

NATURAL ENVIRONMENT RESEARCH COUNCIL

EVALUATION PANEL REPORT

**Evaluation of progress with delivering
NERC's Natural Hazards Theme**

March 2011

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

INTRODUCTION

1. This evaluation was commissioned by NERC's Director, 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 Natural Hazards theme is the fourth to be evaluated, following a pilot evaluation of the Climate System theme, in June 2010, and evaluations of the Biodiversity and Sustainable Use of Natural Resources themes in October 2010. The intention is to evaluate each theme every two years via a rolling programme.
2. Natural Hazards is one of seven science themes set out in NERC's strategy Next Generation Science for Planet Earth¹. The strategic objective of the theme is '*to increase knowledge to improve the forecasting and mitigation of natural hazards*'. To achieve this objective, NERC has defined ten scientific challenges:

Cross-cutting:

1. Integrated risk assessment & scientific advice
2. Uncertainty in forecasting and risk assessment

Enabling better forecasting and mitigation of the risks of hydro-meteorological hazards:

3. Storms
4. Flooding
5. Droughts, heatwaves & wildfires
6. Coastal flooding & coastal erosion
7. Landslides & subsidence

Enable forecasting and mitigation of the risks of geo-hazards:

8. Volcanoes
9. Earthquakes
10. Tsunami

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. The design incorporated lessons learned from the preceding theme evaluations.
4. The customer and stakeholders requested evidence that will:
 - Provide information to SISB and Council on progress with delivering the Natural Hazards theme;
 - Inform strategy and investment planning, including future Theme Action Plans and refreshes of NERC strategy, and decisions on management of current investments;
 - Provide evidence of achievements and highlights for publicising to external audiences, including government, the research community, and research users.
5. The evaluation was conducted by a Panel comprising representatives from key stakeholder groups (**Annex A**) and met for one day, in March 2011. The Theme Leader and Science and Innovation Manager attended *ex officio* and were not present during the Panel's concluding discussions. The Panel's objective was:

To undertake a high-level overview of progress with delivering the Natural Hazards theme at this stage, nearly 3 years into implementing the strategy

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

6. The Panel's Terms of Reference are attached as **Annex B**. They covered:
 - Inputs: the extent to which each challenge and the whole theme is being addressed;
 - Outputs: the extent to which each challenge and the whole theme has been achieved; and
 - Performance: the extent to which investments are being effective in meeting theme challenges and delivering outcomes.
7. The scope was limited to investments current at, or planned since, July 2008, when implementation of the strategy commenced at the approval of the first Theme Action Plans. The Panel were provided with information on NERC's major investments relevant to the theme², listed in **Annex C**. Key facts about the major investments are included at **Annex D**.
8. This report summarises the Panel's findings against their ToR, with proposals for ways in which delivery of the theme might be strengthened. The report will be considered by SISB, and copied to Council along with a management response setting out any actions in response to the Panel's proposals. Both report and response will be published on NERC's website.

² Including Research Programmes managed by Swindon Office, Research Programmes managed by NERC Research Centres, and Responsive Mode grants.

TOR 1: INPUTS

9. 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.
10. The Panel concluded that the theme is generally in good shape, has generated some exciting new investments, and is generally on track to deliver its overarching strategic objective, *to increase knowledge to improve forecasting and mitigation of natural hazards*. Natural hazards and their consequences are inherently interdisciplinary in character, and work with and by other research communities, funders, agencies, businesses and NGOs is crucial to delivering the theme. The Theme Leader and investments to date have successfully generated and strengthened engagement with many of these parties, and the benefits of these partnerships are already apparent. To achieve the theme's wider aims of resilience and mitigation, RCUK and NERC need to seek greater engagement with a broader range of research communities and research funders (see further discussion below).

