

Rapid Climate Change (RAPID) Implementation Plan

(updated 10/02/05)

Introduction

Rapid Climate Change (RAPID) is a UK NERC (Natural Environment Research Council) directed programme designed **to improve our ability to quantify the probability and magnitude of future rapid climate change**. The programme aims to investigate and understand the causes of rapid climate change, with a main (but not exclusive) focus on the role of the Atlantic Ocean's thermohaline circulation (THC). The scientific objectives of the RAPID programme are described in full in the RAPID Science Plan, which constitutes the principal planning document for the programme (see <http://www.soc.soton.ac.uk/rapid/Scienceplan.php>). Within the Science Plan, the areas of research that RAPID will fund have been defined. The Science Plan also defines the additional aims of building the RAPID community in the UK, of establishing links with the UK user community and relevant international programs, and of providing training for the next generation of UK climate scientists.

This Implementation Plan aims to define the strategy by which the objectives of the Science Plan will be achieved. It also provides a timetable for activities within the RAPID programme. **Note that this is a “living document” and should be consulted regularly, as it will be updated periodically.**

The principal method for achieving the scientific aims of the RAPID programme will be by means of funding proposals submitted in response to announcement of opportunity (AO) calls. Inter-disciplinary collaboration between RAPID scientists will be encouraged through funding and through a series of science workshops and annual meetings. The programme also has a science co-ordination team, which will act as a focus for the RAPID community by facilitating communication and promoting national and international collaboration.

The exploitation of the results of the programme will be realised through the programme's plans for Knowledge Transfer. This will include the appointment of a Knowledge Transfer facilitator who will work as part of the programme's science co-ordination team to bridge the gap between the research and user/stakeholder communities (see details below). Dissemination of data within the programme and to the wider community is described in the RAPID data management plan (see <http://www.soc.soton.ac.uk/rapid/Dataplan.php>) and subject to the RAPID data policy (see details below). The primary aim of the RAPID data policy is to enable access to RAPID data and maximise the exploitation of the results.

Building a RAPID community in the UK

The programme aims to bring together the RAPID research community in the UK. Inter-disciplinary research will be encouraged to promote collaboration between the scientific areas

relevant to rapid climate change (e.g. palaeo-climate, general ocean circulation modelling, THC monitoring).

Annual scientific meetings (in which representatives of all funded projects are required to participate) will be organised to provide a platform for scientific discussion and exchanges, and to help develop the RAPID community in the UK through the participation of PIs, post-doctoral researchers and students. These regular meetings will provide the opportunity for the international context of RAPID research to be presented, in particular through contributions by invited speakers from other international research programmes. In addition, science workshops will be held to stimulate research on specific topics relevant to the scientific objectives of the RAPID programme (e.g. integration of palaeo-data and climate models, meridional overturning circulation (MOC) / THC monitoring methodology).

The science co-ordination team will work within the RAPID programme to promote awareness of the aims and the achievements of the programme. The Science Co-ordinator will establish liaison with and between award holders in the programme and assist in building the RAPID community. He will facilitate collaboration, develop opportunities for co-funding and partnerships (including with international partners) and promote the exploitation and communication of the programme results. A dedicated web site (<http://rapid.nerc.ac.uk> or <http://www.soc.soton.ac.uk/rapid/>) has been set up to present up-to-date information on activities within RAPID, and to communicate the aims and work of the RAPID programme to the wider community. The web site will also act as a source of information to assist the formation of new links between the RAPID community, the UK user community and the international climate research community.

Funding for science

The aims of the programme will be achieved through a number grants rounds (announcements of opportunity - AOs) designed to address specific science objectives of the RAPID programme. Each AO may involve a preliminary outline bid stage, prior to entering into full assessment of applications for funding. The schedule for the AO calls is presented in the Timetable below. Four AOs have been issued so far: the first and second “Science” AOs (see <http://www.soc.soton.ac.uk/rapid/finalaogeneral.php> for the first AO and <http://www.soc.soton.ac.uk/rapid/SecondAO.php> for the second AO), an additional AO targeting the MOC monitoring system (see <http://www.soc.soton.ac.uk/rapid/mocao.php>), and a Joint International AO issued with the Netherlands Organisation for Scientific Research and the Research Council of Norway (see <http://www.soc.soton.ac.uk/rapid/JointAO.php> and below).

