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Groundwater Unmasked: Combining Techniques to Trace Groundwater in Lowland Streams

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Seepage of groundwater produces a significant part of stream discharge. This base flow component is of vital important for stream functioning as it prevents streams from falling dry and provides a specific water chemistry and temperature. The interaction between groundwater and surface water is complex and highly heterogeneous both in space and time. The location of groundwater seepage can be found using several techniques which we combined to reduce uncertainties.

We applied the different techniques in two lowland streams in the Netherlands, which have different geological and hydrological settings. Two glass fibre cables with a length of 1.5 km were placed in the streams for the application of Distributed Temperature Sensing (DTS). The high-frequent spatially distributed stream temperature measurements revealed local hotspots of groundwater/surface water interaction. These were compared with measurements from the groundwater tracer Radon-222, vertical flux measurements using seepage meters, vertical temperature profile measurements and visual seepage indicators.

Groundwater/surface water interaction was found to vary spatially in a spectacular way: whereas seepage occurred on one side of the stream, no seepage was found on the opposite side at only meter distance. It is essential to include these small scale differences as they can result in contrasting ecological habitats. Although combining groundwater tracing methods proved to be valuable, capturing the heterogeneity and quantifying the amounts of water exchange stay the most challenging problem facing research on groundwater/surface water interaction.