# YSR 2010 Aussois Programme

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| **Sunday** | **05. September** |
| **17.00** | **Little hiking excursion** trough the beautiful landscape.<br>**Meeting point: 17.00h at the reception, duration approx. 2h** |
| **20.00** | **Dinner** |
| **Monday** | **06. September** |
| **07.45 – 09.00** | **Breakfast** |
| **09.00 – 09.15** | **Introduction** |
| **09.15 – 10.00** | **Poster presentation, part I** (Chair: Malaak Kallache) |
| **10.00 – 10.30** | **Coffee break** |
| **10.30 – 12.00** | **Poster presentation, part II** (Chair: Malaak Kallache) |
| **12.00 – 12.30** | **Douglas Maraun**. *Extreme Value Theory - A Brief Introdcution to the Block Maxima Approach.* |
| **12.30 – 14.00** | **Lunch** |
| **14.00 – 15.00** | **Douglas Maraun** *The influence of synoptic airflow on UK daily precipitation extremes: Observed and modelled spatio-temporal relationships.* |
| **15.00 – 16.00** | **Julie Carreau** *Statistical downscaling of precipitation with neural network conditional mixture models.* |
| **16.00 – 16.30** | **Coffee break** |
| **16.30 – 17.30** | **Henning Rust** *Block maxima approach: Temporal variation, covariates and the influence of synoptic airflow on UK daily precipitation extremes.* |
| **17.30 – 18.00** | **Gwladys Toulemonde** *Hidden Markov Models for Gumbel Maxima* |
| **19.30** | **Seminar dinner** |
| **Tuesday** | **07. September** |
| **07.45 – 09.00** | **Breakfast** |
| **09.00 – 09.30** | **Round table**: Discuss questions and comments collected at the black board during Monday. |
| **09.30 – 10.30** | **Esterina Masiello** *On some statistical issues related to extreme value theory and insurance.* |
| **10.30 – 11.00** | **Coffee break** |
| **11.00 – 12.00** | **Cecile Mercadier** *Risk measures and multivariate extensions of Breiman's Theorem.* |
| **12.00 – 12.30** | **Discussion:** Funding opportunities for young researchers. Experience in writing proposals. (Chair: Douglas Maraun, Keeper of the minutes: Cecile Mercadier) |
| **12.30 – 14.00** | **Lunch** |
| **14.00 – 16.00** | **Wikipedia session**: Discuss English wikipedia pages on extreme value theory, detect sections with potential for improvement, form groups to improve pages during upcoming months. (Chair: Pierre Ribereau) |
| **16.00 – 16.30** | **Coffee break** |
| **16.30 – 17.30** | **Nicolas Eckert** *Use of a numerical model within a Bayesian framework for evaluation of extreme avalanches and optimal design of defense structures.* |
| **17.30 – 18.00** | **??????** |
| **19.30** | **Dinner** |
| **21.00** | **Debate:** Global warming, Insurance, and Extreme Value Theory.<br>(Chair: Mathieu Ribatet. Keeper of the minutes: Esterina Masiello) |
| **Wednesday** | **08. September** |
| **07.45 – 09.00** | **Breakfast** |
| **09.00 – 09.30** | **Round table:** Discuss questions and comments collected at the black board during Tuesday. |
| **09.30 – 10.30** | **Benjamin Renard** *Extreme Value Theory and Practice in Hydrology* |
| **10.30 – 11.00** | **Coffee break** |
| **11.00 – 12.00** | **Juliette Blanchet** *Spatial modelling of extreme snow depth in Switzerland.* |
| **12.00 – 12.30** | **Mathieu Ribatet** *Geostatistics of Extremes, part I* |

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| **12.30 – 14.00** | **Lunch** |
| **14.00 – 14.30** | **Mathieu Ribatet** *Geostatistics of Extremes, part II* |
| **14.30 – 15.00** | **Round table**: Discuss questions and comments collected during Wednesday. |
| **15.00 – 15.50** | **Networking Session** (Chair: Malaak Kallache). |
| **15.50 – 16.00** | **Closure session** |
| **16.15** | **Departure** |

**Juliette Blanchet**
*Spatial modelling of extreme snow depth in Switzerland.*
The modeling of extreme snow depth is important for adequate risk management and land-use planning in mountainous countries. An important issue is to model extreme events anywhere in space, and not only at some specific locations: this is the framework of spatial extremes. A natural approach to such modeling is through the theory of max-stable processes, which can be seen as an infinite-dimensional extension of multivariate extreme value theory. We describe in this talk a family of max-stable processes for modeling the spatial distribution of extreme snow depth in Switzerland. The models we proposed are based on a climate transformation that allows us to account for the presence of climate regions and for directional effects, for example resulting from synoptic weather patterns. Estimation is performed through pairwise likelihood inference and models are compared using an appropriate penalized likelihood criterion. Particular attention will be paid to model validation at high altitude and in rugged terrain. Some limitations of the model will be raised and future research directions will be given.

