Comparing Fiber-Optic Distributed Temperature Sensing to Hydrochemistry for understanding groundwater inflows to streams
Abstract n°2122

Daughney Christopher J., Lower Hutt, New Zealand

c.daughney@gns.cri.nz

Martindale Heather, GNS Science, Lower Hutt, New Zealand

Lovett Abigail, GNS Science, Wairakei, New Zealand

Moridnejad Maryam, GNS Science, Wairakei, New Zealand

Donath Franziska M., Georg-August-Universität, Göttingen, Germany

Cameron Stewart G., GNS Science, Wairakei, New Zealand

Morgenstern Uwe, GNS Science, Lower Hutt, New Zealand

KEYWORDS: fiber-optic distributed temperature sensing, hydrochemistry, groundwater-surface water interaction

Fiber-optic distributed temperature sensing (FODTS) is an established technique for identifying locations and quantifying fluxes of groundwater inflows into rivers and streams. FODTS has the advantage of being able to provide very high spatio-temporal resolution of groundwater inflows relative to conventional methods such as differential stream flow gauging. However, in the traditional longitudinal configuration in which the FODTS cable is deployed along the stream bed, the method may not provide detail on hyporehic exchange. Even where FODTS is used to examine longitudinal and vertical temperature profiles, it provides relatively little information on the flow paths along which inflowing groundwater has travelled. In this study we employ hydrochemical methods to complement FODTS surveys in New Zealand settings, including Ngongotaha Stream, situated in ignimbrites and related volcanic sediments+ and the Hutt River in a greywacke gravel setting. Longtudinal FODTS surveys were carried out in both rivers under baseflow conditions. In the Ngongotaha Stream study, water samples were collected for analysis of major dissolved constituents at the reach scale and also across the wider catchment. Interpretation using multivariate statistics indicated that the hydrochemical data, particularly silica concentration, clearly identified the aquifer of origin for the water inflows – information not provided by FODTS alone. In the Hutt River study, samples were collected for radon analysis at a spacing of ca. 250 m. The pattern of groundwater inflows inferred from FODTS and stream gauging did not always align with the radon concentrations, likely because the techniques capture hyporheic exchange to different extent. This study has illustrated the strengths of FODTS in two different hydrological and geological settings, and also demonstrated the utility of collecting complementary hydrochemical data to aid FODTS interpretation.