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Practical Estimation of Minimum Night Flow in Water Distribution Networks: Large-scale Application to the City of Patras in Western Greece

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Abstract

In the present work we develop and test a non-parametric statistical methodology to obtain point estimates of Minimum Night Flow (MNF) in Water Distribution Networks (WDNs). The methodology constitutes a simplified version of the approach of Serafeim et al. (2021) for confidence interval estimation of background losses in WDNs, that simultaneously analyzes all night flow measurements, producing robust estimates independent of the nominal resolution of the available data.

In addition to being simpler to apply and computationally more efficient, the developed method can be applied to any WDN independent of its size, age and overall condition, its specific geometric characteristics (intensity of altimetry, average diameter etc.), inlet/operating pressures, and the nominal resolution of the flow data.

The effectiveness of the method is tested via a large-scale application to the WDN of the City of Patras in western Greece, which consists of 79 Pressure Management Areas (PMAs) with more than 700 km of pipeline grid. To do so, we use flow data at 1 min temporal resolution, provided by the Municipal Enterprise of Water Supply and Sewerage of the City of Patras, for the 4-month winter period from 01 November 2018 – 28 February 2019, which are progressively averaged to coarser temporal resolutions, in an effort to test the sensitivity of the developed method to the nominal resolution of the data.

The obtained point estimates of MNF are assessed on the basis of the confidence intervals obtained by the approach of Serafeim et al. (2021), highlighting the accuracy and robustness of a simple non-parametric approach in providing MNF point estimates at a minimum of effort.

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References

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