

# High river flows are changing - What are the main drivers in Wallonia (Belgium)?

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Source: Maud Grandry

## Context

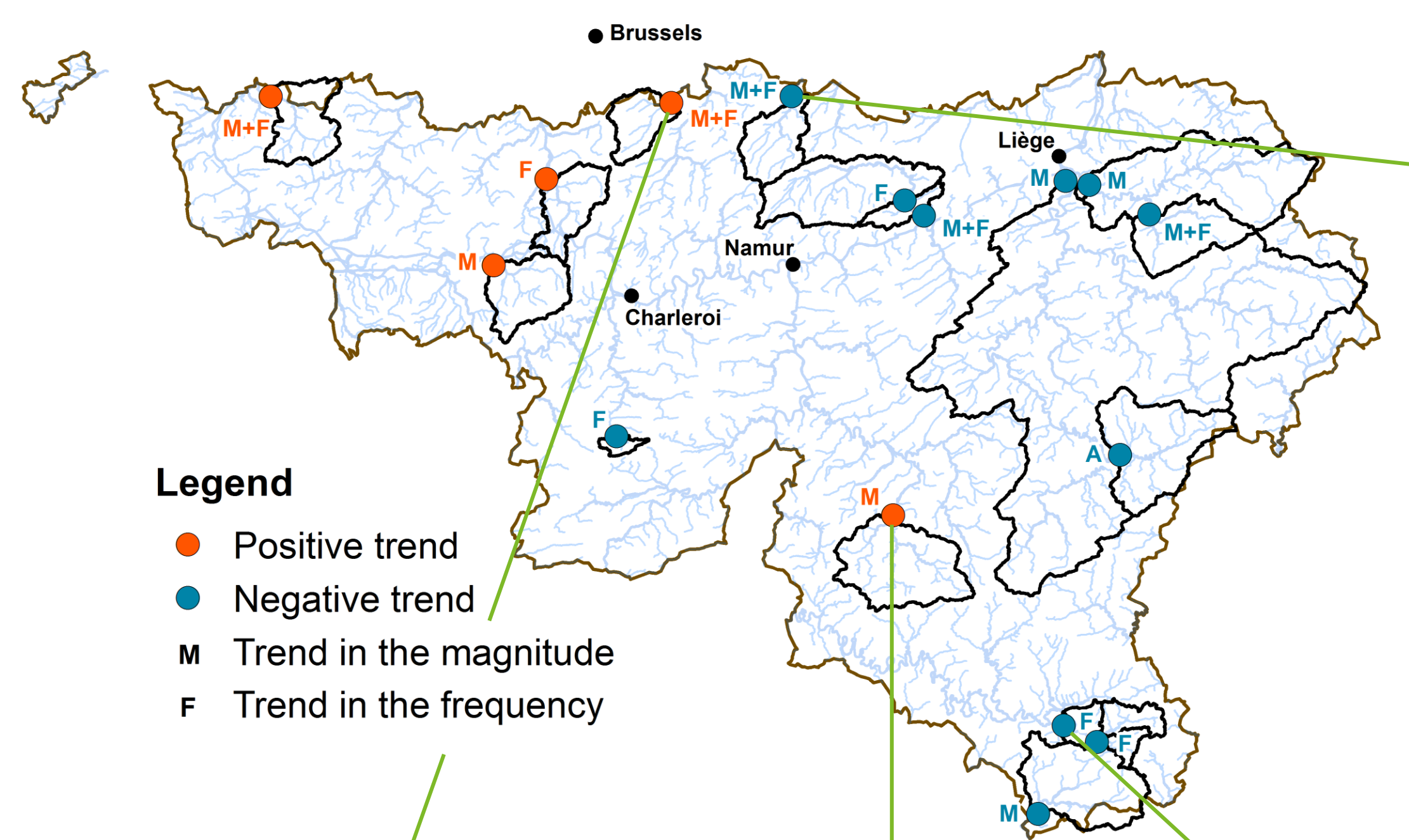
Changes have been detected in the magnitude as well as in the frequency of high flows: **19%** of the sites analysed in Wallonia (16 out of 84 sites) show either a **positive or negative trend**. This study aims at understanding, for each catchment, how the different **factors** and their combinations **drive** the changes in high flows.

