Session: B2 Oral presentation

Extreme value theory and single-event attribution

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The problem of single-event concerns how to attribute a single extreme event, such as a heatwave or hurricane, to different forcing factors in the climate. As a specific example, we focus on the June-July-August mean temperature for a region of western Europe corresponding to the European heatwave of 2003. A number of earlier researchers have looked at this problem, in particular Stott, Stone and Allen (Nature, 2004), who proposed the "Fraction of Attributable Risk" (FAR) as a measure of the extent to which the risk of such an extreme event can be attributed to human as opposed to natural causes. The present analysis is an extension and elaboration of their approach, designed to more fully embrace the application of extreme value theory and thereby provide improved quantitative measures of uncertainty. A time series of observational data is calculated using the University of East Anglia land-only variance-adjusted temperature anomalies, and this is compared with two sets of climate model calculations of the same quantity: one from control runs, the other from twentieth century runs containing all the known climate forcings. By fitting an extreme value model to the observational data in combination with either the control or the twentieth century model runs, we are able to derive point and interval estimates of the probability of the observed event under either a control or forced climate scenario. This in turn leads to improved estimates of the risk ratio or, equivalently, the FAR. The analysis is intended to point towards a general methodology for making calculations of this nature.