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Urban water loss assessment in real distribution networks: use of smart-meters with incomplete readings

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In a context of increasing water scarcity all over the world, water loss reduction in distribution water networks is a key objective in many countries to ensure the sustainable management of water resources. The increase of water losses in the distribution networks leads to intensify the water subtraction from the environment with an impact on the sustainability of water resources in future decades. In particular, the concentration of population and activities in urban areas is often severely impacting the water availability also for the residential sector.
In addition to denote the condition of the network infrastructure, water losses may represent the “biggest user” of water supply systems and their estimation and control is therefore one of the key water demand management strategies. The recent availability of smart metered high-resolution water consumption data in urban water distribution networks introduces, through the synchronous readings of the smart meters, new perspectives in the proactive approach to the monitoring of water losses. On the other hand, measuring equipments and/or transmission systems problems are unavoidable in real-world networks and, if not appropriately addressed, such missing or unreliable data may compromise the ability to use smart meters to estimate water losses. A Synchronous Water Balance methodology is here presented, that allows the near-real time assessment of water losses taking into account incomplete readings through a water consumption data validation and reconstruction model. The impact on water loss monitoring due to the lack of an increasing number of smart meters is investigated applying a random sampling, evaluating the corresponding error. The results of the proposed methodology, tested on a district of the city of Fano (Italy), indicate that the availability of near real-time synchronous water consumption measures can indeed substantially improve the assessment of water losses.