Recent advances in the statistical analysis of extreme environmental and actuarial risk

List of talks and abstracts

Cláudia Neves: *On trend estimation and testing with application to extreme rainfall*

Extreme Value Theory provides the rigorous mathematical justification for being able to extrapolate outside the range of previously observed events. The primary assumption is that the observations are independent and identically distributed. Although the celebrated extreme value theorem still holds under several forms of weak dependence, relaxing the stationarity assumption, for example by considering a trend in extremes, leads to a changeling problem of inference on the frequency of extreme events. Some studies deem climate change is not so much about the magnitude but rather in the frequency the extreme phenomena: the average rainfall may not change much, but heavy rainfall may become more or less frequent, meaning that observations have different underlying distributions. We present statistical tools for tackling the evolution of extreme values over time and/or space by considering a trend on the frequency of high exceedances. The methodology is applied to daily rainfall data from several stations across Germany.

David Walshaw: *Recent advances in models for dependent extremes*

One of the key aspects of assessing environmental risk is the handling of the dependence between extreme values that can occur, for instance, from environmental records obtained at nearby locations. In stark contrast to the marginal behaviour, the dependence characteristics are very slow to converge, and it is very difficult to distinguish between the class of dependence which persists in the tails (Asymptotic Dependence) and that of dependence which decays to zero in the limit (Asymptotic Independence). In this talk we consider the implications of modelling choices which align with one or other class, and discuss the potential benefits and difficulties of using recently developed models which incorporate both classes simultaneously. We set the discussion in the context of a real application concerning extreme wind speeds in Central Eastern England.

Gilles Stupfler: *Asymmetric least squares techniques for extreme risk estimation*

Financial and actuarial risk assessment is typically based on the computation of a single quantile (or Value-at-Risk). One drawback of quantiles is that they only take into account the frequency of an extreme event, and in particular do not give an idea of what the typical magnitude of such an event would be. Another issue is that they do not induce a coherent risk measure, which is a serious concern in actuarial applications. In this talk, I will explain how, starting from the formulation of a quantile as the solution of an optimisation problem, one may come up with two alternative families of risk measures, called expectiles and extremiles. I will give a broad overview of their properties, as well as of their estimation at extreme levels in heavy-tailed models, and explain why they constitute sensible alternatives for risk assessment using some real data applications.