

# ENVIRONMENTAL MATHEMATICS AND STATISTICS (EMS)

## A NERC/EPSRC capacity-building programme

### Science & Implementation Plan

#### Overview

The fundamental objective of the Environmental Mathematics and Statistics (EMS) programme is to increase the impact of mathematical and statistical methods in environmental science. This will require:

- more effective deployment of current mathematical and statistical methods in the solution of real environmental problems,
- development of new mathematical, statistical and computational methods aimed at classes of environmental problems that are intractable with current methodologies.

Neither of these developments is possible in the absence of significant enhancements in the quantity and quality of collaborations between the mathematical/statistical and life-science/environmental communities.

Although successful collaboration depends on many factors, a necessary pre-requisite is effective communication between participants from different disciplinary backgrounds. While sufficient appreciation of another's discipline can be acquired from a distance, it is more likely to be obtained by a period of immersion.

The programme is funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Natural Environment Research Council (NERC) with a budget of £2.75 million to be allocated over three years. A **Steering Committee** will provide advice to the Research Councils. The Steering Committee believes that the best strategy is to give funding priority to activities that will increase the proportion of both communities possessing sufficient expertise in the other discipline to make long-term cross-disciplinary collaboration viable. It considers this capacity-building use of the funding more likely to achieve the programme's aims than funding a handful of major technical or methodological developments, and so the programme will not offer research grants.

As a consequence of this strategy, there will be **three main funding modes**:

**Discipline-hopping awards** – providing salary replacement and ancillary costs for established researchers spending periods of between 3 and 12 months in close collaboration with an active research group in the adjunct discipline (e.g. a mathematician working with a group engaged in environmental issues or an experimental ecologist working with a theoretical group).

**Postdoctoral research fellowship awards** – enabling postdoctoral researchers with one discipline background to carry out a prolonged period of research in the adjunct discipline.

**Research studentships** – enabling graduates from any appropriate background to receive training in an existing multi-disciplinary team addressing environmental

problems. These will be expected to carry a significant training element in both disciplines.

**Workshops and short-term training** - A further tranche of funding will support workshops and short-term (1-2 weeks) training activities in specific skills. The workshops will be designed to bring together established researchers in cognate study areas and hence catalyse the formation of multi-disciplinary project teams. Short-term training will focus on broadening workers' training and on disseminating new methodologies in environmental mathematics and statistics. The course materials will be primarily designed to enable workers with roots in the environmental/life-science disciplines to acquire basic mathematical/statistical skills.

### **Programme Deliverables**

The programme aims to build capacity in, and better communication and links between, the mathematics/statistics and life/environmental science communities. It will result in increased numbers of:

- Scientists with primary training in the life or environmental sciences who have sufficient knowledge of mathematical, statistical and modelling techniques to use them in addressing environmental problems
- Mathematicians and statisticians who have sufficient familiarity with the practicalities of environmental investigation to pursue effective collaborative work in environmental science
- Environmental scientists with sufficient understanding of the power (and limitations) of mathematical and statistical approaches to facilitate effective collaboration with mathematicians and statisticians in applying leading-edge methodologies to environmental problems and in devising new approaches to currently insoluble classes of problem
- Individuals with primary training in mathematical sciences who are engaged in the solution of life science or environmental problems or in devising tools and methodologies for the solution of such problems.

### **Funding modes**

**Discipline-hopping awards** are intended to enable scientists in established academic positions (not postdoctoral researchers) to spend periods of between 3 and 12 months in close collaboration with an active research group working in the adjunct discipline. The awards will meet a combination of salary replacement and ancillary costs up to £50k. Applicants will be expected to demonstrate both the scientific excellence of the proposed research and the skills transfer that will accompany it. The Steering Committee believes that skills transfer is best facilitated by physical proximity, and welcomes proposals for this arrangement, for example by including the costs for a period of residence in the institution where the skills transfer and collaboration will take place. There will be two calls for proposals for discipline-hopping awards under EMS, one in January 2002 and the second in early 2003.

