PhD in Understanding and Managing Extremes, Pavia

Stochastic Modelling of Weather Risk

David Stephenson and Ben Youngman
University of Exeter, UK

3-day model (2 ECTS credits)

Module aims:

This module aims to give students:

- a brief introduction to stochastic process modelling relevant to natural hazards such as European windstorms;
- the practical ability to develop and fit Poisson and Gaussian process models to historical storm data sets using the R statistical language
- an appreciation of important issues such as clustering, dynamic modulation of rates, and recalibration of climate model storms.

Module Programme:

The module consists of 16 hours of contact time divided as follows: six 1-hour lectures (2 per day), three 3-hour statistical computing sessions (1 per day), and 1 hour of general discussion. The students are expected to be present for all this and in addition do 20 hours of self-study (revision of material and assignment work).

Day 1:
Lecture 1. Introduction to Extreme Weather Events and European Windstorms (David)
Lecture 2. Stochastic Modelling Framework for Natural Hazards (Ben)
Statistical computing practical:

- Review of statistical modelling skills in R
- Exploratory Data Analysis of windstorm data

Day 2:
Lecture 3. Modelling storm counts using the Poisson process (David)
Lecture 4. Stochastic recalibration (Ben)
Statistical computing practical:

- Poisson regression modelling of storm counts
- Simple recalibration of meteorological phenomena

Day 3:
Lecture 5. Modelling aggregate losses using marked point process models (David)
Lecture 6. Advanced stochastic recalibration (Ben)
Statistical computing practical:

- Modelling frequency-intensity relationships
- Gaussian process recalibration of meteorological phenomena

Module Assessment:
This will be based on a short assignment that each student will be expected to write up as a short report.

Module Prerequisites:
Basics of Statistics and Probability
Further Probability and Statistics
Meteorology, Wind and Hydro-Geological Risk