The funding made available for the first Science AO by the Steering Committee was ~£6-7M, and for the MOC AO was ~£5M. The funding available for the second AO was ~£3M, while that for the joint AO was €1.5M (UK contribution).

In order to break down some of the disciplinary boundaries, proposals that involve researchers from a variety of disciplines will be particularly welcomed through the AO process. Specific

cross-disciplinary topics for which proposals will be welcomed include: palaeo observations and modelling, present day observations and modelling, and present day and palaeo observations.

Timetable for AOs and meetings

<i>18 Dec 2001</i>	<i>Steering Committee (SC) meets to discuss first AO</i>
<i>17 Jan 2002</i>	<i>first science AO and monitoring system AO issued</i>
<i>1 Feb 2002</i>	<i>Town Meeting</i>
<i>28 Mar 2002</i>	<i>closing date for outline bids</i>
<i>30 Apr 2002</i>	<i>SC meets to assess outline bids</i>
<i>early / mid May 2002</i>	<i>feedback to applicants</i>
<i>15 Jul 2002</i>	<i>closing date for full bids</i>
<i>25-26 Nov 2002</i>	<i>assessment meeting (SC + co-opted PRC members)</i>
<i>Dec 2002</i>	<i>feedback to applicants</i>
<i>21-22 Jan 2003</i>	<i>RAPID KO meeting</i>
<i>early 2003</i>	<i>issue of award letter / first round projects begin</i>
<i>2 June 2003</i>	<i>SC meeting</i>
<i>16 Oct 2003</i>	<i>second "Science AO and joint AO with the Research Council of Norway (NRC) and the Netherlands Organisation for Scientific Research (NWO)</i>
<i>15 Dec 2003</i>	<i>closing date for outline bids</i>
<i>11-12 Feb 2004</i>	<i>SC meets to assess outline bids for 2nd "Science" AO, and international group of experts meets to assess Joint International AO outline bids</i>
<i>late Feb- early March 2004</i>	<i>feedback to applicants</i>
<i>17 May 2004</i>	<i>closing date for full bids to RAPID 2nd "Science" AO</i>
<i>1st June 2004</i>	<i>Closing date for full bids to Joint International AO</i>
<i>6-8 Sept 2004</i>	<i>First RAPID annual meeting, Nottingham University</i>
<i>27-28 Sept 2004</i>	<i>SC meets to assess full bids for 2nd "Science" AO</i>
<i>12 Oct 2004</i>	<i>International group of experts meets to assess full bids for Joint International AO</i>
<i>Oct-Nov 2004</i>	<i>Feedback to applicants of 2nd "Science" AO</i>

<i>Jan 2005</i>	<i>Feedback to applicants of Joint International AO</i>
<i>28 June 2005</i>	<i>RAPID science workshops, Swansea University</i>
<i>29 June–1st July 2005</i>	<i>Second RAPID annual meeting, Swansea University</i>

A Town Meeting was organised early on in the programme to present the objectives of RAPID and initiate a dialogue with and within the UK science community. The meeting took place shortly after the first AO had been issued (see Timetable above). The meeting was aimed at helping the UK science community to identify common interests and forge links with potential partners from different disciplines.