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

Challenge	Panel comments (<i>acronyms – Annex E</i>)
<p>1. Integrated risk assessment & scientific advice</p> <p>2. Uncertainty in forecasting and risk assessment</p>	<p>The Panel considered both challenges together, as they are fundamentally interlinked (and, as worded, difficult to separate). These are innovative challenges that are currently a significant gap, and hence have great potential to deliver widespread benefits across the whole natural hazards area. The primary investment in this area, the Probability, Uncertainty and Risk programme, should help to encourage experimentation with novel methods, and bring together different interested communities, including EPSRC, which, the Panel note with approval, has been involved from the outset. It is important that the programme interacts with, and contributes to, other programmes in the hazards area.</p> <p>Proposal 1: Given the wording of Challenge 1, Challenge 2 is misleading. ‘Uncertainty in Forecasting and Hazard Assessment’ would be more appropriate.</p> <p>Proposal 2: NERC should consider ways in which the Probability, Uncertainty and Risk programme could interact with and support other programmes, for example through testing ‘real-life’ examples, and initiating short-term postdoctoral researcher exchanges to build interdisciplinary awareness and capacity.</p>
<p>3. Storms</p>	<p>The theme's early investment in this area (the Storm Risk Mitigation (SRM) programme) was both timely and at an appropriate level, focussing primarily on physical processes. SRM appears to be on track, although its ultimate success is dependent on progress with climate modelling. This challenge could now benefit from an enhanced focus on mitigation strategies and societal impact, i.e. greater interaction beyond the NERC research community. Future priorities in this challenge area could include polar low pressure systems, modelling the junction between the troposphere and stratosphere, and building on work initiated by the other themes, e.g. the Joint Climate & Weather Research Programme.</p> <p>Storm surges and extreme wind are current gaps, the latter is a particular concern for the insurance industry, while the former is of high relevance to facilities, such as nuclear power stations, at coastal locations.</p>

Challenge	Panel comments (<i>acronyms – Annex E</i>)
4. Flooding	<p>The Panel support the Theme Leader’s decision to spend time co-ordinating and working with the various research and end user communities to identify priorities for flooding research. LWEC’s work co-ordinating development of the UK Flood Research Strategy will be a significant step forward (this approach would also yield significant benefits in other natural hazards areas). The ecological impact of floods (and droughts) is not a theme focus, but is being addressed through the FRS. Collaboration with EPSRC is crucial for achieving success against this challenge.</p> <p>The interaction between pluvial, fluvial and groundwater flooding is a current gap. Pluvial flooding and its impact, e.g. polluted sediments, is currently a gap but would be addressed by the proposed TAP3 action <i>Flooding from intense rainfall</i>.</p>
5. Droughts, heatwaves & wildfires	<p>This challenge has had a relatively slow start, but this is appropriate given its complexity; it will take time for the communities involved to identify the research priorities. The Changing Water Cycle programme (CWC) should deliver in the drought area.</p> <p>Heatwave research is a current major gap. Ecological resilience and wildfires are currently gaps, but would be addressed by the proposed TAP3 action <i>UK Droughts</i>.</p>
6. Coastal flooding & coastal erosion	<p>The <i>Coastal Sediment Systems</i> programme should contribute directly to users’ needs, having been designed in collaboration with Defra and the EA. Other than this consortium, the level of investment against this challenge seems low.</p> <p>Storm surge research is a current gap, and an area in which the user community would particularly benefit from improved knowledge. The Met Office would be an essential partner for activity in this area.</p>
7. Landslides & subsidence	<p>The Arctic Research Programme is contributing to understanding submarine landslides. The flooding, earthquake and volcano programmes are also contributing towards this challenge.</p> <p>Swell-shrink induced subsidence would be addressed by the <i>UK Droughts</i> action.</p> <p>There is currently no co-ordinated approach to UK landslide, subsistence and heave research, and this area is of major interest to the insurance industry. This is a significant gap, and the Panel welcome its identification as a future priority in TAP3.</p>
8. Volcanoes	<p>The Increasing Resilience to Natural Hazards programme contributes significantly to meeting this challenge, as does the RM consortium <i>Characterisation of the Near-Field Eyjafjallajökull Volcanic Plume and its Long-range Influence</i>. A good NERC and ESRC partnership, building partly on the relationship and interdisciplinary capacities fostered through the NERC-ESRC studentship programme, has strengthened the Increasing Resilience programme, and should help to guarantee its success.</p> <p>The cascading effects of large volcanic events, including natural forcing of climate change, are a current gap.</p>

