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A coupled human-water system from a systems dynamics perspective

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Traditionally, models used in hydrological studies have frequently assumed stationarity. Moreover, human-induced water resources management activities are often included as external forcings in water cycle dynamics. However, considering humans' current impact on the water cycle in terms of a growing population, river basins increasingly being managed and a climate considerably changing, it has recently been questioned whether this is still correct. Furthermore, research directed at the evolution of water resources and society has shown that the components constituting the human-water system are changing interdependently. Goal of this study is therefore to approach water cycle dynamics from an integrated perspective in which humans are considered as endogenous forces to the system. The method used to model a coupled, urban human-water system is system dynamics. In system dynamics, particular emphasis is placed on feedback loops resulting in dynamic behavior. Time delays and non-linearity can relatively easily be included, making the method appropriate for studying complex systems that change over time. The approach of this study is as follows. First, a conceptual model is created incorporating the key components of the urban human-water system. Subsequently, only those components are selected that are both relevant and show causal loop behavior. Lastly, the causal narratives are translated into mathematical relationships. The outcome will be a simple model that shows only those characteristics with which we are able to explore the two-way coupling between the societal behavior and the water system we depend on.