



Monitoring stream temperature with fibre-optic cables to analyse the importance of shade and groundwater

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The water temperature is a determining factor for stream ecology as it influences (bio)chemical processes, the presence of species and the functioning of ecosystems. Stream water temperature is determined by a combination of processes at the surface and in the subsurface. Air temperature, radiation and morphology play a role at the surface, whilst the inflow of groundwater is important from the subsurface. To gain more insight in the effects of these different processes on the heat budget of streams, we continuously monitored stream temperature in two lowland streams in the Netherlands both in summer and winter using long (~1.5 km) fibre-optic cables (Distributed Temperature Sensing). We found several locations with significant inflow of groundwater, which were verified using various other measurements such as those of the isotope Radon-222. Groundwater provides a cool input to the stream in summer and a warm input in in winter. The stream temperature measurements also revealed cooling in shaded stream stretches on summer days. Our measurements show that the heterogeneity of the stream temperature is large, and can be measured with the fine scale DTS technique. Using a heat budget model we analysed the importance of air temperature, shade and groundwater, and explored the effect of climate change and different management options.