

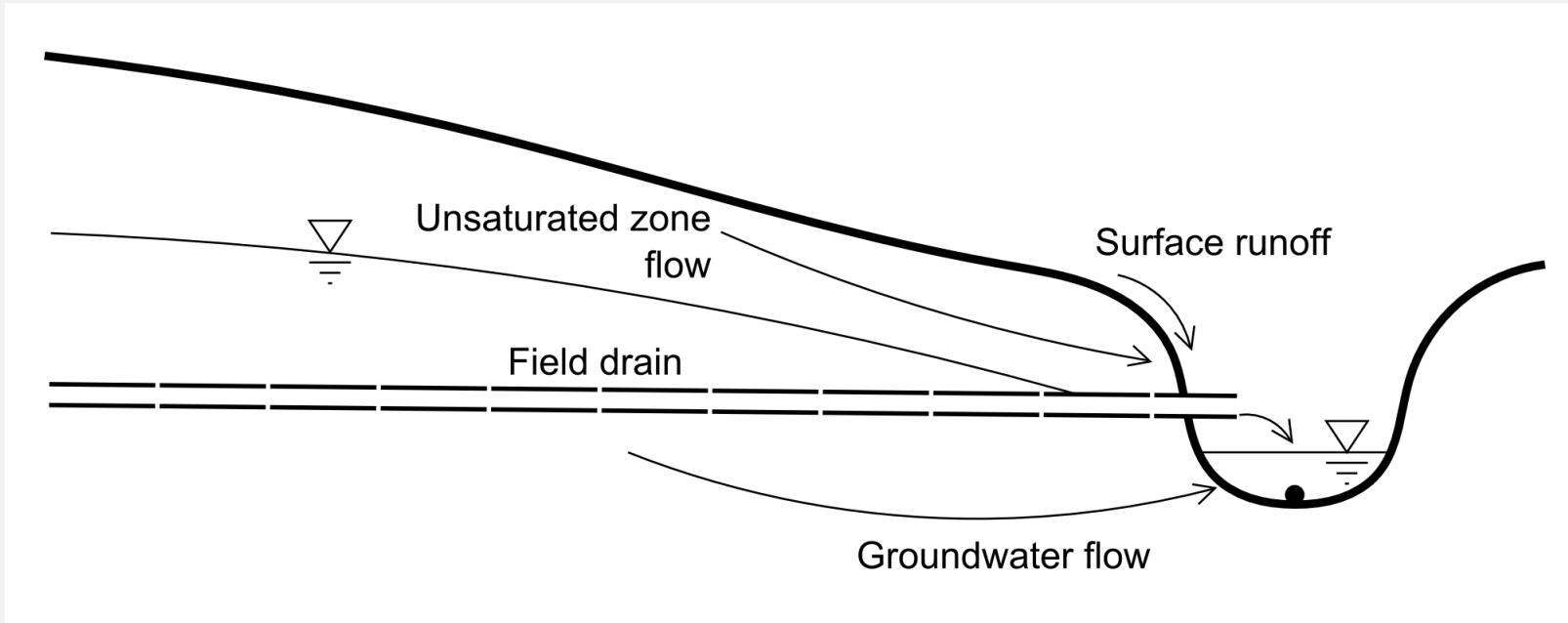
# Identifying flow pathways using Fibre Optic Distributed Temperature Sensing (FO-DTS)

