

Chemical characterization of urban runoff waters aimed for managed aquifer recharge

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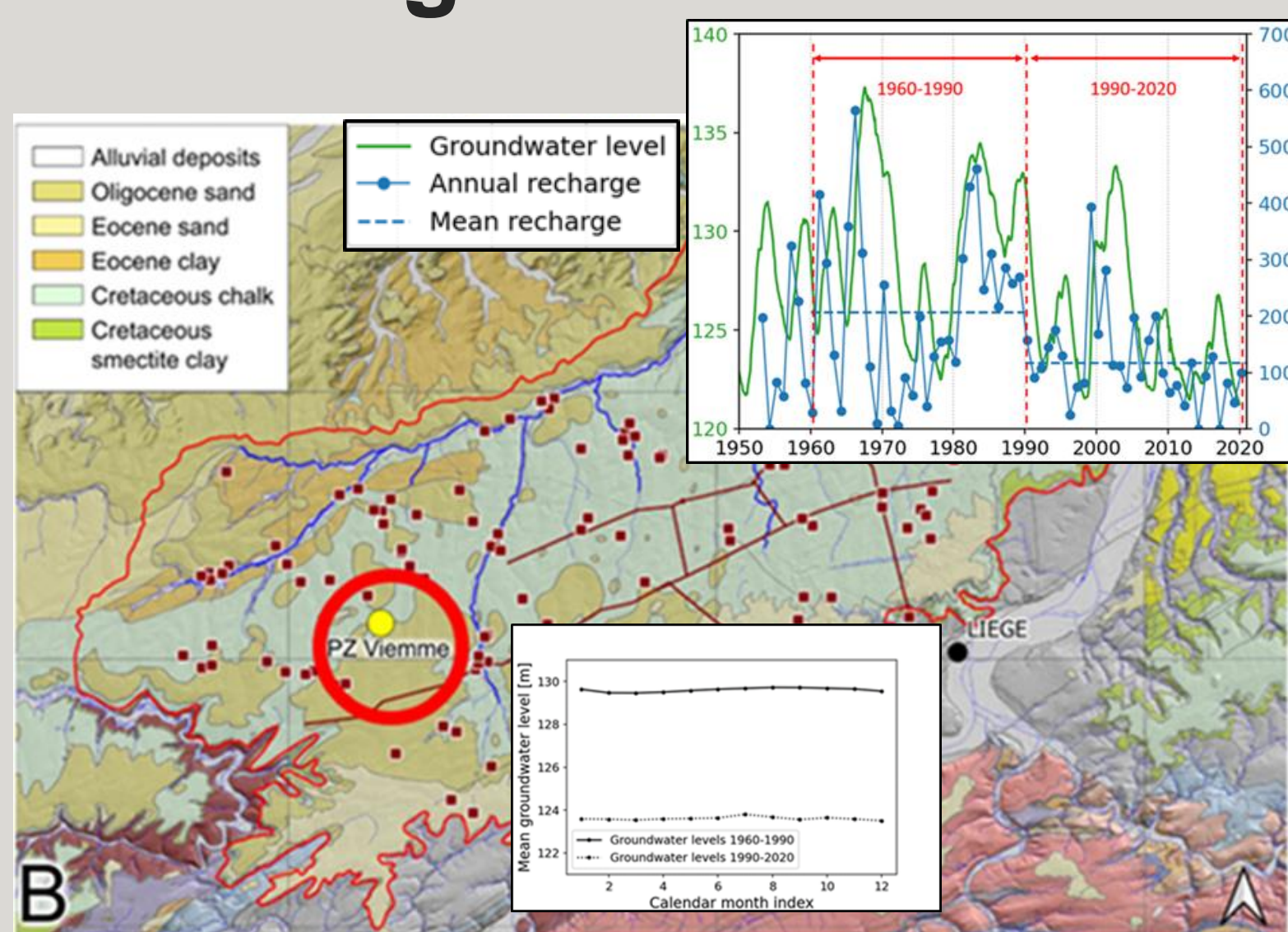
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Abstract

Groundwater availability and sustainability are threatened by several factors such as climate change and anthropogenic pressures. This is notably the case in the Hesbaye chalk aquifer which is threatened both in terms of quantity and quality. In this context, Managed Aquifer Recharge (MAR) has been progressively seen as a solution to store alternative waters in aquifers for subsequent recovery or environmental benefits. However, it is fundamental to control the quality of the infiltrated water to avoid any deterioration of the groundwater resource.

