Assessing the potential of digitalization by real-time monitoring of bacterial concentration in urban water systems

Co-Authors

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Digital solutions open up a variety of opportunities for the water sector. Digital water is now seen not as an 'option' but as an 'imperative' (Sarni et *al.*, 2019) for a more sustainable and secure water management. Many solutions leverage the latest innovations developed across industries and business activities including advanced sensors, data analytics and artificial intelligence. The potential of digitalization might outweigh its associated risk if digital solutions are successfully implemented addressing a series of gaps and barriers such as ICT governance, cybersecurity, data protection, interoperability and capacity building.

Within this context, the H2020 innovation project digital-water.city (DWC) aims at boosting the integrated management of waters systems in five major European cities – Berlin, Copenhagen, Milan, Paris and Sofia – by leveraging the potential of data and digital technologies. Goal is to quantify the benefits of a panel of 15 innovative digital solutions and achieve their long-term uptake and successful integration in the existing digital systems and governance processes.

One of these promising technology is a new sensor for real-time bacterial measurements, manufactured by the company Fluidion (ALERT System; Angelescu *et al.*, 2019). The device is fully autonomous, remotely controllable, installed in-situ and allows rapid quantification of E.coli and enterococci concentrations.

Ensuring microbial safety is one of the key objectives of bathing water management, and it is also a critical aspect for water reuse. The European Bathing Water Directive (BWD) (76/160/EEC, 2006) uses fecal indicator bacteria for quality assessment of marine and inland waters. A major challenge regarding bathing water management is that concentrations of fecal bacteria may show spatial and temporal variability. In urban rivers, discharges from CSO and stormwater may contain high amounts of fecal bacteria and contaminate bathing water quality. Bathing water surveillance in Europe is only based on monthly grab samples and event-scale variability is detected only by chance as pollution events may occur between sampling intervals.

The ALERT System is currently tested in Berlin and Paris using side by side laboratory comparison to understand temporal variability and spatial bacterial distribution in the local rivers (Seine, Marne and Spree). In Milan, the system is being deployed to provide early warning of bacterial and toxic contamination linked to water reuse at a major wastewater treatment plant. Preliminary analysis have shown that the device shows metrological capabilities comparable to those of an approved laboratory using MPN microplate techniques and is suitable for bacterial pollutant concentration ranges such as urban streams and wastewater treatment plant.

The technology opens up new opportunities for the water sector for a range of applications such as the planning of pollution reduction measures, the continuous monitoring of bathing water quality and the assessment of contamination risk by the reuse of treated wastewater for irrigation. In particular, it is a key innovation to contribute to the objective of Paris city and other local municipalities to provide permanent and safe opportunities for bathing in the Seine river for the 2024 Olympic and Paralympic Games, and beyond.

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