**Postdoctoral research fellowships** are intended to allow:

- Postdoctoral scientists with a mathematical or statistical background to carry out a prolonged period of research in an environmentally focused research group,

**OR**

- Post-doctoral scientists with a life science/environmental science background to carry out a prolonged period of environmentally related research using cutting-edge mathematical or statistical techniques.

In addition to the normal tests of scientific excellence, proposals will be expected to demonstrate a significant interdisciplinary skills transfer element. Such transfers may occur as a result of the nature of the group in which the scientist will work or may be the result of appropriate training or coursework. There will be two calls for postdoctoral research fellowships, one in 2002 and the other in 2003. The closing dates for receipt of fellowship applications will be the same as for the NERC fellowship scheme ie 15 November.

**Studentships** funded under the EMS programme will have a strong cross-disciplinary training element. All studentship applications must demonstrate the following clearly:

- (i) training in both the environmental sciences and mathematics/statistics, including attendance at any necessary taught modules;
- (ii) that the student will work in a strong multidisciplinary research environment;
- (iii) effective joint supervision in both disciplines;
- (iv) the research areas and supervisory track records of both supervisors; and the type of student expected ie. a mathematician/statistician or an environmental scientist.

Where it can be established that training needs are particularly extensive the Steering Committee will consider proposals for a 1+3 year funding package in order to provide up to one year of Masters' course training before embarking on a PhD programme. Extended PhD studentships will not be provided. The Masters' course selected must have been approved by the Research Councils.

In order to attract students of the highest calibre, the stipend for EMS studentships will be subject to a £4k per year enhancement about the NERC base rate. There will be two calls for studentship proposals, one in January 2002 for students starting in academic year 2002/3 and a second in early 2003 for students starting in academic year 2003/4.

**Workshops and short-term training.** It is intended that support of the following will fulfill the **training and community development** part of the Programme:

- Community-building workshops focussed on specific research areas.
- Short-term training designed to increase uptake of specific methodologies.

It is intended that there will be calls for proposals for workshops and training courses within the programme. A Working Group consisting of some Steering Committee members and Research Council representative(s) will draw up a plan for support of workshops and training courses.

## **Data Management**

It is NERC policy that research programmes ensure the long-term availability of data collected by award holders, to maximise the application and exploitation of their results. In most cases, NERC Designated Data Centres are used, both for quality-control and archiving, with costs covered from central programme funds. After a period of sole access by PIs for publication preparation, such data are made available to other programme participants and the wider community. Award holders are strongly encouraged by the EMS Steering Committee to make all methodological developments available as public domain software.

## **Ownership and exploitation of Intellectual Property (IP)**

Ownership of IP and IP Rights arising from NERC awards lies with the grant holding body (university, NERC Centre/Survey or other NERC-approved institution). Whilst all recipients of NERC funding must endeavour to ensure that the outcomes of their research are used to the advantage of the UK, NERC retains the right, for a limited period, to exploit IP in partnership with grant recipient organisations to the benefit of the UK and the organisations. This is to avoid circumstances where fragmentation of IP would reduce the likelihood of exploitation (eg for datasets collected by several research groups).

## **Programme Responsibilities**

The EMS Steering Committee is responsible to NERC and EPSRC for directing and integrating the Programme science, for recommending applications to be funded, and for promoting the transfer of outcomes to the user community. **It is chaired by Professor W Gurney**, Department of Statistics and Modelling Science, University of Strathclyde, Glasgow G1 1XT. Tel: 0141-548-3385. Fax: 0141-552-5079. Email: bill@stams.strath.ac.uk. Programme administration and co-ordination is the responsibility of the **Programme Co-ordinator, Dr Lisa Hole**, Science Programmes, NERC Polaris House, North Star Avenue, Swindon SN2 1EU. Tel: 01793-411506. Fax: 01793-411502. Email: l.hole@nerc.ac.uk.