Challenge	Panel comments (<i>acronyms – Annex E</i>)
9. Earthquakes	The Increasing Resilience programme and RM consortium grants will make major contributions to this challenge. The challenge benefits from a strong natural science community, but more could be done to foster greater collaboration with the engineering and social sciences communities. The absence of EPSRC from this programme is a concern since much of the mitigation relates to building robust structures. Vulnerability of coastal communities and facilities to earthquake-related tsunamis is a possible missing gap. The programme should focus on reducing risk to earthquakes in developing World countries by improving knowledge of the seismic cycle, an arena where the UK has world-class expertise. A multidisciplinary approach will be vital for addressing resilience and mitigation. The volcanological community have demonstrated how this can be done well.
10. Tsunami	There has been comparatively little investment in this challenge, but this is appropriate given the level of risk to the UK. However, tsunami research might be integrated into the Earthquakes programme. The Arctic Research Programme will investigate tsunamis caused by seafloor instability, and NOC is contributing to the challenge through its work on warning systems.

Proposal 3: NERC should consider ways of addressing current gaps in delivery of the theme:

- **Challenge 3 Storms – storm surges and extreme winds;**
- **Challenge 4 Floods – interactions between pluvial, fluvial & groundwater flooding;**
- **Challenge 5 Droughts, heatwaves & floods – ecological resilience, and heatwaves;**
- **Challenge 6 Coastal flooding & coastal erosion – storm surges;**
- **Challenge 7 Landslides & subsidence – co-ordination required for landslide, subsidence and heave research;**
- **Challenge 8 Volcanoes – cascading effects of large volcanic events, including climate change.**
- **Challenge 9 Earthquakes – find ways to involved the UKs world class earthquake engineering community with input from EPSRC. Consider fous on improving knowledge on seismic cycles and hazard in the developing world.**

11. The programmes as implemented do broadly match the actions described in the Theme Action Plans, with the exception of CWC, in which the projects remain in discrete disciplinary areas. The Panel understands that this was partly due to disconnect between Theme Leaders and office staff, and is satisfied that lessons have been learned, and that the upcoming CWC call will address this issue.

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

12. All of the challenges have been addressed, to different degrees, and the balance of investment is broadly appropriate, proportionate to the hazards' risks to the UK. Despite the punctuated nature of TAP investments, coverage has been good, acknowledging the gaps identified above. Where necessary, community-building and prioritisation processes have been undertaken before large investment, which is appropriate. There is significant support for this theme through RM, especially through consortium awards in volcanology and seismology. It should also be noted that detailed coverage of research investment at the challenge level will not be knowable until the outcome of funding rounds.

13. To achieve its overarching objective, the theme needs to support a range of basic to applied research. The theme currently should take more consideration of development drivers such as

population growth and urbanisation. The Panel commends NERC and the TL for involving end-users in programme development, as for user-oriented research, this is crucial for ensuring that the right research questions are addressed. The TL's commitment to encouraging the research community to work across disciplines has been excellent and should continue. In AOs, it is important for NERC to communicate very clearly the rationale behind the programme, to ensure that applicants propose projects that will deliver most appropriately for NERC and the anticipated beneficiaries.

14. The importance of improved engagement with social sciences is reflected in an over-emphasis on physical processes and climate change in some programmes, e.g. CWC, with too little emphasis on human development drivers, such as population growth and urbanisation.

Proposal 4: NERC's efforts to involve research users throughout the course of user-oriented research programmes, although sometimes time-consuming, have yielded significant benefits and should continue.

15. As noted above, delivery of this theme relies on work with and by other funders and research communities. There has been some excellent progress yielding significant benefits (e.g. the FREE programme successfully brought together the natural sciences and engineering communities; volcanology and social sciences have collaborated to great effect in Montserrat), but more work is needed to engage more broadly, particularly with the engineering, medical and social science communities. LWEC's work should help to bring about this change, but NERC needs to recognise that this is a major time commitment, and cannot be achieved by a part-time Theme Leader alone.