Information is available on the RAPID web site about the projects funded through the MOC monitoring AO (<http://www.soc.soton.ac.uk/rapid/mocr1awards.php>), the 1st “Science” AO (<http://www.soc.soton.ac.uk/rapid/r1awards.php>), the 2nd “Science” AO (<http://www.soc.soton.ac.uk/rapid/AO2FBsuccess.php>) and the Joint International AO (<http://www.soc.soton.ac.uk/rapid/Jointposit.php>). The programme includes provision for the training of researchers, to help address the current shortage of scientists with the necessary breadth of knowledge required in the field of climate change research. Funding of research students will be possible in the form of tied studentships only. Stand-alone studentships and NERC fellowships will not be funded under this programme.

Small Business Research Initiative (SBRI)

A proportion of RAPID funding (£500K) has been made available for Small and Medium Sized Enterprises (SMEs) as part of NERC’s Small Business Research Initiative (SBRI). The SBRI aims to stimulate innovation in the economy by encouraging more high-tech small firms to start up or to develop new research capacities. Four projects have now been funded under SBRI (see <http://www.soc.soton.ac.uk/rapid/SBRI.php>) and the funds available for SBRI have now been fully allocated. Therefore no further SBRI funding will be available under RAPID.

MOC monitoring system

The RAPID programme aims to develop and implement a prototype pre-operational system to observe the North Atlantic Meridional Overturning Circulation (MOC) strength and structure. The system includes elements of both observations and modelling.

As a minimum requirement the system will be able to monitor the strength and structure of the Atlantic MOC on time scales from months to decades, and collect about 3-4 years of continuous data during the 6-year course of the programme. The system will also provide some estimate of the heat and freshwater transports associated with the MOC (the full system requirements are given in the AO). As a long-term aim will be to ascribe cause to any changes that occur in the MOC, the system will take account of processes, such as ocean-atmosphere interactions, likely to cause such changes. Additionally, given the broad geographic spread of potential upstream

influences on the MOC (ranging from the Canadian Arctic Archipelago to the Nordic Seas and Fram Strait), collaboration with other international observing efforts is essential to cover the full range of mechanisms believed to control or modulate the MOC (see also below “Links to the Norwegian Ocean Climate project,” “Links to NWO and NRC,” “Links to NSF” and “Involving the wider community”).

The precise scientific methodology to be adopted for monitoring the MOC has been determined through a dedicated Announcement of Opportunity (AO). This ensured that a range of approaches was considered and evaluated through peer-review to ensure scientific excellence. Note will be taken of the WMO approved principles for climate monitoring, as appropriate (see annex). By the end of the programme, a design for a cost-effective operational version of the monitoring system, and any technological and other developments necessary to its implementation, will have been produced. The long-term objectives of this system would be to detect and attribute changes in the MOC on a decadal time-scale, and to aid prediction of future MOC changes, including early warning of rapid climate change. The Hadley Centre has provided some advice, based on their ocean modelling capability, to those submitting a bid (for details see <http://www.soc.soton.ac.uk/rapid/modellingsupportmoc.php>). The Steering Committee allocated ~ 25% of the programme budget for the development and implementation of the monitoring system. More details of the funded MOC monitoring projects can be found at <http://www.soc.soton.ac.uk/rapid/mocr1awards.php>.

Requirement for ship time, services and facilities

NERC offers a range of services and facilities that are accessible free of charge to eligible researchers through research grants and training awards. Special requirements for ice-capable ships are anticipated in support for physical process studies at higher latitudes. The Steering Committee has decided that, for logistic and cost reasons, it will only support the deployment of NERC ships in the N. Atlantic. Information on the RAPID cruise programme is available through the RAPID data centre catalogue at <http://www.bodc.ac.uk/projects/rapid/> (see more details below).

Other facilities directly relevant to the scope of the RAPID programme include: the analytical laboratories facilities for ¹⁴C AMS dating analysis at the Radiocarbon Laboratory (RCL); the UK national deep sea core repository at the British Ocean Sediment Core Repository (BOSCOR); the NERC Isotope Geosciences Laboratory (NIGL) and the computing infrastructure at the High Performance Computing (HPC) Facilities. Estimates of the HPC needs to support the modelling activities required to deliver RAPID science showed that it would not be possible to accommodate them from the existing NERC provision. Therefore the RAPID programme includes a specific provision for HPC resources.

