MAY 12, 2020
CAS SPRING MEETING:
ACI/ACRI UPDATE

Rich Gibson, Senior Casualty Fellow, MAAA, FCAS

ACI/ACRI—Basics

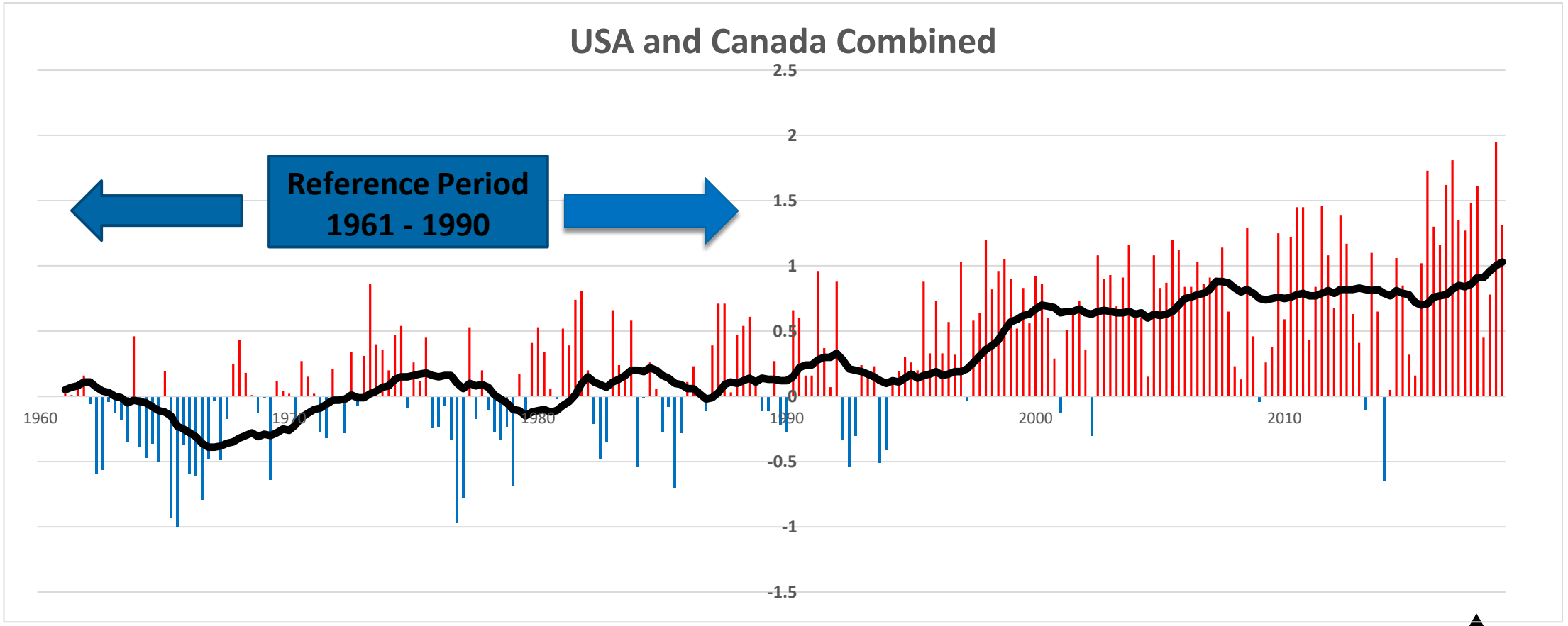
- Climate risk continues to be an important public policy issue
- Actuaries are making an impact

- ACI – Actuaries Climate Index
- ACRI – Actuaries Climate Risk Index

ACI—Background

- An educational tool providing information about weather trends in the United States and Canada, updated quarterly
- Retrospective analysis of data as opposed to a forecast of future trends
- Covers rainfall, temperature, dry spells, wind speed, and sea level
- Breaks U.S. and Canada into 12 regions, and analyzes each region separately
- Spans the period from 1961 to the present, with 1961–90 as a reference period
- Foundation for Actuaries Climate Risk Index

Actuaries Climate Index® (ACI), 1961–2018: reveals increasing frequency of extreme weather



ACI—Components

- Six component:
  - Warm temperature index
  - Cool temperature index
  - Extreme precipitation index
  - Consecutive dry days
  - Extreme wind index
  - Sea level index
- Combined to form the ACI

U.S./Canadian Actuarial Associations Responsible for the Actuaries Climate Index

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Canadian Institute of Actuaries / Institut canadien des actuaires

