DECISION SUPPORT SYSTEM FOR THE SAANE RIVER BASIN

FLOOD MANAGEMENT BASED ON FLOW FORECAST

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INTRODUCTION

The Saane River basin is located in the Pre-Alps of Switzerland (surface: 1861 km^2, mean elevation: 1140 m.a.s.l.). The hydrological regime of the river is strongly influenced by snow and thus characterised by high discharge during spring. In addition, several hydropower plants are located on the river and have a impact on the daily discharge. In the lower part of the basin, the Saane River flows through the City of Fribourg (~35'000 inhabitants). In case of flood events, the potential of damages is therefore important. In the past, flood retention effects by dams have already been observed and analysed. Since 2006, a day-to-day flow forecast system is under operation for optimizing hydropower production. The first aim of the present study is to define the potential of discharge reduction due to preventive turbine operations based on hydro-meteorological forecasts. The second goal consists in a design of an operational Decision Support System (DSS).

METHODS

The hydrological model is based on the *Routing System* approach (Jordan, 2007; Schaefli et al., 2005). The preventive operations are based on the available volume in the reservoir, the inflow and the electricity market price.

RESULTS

The resimulation of historical flood events shows the potential of discharge reduction, even if the preventive turbine operations are carried out shortly before the peak discharge (see Fig. 1).

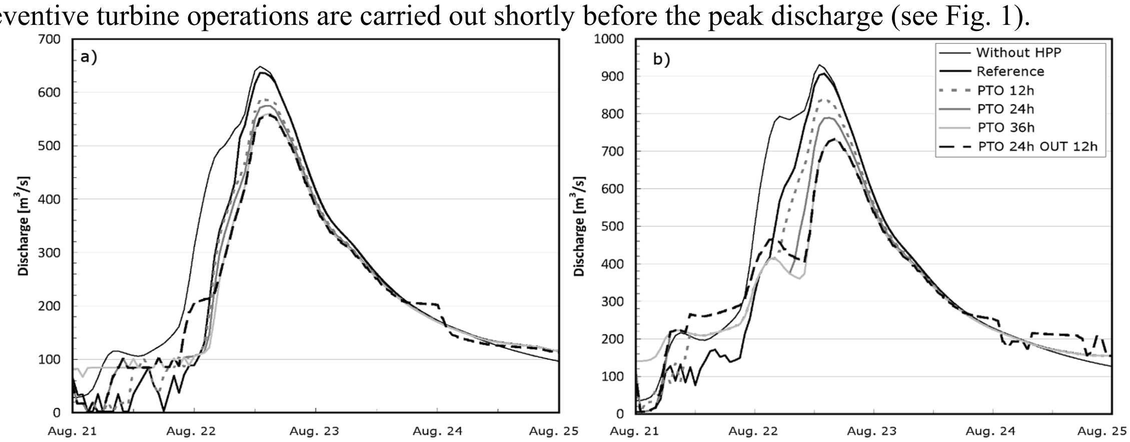

Fig. 1 Hydrograph of the Saane River in Fribourg (a) and in Laupen (b) upstream of the junction with the Aare River in august 2005. Flood peak reduction due to preventive turbine (PTO) and bottom outlet (OUT) operations for different lead time (12h, 24h, 36h) compared to reference case (Reference) and situation without hydro power plant (Without HPP).

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Indeed, a lead time of 12 hours allows a discharge reduction of 10% approximately, from 930 m^3/s to 840 m^3/s.

The DSS contains two parts. The first one forecasts reservoir inflows and computes optimal turbine operations in order to minimize the downstream peak. The second unit is a GIS based *Expert Area* (see Fig. 2). The maps are computed in real time and can be compared to historical flood events.

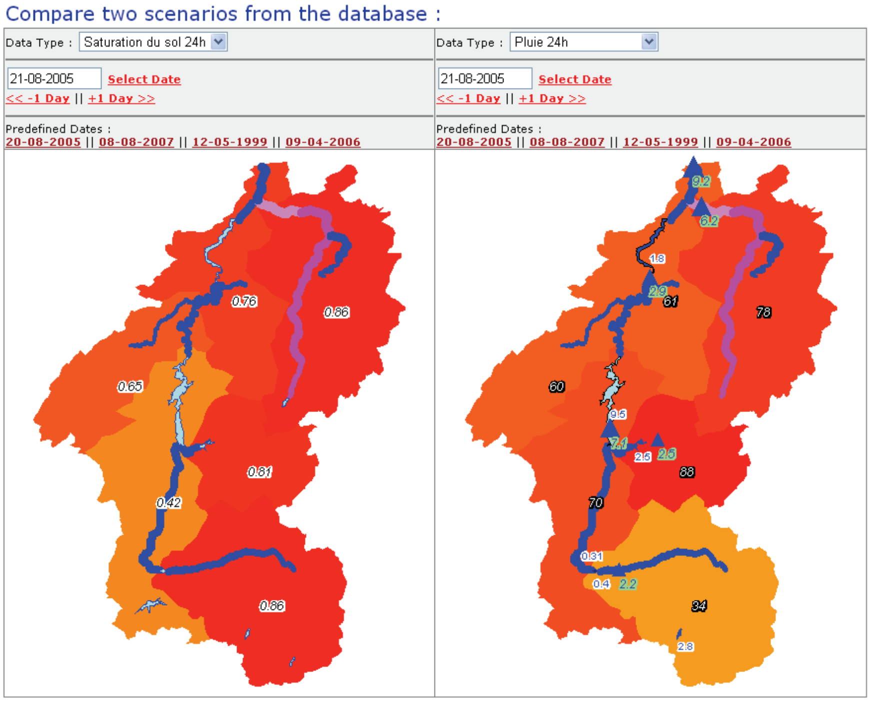

Fig. 2 User interface of the *Expert Area* in the DSS. Map of soil saturation [0-1] (on the left) and daily precipitation [in mm] (on the right) in august 2005.

Based on the hydro-meteorological simulation, the following maps are computed:

- Total precipitation for 24 hours and 48 hours
- Snow cover and snow melt
- Soil saturation
- Air temperature
- River discharge and residual volume in the reservoirs

The relevant hydro-meteorological processes leading to flood events have to be highlighted to support decision makers.

CONCLUSION

In the Saane River basin, important peak reduction can be achieved by preventive turbine operations. Nevertheless, an active flood management is required. Therefore, an innovative DSS has been set up to provide relevant information for decision making.

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