



## Statistics for Environmental Evaluation: Quantifying the environment- Part II.

### Course information A NERC-supported short course and workshop.

**Tuesday January 5th to Friday, January 8<sup>th</sup> 2016**  
**University of Glasgow**

#### Aims

The aim of this training is to provide environmental scientists with a thorough knowledge of and skills in three key areas of recent statistical development- flexible regression methods, spatio-temporal modelling and functional data analysis and to address the issues of risk and resilience in a linked workshop.

Building on the August 2015 training course, there will be a focus on key statistical methods, which are fundamental to Environmental science, namely exploring relationships (generalized additive mixed models, quantile regression, changepoint detection), spatio-temporal modeling, and functional data analysis (FDA) methods. Each topic will be covered at a sufficient level, to ensure that the students gain knowledge of the statistical techniques and the types of questions for which they would be appropriate. There will also be practical sessions associated with the topics.

#### Training course syllabus

##### Flexible regression methods:

Introduction to some of the theory and application of flexible regression models including generalised additive models, and quantile regression in environmental contexts. The sessions and lectures will illustrate the appropriate uses and restrictions of advanced regression models, using R.

##### Spatio-temporal modelling

Introduction to statistical approaches to modelling data that have spatial and temporal structure. The sessions will first summarise the purely spatial and purely temporal modelling, including : geostatistics, areal (lattice) models including Markov Random fields and point process models including homogeneous and inhomogeneous Poisson processes, followed by developments in spatio-temporal modelling.

##### Functional data analysis

Functional data analysis is a very powerful statistical methodology, which treats time series data in new ways (the “datapoint” becomes the curve). A brief introduction to methods in functional data analysis, with an emphasis on data arising from environmental monitoring devices and optical or mechanical tracking devices will be given. We also discuss some techniques that are unique to functional data: curve alignment and the analysis of rates of changes or derivatives.

##### Workshop: quantifying environmental risk and resilience.

The associated advanced workshop will focus on **quantifying environmental risk, and resilience-how does the past (data) inform the present and the future (statistical models)**. A key element of the workshop is to develop an awareness of: the interconnected effects of environmental hazards and vulnerabilities; the rise of the scientific citizen (and the use of citizen science) and uncertainty quantification. Sessions will cover the role of precautionary approaches to policy making and the nature of evidence. Sessions will be delivered by GU staff with several guest lecturers.

##### Course material and venue

This is an advanced course and so builds on the material covered in a previous course run in August 2015. Course notes (handouts and/or overheads/powerpoint slides etc) will be made available to the course participants. The computer sessions will take place in the Level 1 computing Lab in School of

Mathematics and Statistics, which is a networked PC lab with 42 machines running Windows (with a variety of statistical software including R) and with access to the web. The School of Mathematics and Statistics is in the Mathematics building D4 on the campus map; between University Gardens and University Avenue. <http://www.gla.ac.uk/general/maps/index.html>

**Lecturers**

The lecturers on the course include Professor Marian Scott, Drs Duncan Lee, Claire Miller, Ruth O'Donnell and Surajit Ray, University of Glasgow. Guest lecturers include Prof Peter Craigmile, Ohio State University, Dr Robert Willows, Dr Jim Hansom, Geographical and Earth Sciences, Professor Denis Fischbacher-Smith, Professor of Risk Management, University of Glasgow.

<b>Date</b>	<b>Theme</b>	<b>Topic</b>	<b>Lecturer</b>
<b>Tuesday</b> 9.00-9.30 9.30-10.30  10.30-10.50 10.50-12.20 12.20-12.50 12.50-14.00 14.00-15.15 15.15-15.35 15.35-16.30 16.30-17.30 17.30	<b>Flexible regression</b>  Coffee Lunch  Coffee  reception	Registration Flexible regression refresher  GAMM  Practical session Quantile regression  Tipping points Regression problem solving session	Claire Miller, Ruth O'Donnell, Marian Scott  Claire Miller  Claire Miller and Ruth O'Donnell Marian Scott  Marian Scott all
<b>Wednesday</b> 9.00-10.00 10.00-11.00 11.00-11.20 12.00-13.00 13.00-13.45 13.45-15.15 15.15-15.35 15.35-16.40 16.40-17.30 17.45	<b>Spatio-temporal</b>  Coffee  Lunch  Coffee  Buffet dinner	Geostatistics in practice Areal modelling and examples  Point process models and examples  Spatio-temporal modelling  Spatial problem solving session Environmental risk and resilience	Duncan Lee/Marian Scott Duncan Lee  Marian Scott/Duncan Lee  Duncan Lee  all Denis Fischbacher Smith
<b>Thursday</b> 9.00-11.00  11.00-11.20 11.20-13.00 13.00-13.45 13.45-15.00 15.00-15.20 15.20-16.50 16.50-18.15	Coffee  Lunch  Coffee	Functional Data Analysis and its environmental applications?  Problem solving session  Coastal vulnerabilities  Data and models-risk I Regulation, risk and resilience	Marian Scott/Surajit Ray  all  Jim Hansom, GES  Peter Craigmile, OSU tbc
<b>Friday</b> 9.00-10.45 10.45-11.15 11.15-12.30 12.30-13.15 13.15-15.00  15.00-15.20 15.20-17.00 17.00 17.30	Coffee  Lunch  Coffee  Course dinner	Data and models- risk II  Problem solving session  A Communicating and visualising environmental risks or B volcanic risks  Data and models- risk III Course round up	Peter Craigmile  all  Alasdair Rae, U of Sheffield  tbc  Peter Craigmile