**Introduction**

Several catchments in Northwestern Switzerland have been recurrently flooded within the past years. Statistical models that consider all flood processes under the same distribution are commonly used in this region for estimating flood protection measurements. However, this approach does not represent the weather variability in time and does not differentiate between flood mechanisms. On the contrary, floods provoked by several mechanisms (e.g. flash floods, rain-on-snow floods, snowmelt floods, etc.) are assumed the same and equally likely to occur. We investigate regional patterns and dominant parameters that differentiate flood processes, by using discharge observations with high temporal resolution (e.g. 10-15 min) of different catchments sizes (4 to 74 km²).

**Motivation**

895 flood events were obtained by using the peak over a threshold (POT) approach. Fig. 2 illustrates the frequency of occurrence of POTs and annual maximum floods (AMax) over the twelve calendar months. Both have a similar frequency distribution over the months: the maximum number of occur in July for the summer season (Apr-May-Jun-Jul-Aug-Sept) and in December for the winter season (Oct-Nov-Dec-Jan-Feb-Mar). Nevertheless the frequency of the POT floods has a smoother distribution, which indicates that the AMax method misses important floods of the non dominant months. Fig. 3 shows an example of the POTs for the data series of one station where on the year 2008 no extreme discharge is selected. Once the extreme floods are identified, flood hydrographs are separated by finding the equilibrium of the discharge difference $\Delta Q(t)$, (see example in Fig. 4).

As an example, the obtained flood hydrographs of two stations are displayed in Fig. 5 with the color indicating the season when the flood event occurred.

The curves in Fig. 5 show that the hydrograph shapes are different and correspond to different mechanisms. Sep-Oct-Nov floods do not occur very frequently and have rather small peaks, which agrees with the data in Fig. 2. Jun-Jul-Aug floods have sharp and slim peaks, which are indicators of flash floods produced by convective precipitation. Larger floods with a long period are typical of Mar-May. The frequency distribution over the months: the maximum number of occur in July.

**Precipitation Entropy**

We investigate the entropy of precipitation as a parameter that describes the meteorological input of the flood event. Higher entropy values indicate that the input is uniformly distributed within all intervals of the evaluated period. On the other hand lower entropies indicate that the precipitation came within a short time interval.

Next the precipitation entropy for the time interval of a day (12 hours before/after the peak) was calculated for all defined POTs. Fig. 7 shows this entropy vs. the peak to volume ratio, the different colors identify the seasons. In winter the entropies are by average higher than those in summer, due to the presence of convective precipitation in summer (Fig. 7). This is also notable by the higher average peak to volume ratios, where convective precipitation leads to flashfloods.

To further study the influence of the precipitation entropy on the hydrograph shape, the skewness and kurtosis of the hydrograph were calculated assuming each flood wave as a distribution function. Fig. 8 shows that as the entropy decreases both the kurtosis and the skewness increase, explained by the rapid reaction of the catchment to intense events (convective precipitation) resulting on a steeper hydrograph (flash flood). Lower skewness and kurtosis for flatter hydrographs representing longer catchment respond to precipitation events with and evenly temporal distribution.

As next step the spatial distribution of the flood causing precipitation entropies will be investigated. A comparison of catchment characteristics (as slope, length, area, shape, etc.) will be developed, looking for regionalization potential to ungauged catchments.