**Julie Carreau**
*Statistical downscaling of precipitation with neural network conditional mixture models*
Global circulation models (GCMs) are the main tool to simulate atmosphere-ocean dynamics and to analyze climate variables. By forcing GCMs with greenhouse gas emission scenarios, we can get a better understanding of upcoming climate changes. GCMs operate on a 3D grid which covers the Earth and the grid spatial resolution is in the order of 200 km. GCMs are thus good at reproducing large-scale climate variables such as the sea level pressure. However, they are not skilled at simulating small scale variables such as precipitation. Precipitation has a strong spatial variability which cannot be captured by GCMs. Proper simulation of precipitation is relevant for many impact studies (on agriculture, vegetation, flood risk assessment, hydro-electricity planning).

Downscaling techniques have been developed to bridge the gap between large and small scale variables [Hewitson and Crane 1996]. There are two sets of techniques, either dynamical or statistical. The dynamical downscaling techniques consist in refining GCMs over a higher resolution grid which covers a restricted region. These regionalized GCMs are called Regional Climate Models (RCMs). Statistical techniques relate local climate variables with large scale atmospheric variables by performing either regression (a technique known as transfer functions) or conditional density estimation (which is called stochastic weather generators). Weather typing is yet another statistical technique : atmospheric circulation patterns are clustered into weather types. Weather typing can serve as a pre-processing step before regression or conditional density modelling.

In this work, we compare neural network based transfer functions with a class of stochastic weather generators called conditional mixture models [Bishop 1995]. A conditional mixture is a mixture whose parameters are functions of the input. When downscaling precipitation, it means that given large-scale atmospheric information, the distribution of precipitation is modelled by a mixture, and the mixture parameters vary according to atmospheric information. The relationship between large-scale information and mixture parameters is learned by a neural network. This way, conditional mixtures can be seen as an extension of neural network models. Conditional mixtures predict the full conditional distribution from which we can extract confidence intervals whereas standard neural networks provide only point-wise prediction. Also, by resorting to heavy-tailed mixture components, extreme rainfall events can be properly taken into account. A special discrete component can be included to model the occurrence of rainfall.

We compare three conditional mixture models which differ in the type of components included (Gaussian, Log-Normal and heavy-tailed Pareto type) with standard neural networks models. We evaluate each model at downscaling precipitation data from three stations in the French Mediterranean area. The sea level pressure fields from NCEP/NCAR reanalysis data are chosen as the large-scale atmospheric predictors.

[Hewitson and Crane 1996] Hewitson, B. C. and Crane, R. G., Climate downscaling: techniques and application, CLimate Research 7:85-95, 1996.
[Bishop 1995] Bishop, C., Neural Networks for Pattern Recognition, Oxford 1995

**Nicolas Eckert**
*Use of a numerical model within a Bayesian framework for evaluation of extreme avalanches and optimal design of defense structures*
In the context of rapid mass movements, evaluating extreme events is a crucial question for hazard zoning and the design of defense structures. However, the direct use of standard extreme value theory (EVT) is difficult because of the dependency of traveled distances on topography. The difficulty can be overcome by combining a mechanical model for flow propagation with a stochastic model describing the variability of the different inputs/outputs. Crucial problems are then model identifiability and finding a reasonable compromise between precision of the description of the flow and computation times. In this talk, these points are illustrated with a depth-averaged set of equation describing the propagation of snow avalanches which is used within a hierarchical Bayesian framework. First, the joint posterior distribution of model unknowns is estimated using a sequential Metropolis-Hastings algorithm. Second, the point estimates are used to predict the joint distribution of different variables of interest for hazard mapping. Recent developments are employed to compute pressure distributions taking into account the rheology of snow. Third, the optimal design of a defense structure is performed by combining a cost function and the hazard model.The different steps of the method are illustrated with a real case study from the French Alps. Model assumptions and coherence with EVT are discussed.

