NOAA Storm Events in Literature

What is the Storm Events Database

[Add a brief description of this database, including: who collects it; what data is collected; how it's collected; where the database is available; any major changes over time to what data have been collected and how they've been collected; information about what's included in each "entry" in the database.]

Use of Storm Events Database in research on societal impacts

[Add some examples of papers in which this database was used to identify storm exposures, and then the paper was looking at how they impacted humans.]

Concerns with Storm Events Database

Hazard Bias

Within the Storm Events database, there may be inaccurate recording in the number of certain hazard types. This may arise from the difficulty of sorting storm events that include multiple types of hazards. There are definitional differences between events as well as certain events correlating to multiple event categories. NOAA Storm Events defines the types of events that are allowed in the data set. This can be found under Table 1 of Section 2.1.1 of NWS Directive 10-1605 at http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf. NOAA Storm Events also states that "In the event it is obvious that a continuous or nearly continuous swath of thunderstorm wind or hail damage occurred, a single event should be entered into Storm Data. This single event would be described as occurring from Point A to Point B, during Time C to Time D. The related event narrative could describe the width and length of the damage swath. Scientifically, a swath is more accurate and reduces the chance of a researcher interpreting a single event as a series of events occurring across multiple points."

There is also limited information on event severity or distinction between events within the database (Luh et al. 2015). The NOAA Storm Data Disclaimer states that "Some information appearing in Storm Data may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS" ("Storm Data Faq Page," n.d.).

- P(event recorded | event happened) may be different by events
- This is influenced by the goal or audience of the database
  - For example, the US is esepcially concerned with monetary losses from floods so it may be more likely for flood events to be reported (Gall, Borden, and Cutter 2009)
  - The National Flood Insurance Act passed in 1968 created the National Flood Insurance Program which helps provide flood insurance

    *script to pull up number of floods compared to other events in noaa, no difference in monetary loss estimates pre and post 1968, so is this example not valid here?
- This also arises from the difficulty of sorting storm events that include multiple types of hazards

  - Definitional differences (Gall, Borden, and Cutter 2009)
  - one episode can correlates to mulitple events (Konisky, Hughes, and Kaylor 2016)

    *script for how noaa deals with this? or examples of this?

- we could list event_type from database?
- interrupted time series analysis: change in flood policy since 1996
  - years of big policy changes for floods (flood insurance)

Temporal Bias

Temporal bias can occur in the Storm Events database as the number of storm events and loss estimates change over time. This occurs as a result of changes in recording strategies, advancements in monitoring and detecting sotrm events, or better monetary loss accounting. For example, in the NOAA database, from 1950 to 1954, only tornado events were recorded ("Storm Events Database," n.d.). From 1955 to 1992 only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data ("Storm Events Database," n.d.). From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files("Storm Events Database," n.d.). Starting in 1996, 48 event types are recorded("Storm Events Database," n.d.). During these changes, The NWS reports that there was reduced funding from 1976 to 1979 that led to a decrease in flood damage data collection (Downton, Miller, and Pielke Jr 2005). Additionally, after 1983, Congress began to require The US Army Corps of Engineers to provide yearly flood damage reports in contract with the NWS (Downton, Miller, and Pielke Jr 2005). This provides a more consistent report of flood damage that may not have otherwise been reported. These changes pose inconsistensies in the number of certain storm events over large periods of time.

More temporal bias may occur from seasonal differences in number of events reported. NOAA exhibits higher rates of rip currents in the summer versus the winter.

- New process for loss estimation developed by NWS in 2007
- Switch between categorical estimates to whole dollar figure estimates: uses logarithmic at some point?
  - pull up loss data for events pre and post 1995
  - check for changes in reporting for NOAA under Database Details
- Seasonal Differences in number of events reported
  - Example of rip currents in summer vs winter
    * run for our data and check literature for seasonality of the weather event
    * Direct quote: The strength of rip currents can be seasonal. During hurricane season (from June to November) there is a greater chance for rip currents to develop.("Rip Current," n.d.)
    * Rip currents are related to several envrionmental factors including waves (surf heights, period, direction), beach (slope, orientation, material), water levels (tidal cycle, tide ranges), winds (affect wave breaking) and wind-driven currents alongshore, others like local coastal configuration and beach and promontories by natural or human made. ("Rip Currents: A Natural Killer on Beaches," n.d.)
    * The most likely scenario for rip hazards is not high surf but high exposure of beachgoers in the warm water of the summer-fall period. When low-energy, longer-period waves (significant wave heights of 0.5 -1.5 meters in 10-15 second sequences) lead to the highest number of rip incidents. During spring/neap tides or very low daily tidal cycles, a mass rescue event can occur, with hundreds of rescues in several locations on a beach, or at several beaches under the same conditions. ("Rip Currents: A Natural Killer on Beaches," n.d.)
    * create table of number reported by lifeguards or media vs month of the year

  - other events that are more or less reported?