Core team

At the present time the Steering Committee does not envisage a need for a core team activity in RAPID. This may be re-considered by the Committee as the programme develops.

Links to the Norwegian Ocean Climate project

The RAPID programme aims to develop links with the Norwegian Ocean Climate project (NOCLim; see <http://www.noclim.org/>). Therefore, as part of the AO process, the Steering Committee welcomes bids that plan to develop such links.

To enable this process, a limited amount of travel funding was made available (independently of the science AO) for a small number of UK scientists to attend the NOCLim meeting in May 2002. Allocation of the travel funds was made on the basis of short science cases to the Science Co-ordinator (see <http://www.soc.soton.ac.uk/rapid/UKNorwayTravelGrants.php>), demonstrating the relevance of the potential collaboration for the RAPID objectives and its expected scientific gains.

Links to NWO (Netherlands) and NRC (Norway)

Links have been developed with the Netherlands Organisation for Scientific Research (NWO) and the Research Council of Norway (NRC). These resulted in a joint AO for proposals involving researchers in the Netherlands, Norway and the UK, with a total of €4M of funding being made available (see <http://www.soc.soton.ac.uk/rapid/JointAO.php>). The aim of the Joint programme is to build on the substantial ongoing investments made by all three research councils on the science of rapid climate change, in pursuit of objectives that will benefit from a cross-national effort. A dedicated web-based portal was set up (<http://www.soc.soton.ac.uk/rapid/Jointcall.php>) to provide information on rapid climate change activities in each country and to encourage cross-national collaborations by establishing a voluntary database for potential bidders. The Joint International call consisted of two-stage process, which attracted thirty-five proposals at the outline bid stage. Scientific feedback was provided to successful applicants to guide them in the preparation of the full bids. Joint evaluation of the outline and full bids was undertaken by a group of international experts, which included members of the RAPID Steering Committee (see Timetable above).

Links to NSF (USA)

In developing ideas for the MOC monitoring system, collaboration has been established with the National Science Foundation (NSF) in the USA. As a result of this a joint review of proposals was undertaken and in addition to the RAPID funded MOC studies, the NSF is funding a number of complementary studies. For details of the NSF funded proposals see <http://www.soc.soton.ac.uk/rapid/kickoffmeeting2003.php>.

Involving the wider community

One important aspect of the programme is to establish links between the RAPID community in the UK and international ventures in climate variability research (e.g. the international ASOF (Arctic Subarctic Ocean Flux array) and CLIVAR programmes, and related programmes in other EU countries). This aspect will be facilitated by the Science Co-ordinator, who will also help develop links and promote new partnerships between the RAPID community and the UK

user community (e.g. Hadley Centre, DEFRA, Tyndall Centre). As the full observing effort necessary to monitor the causes of change in the THC / MOC is too large for any single national effort to achieve, it will be important and necessary to devote a greater-than-normal effort to international collaboration. In developing the international links the Science Co-ordinator will work together with a small International Links sub-group appointed by the Steering Committee (see below).

The RAPID programme has the potential to pursue pan-European and broader collaboration through the new European Union Framework 6 Programme mechanism of Integrated Projects. The recently signed EC/US agreement - "European Commission-National Science Foundation (USA) Implementing Arrangement for Co-operative Activities, in the areas of climate research, marine science and technology, seismic risk and hazards reduction, Arctic research and environmental biology" - provides the opportunity for a broader collaboration with the USA. The science co-ordination team will investigate how these opportunities may be exploited, with the aim of complementing and extending the work being carried out in the UK.

