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Modelling the fate and transport of microbial pathogens during floods and rainfall events in an alluvial wetland area supported by microbial source tracking

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Alluvial wetlands are important natural habitats and contain valuable drinking water resources. The transport of pathogens via the inflows of river water or the release and runoff from animal faecal deposits into the backwater bodies can pose health risks. The aim of this study was to develop a combined modelling approach for predicting the concentrations and loads of protozoan reference pathogens during floods and rainfall events in an alluvial wetland river. The probabilistic-deterministic model QMRAcatch (v 1.1 python backwater) was newly adapted to account for short-time variations in the flow and microbial transport of alluvial wetlands. The wetland discharge rates, together with the inundated volumes and areas served as input to the model. The latter were determined by means of regression analysis based on results of a 2D hydrodynamic flow model during a flood event. To evaluate the model performance of QMRAcatch, we used concentrations of human, ruminant, pig and bird associated microbial faecal source tracking (MST) markers and E. coli measured in the Danube and in the wetland river from 2010 to 2015. The microbial die-off / degradation was identified to be the most relevant optimization parameter. To obtain this parameter, we conducted a literature survey on the degradation of MST markers in water environments, determined confidence limits of the temperature-dependent rate coefficients, and adjusted them within these limits during the optimization. Scenarios of the different transport pathways of Cryptosporidium and Giardia into the wetland bodies during

floods and rainfall events were then simulated. The scenarios showed that the highest loads of Cryptosporidium and Giardia were transported via the main river into the wetland during high flows, followed by the rainfall-induced release from animal faecal deposits, and the resuspension in flooded areas. The combined modelling approach is useful to support the drinking water safety management of alluvial wetlands.

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