UK Climate Resilience: Present and future climate hazard	
Closing date	5 March 2020
Funding available	£700K across two awards
Funding mode/stream	Strategic Priorities Fund (SPF)
NERC Core or UKRI/Collective Fund budget	UKRI
Project duration	24 months
Funding partners (if applicable)	Met Office, UKRI (AHRC, EPSRC, ESRC)
Start date requirements (if applicable)	3 August 2020
Call aims and objectives	Proposals are invited to develop and evaluate new methods and techniques to characterise current and future climate hazards and underlying driving processes, including understanding the robustness of the methods. As a minimum, applications should include hazards related to precipitation and temperatures, including their extremes, proposals are encouraged which consider derived hazard indices or other metrics, including joint hazard and persistent events, of relevance to UK climate resilience.
Eligibility criteria	Standard UKRI eligibility, plus SPF eligibility (Public Sector Research Establishments (PSREs) with 10 or more researchers with PhDs (or equivalent) are eligible to apply.) Investigators may be involved in no more than two proposals submitted to this call and only one of these may be as the lead Principal Investigator.
Contact	climateresilience@nerc.ukri.org

Strategic Priorities Fund

UK Climate Resilience: Present and future climate hazard

Announcement of Opportunity

Issued:	December 2019
Proposal deadline:	5 March 2020 (4pm)
Outcomes announced:	June 2020
Latest start date:	3 August 2020

1. Summary

UK Research & Innovation (UKRI) is inviting proposals for the funding opportunity *Present and future climate hazard* through the UK Climate Resilience programme, funded through the Strategic Priorities Fund (SPF) Wave 1. The programme aims to draw together fragmented climate research and expertise to deliver robust, multi- and inter-disciplinary research into climate risks and adaptation solutions. This will help to ensure that the UK is resilient to climate variability and change, and powerfully positioned to exploit the opportunities of adaptation and green growth.

It is widely expected that society will face serious challenges from projected changes in average climate conditions and climate variability; however, our understanding of potential impacts and necessary approaches to adaptation in the UK requires improvement. This programme has been devised to improve our understanding of how the UK can enhance its resilience to climate change and variability.

The UK Climate Resilience programme is a £18.6 million collaboration between UKRI, led by the Natural Environment Research Council (NERC) and the Met Office, with the Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC) and the Arts and Humanities Research Council (AHRC).

For this opportunity up to £700K available, to be delivered through a maximum of two projects, each up to the value of £350K (at 80% FEC).

Projects should have a start date no later than 3 August 2020 and have a duration of no more than 24 months.

2. Background

2.1 Strategic Priorities Fund

The Strategic Priorities Fund (SPF) has been set up to build upon the vision of a 'common research fund' set out in Sir Paul Nurse's independent review of the Research Councils. The fund will drive an increase in high-quality multi- and interdisciplinary research and innovation, ensure that UKRI's investment links up effectively with Government departments' research priorities and opportunities, and ensure that the system is able to respond to strategic priorities and opportunities.

2.2 UK Climate Resilience

This Programme aims to draw together fragmented climate research and expertise to deliver robust, multi- and inter-disciplinary climate risk and adaptation solutions research ensuring the UK is resilient to climate variability and change and powerfully positioned to exploit the opportunities of adaptation and green growth.

Climate change and variability affect all aspects of society through impacts on both human and natural systems as well as built and engineered environments. Effective adaptation builds capacity to respond to this variability and change and is one of two broad and increasingly important strategies (along with mitigation) for the management of risk from climate (Moss et al. 2013, Science 342[1]). Even under the most optimistic mitigation scenarios there is an urgent need to build resilience and accelerate adaptation to climate variability and change (IPCC 2018). Informing the extensive range of actions needed to manage climate risks, reduce damage without exacerbating existing inequalities, and realise emerging opportunities, is a critical scientific, societal and cultural challenge.

It is widely recognised that single disciplinary approaches will not be able to 'solve' this complex challenge; what is needed are multi- and inter-disciplinary research efforts, that include the natural, physical, engineering, health, arts and social sciences. Addressing this challenge also requires the engagement and involvement of a wide range of stakeholders, comprising industry, other practitioners and policy-makers.

