s::can
Intelligent. Optical. Online.

Danube River Monitoring from Berlin to the Black Sea - 3850 km of surface water monitored with s::can products

Environmental monitoring

Researcher Carsten Riechelmann traveled on his self-made catamaran through Europe, which he equipped with an s::can system to georeference the measured data. Longitudinal continuous profiles of all parameters were registered and displayed in real-time on online maps.

Parameters monitored:

- TOC
- DOC
- COD
- CODf
- TSS
- NO3
- NH4
- pH
- K
- Dissolved Oxygen
- Temperature
- Conductivity

Facts & Figures

Application:
Surface water

s::can Partner:
GWU-Umwelttechnik GmbH

Key Products installed:
con::cube, spectro::lyser, ammo::lyser, oxi::lyser, condu::lyser

Background

The German water engineer Carsten Riechelmann built the wooden catamaran, Esperanto, with the help of 90 volunteers from 20 different nations. The vessel is meant to be used as an environmental monitoring station and occasionally as an event stage. After working with s::can equipment in wastewater research, Riechelmann realized that the high measurement frequency of the spectro::lyser can be used for a new form of dynamic surface water monitoring.

Challenge

Independent boats moving on water bodies could be used for collecting data of anthropogenic impacts. If a reliable data acquisition and calibration system is developed and the data is openly accessible, then water pollution is getting transparent for the public. This public awareness can help to increase the political leverage on individuals or companies that are profiting from pollution discharge.

s::can's solution

The boat was equipped with the terminal con::cube, spectro::lyser, ammo::lyser, oxi::lyser and condu::lyser. An instrument carrier holds the four sensors in the (up to 15 km/h fast) water stream. To adapt to the 1 kWp solar system, a low voltage con::cube was installed together with the automatic cleaning system ruck::sack for the spectro::lyser. Via the Wi-Fi module and the Modbus protocol, the con::cube was connected to a Raspberry PI. GPS coordinates were uploaded every two minutes together with measured parameters to a database. The tool Grafana visualized immediately each parameter on a map. Laboratory samples in the first year and the data of the Joint Danube Survey 4 in the second year were used to validate and to calibrate the online data.

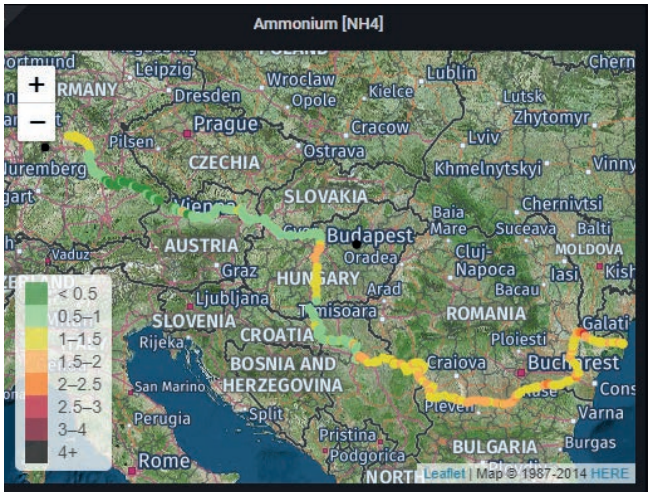
Benefits

The s::can equipment was very stable and performed reliably. The low energy demand of the s::can system was ideal for the usage on board with limited energy supply. A full dataset was delivered every 200 m according to the average speed of the boat. The data could be checked directly on the con::cube or on any mobile phone. The mobile and geo-referenced application made it possible to examine spots where pollution sources were expected. This can help decision makers get a real-time overview to locate pollution sources and take counter-actions.

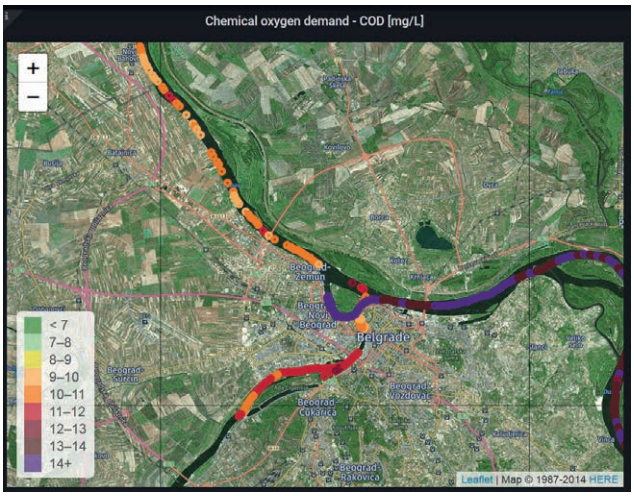
> **"The tour was an amazing opportunity to prove that an s::can system can be used as a pen to draw pictures that show over thousands of kilometers the world's current water quality situation."**
>
> Dipl. Ing. Carsten Riechelmann, Water engineer and researcher

Process schematic

In the course of the 2-year project, 3850 km of surface water were monitored with s::can. From Berlin to the Black Sea, the waterway led the wooden vessel through Germany, Austria, Slovakia, Hungary, Serbia, Croatia, Bulgaria and Rumania and allowed an extensive river monitoring through half of Europe.



The picture of the Danube catchment illustrates how Ammonium concentration is influenced by large cities. This can have a major impact on the aquatic environment of these areas.



The mobile and geo-referenced application made it possible to examine where pollution occurred. Belgrade, as a big city with mostly no wastewater treatment had a clearly visible influence on the COD concentration.

By operating an s::can system on a boat, it is possible to record a nearly complete concentration profile of the organic contaminants (COD, BOD, TOC), nutrients (NH4, NO3) and the basic parameters pH, temperature, dissolved oxygen and conductivity. Variations in the concentration become visible which allows the tracing of water-polluting discharge points and makes it possible to document them as well as relate them in a way that has never been possible in the past.

The con::cube on the bridge deck is a compact, powerful and versatile terminal for data acquisition and station control. Integrating the newest processor technology, con::cube's very flexible options for connecting to SCADA or any central database system make it perfect for station control. Up to 64 channels/ parameters can be displayed.

s::can's fully submersible spectro::lyser as well as an ammo::lyser, oxi::lyser and condu::lyser were used to monitor a wide range of parameters all the way from Berlin to the Black Sea. All these sensors require very little maintenance and were ideal for using in multiple applications with long term stability.

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