

NATURAL ENVIRONMENT RESEARCH COUNCIL

EVALUATION PANEL REPORT

**Evaluation of progress with delivering
NERC's Climate System Theme**

August 2010

*This document reports the conclusions of a Panel of experts.
The views expressed are entirely those of the Panel.*

EXECUTIVE SUMMARY

This document reports the findings and conclusions of a Panel convened in June 2010 to evaluate progress in delivering NERC's Climate System theme.

Main Findings

Topic	Conclusions
INPUTS: The extent to which each challenge, and the whole theme is being addressed by relevant investments (ToR 1a&b)	NERC has made a promising start with this theme. Many existing investments were relevant to the theme and have been productive, and the new investments will make substantial contributions. However, there are some gaps and areas where a more focussed approach is needed. Urgent action is needed if NERC wishes to maintain the UK's world leading position in the field of high resolution modelling.
OUTPUTS: The extent to which each challenge, and the whole theme has been achieved (ToR 2a&b)	NERC clearly supports a vibrant research community and research portfolio that is generating outputs that contribute to many of the challenges. However, the current financial climate poses a risk to delivery of the theme in the many areas where delivery depends on work funded by other organisations.
PERFORMANCE: The extent to which investments are being effective in meeting theme challenges and delivering outcomes (ToR 1c and 2c)	The Panel did not have the time, information or knowledge to answer these questions confidently or comprehensively. At this early stage, the aspirations look good, and no major issues were identified except that the long lead-time for developing the recent research programmes is a concern.

Proposals

1. To remain the world leader in climate system science, NERC needs to work closely with the Met Office and other government departments, developing a common strategy aimed at delivering a step change in capability (paragraph 11);
2. To increase the productivity of investments in this theme (i.e. to improve delivery of the theme), NERC needs to make more of the international context - identifying and building on UK strengths, making use of leverage and opportunities, and exploiting synergies (paragraph 12);
3. To maintain progress with delivering the theme, NERC should consider ways to address the fact that delivery relies in places on work funded by other organisations, which may be at risk in the current financial climate (paragraph 17);
4. To improve understanding of the theme, the wording of the strategic objective and challenges should be clarified (paragraph 19, suggestions at Annex C);
5. Challenge 1 (high resolution modelling): If NERC wishes to maintain its world leading position in this field, it would need to assign long-term funding for the work (paragraph 8);
6. Challenge 2 (mitigation and adaptation strategies): NERC needs to build on its successes to date, working with partners such as LWEC to facilitate the exchange of knowledge between the research community and relevant research users. This should include both research programmes and responsive mode (paragraph 8);
7. Challenge 3 (observations): NERC needs to clearly define its role in this area (paragraph 8)
8. Challenge 5 (sensitivity of the climate system): Research on the Carbon cycle is a gap; NERC should consider ways of taking this area forward through TAP and Centre planning processes (paragraph 8);
9. Challenge 6 (natural variability): Implementation of this challenge requires more focus and co-ordination (paragraph 8);
10. Challenge 7 (water cycle): The changing water cycle at shorter time scales is a gap; NERC should consider ways of taking this area forward through TAP and Centre planning processes (paragraph 8); and
11. Challenge 8 (geo-engineering): As the field develops internationally, NERC needs to identify its role and define a focussed approach. This should include considering the other environmental implications of geo-engineering, which are of interest to research users (paragraph 8).

INTRODUCTION

1. This evaluation was commissioned by NERC's Director for Science Delivery (DSD), to meet a high priority need for evidence on progress with implementing the science themes set out in NERC's strategy. The climate system theme was selected as a pilot; the remaining themes will be evaluated through a rolling programme whereby each theme is evaluated every two years.
2. The climate system theme is one of seven science themes set out in NERC's strategy *Next Generation Science for Planet Earth*¹. The strategic objective (grand challenge) for the theme is *'To develop and use risk-based predictions of the future state of the climate on regional and local scales, from days to decades'*. To achieve this objective, NERC has defined eight scientific challenges for this theme (**Annex A**).
3. The evaluation was designed to meet the evidence needs of DSD (the main customer for the evaluation) and other key stakeholders including the Science and Innovation Strategy Board (SISB) and the Head of Strategic Management. They stated that the evidence will:
 - Inform strategy and investment planning – by Council and SISB, including future refreshes of NERC strategy and future Theme Action Plans;
 - Inform management of current investments, including more detailed evaluation of any specific components of the Theme; and
 - Provide evidence of achievements and highlights for publicising NERC to external audiences, including government, the research community, and research users.
4. The evaluation was conducted by a Panel comprising the key people responsible for developing and implementing the theme, and representatives from key stakeholder groups (Annex B). The Panel met for one day in June 2010, their objective was:

