

CRAG - IRGC Symposium 2013

WORKSHOP 1 RISK QUANTIFICATION

Thursday, November 21, 10:00 – 17:00, BI A0 448

Risk quantification is a key element of risk analysis and governance, and has its roots in statistics and stochastic modeling. Its purpose is to measure the likely sizes of risks and their physical and economic consequences, in order to underpin their management and insurance.

The focus of this workshop is on the interplay between extreme value statistics, insurance, and risk management. It will address academics and practitioners from various domains, albeit with a particular emphasis on environmental, financial and insurance applications, in order to foster the interaction of researchers across and beyond EPFL with an interest in the methods and applications of risk quantification.

Talks: The format is 40 minutes per presentation plus 5 minutes of discussion

Poster sessions: Contributed posters will be presented during poster sessions at noon and afternoon coffee break

09:00 REGISTRATION DESK OPENS

10:00 RECEPTION

10:30 **Model uncertainty and risk aggregation: an academic response to Basel 3.5.**
Paul Embrechts, ETH Zürich

11:15 **Quantification of natural catastrophe risk for reinsurance**
Andreas Schrafft, Swiss Re

12:00 LUNCH AND POSTER SESSION 1

13:30 **Assessing dependence between extreme risks**
Johanna Nešlehová, McGill University

14:15 **Extreme value methods for univariate and spatial flood risk assessment**
Jonathan Tawn, Lancaster University

15:00 COFFEE BREAK AND POSTER SESSION 2

15:30 **Modelling and estimation of extreme events observed in space and time**
Claudia Klüppelberg, TU Munich

16:15 **On theoretical and practical aspects of catastrophe insurance**
Hansjörg Albrecher, University of Lausanne

17:00 COCKTAIL RECEPTION, AT "LE HODLER" IN THE ROLEX LEARNING CENTER

ORGANISER BIOGRAPHIES

Anthony DAVISON

Professor of Statistics, EPFL

Anthony Davison has published on a wide range of topics in statistical theory and methods, and on environmental, biological and financial applications. His current main research interests are statistics of extremes, likelihood asymptotics, bootstrap and other resampling methods, and statistical modelling. Davison has research links with, amongst others, the NCCR Plant Survival at the University of Neuchâtel, for which he leads a group of researchers undertaking statistical and dynamical modelling. The problems studied here are very varied, ranging from methods for the analysis of microarray data, through modelling the behaviour of wasps and moths, to assessment of the effects of grazing by cows in their pastures. In 2009 he was awarded a laurea honoris causa in Statistical Science by the University of Padova, in 2011 he held a Francqui Chair at Hasselt University, and in 2012 he was Mitchell Lecturer at the University of Glasgow. He has assumed numerous editorial roles throughout this career and is currently Editor of *Biometrika* (2008-). Davison's PhD work was in the area of statistics of extreme concerns rare events, in a project joint between the Departments of Mathematics and Mechanical Engineering at Imperial College, with the aim of modelling potential high exposures to radioactivity due to releases from nuclear installations.

Damir FILIPOVIC

Swissquote Chair in Quantitative Finance, Swiss Finance Institute Professor & Head, EPFL

Damir Filipovic holds the Swissquote Chair in Quantitative Finance at EPFL and a Swiss Finance Institute Senior Chair. He also acts as head of the Swiss Finance Institute at EPFL. He holds a Ph.D. in mathematics from ETH Zürich and has been a faculty member of the University of Vienna, the University of Munich and Princeton University. He also worked for the Swiss Federal Office of Private Insurance as co-developer of the Swiss Solvency Test. His research focus is in quantitative finance and risk management. His papers have been published in a variety of academic journals. He is the author of a textbook titled *Term-Structure Models*.

