System for seven-day low flow forecast developed by the recession limb of the hydrograph

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In Slovenia the Sava River Basin comprises the central part of the country. There are four in-stream hydropower stations situated on the Slovenian part of the Sava River. Good and accurate long-term low flow forecasts are especially important for energy production where hydropower production depends on hydrological conditions.

A basic approach to studying low flows is to analyse the recession parts of the stream flow hydrographs. Within the stream flow hydrograph, recessions are sequences of decreasing flows during periods of no or little precipitation. The dynamics of the flow rates on the recession part of the streamflow hydrograph is usually modelled as:

$$Q_{t+n} = Q_t \cdot e^{(-k \cdot n)},$$

where Q_{t+n} is the flow rate at n-days after the time of the forecast t, Q_t is the flow rate at the time of the forecast, e is the base of the natural logarithm function, k is the recession constant and n is the number of days in advance for which the forecast is made.

By using the decision trees machine learning method and analysis of the recorded recession streamflow data we modelled the recession 'constant' k as being a function of the flow rate at which the 7-day low flow forecast is made and the decrease of the flow rate from the previous day. Low flow forecasting models for most of the Sava River's Slovenian tributaries were developed and the verification of the results yields really good results and improved accuracy in comparison to low flow forecasting models in which a single numerical value is used as the recession 'constant'.

The system consists of nine water-gauging stations connected by way of cellular

phones with a computer situated in the Hydropower Company. The water gauging stations are equipped also by solar panels for power supply. Data transmission is provided automatically, daily or on request. The system was established in autumn 2005 and has suggested useful results.