To undertake a high-level overview of progress with delivering the climate system theme at this stage, 2 years into implementing the strategy

5. The Panel's Terms of Reference are included at **Annex B**. The Panel were provided with existing information on the major investments relevant to the theme², and held brief discussions with Professor Rowan Sutton (Climate System Theme Leader until June 2009) and Dr Dan Osborn (on behalf of the Director of the Living with Environmental Change partnership). The scope was limited to investments current or planned when implementation of the strategy commenced with the approval of the first Theme Action Plans, in July 08.
6. This report summarises the Panel's findings against their ToR, and their proposals for ways in which delivery of the theme might be strengthened.
7. The Evaluation Customer will prepare a management response proposing any actions in response to the Panel's proposals. The report and management response will be considered by SISB, and the findings summarised in NERC's Strategic Management Tool³, which is viewed by Council. The report and management response will also be published on NERC's website.

¹ <http://www.nerc.ac.uk/publications/strategicplan/nextgeneration.asp>

² including Research Programmes, major activities at NERC's centres, and responsive mode consortium grants

³ The Strategic Management Tool uses a balanced scorecard approach to give NERC's Council and other bodies an overview of strategy delivery and progress.

TOR 1: INPUTS

8. The Panel was asked to evaluate the extent to which the theme is being covered by current and planned investments, in the three ways presented below. The Panel were presented with information about the main investments relevant to the theme, including Research Programmes, major activities at Research Centres, and Responsive Mode consortium grants. The Panel noted that, while strategic relevance is not and should not be a funding criterion, it is likely that research supported through responsive mode and fellowship funding contributes significantly to aspects of the theme.

1.a The extent to which each challenge is being addressed by relevant investments

Challenge	Panel comments <i>Acronyms – Annex D</i>
1. Develop high resolution regional predictions for decision making	NERC has been world leading in this area, in particular the work at NCAS and the HiGEM consortium grant, which has influenced the Met Office's research strategy. However the current lack of funding for this work means that there is now a major risk that the UK will lose its lead. As identified in the draft Earth System Modelling strategy, this work urgently needs long-term support.
2. Enable society to develop mitigation and adaptation strategies through climate science	As worded, this challenge is very broad, and cannot be achieved by this theme or NERC alone. There is some coverage of the climate system aspects of the challenge (e.g. Tyndall Centre, ESPA), but achieving the challenge will be mostly about knowledge exchange. This means that links with LWEC, the Hadley Centre and research users are crucial. The QUEST and RAPID programmes have established good relationships with research users, and the increasing involvement of research users in the design of investments is a very positive step. While recognising that not all of NERC's investments should be aimed at meeting user needs, NERC, with LWEC, needs to do more to encourage and assist research programmes to work with relevant research users. NERC, the Hadley Centre and others also need to work more closely together (discussed further at paragraph 11). NERC should also consider ways in which it can better communicate the outputs of responsive mode projects to policymakers.
3. Improve and expand observations to validate climate change detection and prediction	Some coverage, including the RAPID/RAPID WATCH programmes and ICOS, also underpinned by National Capability such as NCEO and the Data Centres. However, a lack of clarity of vision has led to a lack of consistent support. NERC needs to define its role, including identifying and building on UK strengths (as it did very successfully with RAPID), and engaging more with/making more use of the international co-ordinating programmes, which bring a range of benefits including leverage and new opportunities. This should also include strengthening routes for proven prototypes to move into National Capability funding.
4. Increase knowledge of the physical, chemical and biological feedback processes	Has been patchy, particularly with regard to biological feedback processes. Some good examples including various QUEST projects and the OP3-Danum-08 consortium grant, the new research programmes (particularly Macronutrient cycles) will contribute substantially. Progress somewhat dependent on earth system modelling, which is mostly still at an early stage.
5. Improve understanding and modelling of key processes determining the sensitivity of the climate system	Has taken a broad definition of climate sensitivity. Considerable activity including the Arctic, QUEST and APPRAISE programmes, but mostly with a regional focus. The carbon cycle is a current gap.
6. Improve understanding of natural variability and the link with climate change	There has been little focussed investment by NERC, although some partial coverage likely in responsive mode and fellowships, and also some activity in the Met Office. Requires more focus and co-ordination, to move beyond models and to a longer timescale.

