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Berlin Water Model as a decision-support tool for urban water management

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Berlin's groundwater is the city's primary drinking water source and closely linked to surface water via riverbank filtration and groundwater augmentation. Climate change, lower summer flows, increasing treated wastewater shares, stormwater runoff and combined sewer overflows pose growing challenges for water supply and ecological quality. Its interconnected lakes and rivers, flat topography and occasional flow reversals have traditionally required computationally intensive hydrodynamic models, limiting rapid long-term and scenario assessments.

We present the Berlin Water Model, a simplified dynamic mixing model that efficiently represents key quantitative and qualitative dynamics of Berlin's surface waters. Implemented as an emulator, it describes the river-lake-canal network as interconnected, continuously mixed sections and simulates flows, source contributions and substance concentrations at hourly or daily resolution. It integrates long-term data on upstream inflows, wastewater treatment plant (WWTP) discharges, stormwater runoff, combined sewer overflows, waterworks abstractions and meteorological boundary conditions. Calibration against hydrodynamic simulations enables reproduction of key hydraulic features, including flow splitting and temporary flow reversals, while maintaining runtimes suitable for scenario analysis.

Beyond surface water dynamics, we are extending the model towards groundwater-related processes. Dynamic bank-filtration shares for single well galleries were integrated into the Berlin Water Model via regression functions from groundwater modelling studies, extended by KWB model runs within IMPETUS. Ongoing automation of Berliner Wasserbetriebe's steady-state FEFLOW models via the Python interface (IFM) will provide these relationships consistently for changing recharge and abstraction rates. This enables assessment of climate-change impacts, altered abstraction regimes, and temporal dynamics in contributing areas and catchment water balances. Crucially, WWTP-derived effluent loads can be traced from discharge through surface waters and bank filtration to abstraction, supporting evaluation of measures from Berlin's Masterplan Wasser.

The presentation will introduce the framework and show how the combined approach supports scenario analysis, impact assessment and decision-making for a resilient urban water cycle.