CAS

Society of Actuaries 1949

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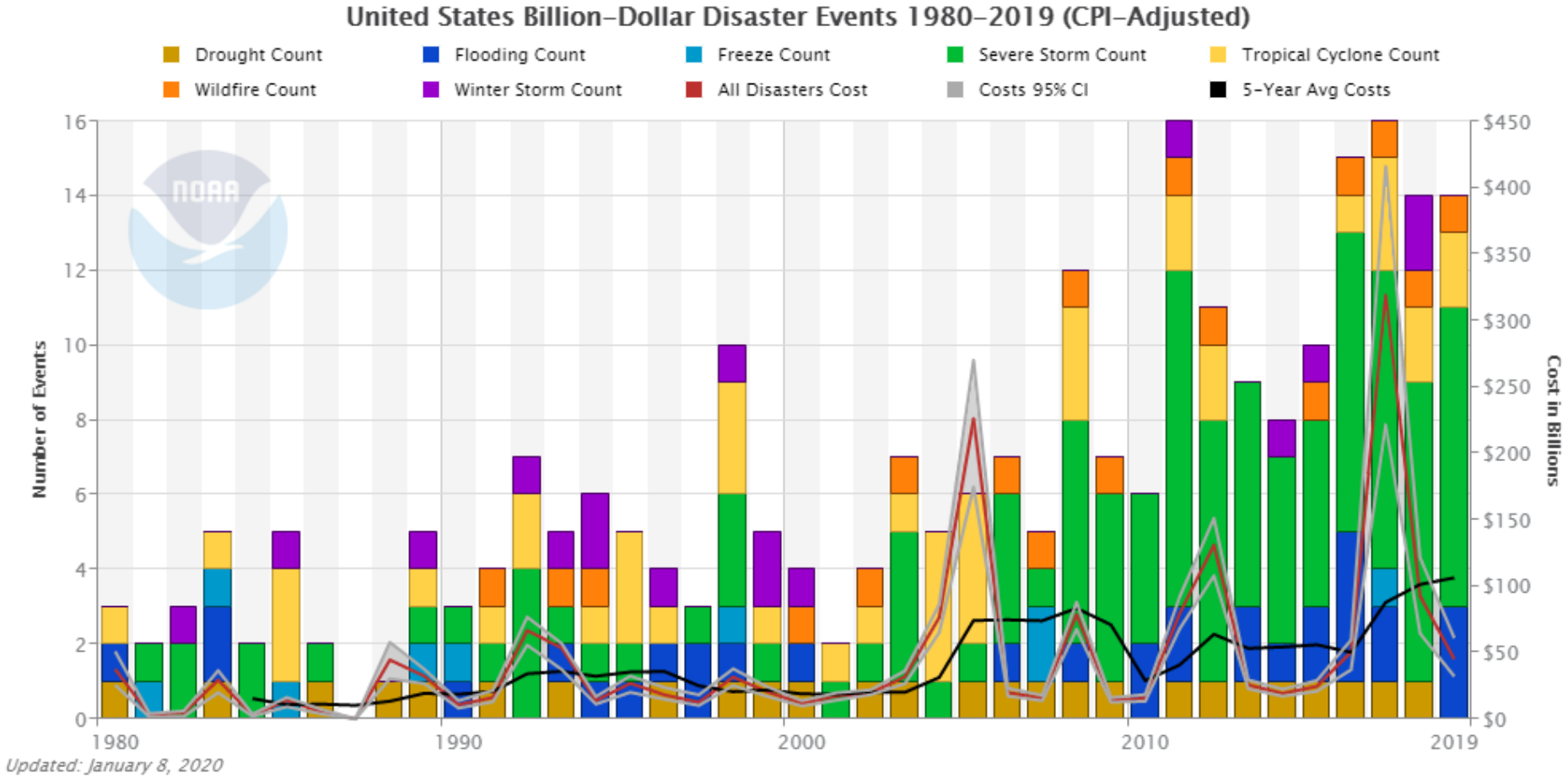
ACI Climate Regions: Large, Climatologically Heterogeneous

