WHITE PAPER

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Environmental and Water Protection Technologies of Coastal Zones in Vietnam EWATEC-COAST

B A C K G R O U N D

The research project is focussed on the Thi Vai river basin and the Can Gio mangrove forest in South Vietnam. The selected project areas are situated in three provinces: Ho Chi Minh City, Dong Nai and Ba Ria-Vung Tau.

The overall objective of the research project is the development, supply and use of water and environmental technologies and service tools in the framework of a management system. The system will allow the users to sustainably improve the environmental and living conditions of the selected coastal zone in South Vietnam. The project takes into account the anthropo-genic influences as well as the natural climate variability and the impact of future climate change on water quantities and water quality.

In addition, the project aims to transfer the EWATEC-COAST concept to other regions (see more at: http://www.tu-braunschweig.de/ewatec).

G E R M A N P A R T N E R S

University of Braunschweig, Leichtweiß-Institute LWI (Coordination) & Institute for Geoecology & Institute of Geosystems and Bioindication; **University of Cologne,** Institute of Geophysics and Meteorology; **University of Applied Sciences Ostwestfalen-Lippe (HS-OWL),** Section for Water Technology (Deputy Coordination), Section for Meteorology and Air Pollution; **University of Siegen,** Research Institute for Water and Environment (fwu) ; **Institute for Water Management IfW GmbH,** Braunschweig; **Engineers for Water, Environment and Data Processing IWUD GmbH**, Höxter; **A3 Water Solutions GmbH**, Gelsenkirchen; **Enviplan engineering company GmbH,** Lichtenau

VIETNAMESE PARTNERS

Viet Nam National University HCMC, Institute for Environment and Resources IER (Coordination of Vietnamese Partners) HCMC University of Technology, Department of Ports and Coastal Engineering, HCMC University of Science, Faculty of Biology; **Ministry of Science and Technology MOST,** Hanoi; **Ministry of Natural Resources and Environment MONRE; Ministry of Agriculture and Rural Development MARD;** Southern Institute of Water Resources Planning SIWRP, HCMC ; **Hanoi University of Science,** Department of Meteorology; **Nhon Trach Industry Zone,** Dong Nai Province, Dang Tu Ky Leather Company ; **Department of Natural Resources and Environment DONRE,** Provinces Dong Nai, Ba Ria–Vung Tau and HCMC ; **Can Gio Mangrove Protection Forest Management Board,** HCMC

EXPECTED RESULTS

With relevance to the water management of the region, the following results are expected from the subprojects:

- Forecast on climate change for the project areas
- Provision of a regional air pollution model
- Integrated model system for water balance, mass transport, surface flow, groundwater flow and water quality
- Bio-reactor model for mangroves at landscape scale with focus on the removal of pollutants in the water bodies
- Modeling of the coastal waters, determination of the loss potential due to onshore storm floods, risk analysis for the coastal zone
- Implementation and optimization of an experimental pilot plant for the purification of tannery wastewater
- Set-up of a model-based management system (planning tool) by integration of above-mentioned components
- Forecast of the water quality effected by anthropogenic influences and climate change in the areas; development of solution concepts

SUBPROJECTS

EWATEC-COAST consists of nine interacting subprojects ranging from meteorological investigations, surface water and groundwater, wastewater treatment to coastal flood protection. Results will be implemented into a water management system.

SUBPROJECT GROUNDWATER

The objective of the subproject groundwater is the development, deployment and operation of a groundwater model for the sediment aquifer of South-Vietnamese coastline, resp. the area around Can Gio and Thi Vai, which are furthermore predisposed to the influences of rising sea levels and changing climate.

The model should be capable to reproduce the regional groundwater flow as well as local saltwater intrusion induced by river- and ocean water, which is one of the processes that degrade water quality by raising salinity to levels exceeding acceptable drinking water standards. It is foreseen to include the model in the effective management of the water resources, in particular groundwater but not exclusively.

For the setup and calibration of the groundwater model data from observation wells regarding groundwater levels, electrical conductivity, and others, are required. Because there is little data on the spot, existing groundwater wells were equiped with appropriate measurement devices.
One important characteristic that a measurement device should have, however, was the corrosion restistance, because we were expecting high salinity in some of the groundwater wells we wanted to equipe.
We have chosen Schlumberger Water Services (SWS)'s Divers® because of their characteristic attributes like corrosion resistance, small size and, at the same time, a high level performance. In particular the CTD Divers together with Baro Divers corresponds fully to the projects ideas and needs. The Baro-Diver measures the atmospheric pressure (p_{baro}) and the CTD Diver measures the pressure exerted by the water column (WC) and the atmospheric pressure (p_{Diver}). In addition to taking pressure and temperature measurements, the CTD Diver also measures the water's conductivity. The 22 mm diameter ceramic casing is suitable for salt water applications. The CTD-Diver is capable of storing a maximum of 48,000 measurements.

