Investigation of stream temperature response to non-uniform groundwater discharge in a Danish lowland stream - DTU Orbit (12/12/2018)

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Non-uniform groundwater discharge into streams influences temperature, a vital stream physical property recognized for its dominant controls on biological processes in lotic habitats at multiple scales. Understanding such spatially heterogeneous processes and their effects is difficult on the basis of stream temperature models often calibrated with discrete temperature measurements. This study focused on examining the effect of groundwater discharge on stream temperature using a physically based stream temperature model calibrated on spatially rich high-resolution temperature measurements. A distributed temperature sensing (DTS) system with a 1.8-km fibre optic cable was used to collect temperature measurements for every 1m of the reach length at 3-min temporal resolution in the stream Elverdamsåen. The groundwater inflow locations identified using DTS data and 24-h temperature measurements (14:00h 6 May 2011 to 14:00h 7 May 2011) were used for further calibration of the stream temperature model. With 19 inflow locations, the model simulated temperature trends closely mirroring the observed DTS profile with a root mean square error of 0.85°C. The aggregation of inflows at specific locations forced the model to simulate stepwise inflow signals and small change in downstream temperature. In turn, the DTS data exemplified spiked signals with no change in downstream temperature, a typical characteristic of lowland streams. In spite of the difference in modelled and measured inflow signals, the results indicate that the represented groundwater inflows imperatively controlled the spatial variations of temperature within the study reach, creating three unique thermal zones.

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