AGU 2012 Fall Meeting, H033: Using Field Measurements and Experiments to Advance Science

Description:
"Advances in hydrologic instrumentation over the past decades have lead to new multi-dimensional and high space-time resolution datasets. LiDAR products, automated water quality sampling, increasing use of isotopic tracers, improved micro-meteorology networks, new soil moisture sensors are all examples of instrumentation that have contributed to these datasets. We solicit submissions that link these advances in field instrumentation with improving our understanding of the hydrologic cycle. We are interested in any studies which focus on using innovative field measurements, whether for model development, parameterization, remote sensing calibration/validation, or other endeavors such as applications. Topics of interest span all hydrologic and ecologic parameters."

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Title: Sensor-based actuation of water samplers in wireless sensor networks

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Abstract Body: Wireless sensor networks (WSN) have started to change environmental monitoring, and as such, real-time sensor data are available in high temporal and spatial resolution. However, sampling of water bodies and the analysis of these samples in the lab will continue to be an essential part of environmental monitoring, as many parameters can only be analyzed with accurate precision in the lab. In a joint project of computer sciences, network engineering and environmental research we integrated an automated water sampler (ISCO 6712) as an actuator into a WSN. Based on the online interpretation of sensor data an actuation schedule for the sampling of water is generated. This actuation schedule is transferred to the water sampling unit for remote execution. Electric conductivity (EC) was chosen as a proxy parameter for water origin (e.g. groundwater or river water in alluvial systems) and thus for changes in stable isotopes and water quality. The onset of river water infiltrating the observed section of the aquifer is detected by EC sampled at several locations and high temporal resolution (2min) using a stream based filtering technique rather than a simple signal threshold. The EC signal is continuously analyzed by the streaming filter defining a sampling event when the EC signal clearly leaves the boundaries of daily oscillation over given a time window. To cope with noise in the EC data, we implemented and evaluated different outlier detection algorithms and plausibility checks to actuate the automated water sampler at the onset of an event and then applying a static sampling scheme. As a next step, we are working on dynamic sampling schemes, which are based on stream processing algorithms predicting the peak and duration of EC events based on deconvolution and geostatistics (Cirpka 2007).