As part of the broadening of the RAPID activities, links were established with a group of observational oceanographers and modellers across Europe, resulting in the submission of an Expression of Interest to the FP6 call in June 2003. For details of the proposed Integrated Project WATCHER (Will the Atlantic Thermohaline Circulation Halt, is Europe at Risk?) see <http://www.soc.soton.ac.uk/rapid/watcher.php>. Due to the changing requirements of the Commission with regard to FP6 Integrated Projects, the full proposal – in response to the call in July 2003 – differed from the Expression of Interest. In response to that call a first stage WATCHER proposal was submitted to the EU in October 2003, led by Prof. Jochem Marotzke (MPI, Germany). This was evaluated positively and the IP consortium invited to submit a second stage proposal in February 2004. Unfortunately, the WATCHER proposal was unsuccessful at the second stage.

Data management

Data collected within the RAPID programme will comply with NERC's policy on data management. The main objective of this policy is to ensure that the data will contribute to a key NERC resource, which will continue to be exploited both scientifically and commercially long after the formal end of the programme. The management of the data collected within the RAPID programme will be the responsibility of the relevant NERC designated data centres (e.g. BADC, BODC), and funds have been made available from the RAPID budget to support this activity. In the absence of a NERC designated data centre for palaeo data, special provision will be made for such data acquired within the programme (while ensuring appropriate links to international projects, such as HOLIVAR). To ensure proper data management the Science Coordinator will work together with a small data sub-group appointed by the Steering Committee (see below).

On the recommendation of the data subgroup, BODC and BADC were commissioned to carry out a data management study (completed in the autumn of 2003). The resulting data

management plan was approved by the Steering Committee at its February 2004 meeting. A dedicated RAPID data centre web site has been set up under <http://www.bodc.ac.uk/projects/rapid/> to provide access to the RAPID data inventory and RAPID cruise programme, as well as to an online facility to access relevant software and model output (<http://badc.nerc.ac.uk/data/rapid/>).

The data subgroup proposed the following data policy for the RAPID programme, which has been ratified by the full Steering Committee and will apply to all projects funded through RAPID:

RAPID Data policy

- a) data should be lodged with the appropriate data centre on acquisition*, together with such metadata as are defined under the RAPID data management plan.
- b) data would be embargoed for 1 year from acquisition, allowing the PI and co-workers to exploit it in the first instance. The metadata would not be embargoed, to allow the wider community to be aware of work being carried out under RAPID and facilitate community building.
- c) data would be made available to the RAPID community after 1 year, and to everyone after 2 years.
- d) anyone making use of RAPID data within 3 years of it being lodged at the data centre would be required to include the PI and/or co-workers (as appropriate) as co-author/s on any resulting papers.
- e) PIs and/or co-workers failing to comply with the RAPID data policy would be subject to appropriate sanctions.

[n.b. Data includes palaeo data, present-day observations, model output, data syntheses, data-model syntheses.]

* On acquisition: the time-scale may vary between data types (for example, real-time data could go directly to a data centre) but the overall aim is to keep the time-scale as short as possible and certainly less than 6 months. This is to ensure that data acquired during RAPID are available to the RAPID community within the lifetime of the programme.

Integrating modelling activities

In order to integrate and strengthen the modelling activities within RAPID, and to be better able to meet the objectives in the Science Plan, the Steering Committee has appointed a modelling sub-group (see below) to work with the Science Coordinator on this aspect of the programme. The Steering Committee has set aside up to £0.5M of the RAPID budget for this activity. The sub-group made recommendations to the Steering Committee in June 2003, about a RAPID climate change model inter-comparison experiment (see

<http://www.soc.soton.ac.uk/rapid/Modexp.php>), along the lines of second international Coupled Model Inter-Comparison Project CMIP-2 (http://www-pcmdi.llnl.gov/cmip/coord_expt.html).

The RAPID Steering Committee decided at the September 2004 meeting to fund a UK coupled model inter-comparison project which will be led by Jonathan Gregory (University of Reading /Hadley Centre). The first step in the project will be to hold a one-day workshop on 28th June 2004 in Swansea University, immediately before to the 2nd RAPID annual meeting (29 June-1st July). The aims of the coupled model inter-comparison workshop is to discuss the scientific objectives of the project with the wider UK modelling community, to decide on the set of experiments and to discuss the resources required for relevant modelling groups to participate in the project.

