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Retrospective-modelling: historical hydrology for future water management

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One way to assess future hydrological regimes is to find evidence from corresponding periods in the past. A problem often exists in describing the historical water system quantitatively. Although substantial variations in historical floods have been identified in Europe since medieval times, quantitative analyses were only carried out from the 1950s onwards. This is partly due to the fact that landscape historical discipline lacks sufficient serial archives and generally tends to describe landscape changes in a qualitative way, whereas the hydrological discipline prefers a quantitative approach. We therefore need to develop an interdisciplinary historical hydrological literacy. Hydrological models can provide good results for current situations, but a lack of historical datasets or reference conditions often prevent a robust analysis. Such so-called retrospective-modelling can be a useful tool to create reference conditions for historical situations and is based on the premise that future hydrological systems will behave more or less in similar ways. This is important for future climate-robust water management.

Our project studies the interactions between landscape use composition and the hydrology through time. Different types and levels of anthropogenic influences will be analysed. It will provide insight into a broad spectrum of hydrological characteristics in a river catchment, such as rainfall-runoff response times, peak floods, variation in ground water depths, meandering capacity and base flow levels. The objective is to demonstrate tools that quantify the space-time variation in hydrological characteristics, including water availability and water use in catchments.

In this study we use the physically-based SIMGRO model, which simulates the flow of water in the saturated zone, the unsaturated zone and the surface water. The research covers the semi-natural Drentsche Aa catchment, northern Netherlands, which has shown several distinctive land use changes since around 1900. These changes were mostly separated in time and are spatially well-documented. In addition, long term hydrological data are available since the 1950s and meteorological data since the 1890s, providing us with sufficient information for sound retrospective-modelling. Addressed will be how historical land use and water management changes affected the hydrological characteristics of a catchment at the regional scale. Presented will be a representative historical situation, but eventually the research will provide a framework of different flow regimes corresponding with earlier relevant past landscape compositions and will therefore contribute to a water management that takes into account the rich natural and cultural history of regional watersheds.