## Methodology

For each station:

- ❖ **Trend detection** in climate variables (daily records)
  - linear regression, Mann-Kendall and Pettitt tests:
    - **North Atlantic Oscillation**: winter index
    - **Rain**: 1, 2 and 3-day precipitation (annual maximum)
    - **Snow**: snowfall (annual total), cumulated snow (annual maximum), and 1, 2 and 3-day melted snow quantity (annual maximum)
    - **Evapotranspiration** (annual total)
  - Poisson regression and Pettitt test:
    - Number of **humid days** per year
- ❖ **Correlation** with the annual maximum peak flows (AM) and the number of peaks per hydrological year
- ❖ Information on **catchment changes**

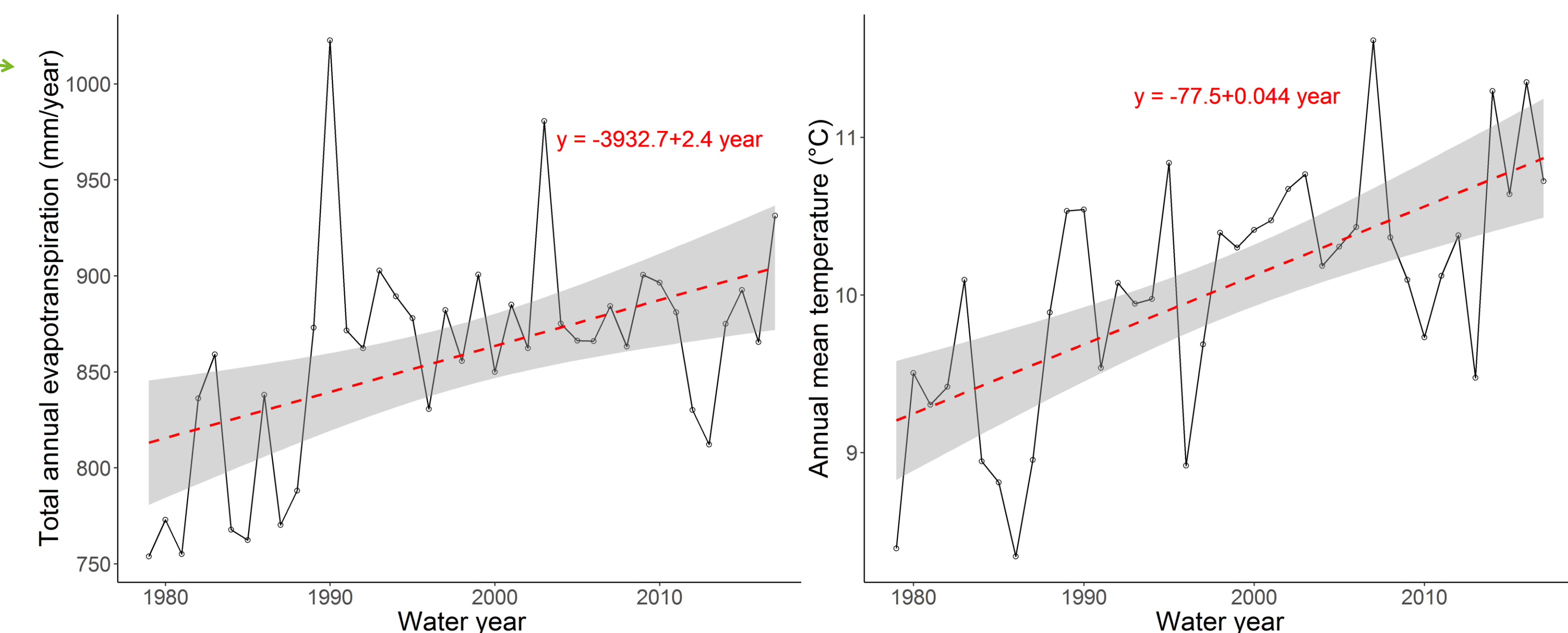
## Results



Map of Wallonia showing the significant trends in high flows.

