

P. Stott: Attribution of Weather and Climate-Related Extreme Events

Unusual or extreme weather and climate events are of great public concern and interest. A question frequently asked is how human influences on climate may have effected the occurrence of such an extreme event. The demand for information is often at its greatest in the immediate aftermath of such events, requiring a rapid response from the scientific community. Additionally, were a legal case to be brought seeking to apportion blame for a weather-related disaster there would be a requirement for objective and scientifically robust information. A related concern is the question of what will likely happen next, and much rests on the development of appropriate adaptation strategies to cope with climate change.

Climate scientists are faced with a daunting challenge in generating and communicating scientifically robust and timely information on the causes of such events and their links to climate change. There is evidence by analysing trends in the statistical distributions of certain types of extremes that the frequency of some extremes has changed and this information can be used to infer the changed probabilities of events. However evidence of changing extremes on a worldwide basis does not necessarily imply that a specific type of recently observed weather event will become more or less frequent in future. The floods in Pakistan during 2010 and the Moscow heatwave in summer 2010 were striking recent examples of extreme weather associated with devastating impacts. More recently (to take an example with parochial interest to the lead author) the UK experienced its coldest December in the national series dating back to 1910 and Central England its warmest April in the Central England temperature record that stretches back to 1659.

It is sometime erroneously stated that it isn't possible to attribute any individual weather or climate event, a statement that is often interpreted to mean that climate change cannot be demonstrated to be a factor. However it has been shown possible to make attribution statements about individual weather and climate events although this has so far been attempted for a relatively small number of specific cases. Research is under way in several centres worldwide, coordinated as part of the international Attribution of Climate-related Events (ACE) initiative, to develop the underpinning science needed to better respond to the attribution challenge. This will require developing real-time monitoring and climate analysis capabilities, ensuring the availability of historical data sets, such that current events can be placed into a reliable and physically consistent historical context, and the development of modelling frameworks to establish plausible cause-effect relationships and quantify the changed probabilities of particular weather events and risks of associated impacts. An important component of this activity is the coordinated attribution experiments being carried out by climate modelling centres as part of the CLIVAR Climate of the 20th Century project.

This presentation will review the scientific progress being made to develop scientifically sound and authoritative assessments of extreme weather and climate events and their impacts. It will consider the scientific approaches being developed, consider the link with seasonal forecasting, review some specific case studies, such as the UK floods of 2000, the European heatwave of 2003 and the Moscow heatwave of 2010, and discuss the challenges involved in validating such model-based approaches and of successful communication between scientists and a variety of interested stakeholders.

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Dr Peter Stott leads a group that develops historical climate datasets and climate monitoring products, and carries out research into the causes of climate variability and change. He has a BSc in Mathematics from the University of Durham, a Master's degree in Mathematics from the University of Cambridge and a PhD from Imperial College London, where he researched the atmospheric dispersion and deposition of radionuclides released in the Chernobyl accident of 1986. After post-doctoral work at the University of Edinburgh, he has been at the Met Office Hadley Centre since 1996,

where his research has focused on the detection and attribution of climate change. He is coordinating lead author for the IPCC Working Group I Fifth Assessment Report chapter "Detection and Attribution of Climate Change: from Global to Regional", having served as a lead author on the Fourth Assessment Report Working Group I and Synthesis Reports. His many publications include a paper in the scientific journal *Nature*, which showed a link between human emissions and the European heatwave of 2003, demonstrating that human influence had very likely more than doubled the probability of such an event.