Threshold Bias

The varying severity of an event creates threshold bias in the storm events database. Events of larger maginutude and/or damage to human health are better documented, while events of smaller magnitude are less reported becasue less people are affected (Gall, Borden, and Cutter 2009). Small events may even be excluded due to threshold criteria in the database (Gall, Borden, and Cutter 2009). For example, ff a flood has received a presidential disaster declaration, FEMA storm survey teams go to the scene and provide extra damage assessments (Downton, Miller, and Pielke Jr 2005).

- Events of smaller magnitude are less reported becasue less people are affected (Gall, Borden, and Cutter 2009)
  - may even be excluded due to threshold criteria (Gall, Borden, and Cutter 2009)
  - verify this under NOAA disclaimer

Accounting Bias

There are discrepencies in the type of loss information collected in the storm events database leading to accounting bias. Until 1994, damage estimates were recorded on a logarithmic scale (Downton, Miller, and Pielke Jr 2005). NOAA now records damage estimates in thousands of dollars. These estimates are comprised of direct and indirect monetary losses. Direct monetary losses from damage to infrastructure, buildings, crops, etc. are easier to quanitfy than indirect losses like lost revenue, business closures, societal losses, environmental damage (Gall, Borden, and Cutter 2009). These monetary losses can also be separated into community, state, refional, and global levels (Gall, Borden, and Cutter 2009). The estimates of damage to insured property are typically obtained from local field office reports that often lack quality and accuracy control (Downton, Miller, and Pielke Jr 2005).

- how does noaa report different types of losses?
- what level does noaa report economic losses at?
- How can nonmonetary losses be quanitifed?
- provide example/tabble of how NOAA records financial losses
  - can this be found in NOAA disclaimer?

Geographic Bias

The reporting of events can be affected by geographic location based on whether or not people are present to record the event. The supply of information is greater in areas closer to the weather event (Konisky, Hughes, and Kaylor 2016). There can also be changes at country or state level over time that lead to excluding or double counting events or loss data (Gall, Borden, and Cutter 2009). The NWS changed its reporting strategy from loss estimates by climate region to loss estimates in specific counties where event occurred around 1995 (Gall, Borden, and Cutter 2009). Currently, the smallest unit of aggregation to use all parts of database are Weather Forecasting Offices and there are about 122 nationwide (Konisky, Hughes, and Kaylor 2016). There may be inconsistencies between county regions and weather forecasting offices. NOAA Storm Events states that "a hydrometeorological event will be referenced, minimally, to the nearest hundredth of a mile, to the geographical center (not from the village/city boundaries or limits) of a particular village/city, airport, inland lake, or location providing that the reference point is documented in the Storm Data software location database."

- Reporting affected by geographic location (Luh et al. 2015)
  - differences between rural/urban
    - tornado example

  - There can be changes at country or state level over time that lead to excluding or double counting events or loss data (Gall, Borden, and Cutter 2009)
  - NWS changed its reporting strategy from loss estimates by climate region to loss estimates in specific counties where event occurred (relevant for data in 1995 during switch) (Gall, Borden, and Cutter 2009)
    * script for checking event location pre and post 1995
- Supply of information is greater in areas closer to weather event (Konisky, Hughes, and Kaylor 2016)
- Smallest unit of aggregation to use all parts of database are Weather Forecasting Offices and there are about 122 nationwide (Konisky, Hughes, and Kaylor 2016)
  - zone and fips script
- Direct Quote from NOAA webbsite: Storm Data has gone through many changes and versions over the years. The source data ingested into the database are widely varied and leads to many questions about the precision and accuracy of the location data ("Storm Data Faq Page," n.d.).
- Direct Quote: 2.4 Location. A hydrometeorological event will be referenced, minimally, to the nearest hundredth of a mile, to the geographical center (not from the village/city boundaries or limits) of a particular village/city, airport, inland lake, or location providing that the reference point is documented in the Storm Data software location database.
- this concept and hazard bias can be grouped together

Systemic Bias

- Differences in initial data collection and compilation create difficulties in comparing databases
  - Source and how losses are computed
  - Actual dollar losses vs inflation adjusted losses
  - Whole dollars vs loss categories

References

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Luh, Jeanne, Elizabeth C Christenson, Aizhan Toregozhina, David A Holcomb, Tucker Witsil, Laura R Hamrick, Edema Ojomo, and Jamie Bartram. 2015. "Vulnerability Assessment for Loss of Access to Drinking Water Due to Extreme Weather Events." *Climatic Change* 133 (4): 665–79.

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