

Anibas¹, C., Bal, K., Banasiak, R., Batelaan, O., Buis, K., De Doncker, L., De Smet, N., Gerard, M., Meire, P., Troch, P., van Belleghem, S. and Verhoeven, R., 2007, Determination of groundwater fluxes via sensing and simulation of hydraulic head and streambed temperatures in lowland rivers. IUGG-IAHS General Assembly 2-13 July 2007, Perugia, Abstract for Session HS1002 A New Focus on Integrated Analysis of Groundwater/Surface-Water Systems: Process Understanding, Conceptualisation and Modelling.

1: Dept. of Hydrology and Hydraulic Engineering
Vrije Universiteit Brussel
Pleinlaan 2, 1050 Brussels, Belgium
canibas@vub.ac.be

In this research the aim is to better understand, simulate and visualize fundamental exchange processes in river ecosystems. The presented work is part of a multidisciplinary project, which includes contributions of engineers, hydrologists, ecologists and biologists. The introduction of innovative, but cost effective field investigations lead to a better perception of the diverse physical and biological processes in margins and inundation areas of water courses and how their interactions determine the exchange of water, dissolved compounds and particulate matter. Several of these processes occur simultaneously, thus the investigations should lead to net rates of exchange between the different parts. Moreover it is necessary to sample data, which fulfill the requirements of modern, data intensive simulation techniques. Field data collection was conducted by sampling temperature data of the riverbed by two different means, firstly by measurement of riverbed temperature profiles at different locations along a river stretch, and secondly by installing nests of piezometers in the riverbed and equipping them with dataloggers. At two different study sites, located in Belgium and Poland, several experiments have been conducted. Respectively, the Aa and Biebrza River represent low land rivers, which are characterized by a small slope and a sandy or peat riverbed. For the rivers a combination of longitudinal and cross-sectional stream bed temperature profiles have been used on a bi-monthly basis. The data set gained in this survey by a T(emperature) stick covers up to 2.5 years for both locations. The measurements are performed with a simple hand-held instrument, which is pushed into the sediment of the riverbed, measuring several temperature points up to about 80-100cm depth. A streambed temperature survey does not lead directly to an estimation of groundwater flux, thermal conductivity of the water and soil matrix is necessary as well. Once obtained, e.g. from literature, a high resolution survey on a local scale is relatively easy to perform. The groundwater fluxes hence were calculated on basis of an analytical equation (Arriaga et al. 2006) and solved with the help of Microsoft Excel or different MATLAB routines. To display the different interaction processes surface, groundwater and eco- biochemical models have been developed, integrated and tested. GIS is used for an appropriate data management, while the generalized modeling platform FEMME, serves as a tool for integrating the different models such as MODFLOW, HecRas, WetSpa, WetSpas, etc. In this research regional groundwater and transport models are used to constrain and provide boundary conditions for smaller local models. As the regional model is able to solve the most common questions on the exchange, the local model should describe the transport and biochemical transformation processes occurring in the hyporheic zone, between groundwater and surface water. Based on data collected from other aspects of the project, a comparison was made of the results gained from streambed temperature measurements with methods like seepage meter measurements, pore-water profiles of chlorides or mass- balance calculations for the stream reach.