This programme provides an opportunity to improve climate risk assessment and enhance UK resilience by encouraging and funding high-quality multi- and interdisciplinary research and innovation using integrative approaches that cross-traditional disciplinary boundaries. It provides space for pioneering research, laying the foundation for future capability and aims to link effectively with Government departments' research priorities and opportunities.

[1] Moss et al., 2013https://science.sciencemag.org/content/342/6159/696

3. Scope

3.1 Programme objectives

The overarching objectives of the UK Climate Resilience programme seek to drive innovative multi- and inter-disciplinary research within the UKRI and Met Office communities to address the knowledge gaps identified above. The central objectives of the programme are:

1. Characterising and quantifying climate-related risks
2. Managing climate-related risks through adaptation
3. Co-producing climate services

Further details about the programme scope are in the UK Climate Resilience Science Plan. The plan was informed by consultation with UKRI and Met Office communities and climate resilience stakeholders from public, private and third sectors, consideration of past and on-going programme activities, Government departments' research priorities, the evolving UK climate resilience research landscape and the state-of-the-art in relevant disciplines.

It is strongly recommended that all applicants read the UK Climate Resilience Science Plan in advance of applying.

3.2 Call scope

Regional and local physical climate phenomena such as heatwaves, intense precipitation and windstorms can be hazardous to human and natural systems as well as the built and engineered environment. Therefore, weather and climate hazard information about present and future conditions is needed to help organisations and decision-makers prepare for climate variability and change to minimise damages and exploit opportunities. Climate hazard information is an important component in the assessment of present and future climate-related risks, in combination with information about exposure and vulnerability.

Hazard information, such as data from the UK Climate Projections (UKCP) and other sources, has been used by UK organisations to assess climate hazard, impacts and risk – e.g., through two rounds of the Adaptation Reporting Power (ARP) – and UK government – through the Climate Change Risk Assessment (CCRA). Climate hazard information is also important in the development of climate services and in voluntary schemes such as the Task Force on Climate-related Financial Disclosures (TCFD), which includes a focus on physical risks.

Hazard information is required to characterise and quantify present and future conditions associated with a wide range of high impact meteorological events such as windstorms, intense precipitation, heat waves and droughts. Whilst there are many methods for estimating current and future hazards, the robustness and inter-comparability of these methods is not well understood. Understanding of how the meteorological phenomena which generate hazards are affected by climate change is often incomplete or missing, yet is essential to robust characterisation and quantification in addition to links with novel mathematical, statistical, engineering modelling and technologies. Therefore, this research

will develop, evaluate and compare methods to characterise present and future climate hazards and underlying driving processes, including understanding the robustness of the methods. The approaches need to be decision-relevant to UK climate resilience.

This research topic primarily addresses the Science Plan Research Theme 1 'Characterising and quantifying climate-related risks', which aims to provide a step change in capability and filling of knowledge gaps to enable robust characterisation and quantification of hazards and risks, including how they are communicated between research communities and more widely. In addition, it will inform the development of climate services (linking to Research Theme 3 on 'Co-producing climate services').

It is anticipated the work will be complementary to existing work in Met Office UK Climate Resilience projects focused on several related areas; there is research focusing on comparing different approaches to estimating the probability of extreme events in the recent past, notably using data from UKCP18 (Lowe et al., 2018[2]), UNSEEN (Thompson et al., 2017[3]) and event attribution (Christidis, 2016[4]) approaches. Additionally, work is underway to characterise and understand extreme events and their repeat frequencies as well as compound events and the large-scale synoptic conditions driving them in the UKCP18 global and 12km datasets. Further assessment of changes in the new high resolution 2.2km scale dataset (Kendon et al, 2019[5]) will be carried out, including assessing changes in lightning, hail, wind, and urban temperature extremes. Additional work to understand larger future increases in winter mean precipitation in the 2.2km compared to the 12km dataset will also be carried out, including diagnosing the convective contribution to this difference. Future changes in heatwaves of 2 to 16 days duration using conditional non-stationary extreme approaches will continue building on the work of Winter et al., (2017[6]). New approaches to estimating the spatial variation of extreme behaviour (Youngman, 2018[7]) will be applied to the UK for wind, precipitation and temperature.

