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A water management decision support system contributing to sustainability

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Deltares and Eindhoven University of Technology are developing a new decision support system (DSS) for regional water authorities. In order to maintain water levels in the Dutch polder system, water should be drained and pumped out from the polders to the sea. The time and amount of pumping depends on the current sea level, the water level in the polder, the weather forecast and the electricity price forecast and possibly local renewable power production. This is a multivariable optimisation problem, where the goal is to keep the water level in the polder within certain bounds. By optimizing the operation of the pumps the energy usage and costs can be reduced, hence the operation of the regional water authorities can be more sustainable, while also anticipating on increasing share of renewables in the energy mix in a cost-effective way.

The decision support system, based on Delft-FEWS as operational data-integration platform, is running an optimization model built in RTC-Tools 2, which is performing real-time optimization in order to calculate the pumping strategy. It is taking into account the present and future circumstances. As being the core of the real time decision support system, RTC-Tools 2 fulfils the key requirements to a DSS: it is fast, robust and always finds the optimal solution. These properties are associated with convex optimization. In such problems the global optimum can always be found. The challenge in the development is to maintain the convex formulation of all the non-linear components in the system, i.e. open channels, hydraulic structures, and pumps.

The system is introduced through 4 pilot projects, one of which is a pilot of the Dutch Water Authority Rivierenland. This is a typical Dutch polder system: several polders are drained to the main water system, the Linge. The water from the Linge can be released to the main rivers that are subject to tidal fluctuations. In case of low tide, water can be released via the gates. In case of high tide, water should be pumped. The goal of the pilot is to make the operation of the regional water authority more sustainable and cost-efficient. Sustainability can be achieved by minimizing the CO<sub>2</sub> production trough minimizing the energy used for pumping.

This work is showing the functionalities of the new decision support system, using RTC-Tools 2, through the example of a pilot project.

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