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Modeling the flow rate increase due to snow-melt in the Sava River Basin

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Today, flow forecasting due to the snow-melt is usually performed as an integrated part of calibrated rainfall–runoff models, but in our research we tried to develop simple empirical 'flow rate increase due to snow-melt' models based on the usage of the M5 machine learning method for the generation of regression and model trees.

Mean daily flow data for the Jesenice gauging station (located on the Sava Dolinka River) for the period from year 1961 to year 2003 were available. For the same period snow cover height and mean daily air temperature data for the Kredarica temperature station and mean daily air temperature data for the Ratece temperature station were also available.

Events when the snow cover height was continiously falling or remained at the same level, when there was no or almost no rainfall and when the mean daily flow at the Jesenice gauging station was continously rising for at least 4 days were selected; 94 events were identified. Among these 94 events only those when the flow rate at the Jesenice gauging station rose for at least 0.5 m3/s during the event were selected; 26 snowmelt events were identified and later included into the analysis.

By using the M5 machine learning method we modeled the flow rate increase at the Jesenice gauging station as a function of event, snow(melt) and temperature characteristics:
- event month;
- flow rate at the start of the snowmelt event;
- snow melt during the event;
- snow cover depth at the start of the snowmelt event;
- air temperature and average air temperature increase at Kredarica temperature station during the snowmelt event;
- air temperature and average air temperature increase at Ratece temperature station during the snowmelt event.

Three models were built; first one by using all of the 94 recorded snowmelt events in the model development process, the second one by using only the selected 26 snowmelt events and the third one (simpler model than second one - with only one leaf) also by using only the selected 26 snowmelt events.