PROJECT TITLE: Climate change’s impact on extreme UK drought and flood risk

DTP Research Theme: Changing Planet

Lead Institution: University of Bristol

Lead Supervisor: Peter Watson, University of Bristol, School of Geographical Sciences

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Project keywords: climate change; extreme weather; drought; flooding; climate modelling.

Project Background
Climate change will have major effects on the risks of extreme flooding and drought in the UK. It is extreme events that cause most weather-related damage to lives and properties. However, it is still uncertain how large the effects will be and even whether the risks are increasing or decreasing, making it difficult to apply our knowledge to disaster risk reduction. This is because extreme events are rare, so we cannot obtain large samples of observed extremes to learn about them, and typical climate modelling experiments also do not sample enough of them. Better understanding of the risks of extreme UK weather such as this is highly important for work such as the UK government Climate Change Risk Assessments.

Project Aims and Methods
The goal of this project is to deliver new understanding of changes in these hydroclimatic extremes using state-of-the-art multi-thousand-year climate simulation datasets (e.g. from www.climateprediction.net). These include large enough numbers of extreme weather events to allow them to be systematically studied. We will use these to understand how the risks of extreme UK flooding and drought will vary as climate change progresses and also the uncertainty in this, including the potential worst case scenarios so that planners can be prepared for all eventualities. One key science question is understanding how changes in these weather extremes are linked to changes in the behaviour of atmospheric features like the jet stream – uncertainty in this is a big factor in determining the size of the risks in the future. The first stages of the project will focus on changes in the weather risks (extreme high/low rainfall and temperature). Subsequently, there will be opportunity to use hydrological models developed at the University of Bristol, which convert rainfall data to river flows, to derive estimates of flooding and drought risks. This will allow us to show for the first time the full range of possibilities for how the risks of these extreme weather events and their impacts will change as the world warms according to physically-based simulations, which is crucial for ensuring that our societies are prepared. Under the supervisors’ guidance, the student will be encouraged to develop the research direction to best reflect their interests and strengths.
Candidate requirements
Candidates should be interested in furthering understanding of how to apply climate simulation data to increasing societies’ resilience to extreme events. They should have good quantitative skills (e.g. from studying a physical science, mathematics or a related subject) and be interested in developing skills in computer programming in order to run models and carry out numerical analysis on large datasets. Prior experience with a relevant programming language like Python or Matlab and using Unix-like systems would be an advantage, but is not a requirement. We welcome and encourage student applications from under-represented groups. We value a diverse research environment.

Collaborative partner
This project will be done in partnership with the Met Office Applied Science & Scientific Consultancy division through co-supervisor James Pope, who will provide expertise on directing the research to answer the most important questions about climate change impacts. There will be opportunity for the student to visit the Met Office to broaden their network and perspectives and to present their research, which will help ensure it reaches a wider audience through their connections to decision- and policy-makers.

Training
The student will gain highly valuable experience from working in a multi-disciplinary team of internationally-recognised researchers with expertise in modelling climate change and its impacts (Drs Watson and Mitchell), deriving hydrological information from climate projections (Dr Coxon) and applying climate change research to solve societal problems (Dr Pope). The student will receive training provided by the DTP, including a £3,250 training budget, and will be encouraged to present the results of the research internationally at conferences.

Background reading and references
- Previous study using multi-thousand-year climate simulations to understand changes in flood risk, which this project can build upon: Schaller et al., 2016, Human influence on climate in the 2014 Southern England winter floods and their impacts. Nature Climate Change, 6, 627–634. https://doi.org/10.1038/NCLIMATE2927

Useful links
School URL: http://www.bristol.ac.uk/geography/courses/postgraduate/

NERC GW4+ DTP Website:
For more information about the NERC GW4+ Doctoral Training Partnership please visit https://www.nercgw4plus.ac.uk.

Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2021/doctoral/phd-great-western-four-dtp/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

The application deadline is Friday 8 January 2021 at 2359 GMT. Interviews will take place during week commencing 8th February 2021.

General Enquiries:
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