Opportunities and challenges for the use of NOAA Storm Events database for societal impacts research

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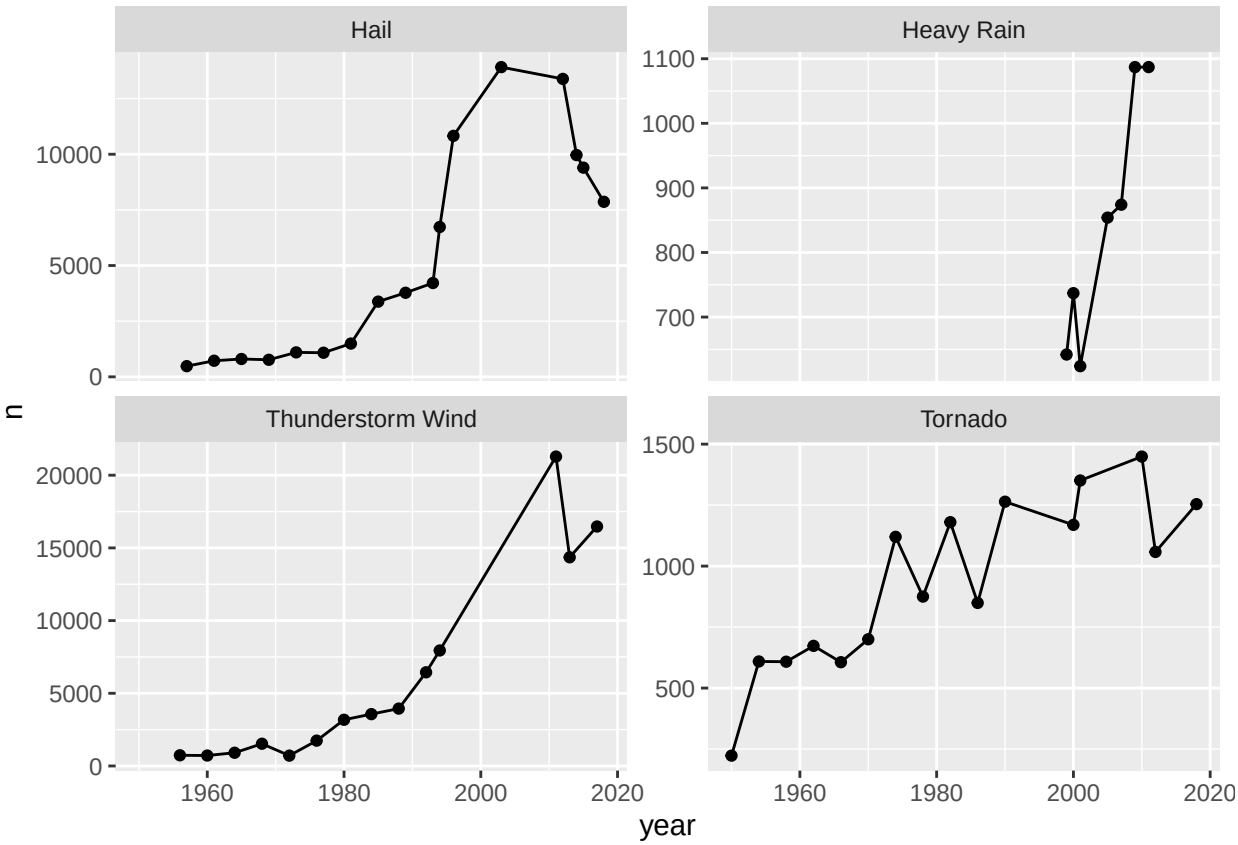
Abstract

Severe weather events currently cause tens of thousands of deaths per year in the United States and cost trillions of dollars in damaged property and economic loss. These weather events and their impacts are tracked and recorded by several organizations such as the National Weather Service (NWS), the National Oceanic and Atmospheric Administration (NOAA), and the Federal Emergency Management Agency (FEMA). This disaster data is used by scientists in several fields of study (economics, epidemiology, atmospheric science, agriculture, etc.) to examine how weather events impact human life and how we can reduce or avoid these impacts. However, storing disaster data faces unique challenges because of the quickly evolving nature of recording processes and weather technology. These challenges pose concerns regarding biases and errors in disaster data. This paper investigates the presence of mechanisms that could lead to biases in the NOAA Storm Events database. This database contains information on storms, significant weather phenomena, rare or unusual weather, and other significant meteorological events across the United States. We use the noaastormevents package in R to examine evidence of bias within the Storm Events weather data and propose ways to avoid errors while using this data in future studies. This examination reveals five major categories of bias present in the Storm Events data set that are common in weather data. These five categories include hazard bias, temporal bias, threshold bias, accounting bias, and geographic bias. We suggest that these biases result from various factors including structural changes over time, reporting errors, inherent bias, and others. Outlining these factors and understanding their impacts will help scientists use large amounts of data appropriately and portray new findings accurately.



The above graph represents the change in reported number of events over time in the NOAA Storm Events database. These four event types–Tornado, Thunderstorm Wind, Heavy Rain, Hail– exhibit a noticeable increase in number of events from 1950-2020 (as compared to other event types). This increase may be attributed to a variety of factors including meteorological change, advances in reporting technology, population growth and movement, etc. We seek to point out how these factors influence the data and if any bias confounds these changes.