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Optimized operation of a multireservoir system by means of Recurrent Neural Networks for inflow forecasting

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The operation optimization of interconnected reservoirs is crucial for effective water resources management. Therefore, a decision support tool for is developed based on the forecasts of natural inflows. Standard forecast procedures are often based on historical streamflows and hydrological modelling of flows using quantitative meteorological forecasts. In recent years, forecasting using deep learning methods and especially recurrent neural networks have gained attention. Compared to other approaches such as regression-based and time series models, artificial neural networks have proven to be more effective and flexible. We propose a long short-term memory network (LSTM) for forecasting inflow into reservoirs with a large watershed. It is trained with observed hourly streamflow and meteorological data and applicable to different forecast horizons. The novelty here is the inclusion of temperature, windspeed and snow into the forecast.

The Drin river cascade (11 830 km²) in Northern Albania was selected as a pilot hydraulic system, whereby the upper part of the Drin river basin covers also parts of North Macedonia, Kosovo and Montenegro. The cascade consists of three large dams in series. The reservoirs are primarily used for energy generation and, secondarily, for flood retention. The studied LSTM forecast horizons (6, 8, 12 hours; >12 hours) indicate that the Recurrent Neural Network provides a proper forecast of the natural inflows into the reservoir cascade and thus represents a valuable tool for the optimization of the operation of the Drin Cascade under multi-criteria conditions.