Project title: Impact of future winter temperature volatility on winter mortality.

Project code: OU23

Host institution: The Open University

Key words: Climate change, human health, excess winter deaths, cold spells, temperature variability

Supervisory team: Principal Supervisor: Neil Edwards (Reader & Director of Research), Open University, neil.edwards@open.ac.uk
Co-Supervisor: Phil Staddon (Lecturer), Open University, philip.staddon@open.ac.uk

Project Highlights:
- Join a world-leading interdisciplinary team investigating climate change impacts on the environment and society
- Research the relationship between human health and cold temperature volatility and model future climate change impacts
- Improve our understanding of climate change risks to human health and influence climate change adaptation policy

Overview:
Climate change is of major concern to most governments worldwide. The UK will experience significant change and by 2050-2080 the local climate will be 2 to 3°C warmer than now. Extreme weather events will become more frequent, including heatwaves, storms, and cold spells. These changes are characterised by an increase in weather volatility. Temperature volatility impacts on health have received considerable attention when investigating impacts of heatwaves, but little work has been performed on cold spells. It had been widely assumed by policymakers and health professionals that a benefit of climate change would be a decline in excess winter deaths (EWDs) in the UK, as winters warm. However it has recently been shown that the link between winter temperatures and EWDs has weakened. The association of year-to-year variation in EWDs with the number of cold days in winter, evident until the mid 1970s, has disappeared per se but rather the drop in temperature that is important; (3) increased temperature volatility, making cold spells more unpredictable. Importantly all three of these mechanisms will be dependent on one or more aspects of temperature volatility. There is evidence that winter temperature volatility has increased in the UK: e.g. the number of days per winter with a mean daily temperature <5°C and showing a 4°C drop from the previous day exhibits an increasing trend for 1990-2011 (R-square 0.31; p 0.007). Probable increases in future winter temperature volatility would mean more days of severe cold despite warmer winters. The nefarious effects on EWDs could be substantial, with the vulnerable being caught off guard by abrupt changes in temperature. There is an urgent need to better understand the impact of future winter temperature volatility on winter mortality.

Figure 1. Rolling 10 year correlation between relative excess winter mortality and the number of winter cold days. Correlation coefficients are from 10 year rolling correlations. Correlation above 0.50 is deemed strong. The relationship between excess winter deaths and number of cold days exhibits a classic correlation breakdown in the late 1970s. From Staddon et al. (2014) Nature Climate Change.
Methodology:
The overall aim of this research is to determine whether increased winter temperature volatility as a result of climate change could lead to increased winter mortality despite generally warmer winters. This project will statistically analyse past cold spells and link this to mortality data to identify patterns in the temperature mortality relationship. The data will be investigated both at the national level but also at the local level for selected examples. The importance of time lags will be addressed. By identifying and describing current relationships between temperature patterns and mortality, it will then be possible to investigate the impact of future temperature volatility scenarios on mortality using mathematical simulation models. It is anticipated that sensitivity analyses will then be performed to identify events of greatest risk and thus suggest when public health interventions should take place. Outputs would include advice on areas of health policy and climate change adaptation strategy.4

Training and skills:
In year 1, students will be trained in research methods, and analytical, modelling and writing skills.
In years 2 and 3, masterclasses will be available to gain expertise in specific areas related to the project. The student will receive training in research approaches in epidemiological studies, use of large data sets, statistical analyses and modelling and other specific skills required for the project. Students will also receive training in communicating science to different audiences (peers, the public, school students, media and policy makers) using a variety of methods including presentations, social media, policy briefing notes, public events and interviews.

Partners and collaboration
Prof Mike Depledge (University of Exeter Medical School) produces impactful research that influences policy. He was Chief Scientist of the Environment Agency.
Prof Hugh Montgomery (UCL and Whittington Hospital) researches links between the environment and health and is a consultant in critical care. The student will have the opportunity to discuss their project with Mike and Hugh, who publish in leading journals (Nature, Lancet, NEJM), work with policy makers, and regularly advise the WHO, the EU and governments.
The supervisors and advisors have extensive contacts at potential partners including MetOffice, Public Health England, Department of Health, and NHS Sustainability Unit.

Possible timeline:
Year 1: Literature review including manuscript for submission; research design; identifying key relationships between temperature volatility and morbidity/mortality data over last 3 decades.
Year 2: Building and a testing simulation model to investigate impacts of increased temperature volatility on morbidity/mortality; running simulations; produce first data-based manuscript for publication.
Year 3: Final model runs; consider policy angle; presenting findings at conferences; finalising papers; writing-up thesis.

Further reading:

Further details:
Students should have a strong background in numerical biology, ecology, environmental science, epidemiology or other strongly numerical subject and enthusiasm for climate change related research. Experience of mathematical modelling is desirable. The student will join a well-established team researching climate change impacts at the Open University.

Interested candidates are encouraged to contact Neil Edwards neil.edwards@open.ac.uk @Neil_R_Edwards for more information.

Applications should include:
- a cover letter outlining why the project is of interest to you and how your skills match those required
- an academic CV containing contact details of three academic references
- an Open University application form, downloadable from: http://www.open.ac.uk/students/research/sites/www.open.ac.uk.students.research/files/documents/Application%20form.docx

Applications should be sent to STEM-EEES-PhD-Student-Recruitment@open.ac.uk by 5 pm on Monday 22nd January 2018