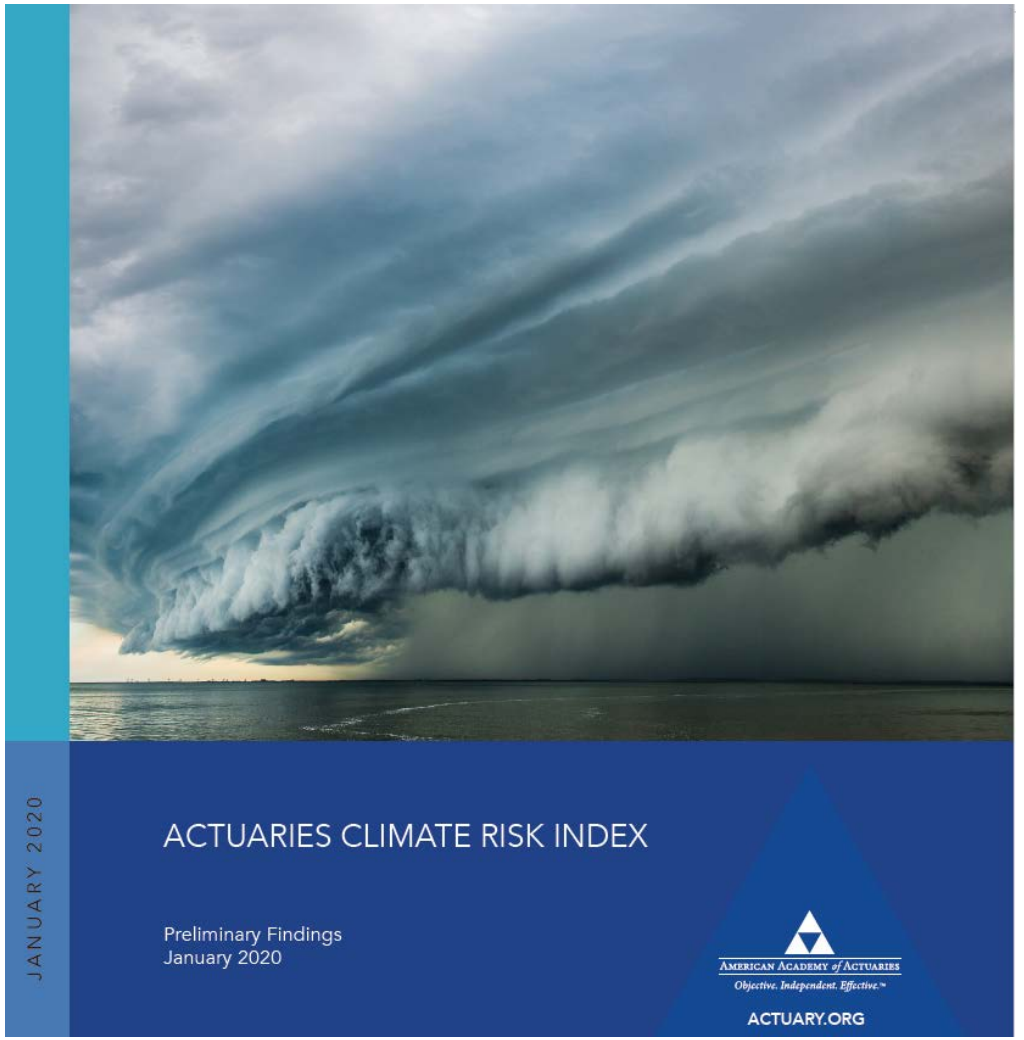
Region	Region Name
CAR	Central Arctic
NEA	Northeast Atlantic
NEF	Northeast Forest
NPL	Northern Plains
NWP	Northwest Pacific
ALA	Alaska
CEA	Central East Atlantic
CWP	Central West Pacific
MID	Midwest
SEA	Southeast Atlantic
SPL	Southern Plains
SWP	Southwest Pacific

Frequency of Billion-Dollar Weather Events in United States Increasing, 1980–2016