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# Flow conceptual model

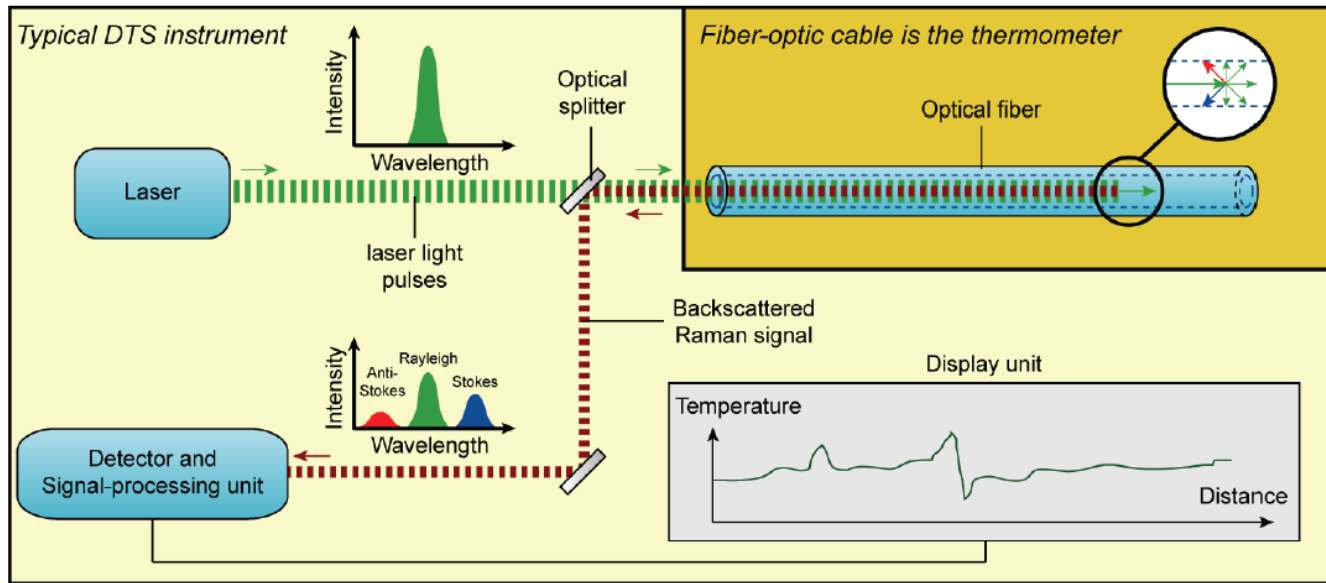


*Conceptual model of flow paths, indicating groundwater flow, field drain discharge, unsaturated zone flow and surface runoff*

Heat carried by flowing water can be used as a 'natural' tracer

- both the temperature dynamics and the temperature itself can be different between groundwater and surface waters

# DTS for high resolution temperature monitoring



*Schematic of a typical DTS system (from Suarez et al., 2011)*

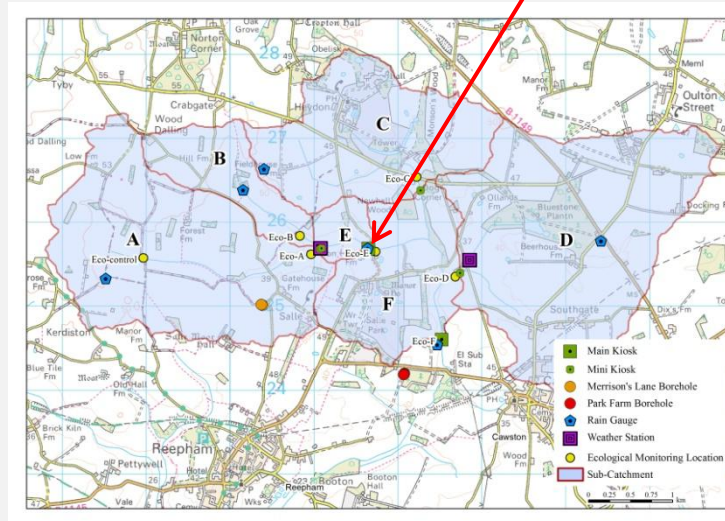
Suárez, F., Hausner, M. B., Dozier, J., Selker, J.S., and Tyler, S.W., 2011. *Heat Transfer in the Environment: Development and Use of Fiber-optic Distributed Temperature Sensing*. In: dos Santos Bernardes, M.A., ed. 2011. *Developments in Heat Transfer*. InTech, pp.611-636

# Experimental set-up



## Measurements:

- Been obtained since March 2012
- Temperature measurement every 2 minutes, for every metre along the cable
- Precision of 0.1°C
- Generates lots of data!

