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Failsafe data transfer of important hydrological values for early warning systems

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For applications like early warning systems and decision support systems (DSS) for quality monitoring of drinking water, especially from karst aquifers, or for flood forecasting and warning systems it is necessary to transmit important hydrological data, e.g. the gauge height and different quality parameter (e.g. SAC, turbidity) in “near real-time” from a measuring station to a Central Monitoring Station (CMS). Thereby it is very important to guarantee a consistent and failsafe data transfer. These measured values are stored in a data base and can be used for further computations or data can be requested in terms of tables or graphics via the internet. This online monitoring system of important hydrological data works automated and maintenance of the measuring site is economized more and more. A special feature of this early warning systems is the possibility of automated alarm messages by exceeding thresholds, implausible developing of values or other criteria via Email or SMS to specific users or a local service team which can verify the data.

In areas with terrestrial infrastructure GPRS (General Packet Radio Service) can be used as transmission medium which enables a fast and cost-efficient transfer of data from the measurement stations to the CMS. One big problem with such terrestrial communication systems is the risk of default when their networks are overloaded, as it can happen during crisis situations (e.g. flood events, thunderstorms). Especially for the surveillance of karst springs it is very important to get data also during times of increased hazards. Therefore it is necessary to have the possibility to transmit the measured values also via communication satellites when a terrestrial infrastructure is not available.

The system presented here is a combination of bidirectional data transmission with a terrestrial communication system and a “near real-time” satellite communication by means of low earth orbiting satellites. Typically periodical measurements are transmitted via GPRS to the central server. The data logger at the measuring site observes the communication state. If the GPRS data transfer does not work it generates a special error message. Due to this alarm the satellite modem will be activated and sends the actual data via the Orbcomm satellite communication system. This is a low cost system for short messages, between six bytes and several kilobytes. For transferring greater messages other systems like Iridium and Globalstar can be used and are implemented in our investigations. This dual data communication system increases the stability of the data transfer and thus improves the reliability of a flood forecast and warning system as well as it reduces the response time in early warning systems which is especially important for surveillance of karst aquifer with short reaction times.