Using LEO-satellite networking for hydrological event-sampling and monitoring

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Global changes in ecosystems, the growth of population as well as modifications of the legal framework within the EU caused in the last years an increasing requirement of qualitative groundwater and spring water monitoring with the target to supply the consumers also in future with high-quality uncontaminated drinking water. Also the demand of sustainable protection of drinking water resources caused the enhanced implementation of early warning systems and quality assurance networks in water supplies.

In the field of hydrogeological investigations event monitoring and event sampling are indispensable tools to get detailed information about parameters of the aquifer and the vulnerability.

The system, which is presented here, enables fully automated event sampling and real-time availability of data. By means of networking via Low Earth Orbiting Satellites data from the catchment area are brought together with data of the spring monitoring station (SMSt) without the need of terrestrial infrastructure for communication and power supply. Therefore a completely automated event sampling procedure is made possible. Furthermore the whole course of input and output parameters, like precipitation (input system) and discharge (output system) and the status of the sampling system, is transmitted via LEO-Satellites to a Central Monitoring Station (CMSt) which can be linked with a web-server to have unlimited real-time data access. The automatically generated notice of event to a local service team of the sampling station is transmitted in combination with internet, GSM, GPRS or LEO-Satellites.

Within the paper the assembling as well as the stream of data and status information

are described in detail.

Assembling: The precipitation station (PSt) is situated in the catchment area of the spring, where the samples should be taken. It is equipped with a tipping bucket, a data logger and a LEO-Satellite modem. It can be supplemented with additional meteorological sensors. The measuring and sampling site at the spring (spring monitoring station, SMSt) is equipped with an additional data logger, a pressure probe to register the changing of discharge, two automatic sampling units (one for the reference sample and one for the periodic samples) and a LEO-Satellite modem for real-time control and data transmission. It can be supplemented with additional hydrological or meteorological sensors.

Stream of data and information: As soon as the trigger-level is exceeded in the catchment area at the PSt (predefined amount of precipitation in a definite period, both parameters are selectable) a trigger report is sent to the SMSt via satellite. There the reference sample is taken automatically. In addition, the PSt starts sending via LEO-Satellite continuously data about the rainfall to the CMSt. The SMSt is now ready to wait, until the second trigger-level (increase of discharge, also programmable), is exceeded. If this happens, the periodic sampling within the event sampling starts automatically and the status information and measured values are continuously sent via satellite to the CMSt and the local service team is informed.