Source: https://www.ncdc.noaa.gov/billions/time-series, accessed March 2020

Actuaries Climate Risk Index (ACRI): Preliminary Findings



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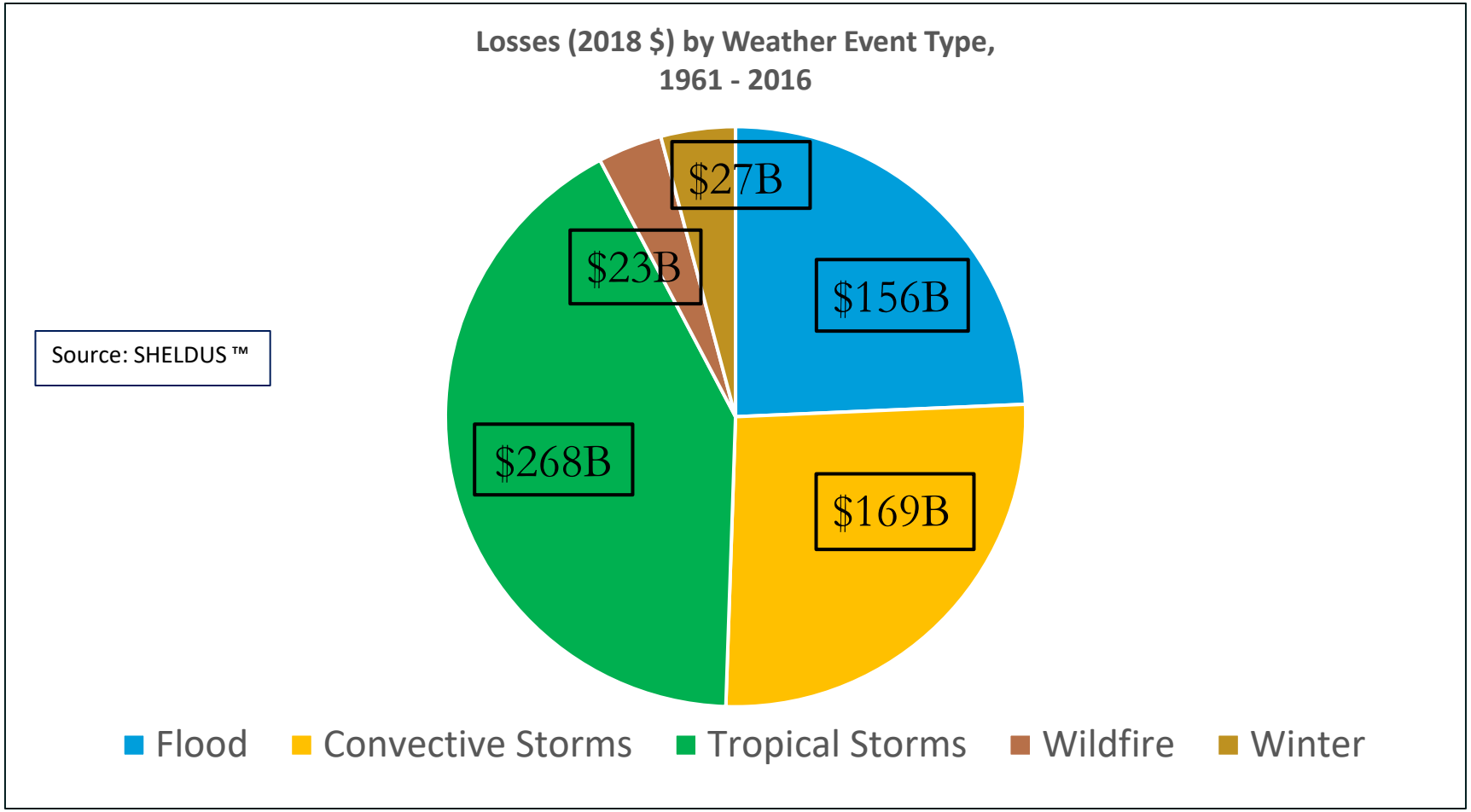
ACRI—Status Update

- ACRI: Preliminary Findings published by American Academy of Actuaries, January 2020
- Estimates relationships between the ACI's weather metrics and weather-related losses; derives ACRI from those estimates
- ACRI 1.0 focuses only on the United States due to data limitations for Canada; uses four of six ACI elements (excludes Drought and Sea Level)

Spatial Hazard Events and Losses Data for the United States (SHELDUS)

- Loss Data from SHELDUS™, Arizona State University
- SHELDUS™ is a county-level hazard data set for the U.S. and covers natural hazards such as thunderstorms, hurricanes, floods, wildfires, and tornados as well as perils such as flash floods, heavy rainfall, etc. The database contains information on the direct losses caused by events (property and crop losses, injuries, and fatalities) from 1960 to present.
- Information primarily derived from National Oceanic and Atmospheric Administration (NOAA) Storm Event Monthly Reports which, since 1996, are included in the NOAA Storm Events database.

