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Bacteria fate and transport in a river - simulating the processes in a flume

Kordula Schwarzwälder (1), Eve Walters (2), and Peter Rutschmann (1)

(1) Chair of Hydraulic research and water recourses engineering, Technische Universität München, München, Germany (schwarzwaelder@tum.de), (2) Chair of Urban Water Systems Engineering, Technische Universität München, München, Germany

The water quality in rivers is influenced inter alia by the inlet of untreated wastewater due to combined sewer overflows. Such processes of water quality degradation are a problem even in Europe and even nowadays. This wastewater is a mixture of organic and inorganic material e.g. bacteria which can be found as freely suspended or agglomerated to sediment in the water phase of a river. To make a prediction of water quality we have to know details about the transport of these bacteria in this bulk phase, about the sorption and desorption rates, the sedimentation and the remobilization of the bacteria.
We investigated the sedimentation and remobilisation processes of E. coli and Enterococci in a flume mimicking an oligotrophic river. The flume is a large-scale flume in the outside area of our lab (Oskar von Miller Institute) to make sure that the influence of different important factors for inactivation e.g. UV-light or grazers can be taken into account. In addition there we are able to use a flume, which is not downscaled but simulates a slice of a river. So we can minimize some scaling problems, which could occur combining a scaled flume and the bacteria which can′t be scaled. We also use natural water coming directly from a natural river. We also had natural soil so realistic grain size. Hence it is possible to simulate realistic effects of the turbidity on inactivation and the sedimentation due to the higher probability of the bacteria to get attached to inorganic material of suspended bed load. It is also possible to get realistic biofilm on the stones, which influences the remobilisation processes and rates of settled bacteria back into the bulk phase.
The results of our experiments are now used for a module in the 3D software Flow3D to simulate the effects of a point source inlet of raw wastewater on the water quality.