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

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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
### ACI Climate Regions: Large, Climatologically Heterogeneous

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Arctic</td>
<td>CAR</td>
</tr>
<tr>
<td>Northeast Atlantic</td>
<td>NEA</td>
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<tr>
<td>Northeast Forest</td>
<td>NEF</td>
</tr>
<tr>
<td>Northern Plains</td>
<td>NPL</td>
</tr>
<tr>
<td>Northwest Pacific</td>
<td>NWP</td>
</tr>
<tr>
<td>Alaska</td>
<td>ALA</td>
</tr>
<tr>
<td>Central East Atlantic</td>
<td>CEA</td>
</tr>
<tr>
<td>Central West Pacific</td>
<td>CWP</td>
</tr>
<tr>
<td>Midwest</td>
<td>MID</td>
</tr>
<tr>
<td>Southeast Atlantic</td>
<td>SEA</td>
</tr>
<tr>
<td>Southern Plains</td>
<td>SPL</td>
</tr>
<tr>
<td>Southwest Pacific</td>
<td>SWP</td>
</tr>
</tbody>
</table>

Source: https://www.ncdc.noaa.gov/billions/time-series, accessed March 2020
Actuaries Climate Risk Index (ACRI): Preliminary Findings
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.


- Flood: $268B
- Convective Storms: $169B
- Tropical Storms: $156B
- Wildfire: $23B
- Winter: $27B

Source: SHELDUS™
Weather-Related Losses Combined, 1961–2016: increasing

TOTAL Losses from Weather Categories Combined
USA Total, Billions of 2018 $
1961–2016
Source: SHELDUS™
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.”

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.