Proposal 5: To ensure delivery of the more applied aspects of the theme, NERC should build on recent progress and continue to prioritise engagement with a broader range of research communities and funders, particularly in the engineering and medical areas. This should include programmes, training and knowledge exchange.

The potential loss of key data, skills and expertise due to the ramp-down of Research Centres' research programme funding may pose a risk to delivery of aspects of this theme.

Proposal 6: NERC should consider the potential impact on delivery of this theme arising from the Research Centre funding rampdown, and ways in which risks to delivery could be minimised.

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

16. The evidence indicates that the theme's investments are broadly on track at this early stage. Some programmes have progressed more slowly than might have been anticipated, but this should not be viewed a problem, as it has enabled beneficial community building and partnership development. Some calls are announced with very short notice which can be detrimental to the community responding effectively.
17. The Panel is pleased to note that NERC is currently evaluating its commissioning process, but is concerned that the current approach to announcing calls may not be attracting the best interdisciplinary and partnership proposals.

Proposal 7: Where new interdisciplinary and user relationships need to be established, and where target communities might not habitually view the NERC website (both particularly

relevant to this theme), NERC should consider ways in which it could provide improved early warning, relationship-building, and advertising of forthcoming calls.

TOR 2: OUTPUTS

18. The Panel was asked to evaluate the extent to which the outputs of the relevant investments have achieved the theme objective. The majority of recent investments are too immature to be producing significant outputs, but some outputs from programmes and projects pre-existed the theme have contributed to the theme's objectives.

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

Challenge(s)	Achievements (<i>acronyms – Annex E</i>)
1. Integrated risk assessment & scientific advice	<p>Integrated Risk Assessment and scientific advice has been a core element of many programmes (e.g. FREE), was a significant component of the SAPPUR scoping study, and is expected to be a key deliverable of many evolving programmes.</p> <p>Valuable input in the Quantifying Uncertainty in Predictions of Climate Change and Climate Impacts programme from the End-to-end Quantification of Uncertainty for Impacts Prediction (EQUIP) consortium.</p>
2. Uncertainty in forecasting and risk assessment	<p>The SAPPUR scoping study, its workshop and broader engagement activities laid good groundwork for the Probability, Uncertainty and Risk programme.</p>
3. Storms	<p>FREE had a number of significant scientific impacts, most notably the development of radar to improve lead time for the prediction of localised storms, which is now embedded in the National Flood Forecasting System.</p> <p>NCAS Challenge 4 <i>Improving predictive capability for high impact weather</i> has contributed, particularly through work on severe wind storms.</p>
4. Flooding	<p>The NERC-supported UK Flood Research Strategy is a major step forward, and outputs will contribute to other NH challenges.</p> <p>FREE projects have contributed significantly to the development of integrated flood risk models including uncertainty quantification and assessment of economic losses through high resolution inundation modelling.</p>
5. Droughts, heatwaves & wildfires	<p>Data and outputs from CEH and BGS (including the Drought catalogue) have been widely used by the UK water industry. The QUEST Programme generated new models, for instance on wildfires.</p> <p>The ESPA Partnership and Project Development Grants and Strengthening Research Capacity awards, e.g. BESSA: Building Ecosystem Services Research Capacity in Semi-Arid Africa, have provided a strong partnership foundation for the main call awards.</p>
6. Coastal flooding & coastal erosion	<p>FREE projects and work by Proudman Oceanographic Laboratory have made a substantial impact in coastal flooding and erosion assessments.</p> <p>The Marine Centres' Oceans 2025 Sea Level and Vertical Land Movement work package has provided valuable information on sea level change and risks for future coastal flooding events.</p>