SPEAKER ABSTRACTS AND BIOGRAPHIES

Paul EMBRECHTS

Professor of Mathematics, ETH Zürich

MODEL UNCERTAINTY AND RISK AGGREGATION: AN ACADEMIC RESPONSE TO BASEL 3.5

The recent financial crises have triggered a multitude of regulatory documents worldwide; some of these were more politically driven, others touched strongly on corporate governance within the banking world going forward, whereas a third category proposes specific guidelines for the calculation of risk capital. The latter, more methodologically oriented documents, very much question some of the rules and practices in the calculation of Risk Weighted Assets. Based on the May 2012 Consultative Document "Fundamental Review of the Trading Book" by the Basel Committee on Banking Supervision, a document I like to refer to as Basel 3.5, I will address in particular its Question 8 p 41: "What are the likely constraints with moving from Value-at-Risk to Expected Short-fall, including any challenges in delivering robust backtesting, and how may these be best overcome?" An important issue in my talk will concern Model Uncertainty, and this mainly through the calculation of best-worst bounds for risk measures under incomplete model assumptions. Part of the talk is based on the recent paper: Embrechts, P., Puccetti, G., Rueschendorf, L. (2013): Model uncertainty and VaR aggregation. *Journal of Banking and Finance* 37(8), 2750-2764. Further background reading can be found on my website: www.math.ethz.ch/~embrechts

BIOGRAPHY. Paul Embrechts is Professor of Mathematics at the ETH Zürich specialising in actuarial mathematics and quantitative risk management. He holds an Honorary Doctorate from the University of Waterloo, Heriot-Watt University, Edinburgh, and the Université Catholique de Louvain. He co-authored the influential books "Modelling of Extremal Events for Insurance and Finance", Springer, 1997 and "Quantitative Risk Management: Concepts, Techniques, Tools", Princeton UP, 2005.

Andreas SCHRAFT

Responsible natural catastrophe models, Swiss Re

QUANTIFICATION OF NATURAL CATASTROPHE RISK FOR REINSURANCE

Natural catastrophe events can impact the economies of entire countries. Understanding the risk of natural catastrophes is therefore critical for underwriting and risk management of a reinsurance company. The presentation will look at the models developed by Swiss Re and how they combine information on earthquake, wind and flood hazard with information on the vulnerability of structures to quantify natural catastrophe risk.

BIOGRAPHY. Andreas Schraft is a civil engineer by training. He is responsible for developing Swiss Re's natural catastrophe models. In his previous role, Andreas was responsible for Swiss Re's Risk Engineering Services team which supports single risk underwriters in the assessment of man made hazards (fires, explosions, product defects, terrorism, risks of pervasive computing among others). Additionally, he was a facultative reinsurance underwriter and client manager for Swiss Re's business in some European markets.

Johanna NESLEHOVA

Associate Professor of Statistics, McGill University

ASSESSING DEPENDENCE BETWEEN EXTREME RISKS

Dependence between rare events is of prime concern in risk management. For example, extreme comovements of prices or huge operational losses in different business lines represent a substantial risk for financial institutions. Severe losses or insurance claims can also result from the simultaneous occurrence of violent storms, fires, earthquakes or floods. Modelling such dependencies is one of the objectives of extreme-value theory, an area of research that stands at the crossroads between analysis, statistics, and probability. In this talk, I will show how dependencies between extreme risks can be quantified using copula-based models and illustrate some techniques of inference relevant to this issue.

BIOGRAPHY. Johanna G. Neslehova is Associate Professor of Statistics at McGill University in Montréal, Canada. She studied mathematics and statistics at Univerzita Karlova v Praze, Universität Hamburg and Carl von Ossietzky Universität Oldenburg. Before coming to McGill, she was at ETH Zürich for five years, as a Postdoctoral Fellow at RiskLab Switzerland and subsequently as Heinz Hopf Lecturer. Her primary research interests are multivariate extreme-value theory, dependence modeling, asymptotic theory, and applications of statistics to risk management and health. She was elected a member of the International Statistical Institute in 2011.

