



An hydrological model to optimize hydropower production

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The study presented here is a project for the “Azienda Elettrica Ticinese” (AET) aiming at the economic optimization of the hydropower management system, using a rainfall-runoff model for improving long and short term management of intakes and reservoirs. It is focused on the Leventina valley, in the upper flow path of the Ticino river. The AET has around 15 water intakes on the Ticino river and in lateral valleys.

The basic idea of the project is to give an estimation of the water arriving at every intake with an hydrological model and then using this water flow time series as the input in the hydropower management model. The short term forecasting is important because of the limited capacity of storage of the reservoirs (less than 1 million m³). The hydrological model chosen for the project is a deterministic, conceptual and ‘storage oriented’ rainfall-runoff model. The choice of such a model is the result of parameter parsimony, adequate representation of the modeled system and the modular structure. The total rainfall is divided into net rainfall and infiltrated rainfall. The latter enters directly into the soil reservoir while net rainfall produces direct runoff. The model has only 3 parameters to calibrate.

The originality of our methodology is the calibration of the model (both at hourly and daily time step) for the two catchments inside the Leventina valley where we have a gauging station corresponding to natural condition. Then we combine the information coming from three neighbouring catchments to correlate the model parameters to physiogeographical characteristics of the sub-basins. In regions which are homogeneous from a hydroclimatological and physiogeographical point of view, hydrographs

can be reproduced via regionalized hydrological models, provided that climatological observation series are available. With the regionalization we have obtained parameters that can be used to estimate run-off in neighbouring non-monitored basins.

The validation of the regionalization was performed using the AET data, coming from the monitored water intakes. The result of the validation is satisfactory.

In the second part of the project we are developing an user-friendly interface of the hydrological model, so that it can be used in real-time condition to give a forecasting of the water flow at every water intakes in the next 72 hours.