Challenge(s)	Achievements (<i>acronyms – Annex E</i>)
7. Landslides & subsidence	Users, particularly the insurance industry, appreciate the excellent work on subsidence and heave, and quality of data currently available, provided by BGS.
8. Volcanoes	Long-term advice on volcanic activity and risk has been provided by NERC, notably BGS, on Montserrat. Development of the Iceland RM consortium. The Oceans 2025 outcomes also include work on submarine pyroclastic flow and volcanic sector collapse at the Montserrat, Cape Verde Islands and Monowai volcanoes.
9. Earthquakes	The COMET initiative and BGS have provided rapid advice on events such as those at L'Aquila and Haiti. The RM consortium project: <i>Subduction zone segmentation and controls on earthquake rupture</i> , led by NOC Southampton has studied the area affected by the 2004 and 2005 Sumatran earthquakes, investigating how fault structure affects the size of large earthquakes.
10. Tsunami	Welcome interventions, and advice about early warning systems, were made by BGS and NOC following the Indian Ocean tsunami. The Marine Centres' Oceans 2025 landslides and tsunami geohazards work package has investigated the frequency and risks of sub-sea landslides around the UK and elsewhere.

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

19. The new investments are generally promising and, if implemented as designed, will make major contributions towards delivering this theme. As discussed above, community and partnership building, in the UK and internationally (particularly through ESPA), is an important and very beneficial output of the development stage of recent programmes, that has contributed and will continue to contribute to enabling delivery of the theme.

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

20. The FREE programme's value was limited by its narrow focus on natural science and limited interaction with social scientists; this is an issue which has been addressed in the design of recent investments. No other larger, mature investments contribute significantly to this theme.

PANEL MEMBERSHIP

Position	Name	Organisation
Chair (SISB member)	Prof Martin Siegert	University of Edinburgh
Chair of the original Strategy Development Panel	Prof Steve Sparks	University of Bristol
NERC Centre representative	Prof Alan Jenkins	CEH
HEI representative	Prof David Demeritt	King's College, London
User representative	Dr Dickie Whittaker	Financial Services KTN

Attending *ex officio*

Prof John Rees, Natural Hazards Theme Leader

Dr Chris Franklin, NERC Science and Innovation Manager

Panel secretaries

Will Thomas, Evaluation Project Manager, NERC Swindon Office

Fiona Goff, Evaluation Team Leader, NERC Swindon Office

Observers

Dr Steven Wilson, Director, Strategy and Partnerships, NERC

Dr Dan Osborn, RCUK Programme Manager for LWEC

PANEL TERMS OF REFERENCE

Purpose

Based on the evidence presented, the Panel is asked to undertake a high-level overview of progress in delivering NERC's Natural Hazards strategy theme at this stage, nearly three years into implementing the strategy.

Objectives

1. Inputs: Evaluate the extent to which the theme is being covered by current and planned investments
 - 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
2. Outputs: Evaluate the extent to which the outputs of the above investments have contributed to the theme objective
 - a) Progress made with each theme challenge
 - b) Progress made with the whole theme (sum of challenges)
 - c) The extent to which larger investments have been effective in delivering outcomes

EVIDENCE PROVIDED TO THE PANEL**Strategic Material**

- Next Generation Science for Planet Earth (NERC Strategy 2007 – 2012)
- Natural Hazards Strategy Development Panel's Theme Report (2007)
- Natural Hazards Theme Action Plan 1 (2008)
- Natural Hazards Theme Action Plan 2 (2009)
- Presentation including verbal update on Theme Action Plan 3

Investments Information

Summary-level information (dates, % relevance to the theme, £ associated with theme, mapping to challenges) for the following, where relevant to the theme:

- TAP Actions (RPs)
- Directed Programmes active at July 2008 and onwards
- Research & collaborative centre programmes
- Consortia

Detailed information for the above, comprising

- PI (or equivalent) questionnaire response submissions to the evaluation process, including details of progress to date & outputs [append template for responses?]
- Relevant programme publications, AOs, business cases etc. as appropriate (one or two supporting documents per programme)

Number, and value of contribution towards theme, of non-Consortium RM grants active at July 2008 and onwards

Spend per challenge for RP, centres & Consortia

LWEC response to the following two questions: To what extent is the theme delivering LWEC's needs?; Could the delivery of the theme be improved in terms of contributing to LWEC's challenges?

SMT commentaries for progress with the NH theme, 08/09 to present

NH theme highlights from NERC Annual Reports, 08/09 & 09/1

THE NATURAL HAZARDS THEME: MAJOR CURRENT INVESTMENTS

Tables 1-4 summarise the major current investments relevant to the theme, which total **£58.0m** plus **£4.3m** in 0910 Research Programme spend at Centres¹, equating to **£21.7m** over 5 years (for broad comparison).

