Geophysical Research Abstracts,
Vol. 11, EGU2009-9751, 2009
EGU General Assembly 2009

Improvement in the knowledge of the genesis of extreme events in mountain areas using a weather patterns approach

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The estimation of the high quantiles of hydrological variables has been recently significantly improved, mostly in the domain of statistics (i.e. the so called extreme values theory).

However, the purely statistical estimation of extremes values based directly on hydrological observation samples is not the only possible approach to the estimation of extreme quantiles. An estimation of extreme discharge can be done, for instance by transformation of other hydrological variables (typically rainfall and temperature), this transformation being dependent on the seasonal hydrological phenomena. Without going as far as using hydrological modeling, but trying to take into account some physics in our extreme value estimation approach, we will show in some examples of high mountain catchments how to split hydrological variables observations in wheater based sub-populations might change our vision of hydrological risk.

First we will show that an appropriate seasonal sampling is essential to take into account the seasonality of precipitation and the snow-related processes. In a less classical way, we show how an additional sampling based on a weather pattern approach can change drastically the extrapolation of extreme precipitation and flow series, independently of the statistical model used for each sub-population.

This issue will be illustrated through the example of the eastern region of the Pyrenees in southern France, with a very complex climate characterized by a north-south contrast induced by the Pyrenean range but also by a east-west contrast due - among others - to the influence of the Mediterranean on the genesis and intensification of rainy events.