Geophysical Research Abstracts
Vol. 17, EGU2015-12016, 2015
EGU General Assembly 2015

Distributed temperature measurements of a mountain stream for catchment hydrogeology understanding

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In mountain regions, natural water resources used for agriculture or drinking water generally come from natural sources. In this context, climate change that could result in the modification of the rainfall and of the snowcover characteristics during winter could impact natural water resources of the valley. The study of the hydrology at the catchment scale is therefore an important issue.
To address this issue, we use Distributed Temperature Sensing (DTS) technology to monitor the variations of water temperature along a stream. This spatially distributed monitoring of temperature is used to assess the origin of the stream water (deep groundwater source, sub-surface water inflows…) in relation to the discharge of the stream and the rainfall conditions. The observation site if the Strengbach / OHGE catchment (Vosges massif, France). We installed an AP Sensing DTS device consisting in a datalogger and 850 m of reinforced fiber optic cable. The first 600 m have been installed directly in the stream and are underwater even for low water discharges; the next 200 m located upslope have been buried in the soil at depth in the main water source area of the catchment; finally the last 50 m are installed vertically in a borehole in the aquifer.
We present a statistical analysis of a time series of 6 months of measurements. In the upper part of the stream, near the source area, the water temperature always remains close to the temperature of the aquifer (monitored in the borehole) indicating that the stream is mainly supplied by local resurgence of groundwater. In the lower part of the stream, the water temperature is more correlated to the air temperature. The analysis highlights several sections along the stream with diffuse lateral surface water arrivals, characterized by temperature anomalies.