

Development of a methodology for estimating extreme floods of dams

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The research is supported by OFEN and takes advantage of the expertise of CREALP, E-dric, HydroCosmos, Dr. Jacques-André Hertig, author of the PMP maps.

Introduction

Dams have to be safe even under extreme flood events. In Switzerland the design flood is defined as a 1'000-years flood which has to be evacuated below the maximum operation level even if one of the spillway gates is out of operation. Furthermore the dam has to withstand without failure for the so-called safety flood which is above a 10'000-years flood event. In alpine regions the determination of such extreme flood events is a challenge due to the special meteorological conditions and the mountain relief.

In the past several research projects have been done on this topic, i.e. CRUEX (CRUEX, 2001), a project to develop a PMP-PMF model with the possibility to integrate alpine hydrologic characteristics where orographic phenomena are very frequent.

In this context, different models have been developed to predict the maximum probable flood: ORAGE (Bérod, 1994), Socont (Bérod, 1997), Faitou (Dubois, 1998) and Routing System (Dubois, Boillat, 2000).

The results have shown that the used models could give realistic values, but should be considered as intermediate results. Research still hasn't concluded in this domain, however it was possible to elaborate PMP maps of Switzerland (Figure 1). A comprehensive methodology that is applicable to alpine catchment areas is still missing.



Figure 1 : Probable maximum precipitation (PMP) in Switzerland, at ground mm/h, duration : 24h (extract) - © OFEG and EPFL-EFLUM-H&L.

Furthermore, research at EPFL led to the model MINERVE, operational in the Valais, what is used to do hydrologic and hydraulic simulations.

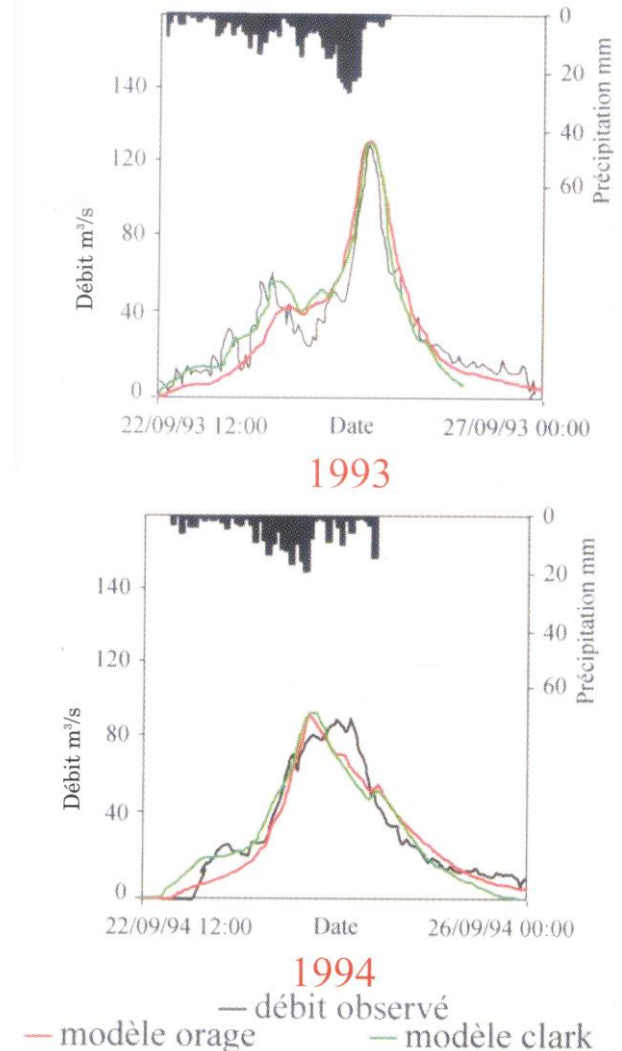


Figure 2: Simulation for the models ORAGE and CLARK for the floods of 1993 and 1994, Mattmark, CRUEX.

Objectives

The objective of this research thesis is the development of a methodology that is suitable for alpine catchments. The existing PMF models will be ameliorated by considering the meteorologic and hydrologic aspects. Spatial distribution of the extreme precipitations for a certain region and their representation by implementation of an SIG module will be established. The methodology for extreme flood computations has to be clear, precise and rigorous. The program Routing System will be modified and completed with the new features. User manuals will be elaborated and workshops will be organized.