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Hydrological functioning and water balance in a heavily modified hydrographic system

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Rivers and canals are often the location for the historical settlement of cities and the backbone for their expansion, as they permit the transport of goods and people, the access to water for industrial activities and energy production, and the evacuation of the domestic and industrial wastewaters. In turn, human activities can result in modifications of the natural river systems to allow for instance ship transport or protection against flooding. The complex interconnected hydrographic network composed of the Zenne and the parallel Charleroi-Brussels-Scheldt Canal, which supports the development of the economy and urbanization of Brussels Metropolitan Area (Belgium), is a good example of such an altered system. The natural water course has been profoundly modified by the deviation of rivers to feed the canal, the control of the water flow in the canal by locks and pumps and the overflow exchange of water between the river and the canal for flood protection purposes. Also, the functioning of this system is strongly impacted by urban hydrology in Brussels, which results in amounts of wastewater discharged in the Zenne River that are nearly equivalent to the natural riverine flow.

Water and water quality management in such complex and altered systems correspond to difficult tasks. They require, as a first step, a deep understanding of their hydrological functioning. Building an accurate water budget is also a necessary step in the investigation of the pollution sources, sinks, dynamics and mass-balance. In order to assess the water quality and provide insights for water management in the Zenne-Canal hydrographic network (cf. other contributions in this session), we established a detailed box-model representation of the water budget for the whole system, with a particular interest on the importance and the effects of the exchanges of water between the river and the canal. A particularity of this study is that, in contrast to the widespread use of hydrological modelling, the advocated methodology was to use as much as possible all available data, such as continuous regional data records for rainfall, waterlevel, discharge and velocity, gauging measurements and field observations.

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