1. Background



Observations in the Geer basin:

- 1 Mean piezometric decline between 1960-1990 and 1990-2020.
- 2 Decrease of the mean recharge during the same period.

Managed Aquifer Recharge (MAR), i.e. storing water in aquifers for subsequent recovery, as a mitigation measure.

Need to characterize waters intended for MAR.

2. Sampling



- What** Runoff water from stormwater basins.
- Why** Chemical characterization to evaluate their suitability for MAR.
- Where** Liège airport. Crisnée municipality.
- How** Grab samples. 5 sampling points.
- Which parameters** Metals, polycyclic aromatic hydrocarbons, contaminants of emerging concerns, ...

4. Perspectives

For each detected Persistent, Mobile and Toxic (PMT) contaminant

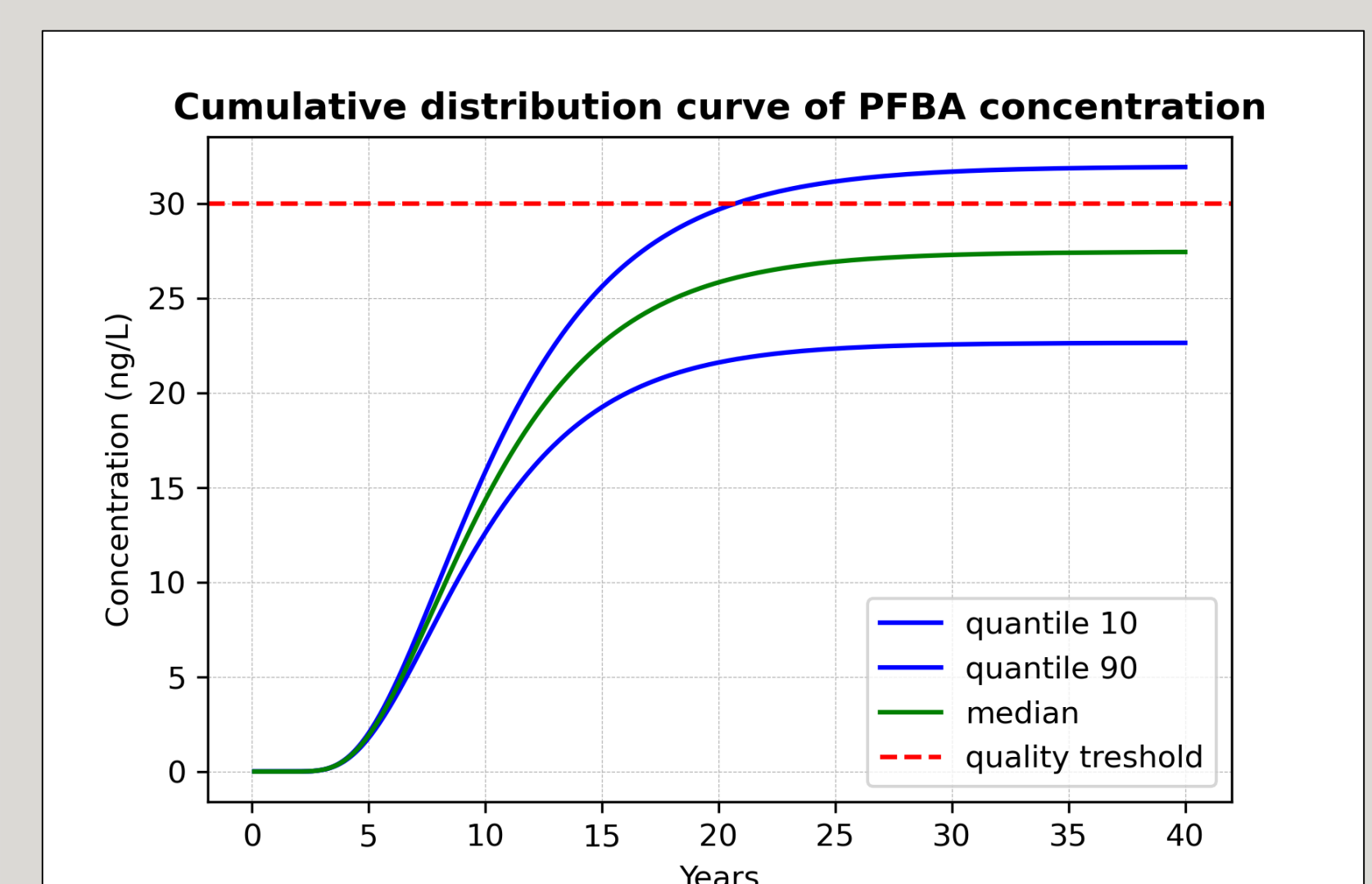
Transport properties

1D transport Modeling

N Monte Carlo simulations

Cumulative distribution function of the selected contaminant concentration over time

