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Localization of groundwater infiltration in the combined sewers of Brussels by stable isotopes measurements (δ18O, δD) by Cavity Ring Down Spectroscopy.

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In the last 20 years research has been conducted to quantify the infiltration of groundwater into the sewers. This groundwater, called parasitic water, increases the volume of waste-water to be treated and consequently the cost of this treatment. Moreover, in the case of combined sewer systems, the parasitic water also limits the sewer capacity and indirectly increases the risks of combined sewer overflows and floods. The infiltration of groundwater occurs trough cracks, sewer collapses and from direct connections with old springs. Different methods quantify the intrusion of parasitic water. Among these, the use of the stable isotopes of water (δ18O & δD) shows good result in catchments or cities close to Mountainous regions (example from Lyon, Zurich), where isotopic signals vary significantly because of continental and altitude effects. However many cities, such as Brussels, are located in more oceanic settings and theoretically offer less potential for the application of the stable isotopes method. In the case of Brussels, river-water from the Meuse is used to produce domestic-water. The catchment of this river extends into the Ardennes, which are affected by slightly different climatic conditions. δ18O & δD analyzes of groundwater from the main aquifer (Ledo-Paniselian-Brusselian) and domestic-water from the Callois reservoir fed by the Meuse River show sufficient isotopic differences in the south of Brussels, but only during the summer. The discrimination potential is better with δD than with δ18O. The improvement of δD measurements (precision, costs,...) brought by Cavity Ring Down Spectroscopy largely contributes to the potential of using stable isotopes method to trace water in Brussels. The first campaigns in the sewers also show a little enrichment (in heavy isotopes) of the waste-water in comparison with the reservoir waters and tap waters. This increases the potential of the method but constrains the sampling to pure waste-water in sewer segments without infiltration generally localized upstream. Anyway, it is in the localization of parasitic water entrance from upstream to downstream that the stable isotopes method is the most powerful. Other methods (e.g. minimum night flow,...) are available at the treatment plants or at flow measurement stations downstream but will not be able to localize parasitic water intrusion towards old springs.