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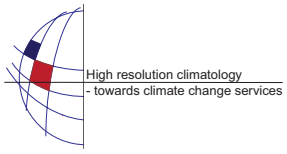

MINERVE flood warning and management project. What is computed, what is required and what is visualized?

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During last decades several flood events caused important inundations in the Upper Rhone River basin in Switzerland. As a response to such disasters, the MINERVE project aims to improve the security by reducing damages in this basin. The main goal of this project is to predict floods in advance in order to obtain a better flow control during flood peaks taking advantage from the multireservoir system of the existing hydropower schemes.

The MINERVE system evaluates the hydro-meteorological situation on the watershed and provides hydrological forecasts with a horizon from three to five days. It exploits flow measurements, data from reservoirs and hydropower plants as well as deterministic (COSMO-7 and COSMO-2) and ensemble (COSMO-LEPS) meteorological forecast from MeteoSwiss. The hydrological model is based on a semi-distributed concept, dividing the watershed in 239 sub-catchments, themselves decomposed in elevation bands in order to describe the temperature-driven processes related to snow and glacier melt. The model is completed by rivers and hydraulic works such as water intakes, reservoirs, turbines and pumps.

Once the hydrological forecasts are calculated, a report provides the warning level at selected control points according to time, being a support to decision-making for preventive actions. A Notice, Alert or Alarm is then activated depending on the discharge thresholds defined by the Valais Canton. Preventive operation scenarios are then generated based on observed discharge at control points, meteorological forecasts from MeteoSwiss, hydrological forecasts from MINERVE and retention possibilities in the reservoirs. An update of the situation is done every time new data or new forecasts are provided, keeping last observations and last forecasts in the warning report.

The forecasts can also be used for the evaluation of priority decisions concerning the management of hydropower plants for security purposes. Considering future inflows and reservoir levels, turbine and bottom outlet preventive operations can be proposed to the hydropower plants operators in order to store water inflows and to stop turbining during the peak flow. Appropriate operations can thus reduce the peak discharges in the Rhone River and its tributaries, limiting or avoiding damages. Results presentation in a clear and understandable way is an important goal of the project and is considered as one of the main focuses.

The MINERVE project is developed in partnership by the Swiss Federal Office for Environment (FOEV), Services of Roads and Water courses as well as Water Power and Energy of the Wallis Canton and Service of Water, Land and Sanitation of the Vaud Canton. The Swiss Weather Service (MeteoSwiss) provides the weather forecasts and hydroelectric companies communicate specific information regarding the hydropower plants. Scientific developments are entrusted to two entities of the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Hydraulic Constructions Laboratory (LCH) and the Ecohydrology Laboratory (ECHO), as well as to the Institute of Geomatics and Analysis of Risk (IGAR) of Lausanne University (UNIL).