Losses by Weather Categories, 1961–2016



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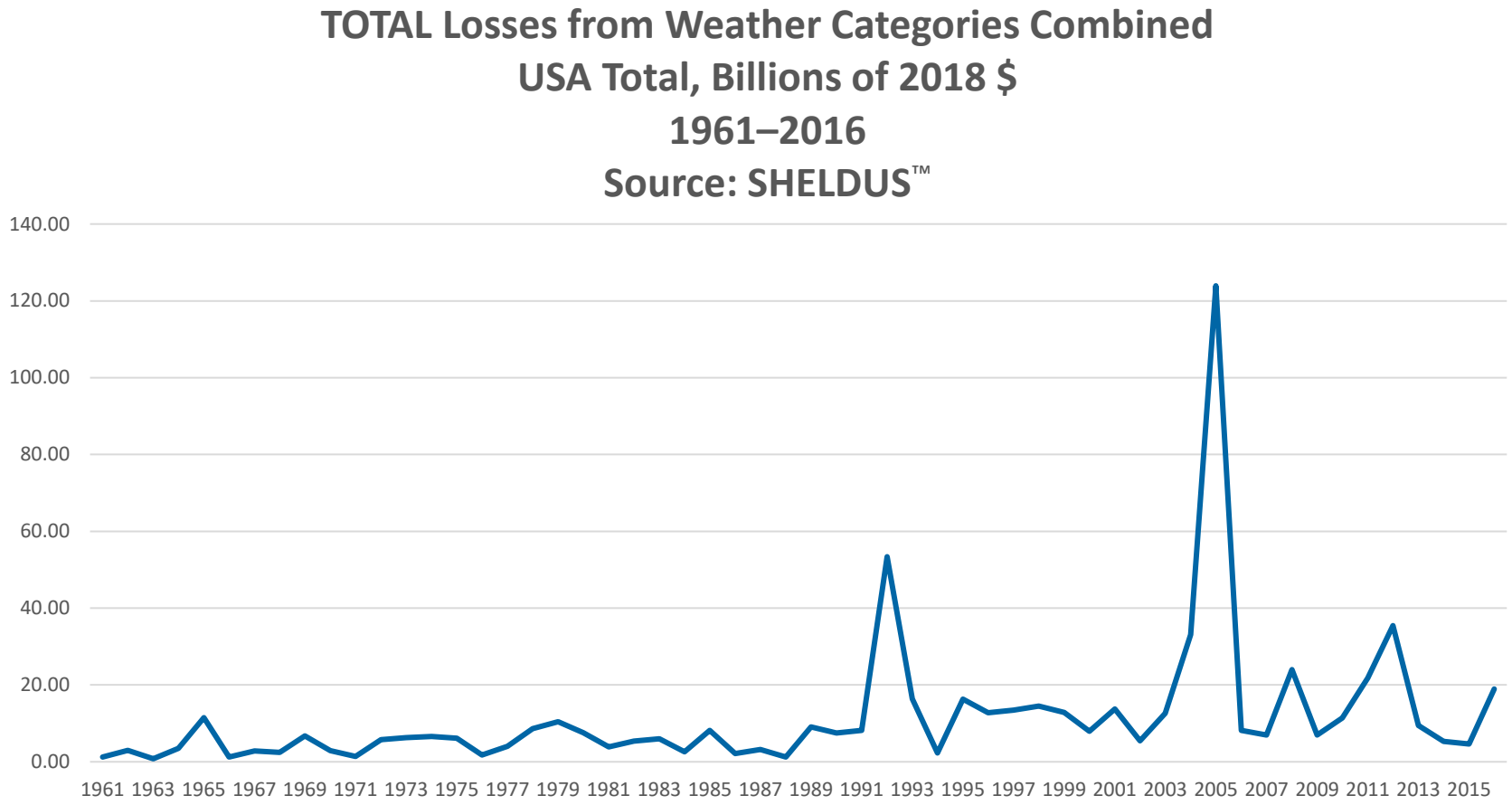
Weather-Related Losses Combined, 1961–2016: increasing



Imprecise Models Convey Insight

"Methods used to estimate the potential economic effects of climate change in the United States … and the studies that use them produce imprecise results because of modeling and other limitations but can convey insight into potential climate damages across sectors in the United States."

GAO 17-720, "Climate Change," September 2017

Greatest Contributor to Increased Cost Is Rising Exposure

"Economic costs of extreme weather events have increased over the period 1960–2000. … However, the greatest contributor to increased cost is rising exposure associated with population growth and growing value of assets."

IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.*

ACRI: Conclusion

- While others find likely large losses due to changes in weather by end of 21st century, little loss yet when controlling for changes in exposure. We find small increases in loss likely already occurred, 1991–2016 (~5% of total weather-related losses).
- We also find substantial uncertainty in these estimates.
- Challenges prompting us to version 2.0.