2 Lowe et al., 2018. https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf
3 Thompson et al., 2017. https://www.nature.com/articles/s41467-017-00275-3
4 Christidis and Stott, 2016. https://www.sciencedirect.com/science/article/pii/S2212094716300640
5 Kendon et al., 2019. https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP-Convection-permitting-model-projections-report.pdf
6 Winter et al., 2017. https://academic.oup.com/climatesystem/article/1/1/dzw006/2912162
7 Youngman, 2018. https://www.tandfonline.com/doi/abs/10.1080/01621459.2018.1529596?journalCode=uasa20

4. Programme requirements

4.1 Programme funding

The funding in this Announcement of Opportunity will be delivered through **two awards**, each up to each up to the value of £350K (at 80% FEC).

Projects should have a start date no later than 3 August 2020 and have a duration of no more than 24 months.

4.2 Proposal requirements

Proposals are invited to develop and evaluate new methods and techniques to characterise current and future climate hazards and underlying driving processes, including understanding the robustness of the methods.

As a minimum, applications should include hazards related to precipitation and temperatures, including their extremes. Proposals are encouraged which consider derived hazard indices or other metrics, including joint hazard and persistent events, of relevance to UK climate resilience.

The primary regional focus of proposals must be the UK (in the context of the northwest Europe region). Proposals should consider carefully and justify choices made in respect of the wealth of available data such as historical records, observed climate data and climate model output such as UKCP18, EURO-CORDEX, CMIP6, European H2020 PRIMAVERA project and Japanese d4PDF project. Future hazard assessment needs to consider a range of plausible scenarios spanning both climate forcing and regional responses, with a primary focus on the present and the next few decades.

UKRI and Met Office jointly deliver the SPF UK Climate Resilience programme. If it would be helpful to discuss Met Office SPF UK Climate Resilience activities in this area please contact Noel Nelson (Noel.Nelson@metoffice.gov.uk). The Met Office will be able to discuss current projects but cannot offer views on the design of responses to this UKRI led call. Met Office will engage with the successfully funded projects to ensure good alignment and to investigate collaboration on the future work. **It is important to note that working with the Met Office is not a requirement of the bid and please exclude the cost of any Met Office project related activity from your budget.**

The UK Climate Resilience Champions[8] and programme Steering Committee will also provide guidance and support to the awarded projects.

[8] https://nerc.ukri.org/research/funded/programmes/ukclimate/news/jsp-champions/

As well as the assessment criteria detailed **Section 6** of this document, the two successful projects will be selected so that they are complementary to each other.

4.3 Knowledge Exchange and Impact

Knowledge exchange (KE) is vital to ensure that environmental research has wide benefits for society, and should be an integral part of any research.

All applicants must consider how they will or might achieve impact outside the scientific community and submit this with their application as a Pathways to Impact statement, with associated delivery costs where relevant. Pathways to Impact activities do not have to be cost-incurring; it is not a requirement to include funded activities. Any funds required to carry out any proposed, outcome-driven activities identified within the Pathways to Impact **must** be fully justified within the Justification of Resources statement.

The Pathways to Impact will identify those who may benefit from or make use of the research, how they might benefit or make use of the research, and methods for disseminating data, knowledge and skills in the most effective and appropriate manner.

An acceptable Pathways to Impact is a condition of funding. Grants will not be allowed to start unless unacceptable Pathways to Impact are enhanced to an acceptable level within one month of notification of the panel outcome.

All funded projects may also be required to engage with programme-wide KE activities, in which case appropriate funding will be provided by the programme.

4.4 Data Management

The UKRI Data Policy must be adhered to, and an outline data management plan produced as part of proposal development. Details of NERC and ESRC data centres are found in the embedded links. UKRI will pay the data centre directly on behalf of the programme for archival and curation services, but applicants should ensure they request sufficient resource to cover preparation of data for archiving by the research team.

