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# An analogue conceptual rainfall-runoff model for educational purposes

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Conceptual rainfall-runoff models, in which runoff processes are modelled with a series of connected linear and non-linear reservoirs, remain widely applied tools in science and practice. Additionally, the concept is appreciated in teaching due to its somewhat simplicity in explaining and exploring hydrological processes of catchments. However, when a series of reservoirs are used, the model system becomes highly parametrized and complex and the traceability of the model results becomes more difficult to explain to an audience not accustomed to numerical modelling. Since normally the simulations are performed with a not visible digital code, the results are also not easily comprehensible.

This contribution therefore presents a liquid analogue model, in which a conceptual rainfall-runoff model is reproduced by a physical model. This consists of different acrylic glass containers representing different storage components within a catchment, e.g. soil water or groundwater storage. The containers are equipped and connected with pipes, in which water movement represents different flow processes, e.g. surface runoff, percolation or base flow. Water from a storage container is pumped to the upper part of the model and represents effective rainfall input. The water then flows by gravity through the different pipes and storages. Valves are used for controlling the flows within the analogue model, comparable to the parameterization procedure in numerical models. Additionally, an inexpensive microcontroller-based board and sensors are used to measure storage water levels, with online visualization of the states as time series data, building a bridge between the analogue and digital world.

The ability to physically witness the different flows and water levels in the storages makes the analogue model attractive to the audience. Hands-on experiments can be performed with students, in which different scenarios or catchment types can be simulated, not only with the analogue but also in parallel with the digital model, thereby connecting real-world with science. The effects of different parameterization setups, which is important not only in hydrological sciences, can be shown in a tangible way. The use of the analogue model in the context of “children meet University” events seems an attractive approach to show a younger audience the basic ideas of catchment modelling concepts, which would otherwise not be possible.