Laboratoire Eau Environnement et Systèmes Urbains (LEESU)

In situ, high-frequency characterisation of dissolved organic matter in aquatic environments under high anthropogenic pressure using a new fluorescence spectrometry technology

In continental aquatic environments, dissolved organic matter (DOM) is a highly complex and dynamic mixture of compounds originating from both natural sources and anthropogenic inputs. It plays a major role in the watercourses' biogeochemical functioning due to the large number of processes in which it is involved. These processes depend not only on the overall concentration of DOM, but also on its chemical nature.

Fluorescence spectrometry is a laboratory analytical technique that has already demonstrated its ability to characterize DOM, paving the way for numerous operational applications. In recent years, there has been a notable increase in the development of fluorescence probes, with the objective of offering continuous and high-frequency measurements. The Fluocopée® probe, developed through a collaboration between LEESU and SIAAP (patented), is one example of such new *in situ* measurement instruments. It offers relatively fine characterization of DOM by monitoring about twenty $\lambda_{excitation}/\lambda_{emission}$ pairs. It is sensitive enough to be used in rivers' continuous monitoring.

The objective of this PhD project was to install the Fluocopée® probe in the Seine basin, both upstream and downstream of the Paris conurbation. Prototypes were deployed at six sites located on the Seine, Marne and Oise rivers, forming a new high-frequency observatory to monitor DOM evolution (MatOS observatory). Installation and maintenance of Fluocopée® probes on such a large scale required the development of various methods to guarantee the quality of data obtained from fluorescence records.

Concurrently, predictive models were developed within the laboratory setting to estimate specific water quality parameters associated with DOM. They have been configured so that they can be implemented in the Fluocopée® probe and then provide high-frequency monitoring of such parameters.

In addition to these quality indicators, interpretation of fluorescence records was supported by numerous analyses already carried out at the MatOS observatory sites (SIAAP multi-parameter measuring stations and SEDIF drinking water intake stations). This comprehensive data set was then exploited to improve the understanding of DOM spatio-temporal dynamics in the Seine with data collected between winter 2023/2024 and the first quarter of 2025.