Geophysical Research Abstracts, Vol. 9, 10019, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10019

Hydrological scenarios under present climate situation in mountainous regions – Application to the upper Rhone, Wallis canton – Switzerland.

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Water resources management and associated hydrological risks require the characterisation of possible hydrological scenarios under present and future climate situations.

Even under the present climate situation and especially in mountainous regions, runoff measurements are not easy to obtain and as a consequence it is difficult to estimate the natural variability of hydrological regimes. In the Alps, the data scarcity problem is enhanced due to the perturbation of the hydrological behaviour of watersheds by hydraulic management (dams and collectors for hydro-power production and flood mitigation). To overcome this limitation an rainfall-runoff model was used for the simulation of hydrological scenarios. The former is driven by the outputs of a multisite stochastic weather generator that produces correlated series of hourly rainfall and temperatures at a number of stations over the catchment. Thus, a number of flood scenarios could be generated and their impact on the Rhone basin could be analyzed.

The hydrological behaviour of the watershed (5250km2) was simulated with the hydro-glaciological model. The model is semi-distributed allowing the generation of scenarios at different hydrologic stations of the Rhone river.

The stochastic weather generator is conditioned by atmospheric circulation indices derived from NCEP reanalyses for the period 1961-2001. It combines statistical downscaling and analogue approaches both widely used for short and long term weather generation.

We will first present the performance of the generator for the simulation of a number of weather variable statistics at various time and space scales. We will especially

show its performance for the simulation of critical weather situations leading to concomitant flood events on major sub catchments of the Rhone. We will finally present the ability of the combined stochastic-deterministic approach to reproduce statistics of key hydrological variables and especially extreme floods at different space scales of the catchment. We will show the interest of the methodology for its use under future climate conditions to estimate potential change impact on hydrological regime of the Rhone.