Table 1: All TAP actions (RPs) relevant to the theme, and Directed Programmes managed by Swindon office with ≥£0.5m relevant to theme

Action	Start date	End date	% NH ²	Amount NH (£m)
Flood Risk from Extreme Events (FREE)	2005	2010	75	5.9
Ecosystem Services for Poverty Alleviation (ESPA)	2007	2016	25	2.5
Changing Water Cycle	2009	2014	22	2.2
Storm Risk Mitigation Through Improved Prediction & Impact Modelling	2009	2014	100	4.9
Quantifying Uncertainty in Predictions of Climate Change & Climate Impacts	2009	2012	50	0.7
Increasing Resilience to Natural Hazards in Earthquake-Prone & Volcanic Regions	2010	2015	100	4.6
Arctic Research Programme	2010	2015	18	2.7
Coastal Sediment Systems	2010	2015	100	3.0
Next Generation Weather & Climate Prediction	2010	2015	9	0.4
Analysis, Propagation & Communication of <u>Probability, Uncertainty & Risk</u>	2011	2014	100	2.4
Total				£29.3m

Table 2: Research Programmes managed by Centres

These programmes are mostly five years in duration, ending in 2012 or 2013.

Centre	0910 NH spend (£m)	Major programmes (where 0910 spend ≥£0.1m) ³	% NH	0910 spend NH (£m)
British Antarctic Survey (BAS)	0.30	Environmental Change & Evolution	30	0.30
British Geological Survey (BGS) ³	0.52	Science Resources & Infrastructure	16	0.34
Centre for Ecology and Hydrology (CEH)	0.12	WA-3 Science for Water Management	40	0.10
National Centre for Atmospheric Science (NCAS)	1.36	NCAS Challenge 1	10	0.22
		NCAS Challenge 3	10	0.18
		NCAS Challenge 4	50	0.91
National Centre for Earth Observation (NCEO)	0.28	Theme 4: High Resolution Predictions	70	0.13
		Theme 6: Dynamic Earth & Geohazards	100	0.11
Marine Centres ⁴	1.75	Theme 1: Climate, Circulation & Sea Level	15	0.35
		Theme 3: Shelf & Coastal Processes	13	0.38

¹ 0809 spend for BGS, awaiting 0910 figures but it is anticipated that there will be little change from 0809 spend.

² As mapped by NERC's Portfolio Planning team in consultation with the Theme Leader or amended by programme managers.

³ Equating to £0.5m over 5 years, to allow broad comparison with other funding modes.

⁴ National Oceanography Centre, Southampton (NOCS), Proudman Oceanographic Laboratory (POL), Plymouth Marine Laboratory (PML), Scottish Association for Marine Science (SAMS), Sea Mammal Research Unit (SMRU), Marine Biological Association (MBA) and Sir Alister Hardy Foundation for Ocean Sciences (SAHFOS)

