

SUMMARY FINAL REPORT

Project title: Workshop on “Statistical Analysis of Computer Code Outputs”

EPSRC Grant reference number: GR/M 64888

Principal Investigator: Professor A O'Hagan, University of Sheffield

1. Background/context

Large and complex computer programs are employed in many fields. They are, for instance, widely used in environmental science to implement models of complex chemical, physical and biological processes. Often, just a single run of such a computer code will take hours or even days on a powerful computer. In such a context, the numbers of runs needed to answer some important questions by standard techniques are prohibitive. There is a great need to develop solutions that make more efficient use of a small number of code runs.

The workshop was focussed on statistical methods which take the observed outputs from a sample of input configurations as data, and use them to make inferences about the output at unobserved inputs, or to answer other related questions.

The workshop was held in the context of growing international interest and activity in this field of Statistical Analysis of Computer Code Outputs (SACCO).

2. Objectives

To bring together experts and younger researchers in this developing field.

To explore approaches to sensitivity analysis, uncertainty analysis and other statistical tools, with particular reference to the three themes of Bayesian modelling, calibration and validation, and correlation structures.

3. Achievements

The workshop took place, as planned, from 10 to 14 April, 2000 at Gregynog, the University of Wales' conference centre in mid-Wales.

EPSRC funding was given to allow us to invite 15 to 20 experienced researchers plus 10 to 15 young UK-based researchers, paying their full local expenses and a contribution towards their travel expenses. In fact over 40 participants took part. Extra funding was obtained from the Royal Statistical Society for 6 PhD

students, and the remainder were self-funded. A wide range of interests was represented, including users of models from many application areas.

The workshop was felt to be highly successful by those participating, and there was considerable interest in developing further activities. A final discussion considered various options, and several of these have been taken forward.

- An application has been made to the EPSRC for funding of a research network in the area, with the specific purpose of developing links with model users.
- A special session on SACCO is to be organised at the SAMO (Sensitivity Analysis of Model Outputs) 2001 meeting. (SAMO is concerned specifically with sensitivity analysis, and has been in existence for several years).
- Several participants at the workshop were invited to take part in a summer programme at the Los Alamos Laboratory, New Mexico.
- An email discussion group has been set up.

Following a recent enquiry to the participants, we obtained replies from 16 of those who attended. They reported the following additional direct results of the workshop.

- At least seven papers had been submitted to journals or were in an advanced state of preparation. One of these was entirely a result of the workshop and the others were influenced by, and benefited from, the interaction at the workshop.
- Grant applications had been made (in addition to the EPSRC application listed above) to the Tyndall Centre for Climate Change Research (UK) and to NASA and NIH (USA), to pursue research ideas that arose directly from the workshop.
- The research of a PhD student of one of the senior participants benefited from the supervisor's attendance. Another reported having attracted a PhD student to begin a project that had been inspired by the workshop.
- Several new collaborations had been formed as a result of the workshop.
- The research area of this workshop was well represented at a Town Meeting to discuss the proposed joint initiative of EPSRC and NERC on "Environmental Mathematics and Statistics". The whole area of quantifying uncertainty in large-scale environmental models is likely to form a significant part of this initiative if it goes ahead.

We believe that this level of influence and new activity within three months following the workshop indicates that it was extremely successful.