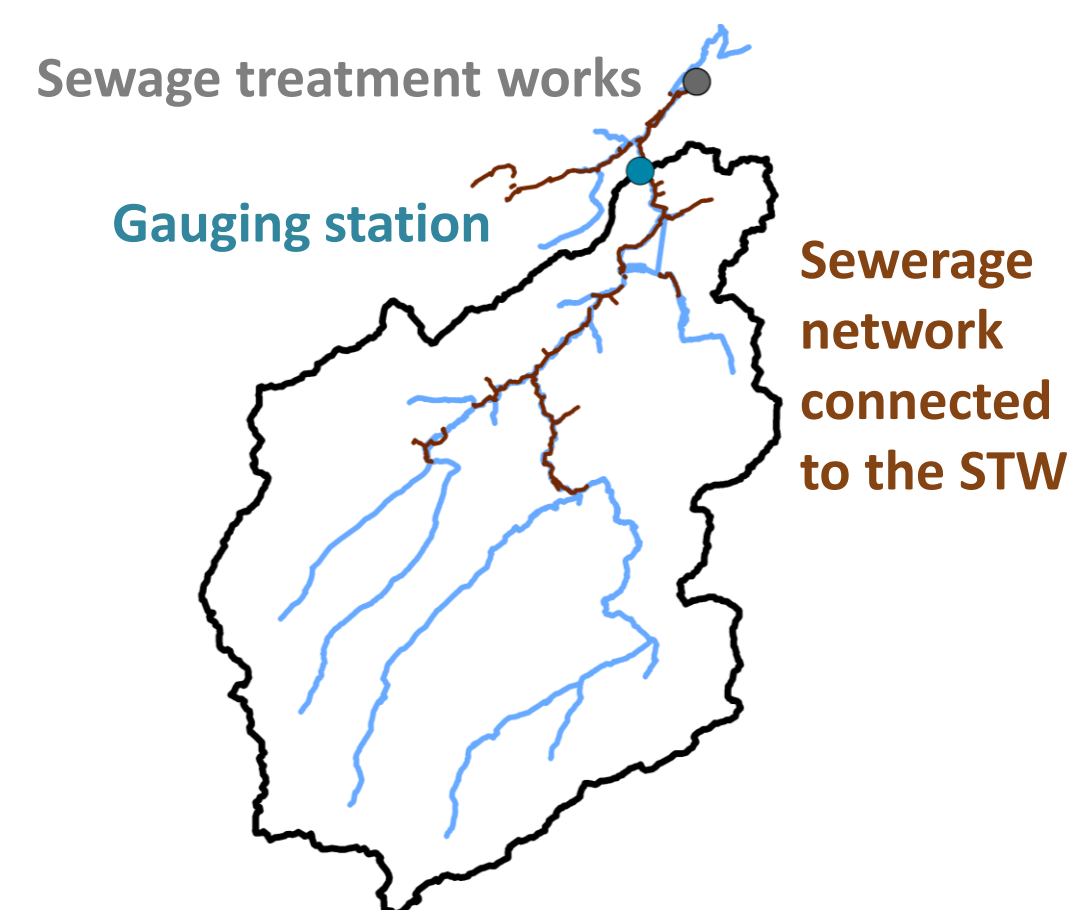
- Long term positive trend in the winter NAO index but not significant and not correlated with the high flow indices

- **Positive trend in evapotranspiration correlated to an increase in the mean temperature**



