

Identifying Flow Pathways with Fibre Optic Distributed Temperature Sensing (FO-DTS)

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Research objectives

Our conceptual model of flow to the drainage channels in the catchment involves field drain discharge, shallow throughflow and groundwater inputs. Since these different mechanisms are all potential pathways for contaminants, it is important to determine how they vary over time and space under different hydrological conditions.

Key messages

- DTS installed in March 2012 to continuously monitor water temperature in a drainage channel
- Flushing events after rainfall and shallow groundwater inflow detected
- Development of temperature-based models may allow flow paths and travel times to be quantified

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Description of research/methods

Different hydrological sources of water often have different temperatures. For the detection of these sources, a DTS system was installed. DTS is the measurement of temperature along fibre optic cables. Starting at Kiosk E at Stinton Hall Farm, over 900 m of fibre optic cable were laid on the channel bed (Figure 1). Since March 2012, temperature measurements have been obtained for every 1.01m of the fibre optic cable, every 2 minutes. Figure 2a shows an example of a temperature measurement obtained at 06:00 on 25/04/2012. The temperature measurements



Figure 1. Schematic of fibre optic cable location

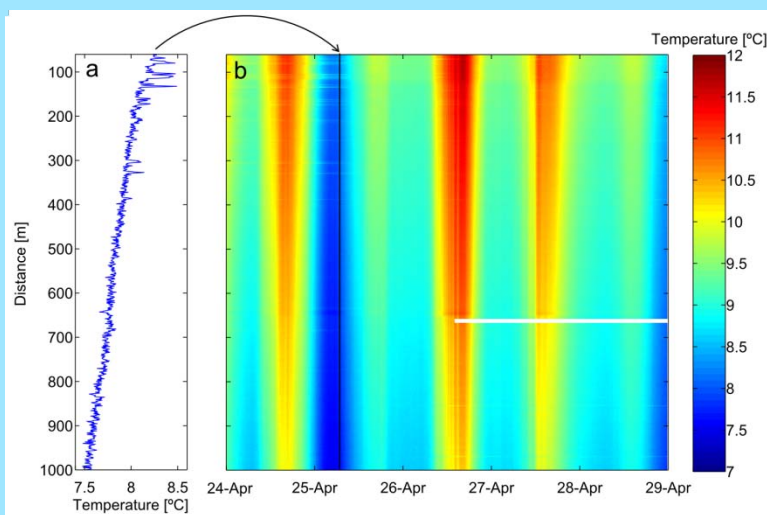


Figure 2. (a) Single temperature measurement, 06:00 on 25/04/2012. (b) 3600 consecutive temperature measurements

can be plotted together, such that the temperature trends over both space and time can be considered (Figure 2b). During and following on from rainfall events, the diurnal temperature signature is much reduced. In the first 400 m, there are several locations where the temperature remains more constant over time. These locations are likely to be regions where shallow groundwater flow is discharging to the channel.

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