Challenge	Panel comments <i>Acronyms – Annex D</i>
7. Improve understanding of the changing water cycle and how it will affect water availability and quality	Good coverage through the Changing Water Cycle programme, although there is a gap in how the water cycle will change over shorter timescales, and in particular the response of floods and droughts.
8. Assess the climatic implications of geo-engineering to intentionally alter and manage the global carbon cycle and/or climate system	Little specific activity as this has only recently been added to the strategy, but considerable activity to develop the models and understanding on which this research will depend, including through QUEST, APPRAISE, BGS and NCAS. As the field develops internationally, NERC will need to identify its role and define a focussed approach. NERC should also manage expectations – while the underlying research is taking place, the community may not yet be in a position to undertake a specific research programme. The other environmental implications of geo-engineering are also important and of interest to research users, and should be explored by other themes.

9. Although not part of its scope, the Panel noted that significant progress had been made towards the Arctic challenge that has now been subsumed into the other challenges (see Annex B).

1.b The extent to which the whole theme (sum of challenges) is being addressed

10. NERC has made a promising start with this theme. Many existing investments were relevant to the theme and have been productive, and the new investments will make substantial contributions. However, there are some gaps, in particular at challenges 2 (mitigation and adaptation strategies) and 8 (geo-engineering, as could be expected given that it was only added to the strategy this year), and areas where a more focussed approach is needed, in particular at challenges 3 (observations) and 6 (natural variability).
11. There are two other issues of relevance to the whole theme. Firstly, the relationship between NERC and the Met Office is fundamental to making progress with this theme. To remain the world leader in this area, the UK needs a step change in capability. The JCWRP and Earth System Modelling strategy have been excellent first steps, but NERC, the Met Office and relevant government departments need to do more to align themselves at the highest level, developing a common strategy (and possibly programme) that will include governance (e.g. ownership of data) and climate services. NERC's particular strength is providing the underpinning scientific understanding and the breadth of science that will enable improved predictions.
12. To maximise productivity and value for money, NERC also needs to make more of the international context, identifying and building on UK strengths, making use of leverage and opportunities, and exploiting synergies. The RAPID WATCH programme is a good example of the considerable benefits of this approach.

1.c The extent to which investments are being effective in meeting theme challenges

13. It is too early to answer this question comprehensively, but the aspirations look good. The decision to establish a small focussed Project Board for RAPID WATCH has considerably improved delivery, and should yield benefits for other research programmes managed in this way. The main concern is that the timescale from Council approval to programmes releasing funds has been too long for at least two of the larger actions (Changing Water Cycle and Arctic Programme). The Panel recognised the need to evaluate the commissioning process and noted that NERC intends to do this later in 2010

TOR 2: OUTPUTS

14. The Panel was asked to evaluate the extent to which the outputs of the above investments have achieved the theme objective, in three ways:

2.a The extent to which each challenge has been achieved

15. The ‘improve’ and ‘increase’ wording of the challenges means that they can never be fully achieved, but the Panel considered progress towards the challenges through identifying recent major contributions from their knowledge of the investments. As expected at this early stage in strategy implementation, the outputs had all arisen from pre-strategy investments, which had not been designed to deliver the current strategy.

Challenge	Panel comments (<i>acronyms – Annex D</i>)
1. Develop high resolution regional predictions for decision making	A number of investments have made major progress in this area, including the HIGEM/NCAS work, and the NEMO model being developed by Oceans 2025. Progress may be affected by the risk discussed above of slipping from the world leading position.
2. Enable society to develop mitigation and adaptation strategies through climate science	The main achievements in this challenge have arisen indirectly through NERC's support for research and researchers, in particular: a) providing robust evidence to inform policy-making, both directly e.g. the Climate Bill, and indirectly via the IPCC; and b) maintaining a vibrant research community from which government and the private sector can draw expertise to inform policy and strategy. As discussed above, NERC cannot achieve this challenge alone, and needs to work harder with partners where appropriate.
3. Improve and expand observations to validate climate change detection and prediction	Good progress, with much more in the pipeline. Examples include RAPID's prototype observing system, and NCEO's satellite work, also much underpinning National Capability such as data centres.
4. Increase knowledge of the physical, chemical and biological feedback processes	Recent work has made substantial contributions to this challenge, including JULES, the CLAW hypothesis (SOLAS), the southern ocean carbon sink research (BAS), and the work on the implications of land use change in Borneo (OP3 consortium grant) and land surface feedbacks (AMMA). It is likely that there will also be many other contributions from responsive mode grants.
5. Improve understanding and modelling of key processes determining the sensitivity of the climate system	Limited progress, including the APPRAISE global aerosol model GLOMAP.
6. Improve understanding of natural variability and the link with climate change	Some progress, including RAPID's advances in understanding Atlantic multi-decadal variability, the longer time scale natural variability in climate derived from ice core analysis at BAS, and activities supported by NCAS Climate
7. Improve understanding of the changing water cycle and how it will affect water availability and quality	Limited progress, including the advances in understanding the west African monsoon (AMMA) and CEH's work on the aerosol feedback onto water use efficiency by plant canopies . The Changing Water Cycle programme will make a major contribution.
8. Assess the climatic implications of geo-engineering to intentionally alter and manage the global carbon cycle and/or climate system	Too early for any outputs, a clear strategy and a delivery plan by NERC is required in this important area, whatever size of investment.