E.g. Perfluorobutanoic acid

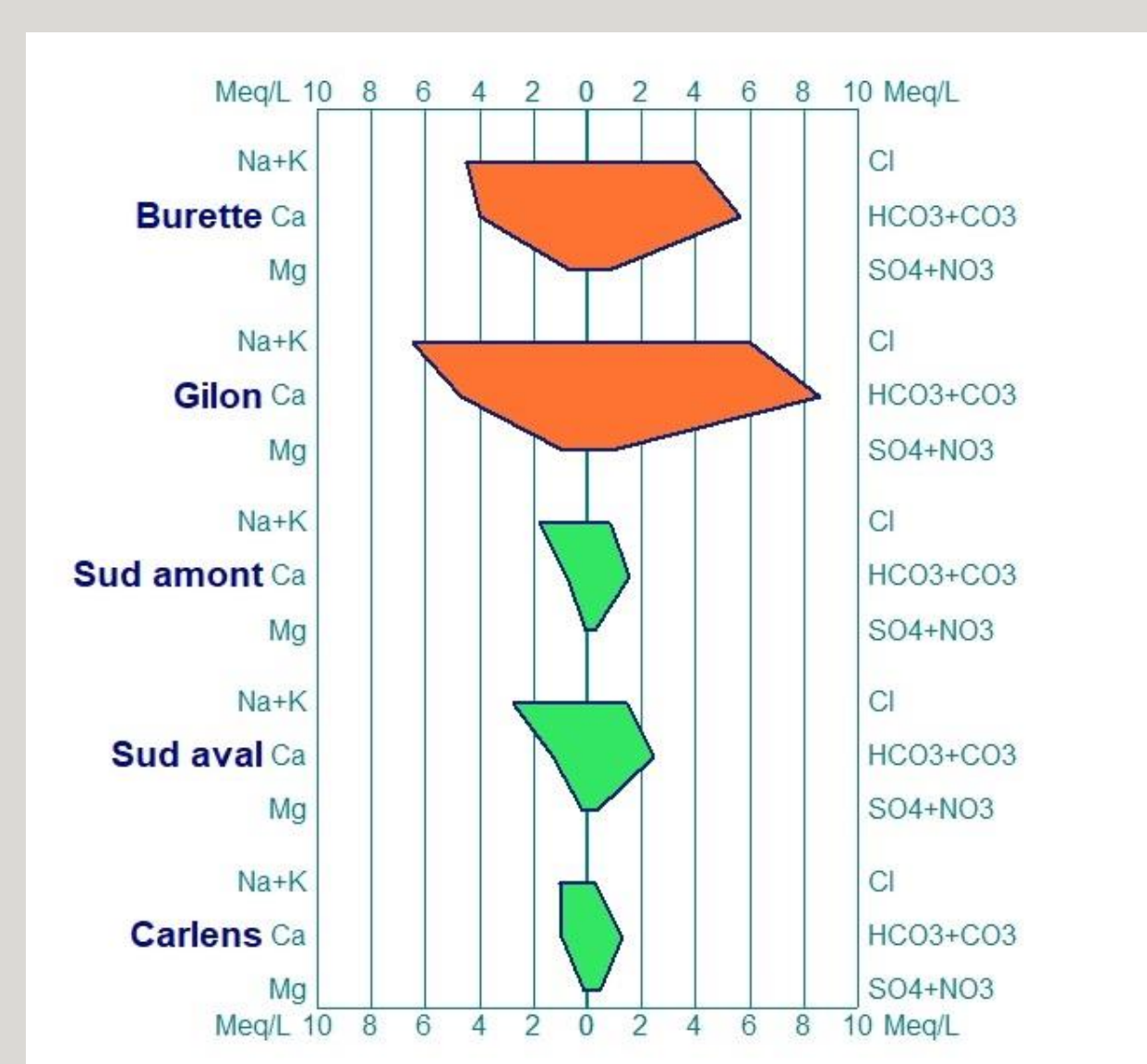


Risk of groundwater deterioration :

$$\frac{\text{Number of simulations with } C \text{ above the limit}}{\text{Total number of simulations}}$$

