

**MSc in Mathematical and Numerical Modelling of the Atmosphere and Oceans  
For students entering in 2012/3**

Awarding Institution:	University of Reading
Teaching Institution:	University of Reading
Relevant QAA subject Benchmarking group(s):	
Faculty:	Science Faculty
Programme length:	1 years
Date of specification:	24/Aug/2012
Programme Director:	Dr Peter Sweby
Programme Advisor:	
Board of Studies:	School of MPS PG taught programmes
Accreditation:	

**Summary of programme aims**

Both the MSc and PG Diploma courses aim to:

- Provide a foundation in the theory and techniques of mathematical and numerical modelling for atmosphere and ocean systems;
- Provide practical experience in the application and analysis of computational simulation processes used in the environmental sciences;
- Introduce students to a range of topics and technical skills in the chosen area, leading to a variety of potential applications and career opportunities;
- Inculcate an insight into current practice in the chosen area, particularly techniques relevant to professional practice;
- Enhance students' communication skills;
- Provide an appreciation of the link between theory and application in the chosen area of study.

The MSc Mathematical and Numerical Modelling of the Atmosphere and Oceans covers a wide variety of mathematical and meteorological topics and technical skills, with a variety of potential applications and career opportunities. The general aim of the programme is to convert new graduates from first degree courses containing a significant amount of mathematics into postgraduates possessing a deeper insight into the modelling of environmental problems, together with practical competence in the application and analysis of numerical techniques.

**Transferable skills**

The programme will provide a range of transferable skills, including generic training in IT (operating systems, programming, computer graphics and word-processing) and in Communication and Research Skills (including good practise and experience in written and oral presentations and in literature searches).

**Programme content**

*Compulsory modules:*

<i>Code</i>	<i>Module title</i>	<i>Credits</i>	<i>Level</i>
<i>Autumn Term:</i>			
MAMI0	Elements of Numerical and Functional Analysis ( <i>introductory module</i> )	0	7
MAMNSO	Numerical Solution of Ordinary Differential Equations	10	7
MAMA3	Theory of Differential Equations	10	7
MTMG01	Introduction to Weather Systems	10	7
MTMW99	Fluid Dynamics of the Atmosphere and Oceans	10	7
MTMG02	Atmospheric Physics	10	7
MAMA5*	Computing Techniques and Projects	20	7
MTMG04*	Weather and Climate Discussion	0	7
<i>Spring Term:</i>			
MAMNSP	Numerical Solution of Partial Differential Equations	10	7
MAMB5*	Communication and Research Skills	10	7
MTMW14	Numerical Modelling of the Atmosphere and Oceans	10	7
MAMB6	Industrial Modelling	0	7

*Summer Term:*

MTMG48	Forecasting Course	0	7
<i>Either:</i>			
MAMC4	Dissertation (for MSc)	60	7
<i>Or:</i>			
MAMC5	Extended Essay (for PG Diploma)	20	7

\*Denotes a module which continues into the following Term(s).

*Optional modules:*

*Autumn Term:*

MAMA10*	Reading Course	10	7
MAMA13	Asymptotic Methods	10	7
MAMA14	Applied Stochastic Processes	10	7
MAMB10	Theory and Techniques of Data Assimilation	10	7
MAMANS1	Advanced Numerical Solution of Ordinary Differential Equations	10	7

*Spring Term:*

MAMB3	Finite Element Methods	10	7
MAMB4	Numerical Techniques for Conservation Laws	10	7
MAMB8	Integral Equations	10	7
MTMW15	Extra-Tropical Weather Systems	10	7
MTMG16	Climate Change	10	7
MTMG21	Oceanography	10	7
MTMG19	Tropical Weather Systems	10	7
MTMW20	Global Circulation of the Atmosphere and Oceans	10	7
MTMG44	Hydrology and Global Change	10	7
MTMG38	Remote Sensing	10	7

*Summer Term:*

MAMC6	Modelling Week	10	7
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\*Denotes a module which continues into the following Term(s).