**Douglas Maraun**
Part 1 (30 min):
*Extreme Value Theory - A Brief Introdcution to the Block Maxima Approach.*

Part 2 (30 min.):
*The influence of synoptic airflow on UK daily precipitation extremes: Observed and modelled spatio-temporal relationships.*

**Esterina Masiello**
*On some statistical issues related to extreme value theory and insurance.*
We will discuss how extreme value theory applies in an insurance context. More specifically, we will focus on the risk of insolvency for an insurance company facing large claims with heavy-tailed distribution. Finally, a multidimensional extension of the problem will be discussed.

**Cecile Mercadier**
*Risk measures and multivariate extensions of Breiman's Theorem*
Modeling insurance risks is a task that received an increasing attention because of Solvency Capital Requirements. The ruin probability has become a standard risk measure to assess regulatory capital. In this paper we focus on discrete time models for nite time horizon. Several results are available in the literature allowing to calibrate the ruin probability by means of the sum of the tail probabilities of individual claim amounts. The aim of this work is to obtain asymptotics for such probabilities under multivariate regularly variation and, more precisely, to derive them from Breiman's Theorem extensions. We thus exhibit new situations where the ruin probability admits computable equivalents. Consequences are also derived in terms of the Value-at-Risk.

**Benjamin Renard**
*Extreme Value Theory and Practice in Hydrology*
Extreme value theory (EVT) is widely used in Hydrology in order to estimate extreme quantiles of rainfall and runoff. This talk will provide an overview of practical applications of EVT to hydrological problems, with an

emphasis on the main challenges in applying EVT to hydrological data. In particular, the following topic will be discussed:

- The joys of hydrological data
- Non-stationarity, non-homogeneity and non-independence
- Uncertainties and validation
- Reducing uncertainty I: the use of incomplete historical information
- Reducing uncertainty II: "Regional analysis", i.e. transferring information from nearby site(s)
- A few challenges facing hydrology, including the modelling of spatial extremes
- A few words about non-EVT-related approaches used in Hydrology to characterize extremes

**Mathieu Ribatet**
*Geostatistics of Extremes*
It is well known that the conventional geostatistics, most often based on gaussian random fields, is not appropriate when trying to model spatial extremes. The aim of this lecture is to present current results on a geostatistics of extremes. In particular the talk will present some results on max-stable processes such as : estimating the spatial dependence of extremes, fitting such processes to extreme spatial data sets and the simulation of various max-stable processes. The talk will end with the current gap of the theory.

**Henning Rust**
*Block maxima approach: Temporal variation, covariates and the influence of synoptic airflow on UK daily precipitation extremes.*
After having been familiarized with the basics of the block maxima approach in the previous talk, this presentation introduces the concept of covariates. Covariates are external variables, such as time, or functions of those which co-vary with parameters of the model. After a general introduction to the concept, the modelling of seasonal variation with trigonometric functions will be discussed in detail using monthly precipitation maxima from the UK.

**Gwladys Toulemonde**
*Hidden Markov Models for Gumbel Maxima*

**Poster contributions**

| Surname | Name | Title |
|---|---|---|
| Castebrunet | Hélène | Climatology of significant natural avalanche events of the past 50 years in the French Alps |
| Lekina | Alexandre | (Estimation de courbes de niveaux extrêmes pour des distributions à queues lourdes) Extreme Level Curves of Heavy-Tailed Distributions |
| Orlowsky | Boris | Trends of extreme event indices in the IPCC AR4 |
| Rietsch | Théo | Extensions of the folding |
| Rousselot | Marie | Statistical downscaling of RCM's climate scenarios in the French Alps - Impact on snow cover |
| Russo | Simone | Sea Surface Temperature Extremes on the Benguela from regional ocean model. |
| Scheuerer | Michael | Ensemble calibration for weather trajectories |
| Schindler | Anne | The annual cycle of intensity and frequency of extreme precipitation events across the UK in observations and future projections |
| Schorgen | Antoine | Lambda-Madogram and Asymptotic Independence |
| Smith | Isabelle | Bayesian hypothesis testing with the posterior distribution of the likelihood ratio |
| Toledano | Michael | ? |
| Worms | Rym | Empirical likelihood based confidence regions for the first-order parameters of heavy-tailed distributions (en collaboration avec Julien Worms) |