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Impact of two centuries of urbanization on urban soil and groundwater. A diachronic study of Paris conurbation water sources.

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Impact of the urbanization on recharge and quality of urban groundwater has been little studied. Due to current focus on preservation and restoration of water bodies, there is an interest in understanding how urbanization through sealed surfaces, new drainage systems, industries, backfills and levelling may have affected groundwater flows and quality.

As urbanization is a long-term development, it is a challenge to have observations at both pre-urbanization and current urbanized stages. Historically, cities water supplied were provided by water springs collected near the cities. It was the case of the city of Paris where was developed two main historic drainage network to collect water springs. The first one, located in the Northeast, the Northern springs, was created in the 12th century. It was mainly used to supply hospices and religious communities as well as fountains in the city. The second one is the "Aqueduc Médicis". Built during the 17th century, it was wanted by Queen Catherine de Médicis to supply fountains of Luxembourg gardens in Paris.

Nowadays, waters from these two aqueducts are not used. During urbanization of Paris conurbation, drainage network that made up these aqueducts have been partially destroyed but large part of main drainage system as well as access manholes are still accessible. As these two drainage systems were of interest for water supply, numerous historical data exist on drainage water volume, temperature, etc. Moreover, it is possible from speleothems analysis to determined origins and quality of water. Thus, these drainage systems are an opportunity to study how changes in urban soil occupation can impact groundwater flow and quality.

For this purpose, our methodology is based on three steps:

i) The description of the past 150-years evolution of soil occupation for the two drainage system watersheds. This description is based on historical cadastral plans and, for the more recent years, on land-use map;

ii) An historical data mining in the archives of the city of Paris that provide water flow measured during the 19th century;

iii) Current measurements of water discharges and quality in the two drainage systems.

This method allowed us to estimate the evolution of imperviousness since the beginning of the 19th century and identify the changes in origin of the soils due to backfill or levelling. A monthly time series of flow records since 1834 for the "Aqueduc Médicis" and 1854 for the Northern springs was also reconstructed. Current measurements are still ongoing and further steps will consist in integrating soil occupation evolution in conceptual modelling.