3. Chemical analysis

■ Crisnée ■ Airport

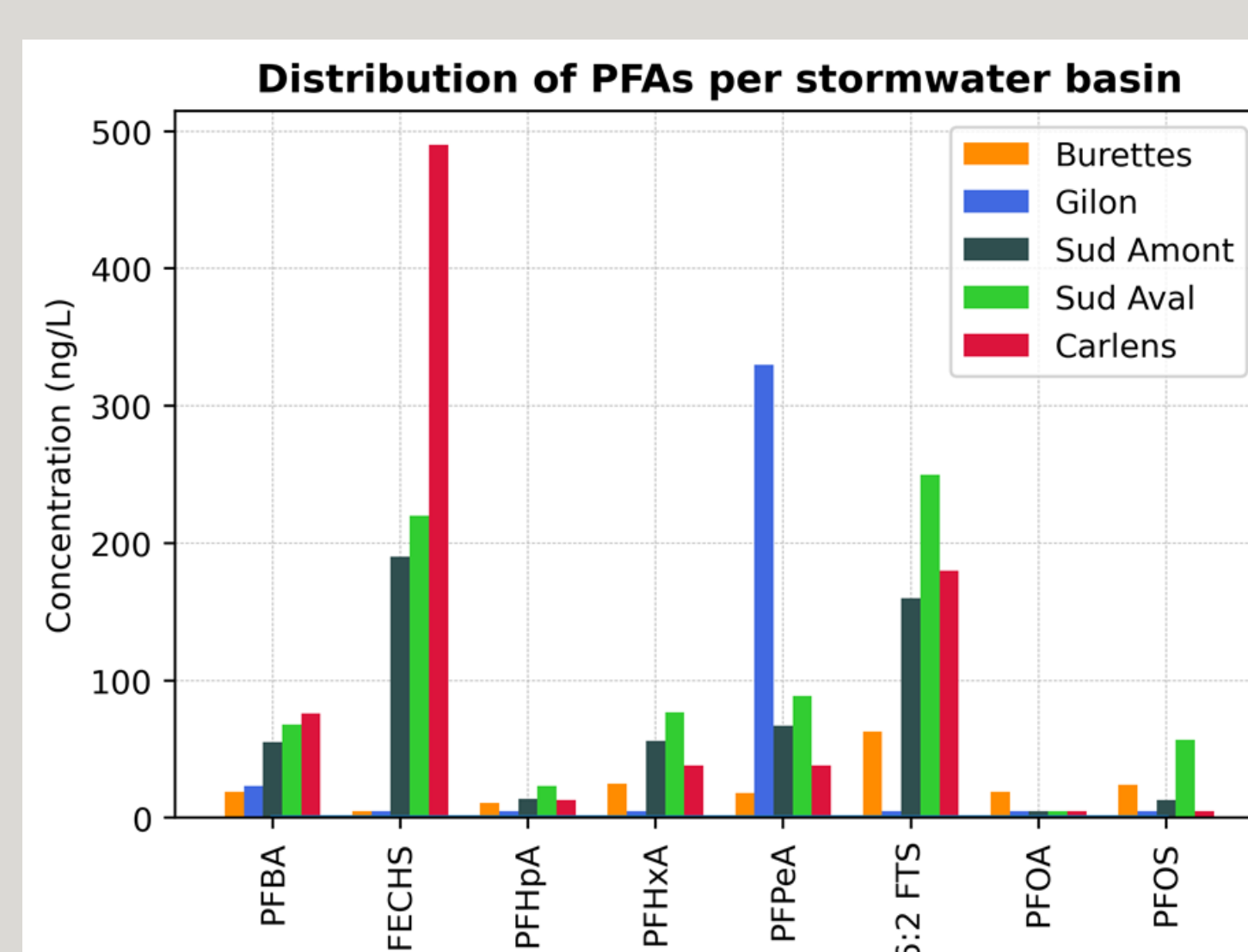


Distribution of major ions per basin:

- Airport runoff water less mineralized than from Crisnée.
- Greater loads of chloride and sodium in Crisnée → wastewater signature.
- Bicarbonate contribution in Crisnée mixed water (runoff and wastewater).

Example of problematic pollutants, PFAS :

- Contaminants of emerging concerns such as poly and perfluoroalkyl substances (PFAS) have been detected.
- Higher loads of PFAS in airport runoff water than in Crisnée.
- Detected PFAS in the airport related to fire training tests (foam, etc...).



Future work

- 1 Collection of **transport properties** for each PMT contaminant in order to evaluate the impact of the infiltrated water on the groundwater resource.
- 2 **Loess characterization** in the Geer basin to evaluate fundamental parameters such as coefficient of sorption, effective porosity, organic carbon content, etc...
- 3 **New sampling campaign**