2.b The extent to which the whole theme (sum of challenges) has been achieved

16. Although it is early days, the achievements above demonstrate that NERC supports a vibrant research community and research portfolio that is generating outputs relevant to some of the challenges. Given that the investments mature enough to produce outputs were designed pre-strategy, some challenges are inevitably covered better than others.
17. Looking forward, the new investments look on track to make major contributions. However, it is also important to note that in many of these areas, NERC is dependent on programmes funded by others. Given the current financial climate, this is potentially a major risk, particularly for work funded by government departments. Close co-ordination and partnership will be even more important than before.

2.c The extent to which larger investments have been effective in delivering outcomes

18. The Panel did not identify any major issues, but felt unable to answer the question confidently in the time available and without detailed knowledge of the delivery of the investments.

OTHER COMMENTS

19. The Panel made a number of other comments:
 - The challenges themselves were sometimes difficult to understand and/or inappropriately worded. If performance is to be assessed against them, they should be more specific and measureable (if not entirely SMART), Specific suggestions for improvements are listed at Annex C;
 - Prior to future theme evaluations, Research Programme managers and Centre directors should be asked to provide an update against each challenge as evidence for the panels; and
 - The recent Geoengineering public dialogue was very impressive and productive, and a good model for future use.

PROPOSALS

20. In summary, the Panel makes the following proposals for strengthening delivery of the Climate System theme:
 1. To remain the world leader in climate system science, NERC needs to work closely with the Met Office and other government departments, developing a common strategy aimed at delivering a step change in capability (paragraph 11);
 2. To increase the productivity of investments in this theme (i.e. to improve delivery of the theme), NERC needs to make more of the international context - identifying and building on UK strengths, making use of leverage and opportunities, and exploiting synergies (paragraph 12);
 3. To maintain progress with delivering the theme, NERC should consider ways to address the fact that delivery relies in places on work funded by other organisations, which may be at risk in the current financial climate (paragraph 17);
 4. To improve understanding of the theme, the wording of the strategic objective and challenges should be clarified (paragraph 19, suggestions at Annex C);
 5. Challenge 1 (high resolution modelling): to maintain its world leading position, NERC urgently needs to assign long-term funding to this work (paragraph 8);
 6. Challenge 2 (mitigation and adaptation strategies): NERC needs to build on its successes to date, working with partners such as LWEC to facilitate the exchange of knowledge between

the research community and relevant research users. This should include both research programmes and responsive mode (paragraph 8);

7. Challenge 3 (observations): NERC needs to clearly define its role in this area (paragraph 8)
8. Challenge 5 (sensitivity of the climate system): Research on the Carbon cycle is a gap; NERC should consider ways of taking this area forward through TAP and Centre planning processes (paragraph 8);
9. Challenge 6 (natural variability): Implementation of this challenge requires more focus and co-ordination (paragraph 8);
10. Challenge 7 (water cycle): The changing water cycle at shorter time scales is a gap; NERC should consider ways of taking this area forward through TAP and Centre planning processes (paragraph 8); and
11. Challenge 8 (geo-engineering): As the field develops internationally, NERC needs to identify its role and define a focussed approach. This should include considering the other environmental implications of geo-engineering, which are of interest to research users (paragraph 8).

THE CLIMATE SYSTEM THEME

Strategic objective/grand challenge

To develop and use risk-based predictions of the future state of the climate on regional and local scales, from days to decades.