4.5 UKRI and Met Office facilities

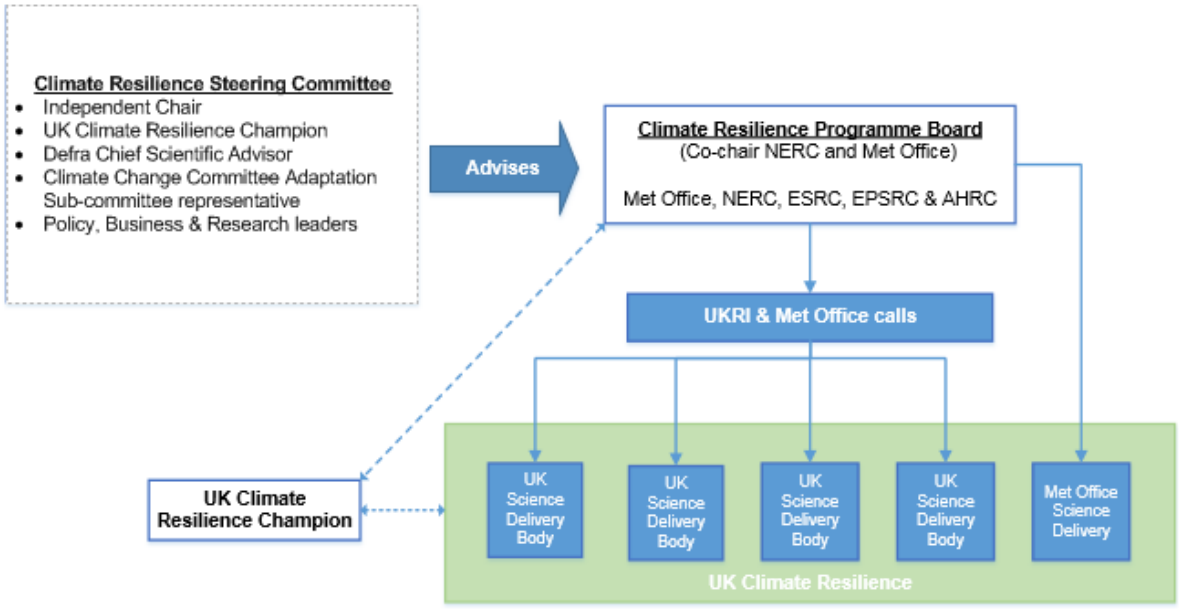
Prior to submitting a proposal, applicants wishing to use a UKRI service or facility must contact the facility to seek agreement that they could provide the service required in the short time frame of these awards and receive a quote for work which the facility will provide, then submit a mandatory ‘technical assessment’ with their proposal.

A list of NERC and EPSRC facilities can be found at the imbedded links. The costs for the service or facility (excluding HPC costs) must be included within the Directly Incurred Other Costs section of the Je-S form and within the facilities section of the Je-S form.

Applicants wishing to utilise the Met Office/ NERC supercomputing facility Monsoon2 should use the following link to find out how to apply.

4.6 Programme management

UKRI and the Met Office jointly deliver the UK Climate Resilience programme. The Programme is managed and overseen by a UKRI/Met Office Programme Board, which is advised by a Steering Committee. Funded grants will be required to work with the UK Climate Resilience Champions and engage with cross-programme activities.



Further details of the governance structure as well as Steering Committee membership can be found on the programme website here.

4.7 Reporting requirements

As with all UKRI grant holders, there will be a requirement to report through the UKRI reporting system ResearchFish; this is an annual requirement and continues for up to five years post grant end.

UKRI and the Champions may also require funded projects to respond to specific and other ad hoc queries for information as required.

4.8 Linking to UK Climate Resilience activities

Successful applicants will be expected to collaborate with the Met Office and other activities funded through the UK Climate Resilience programme.

Applicants may wish to discuss current Met Office UK Climate Resilience activities in this area. To do so, please contact Noel Nelson via Noel.Nelson@metoffice.gov.uk. The Met Office will be able to discuss current projects but cannot offer views on the design of responses to this UKRI led call. Cross-programme collaborations with Met Office activities will be developed between the Met Office and successful applicants.

Applications should not include Met Office as a partner on their application. Please note that working with the Met Office is not a requirement of the bid and please exclude the cost of any Met Office project related activity from your budget.

5. Application process

5.1 How to apply

Closing Date: 4pm on 5 March 2020

Full proposal must be submitted using the Research Councils' Joint Electronic Submission system (Je-S). Applicants should select

Council:	NERC
Proposal Type:	Standard Proposal
Scheme:	Directed
Call:	UK Climate Resilience MARCH 2020

Please note, the call in Je-S will be visible for applicants from **12 December 2019**.