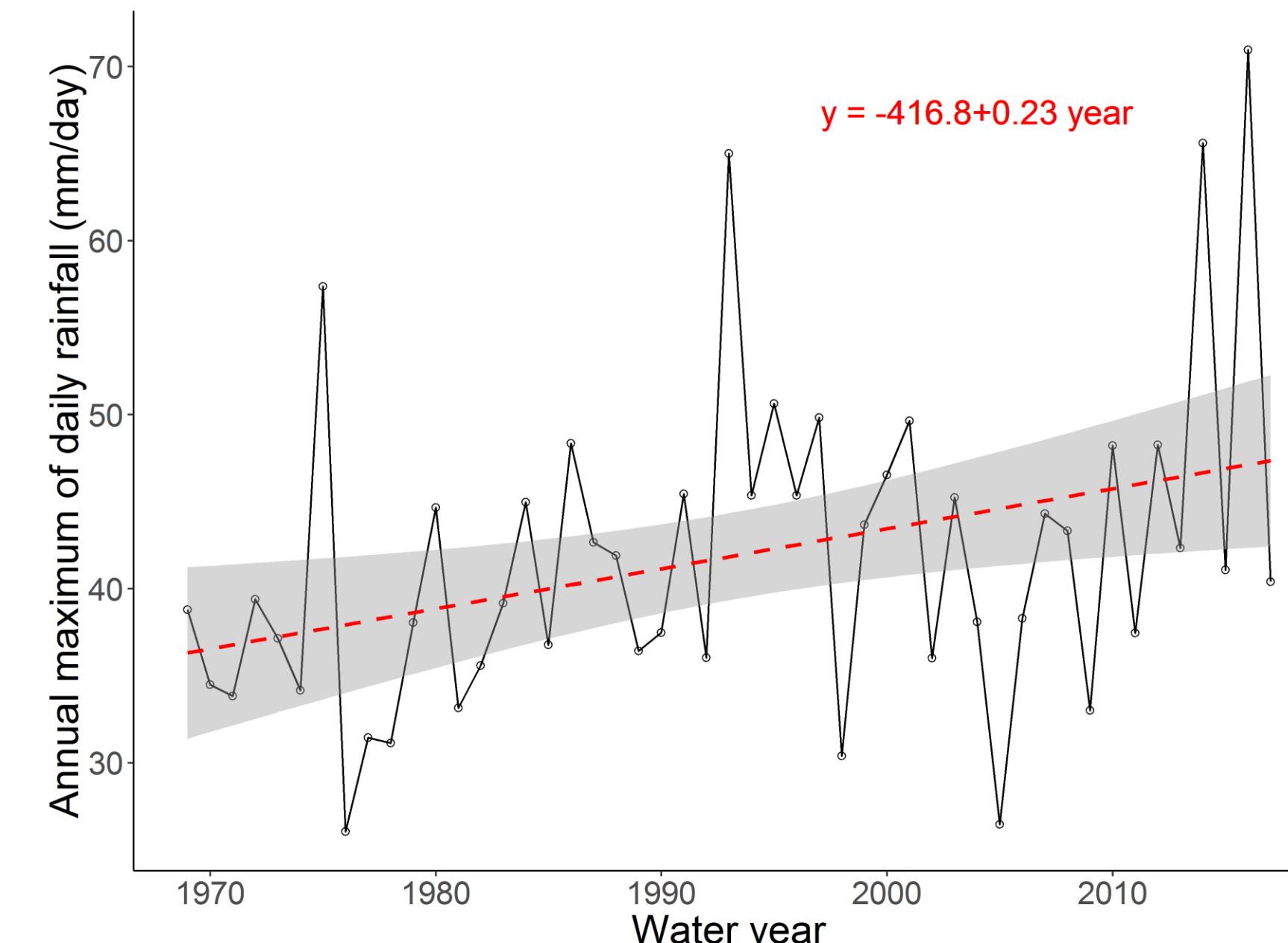
Trends for the River Grande Gette at Saint-Rémy-Geest. Evapotranspiration negatively correlated to the AM and the number of POTs per year. Similar trends for most stations, but correlation with high flow indices not always significant.

