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Catchments as simple dynamical systems: how much data are needed to identify system parameters?

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Considering catchments as simple dynamical systems helps in understanding catchment processes. It also offers an approach to simulate discharge time series for small catchments, purely based on rainfall and evapotranspiration data. The main key behind this approach is an assumed unique storage-discharge relation. Based on this theory, a simple non-linear model was developed for small catchments in temperate climates and applied to the Rietholzbach catchment in Switzerland (Seneviratne et al., 2012), a small catchment in the pre-alpine North-East of Switzerland. For this catchment, 32 years of high quality data are available. The parameters of the storage-discharge relation were obtained through 3 different methods. First, the best possible system parameters are identified through a global optimization procedure using different selections of the full data record as well as the full data record itself. Second, these parameters are compared to the ones obtained by recession analysis following the approach of Kirchner (2010) on the same subsets of the data record as well as on the full data record. Finally, these estimates are compared to a priori (theoretical) estimates based on the Boussinesq equation, to identify the length of the data record that is required to outperform theoretical estimates in absence of any observations. The results will be discussed in the framework of predictions in ungauged basins.

References

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