**Part-time or modular arrangements**

**Progression requirements**

**MSc**

Autumn and Spring Terms: In addition to the compulsory modules, students must choose a total of TWO modules from the list of options, at least ONE of which must be from Meteorology (for the purposes of this condition, MAMB10 Theory and Techniques of Data Assimilation may be regarded as a Meteorology option).

Remainder of the course: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module in the Summer Term and students must complete a dissertation (60 credits) by the fourth week of August.

**Postgraduate Diploma**

There are two possible routes to the PG Diploma:

**EITHER:**

Autumn and Spring Terms: In addition to the modules listed as compulsory, students must choose a total of TWO modules from a list of options (each worth 10 credits), at least ONE of which must be from Meteorology (for the purposes of this condition, MAMB10 Theory and Techniques of Data Assimilation may be regarded as a Meteorology option).

Summer Term: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module.

**OR:**

Autumn and Spring Terms: Students only take the compulsory modules in the Autumn and Spring Terms.

Summer Term: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module. In addition, students complete an extended essay (worth 20 credits) by the end of June.

Both the MSc and PG Diploma contain some non-assessed elements. These include introductory material and attendance at the weekly seminar series.

### **Summary of Teaching and Assessment**

The programme consists of two terms taught courses, with an additional non-assessed course and the literature seminar in the first four weeks of the third term. Teaching is by lectures, supplemented by guided reading and, where appropriate, practical computations. Assessment is by a mixture of open-note examination, closed book examination, coursework and presentation. Where assessment is by examination this takes place in the vacation following the term in which the module is delivered for core modules and for options during the Easter vacation. All assessed modules contribute to the final mark.

The University's taught postgraduate marks classification is as follows:

#### **Mark Interpretation**

70 - 100% Distinction

60 - 69% Merit

50 - 59% Good standard (Pass)

#### **Failing categories:**

40 - 49% Work below threshold standard

0 - 39% Unsatisfactory Work

#### **For Masters Degrees**

To pass the MSc students must gain an average mark of 50 or more overall including a mark of 50 or more for the dissertation and a mark of 40 or more in MAMA5. In addition, the total credit value of all modules marked below 40 must not exceed 30 credits and for all modules marked below 50 must not exceed 55 credits.

Students who gain an average mark of 70 or more overall including a mark of 60 or more for the dissertation and have no mark below 40 will be eligible for a Distinction. Those gaining an average mark of 60 or more overall including a mark of 50 or more for the dissertation and have no mark below 40 will be eligible for a Merit.

#### **For PG Diplomas**

To pass the Postgraduate Diploma students must gain an average mark of 50 or more and a mark of 40 or more in MAMA5. In addition, the total credit value of all modules marked below 40 must not exceed 30 credits and for all modules marked below 50 must not exceed 55 credits.

Students who gain an average mark of 70 or more and have no mark below 40 will be eligible for the award of a Distinction. Those gaining an average mark of 60 or more and have no mark below 40 will be eligible for a Merit.

#### **Admission requirements**

Prior knowledge of meteorology is not necessary. A 1st or 2nd class degree in mathematics or a closely related subject joint with mathematics, or in the physical or environmental sciences with a strong mathematical content is required. Students with other qualifications may be admitted subject to a satisfactory performance in a preparatory (ad hoc) course in the preceding year.