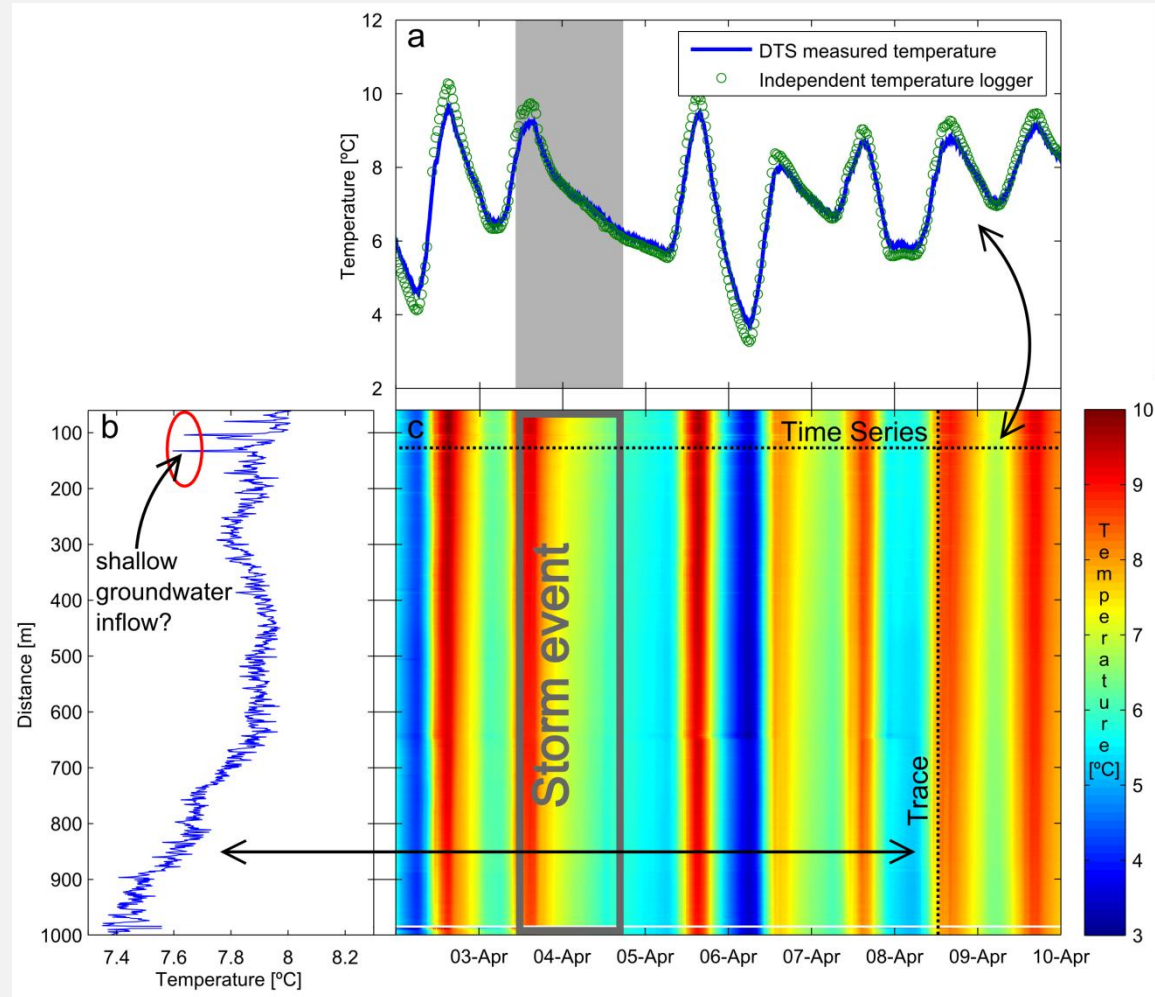


# Typical DTS results so far...

*DTS time series at a point (a), a single DTS trace (b), and combining many of these gives (c)*

These kind of data give us the potential to:

- Detect areas of anomalous temperature where flow to the drainage channel may be significant
- Investigate what is happening during storm events



# Future work

- Electrical resistivity tomography to depths of 4-5m will be carried out to determine the heterogeneity of the tills, sands and gravels beneath the stream bed
  - These exert control over the local permeability and groundwater flow to the channels
- Additional measurements of stream bed temperatures, source temperatures,
- Large data set to be collected spanning over a year
- The data will be analysed with reference to the weather station data
- Hydrochemical data sets will provide additional constraints for temperature based models

