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# Quantifying fine particle transport in the Chamberonne, Vaud-CH

# Quantification du transport des particules fines dans la Chamberonne, Vaud-CH

Urban river ecosystems remain degraded despite the strengthening of water quality regulations over the last decades. Rivers simultaneously transport water and sediment from their catchments, and urbanization alters critical factors of the natural hydrological and sediment regimes, particularly the fine sediment fraction. The latter corresponds to the inorganic and organic matter with a particle diameter between 62 µm and 2 mm. The load, frequency and quality of the fine sediment are sensitive to the water pathway through urban and agricultural areas. Along its trajectory, the particles absorb and work as vectors of toxic substances present in surfaces and soils. Once the quality-degraded fine sediment enters the aquatic ecosystem, it is available for the local trophic chain with perverse ecotoxic effects for the communities.

Recognizing fine sediment as a potential pollution source entails including it as a monitoring variable for sustainable river management. Quantifying the load and characterizing the quality of fine sediment is, however technically challenging. In-situ monitoring relies on periodic sampling and methods subject to a limited range of concentrations. The low temporal resolution of observations motivates the use of sediment transport numerical modeling as a complementary tool for continuous estimations.

This project studied the fine sediment transport in the Chamberonne River, Vaud-CH, via numerical simulations and in-situ measurements approximately 100 m upstream the river reaches Lake Geneva. The Chamberonne crystalizes the challenges of urban rivers; its current deteriorated state results from the increasing impervious surfaces in the catchment and its recurrent use as a pollution collector.
The hydrological model developed in this study divides the catchment into urban and natural sub-basins. The simulated flow was calibrated using observations between September 2012 and October 2017, and it was validated using time series from November 2018 to March 2019. Results show that the model explains up to 60% of the catchment hydrology. Based on the hydrology, the overall fine sediment transport is calculated in terms of the hydraulic capacity from each of the sub-basins.
Results show shifts in the temporal phase and differences in the magnitude of the fine sediment concentration; its rain dynamic shows, however, good agreement.
Spectral analysis of the modeled time series indicates that urban areas control the overall fine sediment response, even though urban sub-basins represent 39% of the total catchment area. At annual scale, time series shows low-frequency extreme events (twice per year). During summer seasons, in particular, high-intensity peaks of fine sediment are found to have weekly and monthly periods, potentially due to the model parametrization.
Finally, future studies could evaluate the impact of the planned delta reconstruction and assess the potential of accumulation zones. Additionally, the model can be used to examine different climate change scenarios and determine how extreme events impacts the fate of the fine sediment in the Chamberonne catchment.

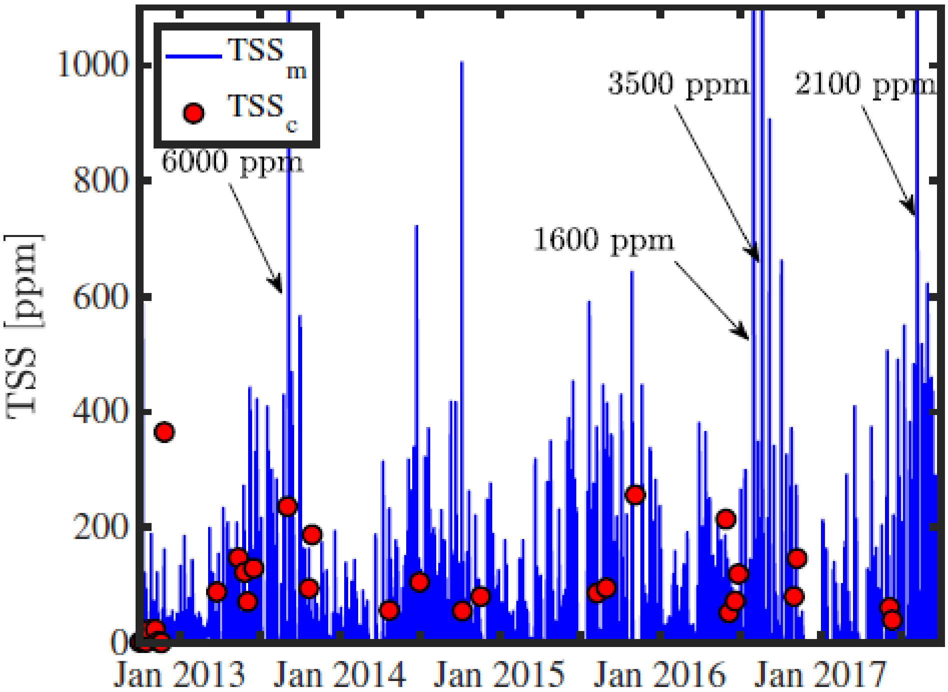


FIGURE 3.5: TSS in the Chamberonne during the calibration period from September 2012 to October 2017. In blue, simulated concentrations ($TSS_m$) and in red concentrations measured by the canton ($TSS_c$). The arrows show high $TSS_m$ values