**Admissions Tutor:** Dr P.K. Sweby

#### **Support for students and their learning**

University support for students and their learning falls into two categories. Learning support is provided by a wide array of services across the University, including: the University Library, the Student Employment, Experience and Careers Centre (SEEC), In-sessional English Support Programme, the Study Advice and

Mathematics Support Centre teams, IT Services and the Student Access to Independent Learning (S@il) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme. Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and advisers in the Student Services Centre. The Student Services Centre is housed in the Carrington Building and offers advice on accommodation, careers, disability, finance, and wellbeing. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions and runs workshops and seminars on a range of topics. For more information see [www.reading.ac.uk/student](http://www.reading.ac.uk/student)

### **Career prospects**

The majority of graduates from the course will pursue careers in the mathematical and environmental sciences. The course will provide the skills and knowledge base for a wide range of careers including:

- Research and forecasting posts in national meteorological services (including The Met. Office)
- Research work and technical posts in universities
- Research and technical posts in other environmental science institutes (such as the Institute of Hydrology and Hydraulics Research Wallingford)
- Research posts in environmental science consultancy firms
- Forecasting and analysis in meteorological consultancies

### **Opportunities for study abroad or for placements**

Not applicable

### **Programme Outcomes**

#### **Knowledge and Understanding**

##### **A. Knowledge and understanding of:**

1. basic theory of differential equations, including well-posedness;
2. Classical finite difference schemes for numerical solution of initial and boundary value problems;
3. aspects of computational grids and their generation;
4. types of problems encountered in industry and techniques for their solution;
5. the C++ and FORTRAN 90 programming languages.
6. the physical processes which drive the atmospheric system giving rise to weather and climate;
7. the feedback between the earth's surface and the atmosphere and the impact of these feedback processes on weather and climate.

##### **Teaching/learning methods and strategies**

- The knowledge is delineated through formal lectures supported by guided reading and problem sheets. Model solutions are provided and feedback given.
- Feedback on the programming is given initially via non-assessed programming exercises, and later assessed projects.
- The industrial expertise is delivered in a series of lectures by outside industrial speakers. (MAMB6).

##### *Assessment*

Understanding is tested through open note examinations and course work.

#### **Skills and other attributes**

##### **B. Intellectual skills - able to:**

1. apply knowledge and understanding gained to a variety of familiar and unfamiliar situations;
2. critically analyse numerical results;
3. show independence and initiative in approaches to problem solving;
4. present material clearly to expert and non-expert audiences in written and oral forms;
5. critically review, synthesise and evaluate

##### **Teaching/learning methods and strategies**

1,2 and 3 are developed by a combination of problem sheets, worked examples, coursework assignments, computing project work and dissertation.  
4 and 5 are addressed by lectures, practice presentations and the literature seminar in the Communication and Research Skills module, and also by the dissertation.

- published research;
6. conduct independent study of a chosen topic and report on the results.

6 is covered by the dissertation.

*Assessment*

1, 2 and 3 (in part) are assessed by coursework and examination. 4 and 5 are mainly assessed through the literature seminar and dissertation. 3 and 6 are assessed by the dissertation.

**C. Practical skills - able to:**

1. program a computer in a structured and effective way;
2. analyse numerical methods and respond to the issues of accuracy, stability and convergence;
3. plan, conduct and report on investigations;
4. reference work in an appropriate manner.

**Teaching/learning methods and strategies**

1 is achieved via the Computing Techniques and Projects module. Most mathematics modules enhance skill 2. 3 and 4 are addressed through guidance on the project/ dissertation work.

*Assessment*

1 and 2 are tested by computing projects and examinations. 3 and 4 are assessed by the project /dissertation.

**D. Transferable skills - able to:**

1. communication: the ability to communicate knowledge effectively through written and oral presentations;
2. computation and IT: use of the computer to solve numerical problems and to analyse and present results using standard and mathematical software;
3. self management and professional development: study skills, independent learning, time management;
4. library skills: effective use of library resources.

**Teaching/learning methods and strategies**

Skills 1 and 2 are developed throughout most of the programme, but especially in the Computing Techniques and Projects and Communication and Research Skills modules. 3 is encourage throughout the programme. 4 is covered by the Communication and Research Skills module and the dissertation.

*Assessment*

1 and 2 are assessed through coursework, examinations, literature seminar and dissertation. 3 is indirectly assessed throughout the programme by its influence on performance. 4 is indirectly assessed in the dissertation.

**Please note - This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance process or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.**