Jonathan TAWN

Professor of Statistics, Lancaster University

EXTREME VALUE METHODS FOR UNIVARIATE AND SPATIAL FLOOD RISK ASSESSMENT

The talk will provide an introduction to a range of recent research on flood risk assessment. There has been a long history of the use of extreme value methods for hydrology. The most widely used approach is the peaks over threshold method in which a high threshold is selected and then the rate and size of the independent peaks of storm events that exceed this threshold are modelled using a Poisson process and the generalised Pareto distribution respectively. In this talk I will describe research that covers departures from both these assumptions which appears to offer considerable improvements. The consideration of the extreme river levels at a site is insufficient for the broader needs of the insurance industry as they are concerned about which properties will be flooded in the same event and what their accumulated loss will be over the portfolio of properties that they insure. To derive the distribution of the financial loss from a flooding events requires models for both the extreme river flows at every location along the river network and a model for the spatial dependence of extreme river levels. I will show how a multivariate extreme value statistical approach, coupled with a simple interpolation scheme and survey data on the likely losses to individual properties for given flood levels, provides a viable approach to this problem.

BIOGRAPHY. Jonathan has been Professor of Statistics at Lancaster University since 1996. He is currently the director of the Doctoral Training Centre: Statistics and Operational Research with Industry (STOR-i). He specialises in extreme value theory, methods and its applications, with the research driven by environmental and financial applications. His research has had major impact on optimising coastal flood protection schemes in the UK, provided evidence of fundamental importance on the likely cause of the sinking in 1980 of the MV Derbyshire to a High Court Investigation, and developed new worldwide mandatory design standards for the hatch strength of ocean-going carriers.

Claudia KLÜPPELBERG

Chair of Mathematical Statistics, TU Munich

MODELLING AND ESTIMATION OF EXTREME EVENTS OBSERVED IN SPACE AND TIME

Often, in modelling meteorological data like precipitation and wind fields, statistical methodology can be applied to reconcile the physical models with the data. For an adequate risk analysis, the statistical modelling of extreme events, such as heavy rain and floods, and severe wind gusts or storms is essential. A natural extension from uni- and multivariate extreme value theory is formed by so-called max-stable random fields. We suggest new statistical models for extreme data measured in space and time. We present the basic aspects and challenges of simulation and parametric and non-parametric estimation of max-stable spatio-temporal random fields. Finally we apply our model to heavy rainfall data in Florida.

BIOGRAPHY. The research interests of Professor Klüppelberg combine various disciplines of applied probability theory and statistics with applications in the area of biological, economic and technical risks. Her fundamental research concentrates on advancing the modeling and extension of the spectrum of methods for risk analysis and risk measurement, but she is also interested in real-world problems and cooperation with industry. After studying mathematics and receiving her doctorate (1987) at the University of Mannheim, Prof. Klüppelberg completed her lecturer qualification at the Swiss Federal Institute of Technology Zürich (1993). Before becoming full professor of mathematical statistics at TUM, she was a professor of applied statistics in Mainz until 1997. She headed up the IAS focus group Risk Analysis and Stochastic Modeling at TUM from 2008 to 2011. Along with more than 100 publications in scientific journals and books, she is the editor of the Springer Finance series of books and the Springer Lecture Notes in Mathematics subseries Lévy Matters. She is an Elected Fellow of the Institute of Mathematical Statistics.

Hansjörg ALBRECHER

Professor of Actuarial Science, University of Lausanne

ON THEORETICAL AND PRACTICAL ASPECTS OF CATASTROPHE INSURANCE

In this talk we give an overview of some recent results and developments in the modelling of insurance risk related to natural catastrophes. In addition to some theoretical results on the statistics of such extremal events, we present a study of flood and storm risk in Austria. The feasibility of the general principle of time diversification in this context is also discussed.

BIOGRAPHY. Hansjoerg Albrecher is Professor of Actuarial Science at the University of Lausanne and a Faculty Member of the Swiss Finance Institute. His research activities focus on insurance, risk theory, risk management and applied probability, with a particular emphasis on linking theory and practice. Hansjoerg has published extensively and is Editor of Insurance: Mathematics & Economics, Co-Editor of the European Actuarial Journal and Editor of the Springer European Actuarial Academy Book Series.