Unravelling the uncertainties of predicting future heatwaves

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(PhysOrg.com) -- As the UK swelters in the grip of a late September heat-wave researchers at The University of Nottingham have warned that while Indian summers could become more common, heat-waves in the future could become even hotter. Moreover, they could have important implications for human health.

However, their research suggests that we are going to have to take a lot more notice of the things we don't understand about the climate. In other words, we have up until now, been underestimating the uncertainties of climate change.

Dr Simon Gosling, in the School of Geography, said: "It is important that we represent this uncertainty when we try to understand future climate change. One way of understanding how heat-related mortality risk will change in the future is through the application of numerical models that simulate the effects of climate change on human health. Up until recently such models have typically produced projections of climate change impacts based upon only one or two possible future climates. However, great uncertainty is associated with the numerical models that simulate future climate, due in part to the limited understanding of the physical climate system. This means that this climate modelling uncertainty is often considerably under-estimated. A more complete treatment of this uncertainty is important for better informing risk-based decision-making."

Using a technique called Perturbed Physics Ensemble (PPE) – Dr

Gosling, in collaboration with experts from The University of Auckland and The Met Office Hadley Centre, ran 17 slightly different versions of a complex climate model to explore what the future climate might look like, and what it might mean for human health. The study, published in the journal *Climatic Change* provides the most complete treatment of climate modelling uncertainty in climate change health impacts assessment to date.

Dr Gosling said: “The European heat wave of 2003 had a devastating effect on human health. The extremely high temperatures have been estimated to have caused over 35,000 deaths across the continent. Climate change predictions indicate that events such as this heat wave could occur more often in the future and that future heat waves could be even more extreme. Moreover, there is evidence that towards the end of this century, every summer in Europe could be as hot as the summer of 2003. Given the scale of the effects of the 2003 heat wave, and the predictions of more frequent and intense heat waves due to climate change, there is a need to understand how these kinds of events may affect human health in the future. Most importantly, we need to know how certain we can be about these predictions.”

By considering the different patterns of climate change projected by 17 climate models, the study gives an indication of the current level of scientific confidence in projected changes in heat-related mortality for six cities; Boston, Budapest, Dallas, Lisbon, London and Sydney. The cities were selected to represent a range of different climates.

Dr Gosling said: "Climate models include complex equations about how the climate works. For example, there are mathematical equations that describe how the sun's radiation reaches the land surface, there are equations that describe how the oceans currents move. Each version of the model used in a PPE is different in terms of the equations the model uses to work things out about the future climate.

“For example, the way that clouds are represented or the way water evaporates from the earth's surface. This is important, because we just don't understand everything about how the climate system works. For instance, we still do not completely understand the role of clouds in affecting climate change. As such, we are uncertain about certain aspects of the climate system. Essentially, we don't understand all the physics of the climate system.”

Dr Gosling’s research demonstrates that relying on a single climate model for estimating future health impacts is not appropriate. The main finding is that although there is a lot of uncertainty, it is very likely that heat-waves could become hotter in the future in London and that heat-related mortality could increase six-fold. This is also true for Boston, Budapest, Dallas, Lisbon, and Sydney. However, Dr Gosling does note that it is possible that humans will acclimatise to warmer temperatures in the future. “The question is, by how much”, he added, “since we have little observational evidence to indicate how much humans can actually acclimatise to hotter and more frequent heat waves”.

More information: The paper can be found at: www.springerlink.com/content/60120mg13721j222/

Provided by University of Nottingham

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