



SoilNet - A hybrid underground wireless sensor network for near real-time monitoring of hydrological processes

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Wireless sensor network technology allows near real-time monitoring of soil properties with a high spatial and temporal resolution for observing hydrological processes in small watersheds. The novel wireless sensor network SoilNet uses the low-cost ZigBee radio network for communication and a hybrid topology with a mixture of underground end devices each wired to several soil sensors and aboveground router devices. The SoilNet sensor network consists of soil water content, salinity and temperature sensors attached to end devices by cables, router devices and a coordinator device. The end devices are buried in the soil and linked wirelessly with nearby aboveground router devices. This ZigBee network design considers channel errors, delays, packet losses, and power and topology constraints. In order to conserve battery power, a reactive routing protocol is used that determines a new route only when it is required. The sensor network is also able to react to external influences, e.g. the occurrence of precipitation. The SoilNet communicator, routing and end devices have been developed by the Forschungszentrum Juelich and will be marketed through external companies. Simultaneously, we have also developed a data management and visualisation system. Recently, a small forest catchment Wüstabach (27 ha) was instrumented with 50 end devices and more than 400 soil sensors in the frame of the TERENO-RUR hydrological observatory. We will present first results of this large sensor network both in terms of spatial-temporal variations in soil water content and the performance of the sensor network (e.g. network stability and power use).