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Resource modelling for control: how hydrogeological modelling can support a water quality monitoring infrastructure

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The knowledge of the physical/chemical processes implied with the exploitation of water bodies for human consumption is an essential tool for the optimisation of the monitoring infrastructure. Due to their increasing importance in the context of human consumption (at least in the EU), this work focuses on groundwater resources. In the framework of drinkable water networks, the physical and data-driven modelling of transport phenomena in groundwater can help optimising the sensor network and validating the acquired data.
This work proposes the combined usage of physical and data-driven modelling as a support to the design and maximisation of results from a network of distributed sensors. In particular, the validation of physico-chemical measurements and the detection of eventual anomalies by a set of continuous measurements take benefit from the knowledge of the domain from which water is abstracted, and its expected characteristics.
Change-detection techniques based on non-specific sensors (presented by quite a large literature during the last two decades) have to deal with the classical issues of maximising correct detections and minimising false alarms, the latter of the two being the most typical problem to be faced, in the view of designing truly applicable monitoring systems.
In this context, the definition of “anomaly” in terms of distance from an expected value or feature characterising the quality of water implies the definition of a suitable metric and the knowledge of the physical and chemical peculiarities of the natural domain from which water is exploited, with its implications in terms of characteristics of the water resource.