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Complexities in the attribution of trends: disentangling drivers of change and the importance of metadata

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The cause of trends detected in hydrological monitoring networks is rarely rigorously explored. Without the known driver(s) of change, information obtained from a trend analysis is of limited benefit in a planning and adaptation policy perspective. Here, using the Boyne catchment in Ireland as a case study, a more in-depth examination of both external and internal drivers of change is undertaken. A widely cited paper on this catchment reported a statistically significant step change in the mid 1970s and linked the cause of increased river flow post 1975 to a change in the North Atlantic Oscillation at that time. A detailed historic and metadata analysis suggested a more complex interplay of multiple drivers internally within the catchment. Most notably, an extensive arterial drainage scheme that was undertaken during the period 1969-86.

In order to eliminate the influence of arterial drainage on river flow a model based approached was employed. River flow data from the pre-drainage period along with meteorological data was used to calibrate conceptual rainfall runoff models in order to reconstruct continuous flow series spanning the pre- and post-drainage eras. Model parameter and structure uncertainties were explored via three conceptually and structurally diverse models. A trend analysis was applied to both the recorded and simulated time series. To assess the impact of arterial drainage on trend direction and magnitude the Mann-Kendall and Theil-Sen Approach was utilised while step changes were assessed using the Rodionov Regime Shift Index.

Results show that when the influence of arterial drainage is removed the previously detected change, attributed to a change in the North Atlantic Oscillation, was no longer present. It is therefore important to explore and understand better the causes of changes of river flow at the catchment scale. While detailed metadata assessments are time consuming and elimination of artificial changes difficult, these results show that misleading information can be acquired from trend analyses which have the potential to led to incorrect and costly planning decisions within the water sector.