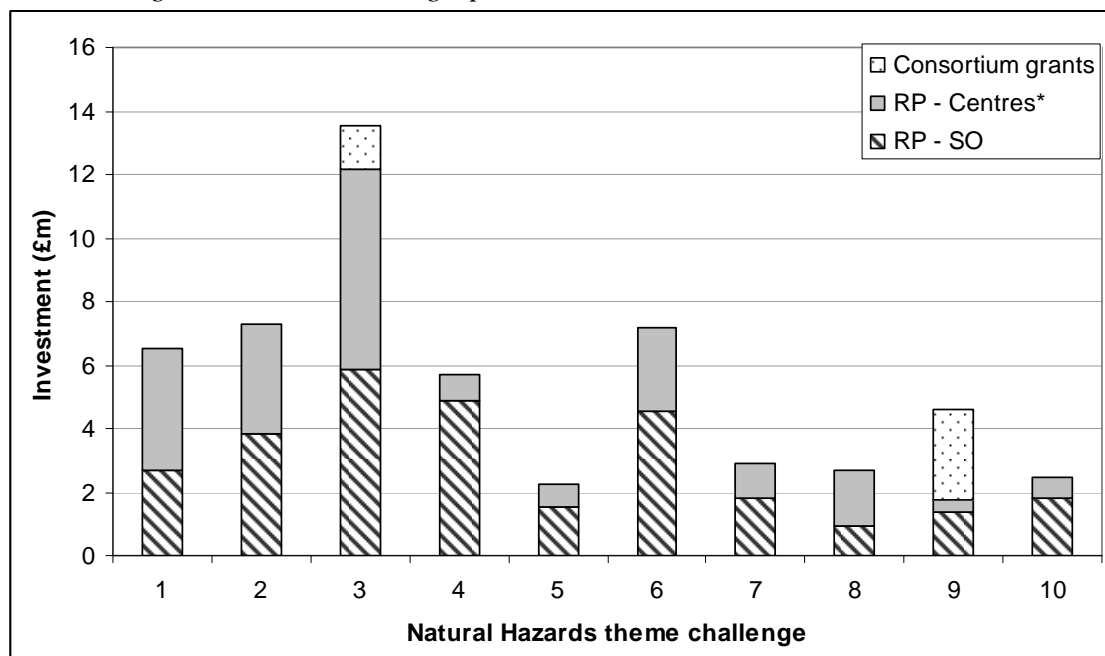
Centre	0910 NH spend (£m)	Major programmes (where 0910 spend ≥£0.1m) ³	% NH	0910 spend NH (£m)
		Theme 5: Continental Margins & Deep Ocean	12	0.31
		Theme 9: Ocean prediction	18	0.40
		National Facilities: BODC, PSMSL & CCAP	10	0.25
Total	£4.33m			

Table 3: Responsive mode: summary of grants current at or started since July 08 classified as ≥50% ‘environmental risks & hazards’

Grant scheme ⁵	No. grants ⁶ (%)	Amount NH in £m (%)
Standard grants	70 (47%)	18.8 (66%)
Consortium grants	3 (2%)	4.2 (16%)
Postdoctoral fellowships	11 (7%)	2.2 (8%)
Small grants	47 (32%)	1.6 (6%)
Advanced fellowships	4 (3%)	1.0 (3%)
New Investigator grants	10 (7%)	0.5 (2%)
MTG Scheme	4 (3%)	0.3 (1%)
Total	149	£28.6m

Figure 1 shows the investments divided by challenge (for the 69% of spend that has been mapped by challenge – this does not include the majority of responsive mode grants).

Figure 1: Distribution of investments that have been mapped by challenge
The challenges are listed at Paragraph 2



* 0910 spend by Research Centres multiplied by 5 years to be broadly comparable with the other investment categories. BGS data is 0809 spend

⁵ Description of the schemes available at www.nerc.ac.uk/funding/available. Doctoral training grants are not included as they are not classified by ENRI. Grants not relevant to the NH theme were excluded.

⁶ Split grants are combined and treated as one.

LIST OF ABBREVIATIONS

AO	Announcement of Opportunity
BGS	(NERC) British Geological Survey
CEH	(NERC) Centre for Ecology and Hydrology
CWC	Changing Water Cycle (Research Programme)
Defra	Department for Environment, Food and Rural Affairs
DSD	(NERC) Director, Science Delivery
EA	Environment Agency
EPSRC	Engineering and Physical Sciences Research Council
ESPA	Ecosystem Services for Poverty Alleviation (Research Programme)
ESRC	Economic and Social Research Council
FREE	Flood Risk from Extreme Events (Research Programme)
FRS	(UK) Flood Research Strategy
LWEC	Living With Environmental Change (Research Programme)
NERC	Natural Environment Research Council
NGO	Non-Governmental Organisation
NH	Natural Hazards theme
NOC	National Oceanographic Centre
RCUK	Research Councils UK
RM	Responsive Mode (funding stream)
SAPPUR	Scoping Study on the Analysis, Propagation and Communication of Probability, Uncertainty and Risk
SISB	(NERC) Science and Innovation Strategy Board
SRM	Storm Risk Mitigation (Research Programme)
TAP	Theme Action Plan
TL	Theme Leader

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