Networking of Automated Event-Sampling Hydro-Meteorological Measuring Sites using LEO-Satellite Communication

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Abstract

A prototype event-triggered water quality monitoring and sampling network using Low Earth Orbit (LEO) Satellite data communication between all triggering and sampling units was developed. It is successfully applied for automated event-sampling in the scope of water quality protection of drinking water resources.

1. Motivation

Event-triggered water monitoring in vast regions is difficult and expensive: A technician has to await a specific triggering event, e.g., heavy thunderstorms. Then he has to get to the sampling devices and start them manually, often “by chance”, because he does not know the situation in the catchment area. A crucial problem is also to take a “reference water sample” just before the investigated event to obtain the aquifer “default” conditions.

2. Event-Triggered Water-Sampling Using LEO-Satellite Transmission

Automated smart triggering of the sampling procedure at the aquifer in the catchment area and measuring networks with LEO-Satellite data transmission simplifies and improves event-triggered water-sampling and can save costs. It eases e.g., to get the reference sample and to start sampling autonomously. Additionally, continuous “on-line” monitoring of the water-parameters (e.g., gauge-level, temperature, conductivity, turbidity) can be provided. Following concept has been implemented:

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Figure 1
Block Diagram of event-triggered Water Sampling using LEO-satellite Transmission (with data-streams 1-4).

Triggering station(s): This meteorological station records rainfall and sends data periodically to a central monitoring station and activation data-sets to all sampling/measuring stations, if the autonomously derived trigger criterion is exceeded.

Sampling station(s): When the activation data-set is received, the automatic sampling unit takes the reference water sample. This status, including the measuring values, is sent to the central monitoring station. A second trigger criterion is derived from the gauge height at the sampling station. Only when this trigger-level is exceeded, another sampling device starts its periodical event sampling with pre-selected time intervals and continuous transmission of the measuring values.

Central monitoring station: It comprises a specifically developed email-client to decode the compressed measurement data sets received as emails. Data is stored in a central database; graphic visualization is provided. A remote Internet access allows to monitor the stations also from outside the laboratory, e.g. via GPRS.

3. Results and Perspectives
A prototype system was successfully implemented first at Peggau, a karstic area 20km north of Graz. ORBCOMM was chosen as LEO-satellite data-transmission system. One of the crucial points was the derivation of correct trigger-criteria for the
precipitation and for the increase-rate of water level at the sampled spring. The results are shown in Figure 2, where chloride as a natural tracer was analyzed.

The prototype system was mainly implemented by FH-students Ch. Gindl, W. Heiner, H. Jagos, Ch. Jezek, M. Kubicek and K. Mederitsch as a 1-year’s project.

In a next step, triggering-events will also be derived from on-line measured quality parameters, which can be used as part of an early warning system or a Decision Support System (DSS). Continuation projects for a centralized data base and visualization system server with Internet-access will follow in 2004/05 as well as projects within the international cooperation network “Knet-Wasser” are planned.

Figure 2
Results of Automated Event Sampling, combining Online Measurements and Laboratory Analyses of Chloride.
Bibliography


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