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Potential of pollution based real time control in combined sewer systems: Chances and challenges of online quality measurements

Control strategies in sewer systems effectively reduce emissions from combined sewer overflows and allow the rigid sewer system to adapt to changing boundary conditions with comparatively little effort. Various research studies have shown that, especially in the context of the European Water Framework Directive as well as changing boundary conditions due to climate and demographic changes, real time control of sewer systems offers an effective opportunity to improve the receiving water quality in Germany. However, the potential of real time control to mitigate the impacts of combined sewer overflows is still not used in practice: most drainage systems are operated with little or no control. One of the reasons for this is that there are still many unknowns considering real time control: in particular, the relationship between the reduction of overflow volumes and emitted loads has not been examined sufficiently. The few implemented sewer control strategies are based almost exclusively on water level and flow measurements and thus aim at minimizing overflow volumes. However, minimizing overflow volumes does not necessarily result in minimizing discharged loads and ecological impacts on the receiving waters. Using high-resolution quality and hydrometric data from combined sewer overflow tanks in Germany these relationships will be observed more closely in this project.

Therefore, extensive load analyses are an important part of the research project. Based on the broad online data basis of two combined sewer overflow tanks in Germany, different control strategies will be developed and their effectiveness in terms of reduction of emitted volumes and pollutant loads will be investigated. The possibilities and limits of quality-based flow control in the combined sewer system will be assessed. Using measured volumes and loads instead of simulated time series as input for the simulation of the sewer system real time control brings the advantage that phenomena that can be parameterized and displayed only insufficiently in models (e.g. first flush effects or local precipitation variability) are taken into account in the real measurement data and thus misinterpretations can be avoided.

The second important section of the thesis is an integrated modeling study that takes into account uncertainties. The aim is to develop a comprehensive picture of the efficiency and effectiveness of different sewer control strategies regarding receiving water quality.

Overall, the studie should provide a better understanding of the substance-specific and hydraulic processes in combined sewer systems thus make an important contribution to closing the knowledge gap between emitted volume and concentration from combined sewer systems and provide basic information on the implementation of an optimal real time control in combined sewer systems.

Figure: Online-Quality sensor

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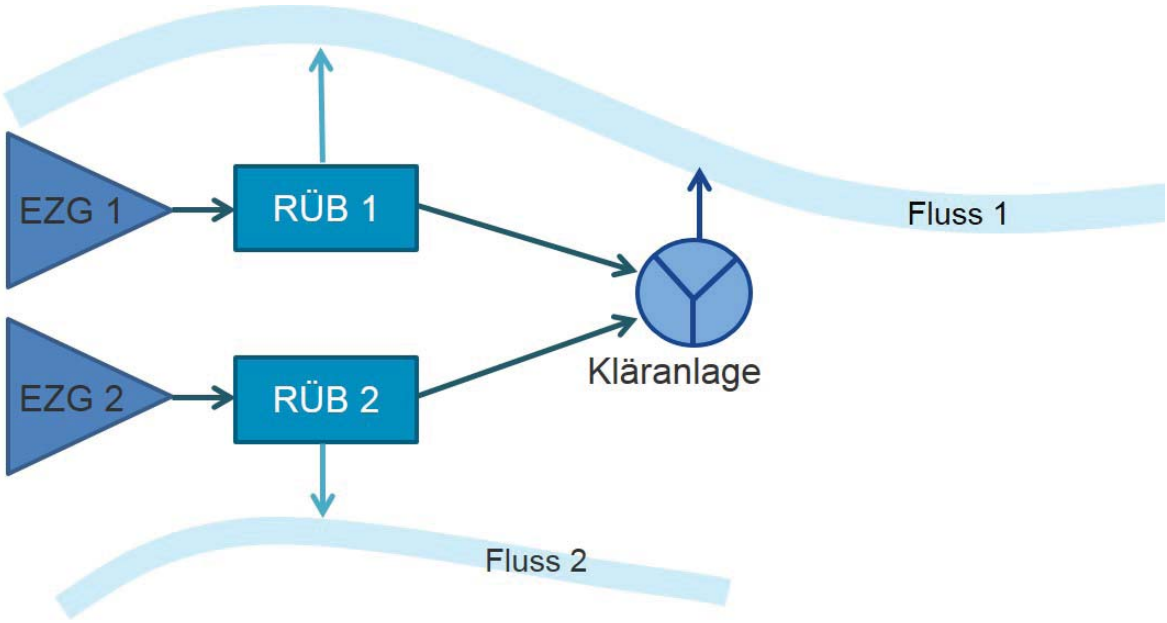

Figure: Schematic representation of a fictitious catchment area to investigate the potential of quality-dependent discharge control

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