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WAREM
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WAREM Seminar
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Master Thesis Presentation

Presenter: Hassan Ali Elagami

Abstract

Determination of Mass Balances in Sewer Systems during Wet and Dry Weather Conditions on the Basis of Spatially and Temporally Limited Information.

Consumption of water resources increases every day because of human activities. In water science, water quantity and quality are the main concern. Nowadays, several ways are used to determine water quality and quantity. Modelling and monitoring of water quality and quantity are used by scientists for a long time. Despite being more accurate, monitoring of water quality is a time consuming and an expensive process. Therefore, modelling of water quality is widely used specially after emerging of new modelling technologies which allow determination of pollutants concentrations in sewer systems.

In combined sewer systems, combined sewer overflows (CSOs) caused by rainfall-runoff or ice melt are major sources of pollutants emissions in receiving waters. CSOs not only contain big volumes of storm water but also high volumes of highly polluted wastewater resulting from domestic and industrial activities. To determine the contribution of each source, mixing ratios are calculated. The term mixing ratio is defined as the ratio between storm water and wastewater volumes during CSO events.

In this thesis, the catchment area of Möhringen in southeast Germany was chosen for research. A simple methodology was used to model the mixing ratios by calculating the ratio between the emitted loads from storm water and waste water flows during CSO events. Concentrations of 100 mg/l in dry and wet weather flows were used for this purpose and inserted in a calibrated SWMM model. However, in general, urban drainage models are subjected to uncertainties such as input, calibration, model structure uncertainties which will be discussed in the theoretical part.

Three main model runs were studied under different model configurations and time spans using reporting time step of 15 minutes. The first simulation used the original SWMM built by Haile (2016) without any modifications using 2014 rainfall data. In second and third simulations, the original model was modified by extracting infiltration water from dry weather flows and the rainfall data of 2012 and 2014 is used to calculate the mixing ratios. To assess the different modeling results, mixing ratios of the first five major CSO tanks were presented and discussed.

The monitored mixing ratios results calculated by Launay et al. (2016) at Spitalgarten in 2014 were compared to the results from modified and non-modified models during the same CSO events. Although, the monitored results from seven CSO events were available, only five events were compared to the modelled ones due to the lack of rainfall data used in the simulation. The lack of information will be discussed in the third chapter.

Despite being more detailed, the modified model did not give different results from the non-modified (original) one. The mixing ratios and proportion of runoff in 2014 were almost identical and were not affected by separating infiltration water from dry weather flow. However, both models gave different results from the monitored ones.
Discharged wastewater volume-CSO event duration relationship was presented for each simulation at different outfall nodes. The relationship suggested that, the discharged wastewater volumes increase with the increase of the CSO event duration. However, it was notices that, the majority of CSO event durations were less than 300 minutes except for Spitalgarten tank which has long overflow events. The relatively long overflow events at Spitalgarten resulted from being the last outfall node before the WWTP and the whole sewer system is connected to it. Furthermore, the correlation between the spatial distribution of mixing ratios throughout the system and population densities in subcatchments was assessed. Despite providing more wastewater volumes, higher population densities in several subcatchments did not decrease the mixing ratios.

At the end, two more model runs were done using a shorter reporting step of 5 minutes in both modified models of 2012 and 2014. The results of the modelled mixing ratios at Spitalgarten outfall node were compared to assess the effect of the shorter reporting time step on the results. However, almost the same mixing ratios were obtained using both reporting time steps.

Date: Tuesday, October 24, 2017 **Time: 17:30**

Location: Pfaffenwaldring 7, Seminar # 11

WAREM Students and other interested parties are cordially invited.