Challenges

1. Develop high resolution regional predictions for decision making
2. Enable society to develop mitigation and adaptation strategies through climate science
3. Improve and expand observations to validate climate change detection and prediction
4. Increase knowledge of the physical, chemical and biological feedback processes
5. Improve understanding and modelling of key processes determining the sensitivity of the climate system
6. Improve understanding of natural variability and the link with climate change
7. Improve understanding of the changing water cycle and how it will affect water availability and quality
8. (new, see comment below) Assess the climatic implications of geo-engineering to intentionally alter and manage the global carbon cycle and/or climate system

The eighth challenge reflects a new priority area identified when NERC's strategy was refreshed in 2010. At the same time, it was decided that the original eighth challenge '*to increase knowledge of the role of the polar and tundra regions in the global climate system*', while an important area of science that must remain part of NERC's strategy, placed inappropriate emphasis on one geographical area, and would no longer be included as it was covered by the other challenges. The Panel was asked to consider the new challenge 8.

PANEL MEMBERSHIP

Name	Organisation	Position
Professor David Fowler	NERC Centre for Ecology and Hydrology	Chair: Member of NERC's Science and Innovation Strategy Board
Dr Richard Wood	Met Office	NERC Climate System Theme Leader
Dr Ned Garnett	NERC Swindon Office	NERC Science and Innovation Manager – Atmospheric and Polar Sciences
Professor Sir Brian Hoskins	Imperial College	Chair of the original Climate System Theme Strategy Development Panel
Professor Pier Luigi Vidale	NERC National Centre for Atmospheric Sciences	NERC Centre representative
Professor David Marshall	University of Oxford	Higher Education Institution representative (member of NERC's Peer Review College Pool of Chairs)
Mr David Warrilow	Department for Energy and Climate Change	User community representative

Panel secretaries

Mrs Fiona Goff
Miss Natasha Guise

PANEL TERMS OF REFERENCE

Purpose

Based on the evidence presented, the Panel is asked to undertake a high-level overview of progress in delivering the climate system theme at this stage, 2 years into implementing the strategy.

Responsibilities

1. Inputs: Evaluate the extent to which the theme is being covered by current and planned investments, including:

- a) The extent to which each **challenge** is being addressed
- b) The extent to which the **whole theme** (sum of challenges) is being addressed
- c) The extent to which new investments are on track; and

2. Outputs: Evaluate the extent to which the outputs of the above investments have achieved the theme objective

- a) The extent to which each theme **challenge** has been achieved
- b) The extent to which the **whole theme** (sum of challenges) has been achieved
- c) The extent to which larger investments have been effective in delivering outcomes

SUGGESTIONS FOR CHANGES TO THE CLIMATE SYSTEM CHALLENGES

This Annex summarises the Panel’s suggestions for improving the wording of the theme and challenges (proposal 4).

Current wording	Panel suggestions
Strategic objective/grand challenge: To develop and use risk-based predictions of the future state of the climate on regional and local scales, from days to decades	Replace ‘regional’ onwards with ‘global and regional scales over the 21 st century
2. Enable society to develop mitigation and adaptation strategies through climate science	Replace ‘enable society to develop’ with ‘With partners, contribute to the development of’; derives from all of the other challenges – consider adding to the grand challenge
3. Improve and expand observations to validate climate change detection and prediction	Meaning unclear - replace ‘to validate’ onwards with ‘for the analysis of climate processes and variability, to test models, to provide the basis for detection and attribution of climate change and to initialise model projections of future changes

LIST OF ACRONYMS

AMMA	African Monsoon Multidisciplinary Analysis UK – Consortium Grant
APPRAISE	Aerosol Properties, Processes and Influences on the Earth’s Climate – Research Programme
BAS	NERC British Antarctic Survey
BGS	NERC British Geological Survey
DSD	NERC Director of Science Delivery
ESPA	Ecosystems Services for Poverty Alleviation (ESPA) – Research Programme
HiGEM	High Resolution Global Environmental Monitoring – Consortium Grant
ICOS	Integrated Carbon Observing System
IPCC	UN Intergovernmental Panel on Climate Change
JCWRP	Joint Climate and Weather Research Programme – Research Programme
JULES	Joint UK Land-Environment Simulator
LWEC	Living with Environmental Change Partnership
NCAS	NERC National Centre for Atmospheric Science
NCEO	NERC National Centre for Earth Observation
OP3 – Danum – 08	Oxidant and Particle Photochemical Processes above a South-East Asian tropical rain forest – Consortium Grant
QUEST	Quantifying and Understanding the Earth System – Research Programme
RAPID	Rapid Climate Change – Research Programme
RAPID-WATCH	Rapid Climate Change: Will the Atlantic Thermohaline Circulation Halt? – Research Programme
SISB	NERC Science and Innovation Strategy Board
SOLAS	UK Surface Ocean – Lower Atmosphere Study – Research Programme

For further information about the Research Programmes listed above, see www.nerc.ac.uk/research/programmes