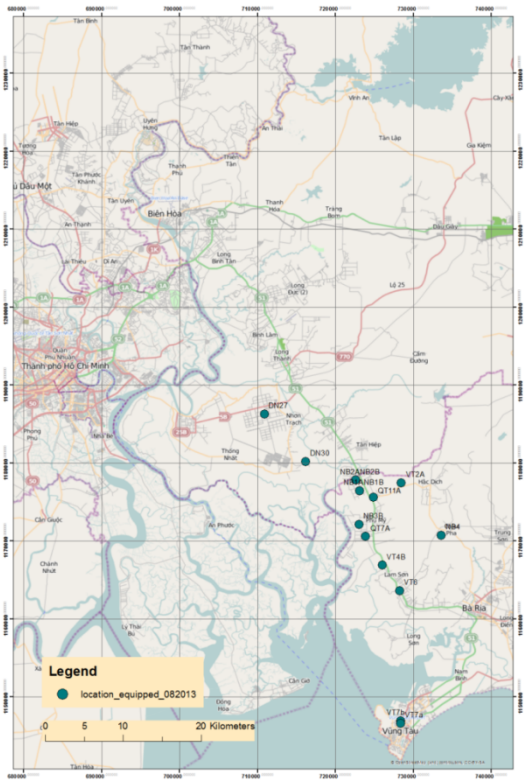


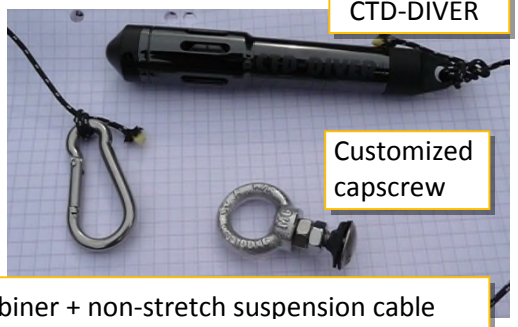
Figure 1. Locations of equiped wells

EQUIPEMENT OF EXISTING WELLS WITH DIVERS AND LOGGERS

In a first phase, during April 2013, fifteen wells were equiped with measurement devices to measure the groundwater level, the temperature and the salinity (see Fig. 1).

Figure 2. **Project coordinator Dr Pätsch , Subprojectleader Dr Dung and colleagues of the Department of Natural Resources and Environment DONRE, Province Ba Ria–Vung Tau, during the equipement process.**

Measurements are subsequently stored in the Diver's internal memory. Due to the specific construction of the observation wells , we needed an adapted attachment to the well capping – see below.



Karabiner + non-stretch suspension cable

Fixing of the karabiner to the capscrew to install the diver into the well

CTD-DIVER connected to Pocket PC via USB Port

Pocket PC

The Diver consists of a pressure sensor designed to measure water press-ure, a temperature sensor, a salinity sensor and memory for storing measurements and a battery. It is an autonomous datalogger that can be programmed by the user.

Figure 3. CTD Diver by Schlumberger Water Services is read out on the spot by Mr. Thang

All divers establish the height of a water column by measuring the water pressure using the built-in pressure sensor. As long as the Diver is not submerged in water it measures atmospheric pressure, just like a barometer. Once the Diver is submerged this is supplemented by the water's pressure: the higher the water column the higher the measured pressure. The height of the water column above the Diver's pressure sensor is determined on the basis of the measured pressure. To measure these variations in atmospheric pressure a Baro-Diver is installed for each site being measured. The barometric compensation for these variations in atmospheric pressure is subsequently effected using
SWS' Diver-Office software package. The compensated values can be related to a reference point such as the top of the monitoring well or a vertical reference datum, for example the vertivcal Vietnamese Hon Dau Datum (m.a.s.l.).

In case of water sampling and pumping in wells with our equipement, it is no problem to get the equipement out for the time of the pumping and sampling process, so that it could not disturb any necessary working procedures of the DONRES. After the sampling process, just put the equipment back into the well.