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Development of an Open Source Based Sensor Platform for an Advanced and Comprehensive in-situ DOC Monitoring

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The impact of global change, intensive agriculture and complex interactions between humans and the environment show different effects on different scales. However, the desire to obtain a better understanding of ecosystems and process dynamics in nature accentuates the need for observing these processes in higher temporal and spatial resolutions. Especially with regard to the process dynamics and heterogeneity of water catchment areas, a comprehensive monitoring of the ongoing processes and effects remains to be a challenging issue in the field of applied environmental research. Moreover, harsh conditions and a variety of influencing process parameters are representing a particular challenge due to an adaptive in-situ monitoring of vast areas.
Today, open source based electronics and cost-effective sensors and sensor components are offering a promising approach to investigate new possibilities of smart phone based mobile data acquisition and comprehensive ad-hoc monitoring of environmental processes. Accordingly, our project aims the development of new strategies for mobile data acquisition and real-time processing of user-specific environmental data, based on a holistic and integrated process. To this end, the concept of our monitoring system covers the data collection, data processing and data integration as well as the data provision within one infrastructure. The whole monitoring system consists of several mobile sensor devices, a smart phone app (Android) and a web service for data processing, data provision and data visualization. The smart phone app allows the configuration of the mobile sensor device and provides some built-in functions such as data visualization or data transmission via e-mail.
Besides the measurement of temperature and humidity in air, the mobile sensor device is able to acquire sensor readings for the content of dissolved organic compounds (λ = 254 nm) and turbidity (λ = 860 nm) of surface water based on the developed optical in-situ sensor probe. Here, the miniaturized optical sensor probe allows the monitoring of even shallow water bodies with a depth of less than 5 cm. Compared to common techniques, the inexpensive sensor parts and robust emitting LEDs allow an improved widespread and comprehensive monitoring due to a higher amount of sensor devices. Furthermore, the system consists of a GPS module, a real-time clock and a GSM unit which allow space and time resolved measurements.
On October 6th, 2015 an initial experiment was started at the Bode catchment in the Harz region (Germany). Here, the developed DOC and turbidity sensor probes were installed directly at the riverside next to existing sampling points of a large-scaled long-term observation project. The results show a good correspondence between our sensor development and the installed and established instruments. This represents a decisive and cost-effective contribution in the area of environmental research and the monitoring of vast catchment areas.