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A multi-technique approach to determine temporal and spatial variability of groundwater-stream water exchange

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Characterizing the spatio-temporal distribution of groundwater-surface water exchange fluxes are of paramount importance in understanding catchment behavior as well as biogeochemical and ecological status. The objective of this study is to quantify the spatio-temporal distribution of the exchange fluxes along the Cakit Stream (Nigde, Turkey) through coupling a set of geophysical techniques and in-stream measurements in a hierarchical manner. First, we conducted electromagnetic induction (EM) surveys over long reaches of the Cakit Stream to pinpoint potential groundwater upwelling sections along the streambed. EM anomalies guided our focus to a 600 meter-long reach of the stream. Along this selected reach, fiber-optic distributed temperature sensing system was utilized to investigate top-of-the-streambed-temperature profiles at fine spatial and temporal scales. Furthermore, nested piezometers and vertical temperature profiles (using iButtons) were installed at three potential locations to investigate vertical hydraulic gradients and exchange fluxes. Water quality parameters were also measured along the reach in-stream and in the piezometers. Our results indicate that the downstream sections of the streambed are characterized by downwelling fluxes regardless of the season, whereas seasonal factors control the direction and magnitude of the exchange fluxes along upstream sections. In this presentation we discuss our results in detail and highlight the effect of streamflow discharge and streambed conditions on the performance of various techniques utilized in this study.

Key words: Groundwater – Surface water interaction, electromagnetic induction, distributed temperature sensing, streambed temperature profile, nested-piezometers.