46th Gregynog Statistical Conference
Programme

The talks will take place in Seminar Room 1 (2nd Floor, far end).

Friday 16 April	16.00	*Tea*	
	17.00	**Dr Adam Johansen** *Sequential Monte Carlo: What, How and Some Reasons Why.*	**Warwick**
	19.00	*Dinner*	
	20.15	**Prof John Gough** *An Introduction to Quantum Probability (lecture/workshop)*	**Aberystwyth**
Saturday 17 April	08.00	*Breakfast*	
	09.30	**Prof Marian Scott** *Simple metrics, complex environmental systems- the statistical development of environmental indicators.*	**Glasgow**
	11.00	*Coffee*	
	11.30	**Prof John Gough** *An Introduction to Quantum Stochastic Processes.*	**Aberystwyth**
	13.00	*Lunch*	
		Afternoon free	
	16.00	*Tea*	
	17.30	**Prof Jianxin Pan** *Joint Modelling of Mean and Covariance Structures for Longitudinal Data.*	**Manchester**
	19.00	*Dinner*	
	20.15	**Prof Paul Harper** *Would you trust a 'simple doctor'?! Current topics in healthcare modelling.*	**Cardiff**
Sunday 18 April	08.00	*Breakfast*	
	09.15	**Dr Madalin Guta** *An Introduction to Quantum Statistics.*	**Nottingham**
	10.45	*Coffee*	
	11.15	**Prof Marian Scott** *Classical design and analysis tools applied to computer models- sensitivity and uncertainty analysis.*	**Glasgow**
	12.30	*Lunch and finish*	

Speakers

Prof Paul Harper	Cardiff
Prof John Gough	Aberystwyth
Dr Madalin Guta	Nottingham
Dr Adam Johansen	Warwick
Prof Jianxin Pan	Manchester
Prof Marion Scott	Glasgow

Staff / Students

Aberystwyth

Staff		Students	
John Lane		Catrin Griffiths	Jeff Smith
Glenda Roberts		Adam Bill	David Ferguson
		Abigail Tudor	Sebastian Wildfeuer

Bangor

Staff		Students
Zoë Hoare	Natalia Hounsome	Joshua Pink
Shubha Sreenivas	Yvonne Sylvestre	
Chris Whitaker	Rhiannon Whitaker	

Cardiff

Staff	
Frank Dunstan	Kerry Hood
Leonid Grishchuk	Terry Iles

Southampton

Russell Cheng

Warwick

Staff	Students	
John Copas	Mouna Akacha	Briony Hill
John Fenlon + Mrs Fenlon	Kadian Johnson	Ruixin Lee
Jane Hutton	Christopher Nam	Duy Pham
Fabio Rigat	Murray Pollock	Hasinur Rahaman Khan
Ewart Shaw	Jennifer Rogers	Francisco Rubio
	Yiqin Shen	Yan Zhou

Abstracts

Prof Paul Harper Cardiff

Would you trust a 'simple doctor'?! Current topics in healthcare modelling.

Although many problems faced by researchers in healthcare modelling are not analytically very different from problems in other industries, unique characteristics of healthcare delivery systems often present many challenges to researchers in this field. This talk will outline some of the current topics in healthcare modelling drawing on the presenter's experience of working on a variety of projects with different healthcare organisations. A wide range of modelling methodologies and applications will be shown with a view to demonstrating the interesting and varied contribution that Operational Research and Statistics can make in supporting healthcare policy making (including working with 'simple doctors'!...).

Prof Jianxin Pan Manchester

Modelling of Mean-Covariance Structures for Longitudinal Data

It is well known that when analysing longitudinal data, misspecification of covariance structures may lead to very inefficient or even biased estimators of parameters in the mean structure. Covariance structures, like the mean, can be modelled using either linear or nonlinear regression models techniques. Various estimation methods have been recently developed for modelling of mean and covariance structures, simultaneously. In this talk, I will introduce such methods on modelling of mean-covariance structures for longitudinal data, including linear and non-linear regression models, variable selection, semiparametric models, etc. Real examples and simulation studies will be presented for illustration.

Prof Marion Scott Glasgow

Lecture 1: Simple metrics, complex environmental systems- the statistical development of environmental indicators

Environmental indicators are widely used and are especially favoured by environment agencies, regulators and policy makers. They relate directly to policy, are simple to present visually, and often form the basis of reporting the current state of the environment as well as tracking changes. In the science arena, we can construct a hierarchy of indices which may relate directly or indirectly to the policy indicator starting with the simplest: a single variable (such as nitrate concentration) in a single water body, a further level of complexity is added by the requirement to present a spatial summary, so the index then represents an aggregated (typically average) value of the variable of interest over space (at river basin, city or country scale). A third level may require a weighting over different variables of interest (e.g. such as different air pollutants). The fourth and final level generates a composite index as a summary of the results of a complex and sophisticated multivariate statistical model (e.g. a biodiversity summary of breeding bird population size or a measure of sustainability).

There remain a number of outstanding statistical issues concerning environmental indices: the index, once generated, is used as a summary statistic, though rarely accompanied by an estimate of its uncertainty. The data which form the basis of the index may not be representative (spatially or temporally), thus the resulting index cannot be representative. Fundamentally the index is a univariate summary of a complex multivariate environmental system, thus our ability to model effects of drivers (such as climate change or management practice) is compromised.

In this presentation, I will discuss some of these outstanding issues and offer some recommendations.

Lecture 2: Classical design and analysis tools applied to computer models-sensitivity and uncertainty analysis.

There is growing use of more complex mathematical and computational models in many fields including environmental science, biology, chemistry, and engineering to mention only a few. Often the model is treated as a black box, and the model predictions are then used as a basis both for management decisions and as an input to further risk analysis. Until fairly recently, there has often been an inadequate, if any, quantification of uncertainty in the outputs of these models. However, now, there is a growing realisation in many quarters that the auditing of uncertainty is essential. Statisticians have long been developing and using techniques for uncertainty assessment and management and this means that there is now a significant opportunity for cross-fertilisation between the statistical and user communities to mutual benefit.

The model output is widely used to inform management and political decisions; the decision-maker not typically being the scientist who designed the model. The quantification of the uncertainties on the model output is critical; inadequate appreciation of the uncertainties, may result in an incorrect assessment of risks. Moreover, within the public arena in applications such as epidemiological and food chain modelling associated with BSE and GMO risks, environmental modelling and energy choice modelling, there is a need to communicate and explore the uncertainty with a much wider group of stakeholders - including the public - and so inform the wider debate.

The statistical analysis of complex computer models is an area where statisticians, decision and risk analysts have an important role to play. The complex computer codes which are used can be characterised in a number of different ways, but the key similarities are:

a) the complex nature of the model, often with high dimensionality of input and output variables, in some cases running into hundreds;
b) the processing time in making model runs -a single run may require several hours to several days of CPU time;
c) sparse data and a need to resort to expert judgement on key variables; and
d) implicit and explicit uncertainties on the inputs and process model parameterisations and discrepancies between the model and the process.

Examples from climate change and the most recent IPCC report will be used to explore some of these issues.