



The search for orthogonal Data in Hydrology – DTS fiber optic Technique for high resolution temperature Data

M.C. Westhoff (1), W.M.G. Luxemburg (1), N.C. van de Giesen (1), H.H.G. Savenije(1) and J.S. Selker (2)

(1) Faculty of Civil Engineering and Geosciences, Delft University of Technology, the Netherlands, (2) Dept. of Biological and Ecological Engineering, Oregon State University, Corvallis, USA (m.c.westhoff@tudelft.nl)

To address the problem of equifinality, orthogonal information is needed. Orthogonal information is data which, independent of the main calibration state variable, sheds light on a different aspect of the rainfall-runoff process and helps to get a better understanding of internal processes of the catchment.

In this research a DTS (Distributed Temperature Sensing) fiber optic cable is used to provide orthogonal information. It is a fiber optic cable which can be up to 10km long, capable of measuring temperature at high resolution. The technique has a resolution of 0.5 meter and 3 minutes with an accuracy of 0.1 °C.

The cable has been installed in a first order stream in central Luxembourg. In the stream, four groundwater sources were detected, located and quantified. Both temperature and the relative discharge can be determined. These values are used as input data in a distributed dynamic energy balance model. The simulated temperature along the whole stream is compared with the observed temperature. It shows that knowledge of the lateral inflow is crucial to simulate the temperature distribution along the stream, and, alternatively, that the temperature can be used to identify hydrograph components. The DTS fiber optic is an excellent tool for identifying inflow sources.

A next step in using the DTS fiber optic is to locate and quantify diffuse sources and losses, separate hydrographs into different runoff components and get a grip on the threshold behavior of these components.