Editorial: special issue on statistics of extremes in weather and climate

Richard W. Katz · Philippe Naveau

Quote

According to usual opinions, the extreme values, and especially those which occur in meteorology, are so irregular that no prediction can be made of the maximum precipitation, extreme temperature, maximum pressure, etc., that will occur in a given period of time.—E. J. Gumbel (1942, p. 95)

There is a long tradition of applying the statistics of extremes to weather and climate, starting at least as early as Gumbel (1942). Many of the applications in the first book on the statistics of extremes involve weather and climate as well (Gumbel 1958). A number of original developments in extreme value theory were motivated by difficulties arising in its application to meteorological or related hydrologic variables, such as the peaks-over-threshold approach and declustering.

Today, weather and climate extremes remain a fertile area of application, with virtually limitless data and a wide variety of extremal behavior ranging from bounded to heavy tails. As anyone who has ever looked at a series of weather maps should be aware, statistical modeling of weather and climate data requires treatment of spatial fields of observations which evolve over time. The climate system is complex and high-dimensional, with external (especially the sun) and internal drivers

R. W. Katz (✉)
Institute for Mathematics Applied to Geosciences, National Center for Atmospheric Research, Boulder, CO 80307-3000, USA
e-mail: rwk@ucar.edu

P. Naveau
Laboratoire des Sciences du Climat et l'Environnement, Centre National de la Recherche Scientifique, 91191 Gif-sur-Yvette, France
e-mail: naveau@lsce.ipsl.fr

and dynamical constraints and with important variations over a wide range of spatial and temporal scales. Further, the specter of global climate change suggests that non-stationarity need be considered in any treatment of extremes. As such, weather and climate extremes pose a number of problems which could serve as a catalyst for further developments in extreme value theory. Despite much effort, this theory does not yet even provide a fully satisfactory spatio-temporal model for extremes. Still climate scientists, in collaboration with statisticians, need to address critical questions about weather and climate extremes.

Papers containing substantive weather and climate applications have only rarely appeared in *Extremes*. So it is hoped that this special issue on the "Statistics of Extremes in Weather and Climate" will rectify this shortcoming. The papers in this special issue are written by both geophysical scientists, primarily climate researchers, and statisticians. This interdisciplinary research endeavor necessitated a review process broader in scope than common for *Extremes*, with each manuscript being refereed by a combination of statisticians and geophysical scientists. We thank all the referees from both research communities.

References

Gumbel, E.J.: On the frequency distribution of extreme values in meteorological data. Bull. Am. Meteorol. Soc. **23**, 95–105 (1942)

Gumbel, E.J.: Statistics of Extremes. Columbia University Press, New York (1958)