

Post-doctoral position at University of Montpellier (IMAG), France

Subject: Simulation of spatio-temporal extreme processes to assess flood hazards

Location: Institut Montpellierain Alexander Grothendieck (IMAG), University of Montpellier, France

Duration: 12 months. Position available from September 1st, 2017, but possibility to postpone the starting date of the postdoc contract by a few months.

Supervisors: Gwladys Toulemonde (IMAG/UM), Julie Carreau (IRD/HSM/UM), Thomas Opitz (BioSP, INRA Avignon)

Mission of the postdoc: We propose a Postdoc position that is funded by the LabEx NUMEV (one of the institutes that is part of a French initiative for fostering scientific excellence on specific topics) and will be part of a project¹ whose aim is to develop stochastic methods for the realistic simulation of spatio-temporal processes integrating extremes events. A major goal of this project is to understand and model the space-time structure of hydrological extremes such as those observed in the French Mediterranean basin, known for its intense rainfall events (*Cevenol episodes*), which have recently received increasing attention. We propose to apply and extend a number of promising recent advances in spatial-temporal extremes modeling based on generalized Pareto processes (Ferreira, de Haan 2014; Thibaud, Opitz 2015) and semiparametric simulation techniques (Chailan et al. 2017) to a large dataset of precipitation reanalysis data available for this study region. In this context, the contribution of the postdoc will extend state-of-the-art methodology with respect to three important aspects: 1) adapting well-studied spatial modeling techniques for extreme events based on asymptotically justified models for threshold exceedances to the space-time setup; 2) replacing restrictive parametric dependence modeling by semiparametric or nonparametric approaches; 3) capturing the strength of potentially decreasing extremal dependence when moving towards higher values, which requires developing models that allow for so-called asymptotic independence.

Beyond the modeling of extreme episodes over space and time which will be the focus of the postdoc, we expect that the results of this postdoc will help to ultimately develop a stochastic precipitation generator that is capable to produce full precipitation chronicles including dry and non extreme wet periods.

The postdoc will work on precipitation reanalysis data, available at an hourly time-step and 1 km spatial resolution, that combine radar reflectivity with rain gauge observations. This data has been produced by Météo-France, the French weather service, for the period 1997-2006 and will soon be available until 2014. The large size of this high-resolution data set presents an additional challenge for the statistical modeling of spatio-temporal extremes.

Required skills: The candidate should have a **PhD in statistics** with a focus on spatial extremes and/or space-time modeling. Additionally, she/he should have a proven interest in environmental sciences. Programming experience in R is required, paired with at least basic knowledge in the statistical treatment of high-dimensional datasets.

Application: A CV and a motivation letter should be addressed to Gwladys Toulemonde (gwladys.toulemonde@umontpellier.fr). For further information, please contact Gwladys Toulemonde. The candidate will be selected as soon as possible.

References:

- Carreau, J., Naveau, P., & Neppel, L. (2017) Partitioning into hazard subregions for regional peaks-over-threshold modeling of heavy precipitation. *Water Resources Research*.
- Chailan, R., Toulemonde, G., Bacro, J.N. (2017). A semi-parametric method to simulate bivariate space-time extremes, *Annals of Applied Statistics*, To appear.
- Ferreira, A., de Haan, L. (2014). The generalized Pareto process; with a view towards application and simulation. *Bernoulli*, 20(4), 1717-1737.
- Thibaud, E., Opitz, T. (2015). Efficient inference and simulation for elliptical Pareto processes. *Biometrika* 102.4: 855-870.

¹ <http://cerise.msem.univ-montp2.fr/>