- **Influence of the installation of the sewerage network**



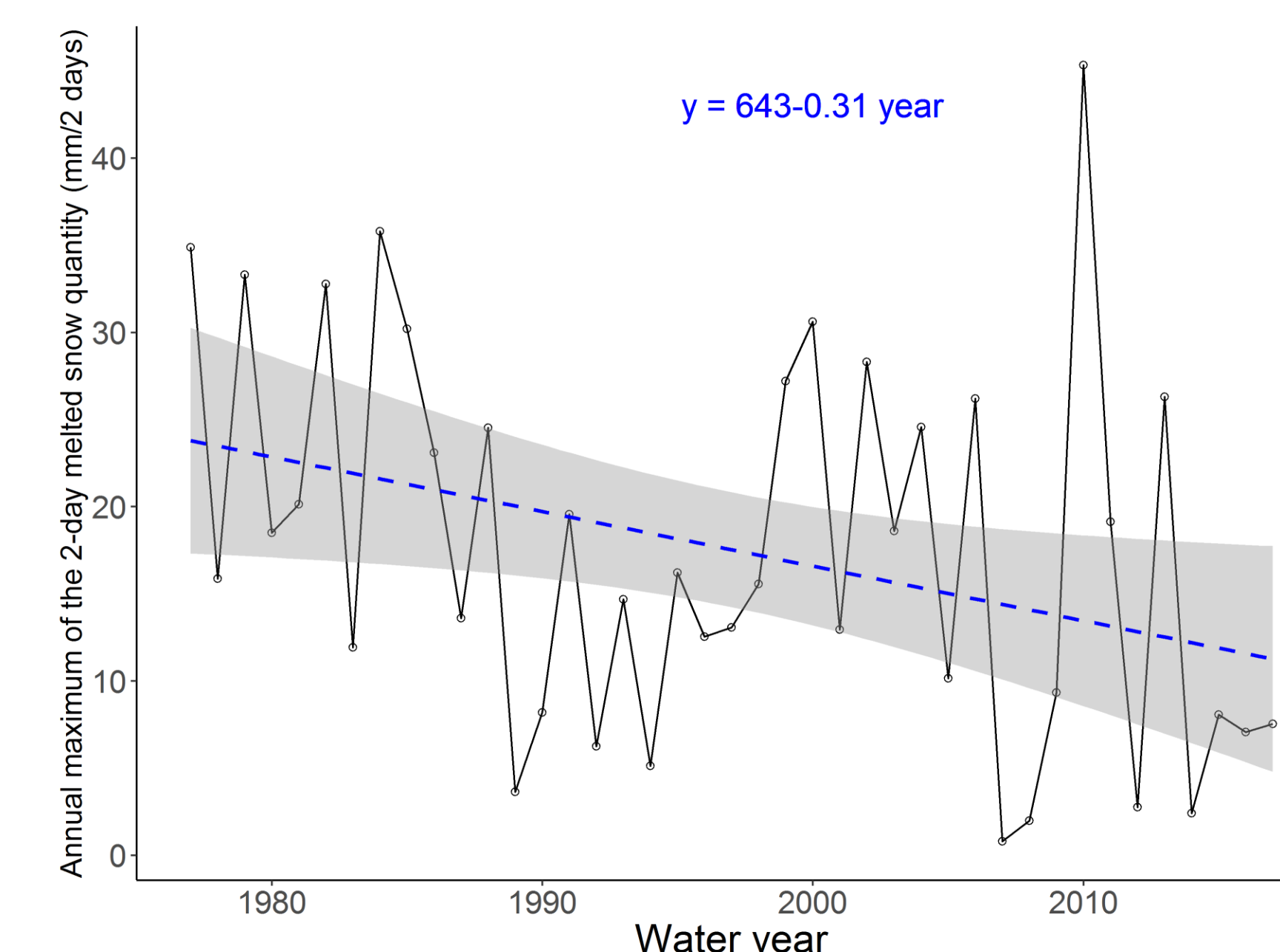
"By-pass" of the Saint-Rémy-Geest gauging station by the sewerage network for a large proportion of the wastewater and rainwater of the catchment since 2004.

- **Positive trend in rainfall**



Trend for the River Lesse at Daverdisse. Correlated to the increase in the AM. Similar trend observed at a few other stations only.

- **Negative trend in snow quantities**



Trend for the River Semois at Sainte-Marie. No correlation with the AM or the number of POTs per year. Similar trend for most stations when looking at the whole dataset (since 1962), inversely correlated with an increase in winter temperatures.

