Optimizing reinsurance protection in case of loss of mutualization

In this project, we will consider situations in which the traditional model of insurance is endangered by the fact that spatial correlations or increase of frequency and severity limit the possibility to mutualize. We will try to optimize the way reinsurance via public private partnership (like the natural catastrophe regime in France) can absorb the risk via appropriate premiums and conditions, depending on the exposure of the insurance companies.

One of the difficulties related to the coverage of extreme risks related to climate is the heavy tail characteristic of the distribution of the loss. Typically, distributions that are considered for the loss L are from the so-called Fréchet domain in extreme value theory, that is such that

$$\mathbb{P}\left(L \geq t\right) = \frac{l(t)}{t^{1/\gamma}},$$

where l is a slow varying function, and $\gamma > 0$, see for example Albrecher et al. (2017) for more details. When $\gamma > 1$, the loss variable may not even have a finite expectation. In this case, the assumptions of the law of large number (which are at the core of the insurance activity) do not hold anymore, with the only solution to leave some part of the risk (typically above a certain limit) to the policyholder or to the state. Even if $\gamma < 1$, the spatial dependence may endanger risk pooling, leading to unaffordable premiums and, again, to the need to leave some part of the risk to the policyholders.

In the present project, we will investigate how increasing the information on the risk may help to better design reinsurance policies, and reduce as much as possible the part of the risk that is not insured.

References

- Albrecher, H., Beirlant, J., & Teugels, J. L. (2017). Reinsurance: actuarial and statistical aspects. John Wiley & Sons.