The call will close on Je-S at 4pm on 5 March 2020 and it will not be possible to submit to the call after this time. Applicants should leave enough time for their proposal to pass through their organisation's Je-S submission route before this date. Any proposal that is incomplete, or does not meet NERC's eligibility criteria or follow NERC's submission rules (see NERC Grants Handbook), will be office rejected and will not be considered.

Proposals for this call should be submitted in standard grant format (except for the reduced case for support length detailed below) following the requirements outlined in Section F of the NERC research grant and fellowships handbook.

Applicants Case for Support document should be no longer than 8 sides A4. Incorporating the previous track record (up to 2 sides A4), and description of proposed research, which

should include how the research fits to the *UK Climate Resilience Present and future climate hazard UK Climate Resilience* call (up to 6 sides A4).

All attachments, with the exception of letters of support and services/facilities/equipment quotes, submitted through the Je-S system must be completed in single-spaced typescript of minimum font size 11 point (Arial or other sans serif typeface of equivalent size to Arial 11), with margins of at least 2cm. Please note that Arial narrow, Calibri and Times New Roman are not allowable font types and any proposal which has used either of these font types within their submission will be rejected. References and footnotes should also be at least 11 point font and should be in the same font type as the rest of the document. Headers and footers should not be used for references or information relating to the scientific case. Applicants referring to websites should note that referees may choose not to use them.

Applicants should ensure that their proposal conforms to all eligibility and submission rules, otherwise their proposal may be rejected without peer review. More details on NERC's submission rules can be found in the NERC research grant and fellowships handbook and in the submission rules on the NERC website.

Please note that on submission to council ALL non PDF documents are converted to PDF, the use of non-standard fonts may result in errors or font conversion, which could affect the overall length of the document.

Additionally where non-standard fonts are present, and even if the converted PDF document may look unaffected in the Je-S System, when it is imported into the Research Councils Grants System some information may be removed. We therefore recommend that where a document contains any non-standard fonts (scientific notation, diagrams etc), the document should be converted to PDF prior to attaching it to the proposal.

No associated studentships can be requested under this call.

The expected start date for projects funded under this Announcement of Opportunity is 3 August 2020.

5.2 Eligibility

Calls under these programmes will be open to eligible individuals in organisations that are normally eligible to apply for research grants from UKRI's research councils.

Public Sector Research Establishments (PSREs) are now also eligible to apply to SPF programmes. If PSREs wishing to apply have not previously applied for UKRI funding and are not currently designated IRO status they will be required to complete an eligibility form to ensure they have the required research capacity, systems and controls in place to manage the research and grant funding. See this link for further information. PSRE applicants should contact avril.allman@nerc.ukri.org at the earliest opportunity to discuss their interests in applying.

Individual and organisational eligibility is detailed in on the UKRI eligibility web pages. UKRI research and fellowship grants for all schemes may be held at approved UK Higher Education Institutions (HEIs), approved Research Council Institutes (RCIs) and approved Independent Research Organisations (IROs). Full details of approved RCIs and IROs can be found on the UKRI website.

Investigators may be involved in **no more than two** proposals submitted to this call and only one of these may be as the lead Principal Investigator.

6. Assessment Process

All proposals received which meet eligibility criteria will be assessed by an independent panel of experts.

The assessment criteria to be used will be as follows:

- **Research Excellence:** relates to the originality and quality of the proposed research and the importance of the questions being addressed;
- **Fit to Scheme:** Proposals will be directly scored against the degree to which they address the objectives and scope of the UK Climate Resilience call. (Details of these can be found in section 3 '*Scope*'). Proposals which do not strongly meet the criteria of the call will not be considered for funding.

Feedback will be provided to both successful and unsuccessful applicants.

UKRI will use the recommendations of the moderating panel along with the overall call requirements and the available budget in making the final funding decisions.

7. Timetable

- Announcement published: December 2019
- Deadline for proposals: 4pm on 5 March 2020
- Assessment panel: May 2020
- Outcomes known: June 2020
- Start date for projects: 3 August 2020

8. Contact

For all enquiries, please contact the UK Climate Resilience secretariat:

Email: climateresilience@nerc.ukri.org
Phone: 01793 411565