

The **Working Group on Risk - CREAR**, with the support of the IDS dpt, Institut des Actuaire, LabEx MME-DII, and the group BFA (SFdS), has the pleasure to invite you to the seminar by:

# Prof. Sebastian Engelke

Université de Genève

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## ‘Graphical Models, Sparsity and Structural Learning for Extremes’

via Zoom Link : <https://zoom.us/j/94745604190>

Conditional independence, graphical models and sparsity are key notions for parsimonious models in high dimensions and for learning structural relationships in the data. The theory of multivariate and spatial extremes describes the risk of rare events through asymptotically justified limit models such as max-stable and Multivariate Pareto distributions. Statistical modeling in this field has been limited to moderate dimensions so far, owing to complicated likelihoods and a lack of understanding of the underlying probabilistic structures. We introduce a general theory of conditional independence for multivariate Pareto distributions that allows to define graphical models and sparsity for extremes. New parametric models can be built in a modular way and statistical inference can be simplified to lower-dimensional margins. We define the extremal variogram, a new summary statistics that turns out to be a tree metric and therefore allows to efficiently learn an underlying tree structure through Prim’s algorithm. For a popular parametric class of multivariate Pareto distributions, we show that, similarly to the Gaussian case, the sparsity pattern of a general graphical model can be easily read of from suitable inverse covariance matrices. This enables the definition of an extremal graphical lasso that enforces sparsity in the dependence structure. We illustrate the results with an application to flood risk assessment on the Danube river.

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**Dr. Sebastian Engelke** is assistant professor at the Research Center for Statistics at the University of Geneva, Switzerland. He obtained his PhD in Mathematics from the University of Goettingen in 2013. Sebastian was previously a research fellow at EPF Lausanne and a visiting professor at the University of Toronto from 2018-2019. His research interests are in extreme value theory, spatial statistics, graphical models and causal inference. He has received several grants and awards including a research fellowship at the Fields Institute in Toronto and an Eccellenza grant (2020-2025) that focuses on the connection of extremes to graph structures, sparsity and high-dimensional inference. Sebastian is an Elected Member of the ISI, member of the Executive Committee of the Bernoulli Society and currently serves as Associate Editor of the journals *Extremes*, the *Scandinavian Journal of Statistics*, and *Dependence Modeling*.

