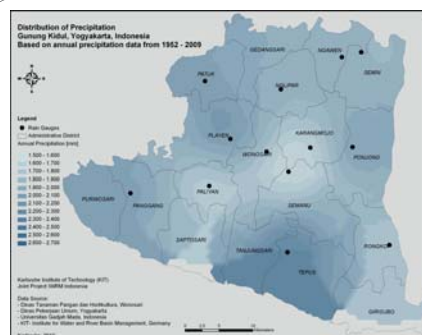
Franz Nestmann, Peter Oberle, Muhammad Ikhwan, Daniel Stoffel

### Karst and Water

- Karst is related to the occurrence of carbonate and gypsum rock
- Approx. 20 % of the world population live on the carbonate rock
- Over a quarter of mankind in the world depends on karst aquifer as their source of water
- In many cases, karst regions are suffering from water scarcity especially during dry seasons due to the absence of surface water storage possibilities
- In many karst regions underground river networks exist with large water potentials even during dry season

### Problem of Utilization of Karst Water

- Poor accessibility, often deeply underground (in some cases the groundwater level is more than 100 m deep)
- Karst water springs rarely exist, the capacity rate shows high variability
- High lifting head causes high operational costs for extraction of the underground water using diesel and/or electric pumps
- High vulnerability to contamination



**Pilot-study area:** Although the study area has annual precipitation of approx. 2,000 mm / year (left), the people are faced with severe water scarcity during dry seasons (right above). The reason: The absence of surface water storage possibilities where the water infiltrates quickly to sub-surface and creates underground river networks with continuous discharge (right below).

### Interdisciplinary Expertise

#### Karlsruhe Institute of Technology (KIT)

- Institute for Water and River Basin Management (IWG)
- Chair of Water Resources Management and Rural Engineering (WK)
- Chair of Aquatic Environmental Engineering (SWW)
- Geodetic Institute Karlsruhe (GIK)
- Institute of Mineralogy and Geochemistry (IMG)
- Institute of Soil Mechanics and Rock Mechanics (IBF)
- Institute of Concrete Structures and Building Materials (IMB)
- Research Center for Steel, Timber, and Masonry (VA-KA)
- Institute of Functional Interfaces (IFG)
- Institute for Technology Assessment and Systems Analysis (ITAS)

#### Justus Liebig University of Giessen (JLU)

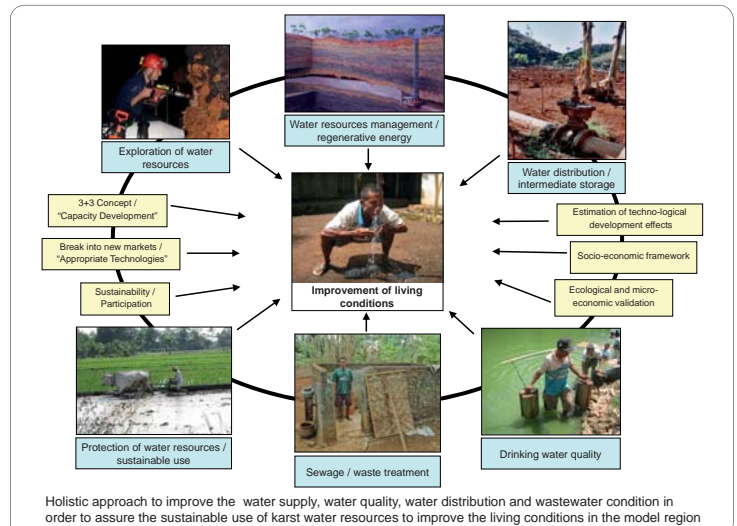
- Institute of Geography (IfG)

#### Water Technology Center (TZW)

- Department of Water Treatment Technology

#### Industry Partners

- KSB AG, Frankenthal
- IDS GmbH, Ettlingen
- COS Systemhaus OHG, Ettlingen
- Geotech. Ingenieurbüro Prof. Fecker & Partner GmbH (GIF), Ettlingen
- CIP Chemisches Institut Pforzheim GmbH
- Huber SE, Berching

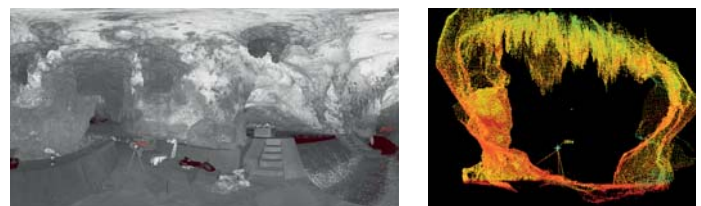


### Sustainable Solutions through IWRM

- Accomplishment of interdisciplinary needs-assessment and usage of management strategy for implementation
- Technological assessment for high sustainability
- Network and coordination, from "Public Awareness" raising to "Good Governance" through Capacity Development campaigns
- Implementation
  - Innovative underground hydropower plant by implementation of appropriate "simple" technologies
  - Real-time optimisation and controlling of water distribution system
  - Construction of pilot-plants for water and wastewater treatment using appropriate and adapted technologies
  - Implementation of web-based GIS as integrated water management tool



Surveying for feasibility studies (left); implementation of underground hydropower plant (middle); simulation model of water distribution networks (right)



Result of 3D laser scanning survey in the Seropan cave: Gray-value image (left); 3D-point cloud (right)

**Contact persons:** Prof. Dr.-Ing. Dr. h.c. mult. Franz Nestmann  
Dr.-Ing. Peter Oberle  
Dr.-Ing. Muhammad Ikhwan

franz.nestmann@kit.edu  
peter.oberle@kit.edu  
ikhwan@kit.edu

www.iwrm-indonesien.de