Technology development

The RAPID programme will support the development of new technology to help address some of its science objectives (see above on SBRI). Technological developments are expected to take place within the RAPID programme for the design and implementation of the MOC monitoring system, both as a pre-operational prototype and at the operational stage. Technological advances will be supported also in other areas, for example where new measuring techniques could provide new key observations of the THC (e.g. under ice profilers).

Progress monitoring and reporting

Progress of the research in the RAPID programme will be monitored by the Science Co-ordinator. He will maintain an overview of scientific progress against the objectives of the RAPID programme and provide a summary of progress for inclusion into an annual progress report to NERC. Information on output and performance will be collated for the RAPID programme as a whole and for individual projects, as part of the regular annual Output Measures exercise operated by NERC. At the end of the RAPID programme a final report detailing the results from the work carried out will be produced.

Knowledge Transfer and communication

The NERC knowledge transfer strategy aims to ensure that the outcomes of directed programmes are used to benefit the UK economy. The exploitation of results from the RAPID programme includes the dissemination of research results to the user and stakeholder community, and the appropriate use of partnership and technology transfer schemes. The development of collaboration and participation of government/industry in scientific research is a key objective of NERC's knowledge transfer policy. Active participation in the RAPID programme will enable users/stakeholders to be aware of new scientific results at an early stage and could have implications for policy makers and industry in their future planning.

The RAPID science co-ordinator submitted a proposal on behalf of the programme to the NERC Knowledge Transfer first call for funding in 2004. Funding was awarded for a RAPID Knowledge Transfer facilitator who will work within the RAPID Science co-ordination team.

The task of the RAPID KT facilitator will be to act as the prime focus for the rapid climate change user/stakeholder community.

Similarly, NERC has a commitment towards informing the wider public about science-based issues and is moving towards greater openness and transparency. In view of the current interest of the wider public in the climate change issues addressed within the RAPID programme, the communication strategy will include the planning of special events (e.g. Science Museum exhibition) for the communication to broad audiences of the various activities and stages of the RAPID programme. The RAPID programme will seek also to raise public awareness of RAPID climate research by promoting and facilitating media coverage of specific RAPID activities and events.

Appendix: Subgroup membership (other members may be co-opted)

International links: B. Dickson, P. Haugan, J. Lowe, P. Valdes & M. Srokosz /
C. Gommenginger

Data: K. Briffa, P. Challenor, S. Tett & M. Srokosz / C. Gommenginger

Modelling: J. Marotzke, J. Slingo, P. Valdes, E. Wolff, R. Wood & M. Srokosz /
C. Gommenginger

Knowledge Transfer: P. Challenor, B. Dickson, R. Wood, Mike Hulme, Chris West (UKCIP)
& M. Srokosz/ C. Gommenginger

Annex: GCOS/GOOS/GTOS CLIMATE MONITORING PRINCIPLES

Effective monitoring systems for climate should adhere to the following principles:

1. The impact of new systems or changes to existing systems should be assessed prior to implementation.
2. A suitable period of overlap for new and old observing systems is required.
3. The results of calibration, validation, data homogeneity assessments and assessment of algorithm changes should be treated with the same care as data.
4. A capability to routinely assess the quality and homogeneity, including high-resolution data and related descriptive information, of data on extreme events should be ensured.
5. Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
6. Uninterrupted stations and observing systems should be maintained.
7. A high priority should be given to additional observations in data-poor regions and regions sensitive to change.
8. Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.
9. The carefully planned conversion of research observing systems to long-term operations should be promoted.
10. Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

Taken from Annex in the WMO's Commission for Climatology document available at:

<ftp://www.wmo.ch/Documents/sessions/CCI-XIII/English/PINKS/PDF/PINK05.pdf>