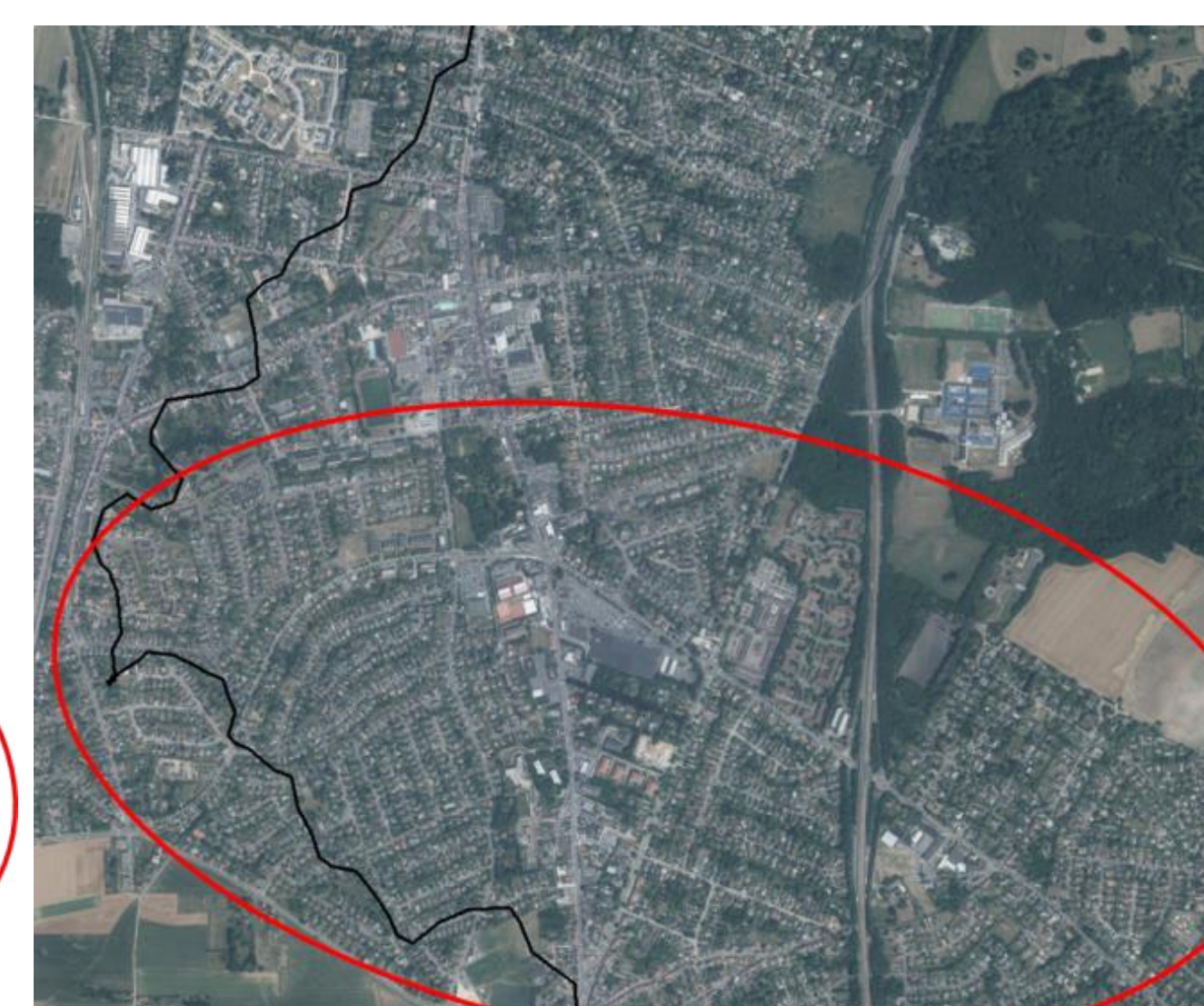
## Conclusion and further works

**Changes in the climate** are noticeable but the correlations with the trends in high flows are not all significant.

- More detailed analysis of other potential drivers: **land-use** changes, **dam** management, other **human modifications** of the channel and the catchment (installation of the sewerage network, construction of flood storage areas, etc)
- Hydrological **modelling**
- Study of the impact on **flood risk management**



Source: SPW



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Example of the increase in built-up areas in Rosières catchment between 1971 and 2017.